PARENTHOOD FROM BIOLOGY TO RELATION. PREVENTION, ASSESSMENT AND INTERVENTIONS FOR DEVELOPMENTAL AND CLINICAL ISSUES

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PARENTHOOD FROM BIOLOGY TO RELATION. PREVENTION, ASSESSMENT AND INTERVENTIONS FOR DEVELOPMENTAL AND CLINICAL ISSUES

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EDITORIAL
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Editorial: Parenthood From Biology to Relation. Prevention, Assessment and Interventions for Developmental and Clinical Issues

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Editorial on the Research Topic

Parenthood From Biology to Relation. Prevention, Assessment and Interventions for Developmental and Clinical Issues

Parenthood represents a fundamental construct that identifies the quality of early adult-infant interactions. In both short and long periods, relationships, as primary interactional experiences, have an essential role in influencing individual's adjustment and psychopathology development during in lifetime. In this scenario, the most important areas of interest and innovation are (a) parents' representation of themselves, both in relation to the child and to their care-giving role; (b) the quality of a couple's relationship, in terms of both conjugal and co-parental bounds, and its influence on the quality of early mother-father-child interactions; (c) the early models of caregiver-baby interaction; (d) the recent approach to the "maternal brain," that represents the contribution coming from neurosciences, linked to the adult's activation and cerebral functioning processes, in association with the parental role. These data are a starting point for the individuation of functioning mechanisms and developmental trajectories of parenting in groups of adults and babies, belonging to normative populations. At the same time, those studies may provide an important introduction to the detection of critical and/or dysfunctional aspects in population of babies and adults at risk (e.g., preterm babies, adopted children, etc.) or in adults' clinical group (e.g., a depressed parents, addicted parents, etc.) or in children with one or more impaired characteristic (e.g., children with organic diseases, with autistic disorders, etc.).

The present Research Topic puts the attention on these themes, particularly, considering the possible aftermaths that empirical research may have on planning and realizing interventional models to support the parental functioning. We are pleased to publish the contributions of 129 international authors that produced 31 articles, from theoretical review to perspective, from case report to original research issues. The great interest for this topic has made us particularly encouraging in exploring and studying, more and more, the prevention and support to parenting and, also, the specific manners of taking on the therapeutic responsibility of the adult-infant relationship.

The topic focuses both on theoretical and empirical perspective, permitting the individuation of methods of observation and assessment, allowing to plan and realize prevention programs and/or interventions, primarily focused on parental support, both in the early stadium of the child's development and in the long-term period. A particular importance was given to integrative research, which combines different approaches and methods: especially, interactive and/or

representational aspects, including data from neuroimaging studies, physiological correlates, and biological data related to parenting. The intercultural aspect care-system between adult(s) and child, as well as review papers on avant-garde themes in this research areas, were also included.

The EBook is organized in sessions, based both on the content and the type of article that we accepted: first, we presented a case report session; then we followed a series of original papers devoted to examining the role of adult attachment in influence and mediated attitudes, symptoms and mental health related to the caregiving system; a series of articles about the neural basis of attachment and the parental brain functioning followed, including both original researches and review articles type; a series of papers considering the "family" viewpoint showed how the family system and the co-parenting can influence both positive and negative children development; and, finally, a new tools validation session, as well as a research on intervention efficacy related to parenting and caregiving system, were presented.

We started the EBook with the important contribution given by three case reports, dedicated to support the very first stages of the mother-infant relationships, respectively within a pediatric primary health care setting (Facchini et al.), enrolling the development of a positive and nurturing dyadic physical contact (Gnazzo et al.), and creating ad hoc attachment-intervention in case of mothers with drug addiction problems (Porreca et al.). All these case reports can be considered as the first step for a more solid research project to assess the efficacy of new tools validation systems (video-feedback in the pediatric system; massages; attachment-related interventions) and to increase dyadic wellbeing throughout positive psychological interventions delivered by practitioners in both clinical and non-clinical but ecological, daily and ordinary caregiving contexts.

A series of original research papers followed, taking into account longitudinally pre-natal and postpartum period with respect to the development of typical vs. atypical parental attachment, feeding practice, and stress characteristics. The role of adult attachment styles in shaping implicit attitudes related to the caregiving system emerged. Maternal attachment remained one of the most important constructs in terms of mediating the psychological relationship with the child (De Carli et al.), in respect to the couple dyadic adjustment (Calvo and Bianco) as well as in relation to child feeding practice and internalizing symptoms (Santona et al.). The attachment pattern was also considered as a mediator in adoptive families, both in the first stage of the adoptive path (Salcuni et al.) and during the adolescence of adoptive children (Pace et al.).

Pre-natal, as well as postpartum period, are important for the well-being of both parents and child. However, in literature, there are a few studies that analyze the relationship between parenting stress, mental health, and dyadic adjustment. The paper we collected with respect to this issue, demonstrated how mental health is an important dimension that mediates the relationship between parenting stress and dyadic adjustment in the transition to parenthood. Effects of symptoms, such as stress, depression and anxiety, were studied during feeding practice in preterm children (Neri et al.; Salvatori et al.), when parents presented eating disorders (Cimino et al.), longitudinally from perinatal to 6 months after birth, in the construction of first time mothers and fathers interaction with the child (Vismara et al.; Mazzeschi et al.), and in relation to dyadic adjustment and parenting stress (Rollè et al.). These findings suggested how much the considered dimensions could be defined as risk factors in the transition to parenthood, and in the very beginning of the emergence of the caregiving system, to establish an emotional bond with their infants.

Recent neuroimaging studies with new mothers and fathers investigated the relationships between parental thoughts/behaviors, neural activation, and infant's developmental outcomes in mothers and fathers. A neuro-imaging mini review of attachment-caregiving system interaction (Lenzi et al.), reported altered activation in limbic and prefrontal areas and in basal ganglia and hypothalamus/pituitary regions. These altered activations are thought to be the neural substrate of the attachment-caregiving systems interaction. Neural and psychological correlates of parental thoughts and actions assessed during the first month postpartum were evaluated showing their effect on child sensitivity (Kim et al.). Results from these neuro-based studies showed how in mothers, anxious thoughts and concerns about the baby were associated with reduced neural responses whereas, in fathers, positive thoughts about parenting were associated with increased neural responses to their own infants. Important papers focused on convergence of psychological, behavioral, epigenetic, and neuroimaging data: Schechter et al. investigated the neuropeptides influences on mothers' PTSD and parenting stress development, and together form a psychobiological signature with direct implications for clinical research on the intergenerational transmission of violent trauma and on motor evoked potential in respect with child gender and crying. The innate predisposition in human adults to respond to infants' signals, in order to satisfy their need and allow them to survive and become young adults capable of taking care of themselves, is well described in a mini review about neural circuits underlying different population parental behavioral responses in front of children's cry (Piallini et al.). The paper by Messina et al. using transcranial magnetic stimulation, highlighted empirically how the brains of adult females appear to be tuned to respond to infant cries with automatic motor excitation. The special issue presented a series of review of existing literature, regarding differences in the parental brain in mammals during carrying practice (Esposito et al.).

In nonclinical families, the co-parenting alliance emerged as a valid mediator between trait anxiety, family system maladjustment, parenting stress (Delvecchio et al.) and the self-perception of parental role (Delvecchio et al.). A higher perception of family maladjustment resulted associated with lower levels of family cohesion and cooperation, and vice versa. The results about co-parenting skills and family adjustment introduced important implications for family studies in Italian culture, and open to comparison with parenting and co-parenting practice in other cultures. Children and adolescents psychopathology in relation to parent characteristics were also analyzed, showing a how caregivers play an essential role in influencing in children eating disorders (Pace et al.) and PTSD

and disruptive disorder (Bizzi et al.). Moreover, Cavallina et al. proposed a perspective that underlined how attachment and parental reflective functioning features in child ADHD development.

A methodological session presented the validation of assessment tools. Salcuni et al. presented the Italian validation of the fear survey schedule for children, comparing parents' vs. children's perception of children's fears and confirming how distant these perceptions can be; Skoczen et al. developed and investigated the psychometric properties of the Computerized Family Relations Test (CFRT) for children, demonstrating empirically the consistency of the explored construct. Finally, a valuable review about Emotional Availability Scales and their use, in theory, research and intervention (Saunders et al.) was included.

The last group of original research was devoted to measure effectiveness of clinical intervention in promoting well-being in child-parent relationship (Riva-Crugnola et al.), when postpartum depression is diagnosed (Tambelli et al.), and to explore the association between infant massage practice and mother-infant interaction, in respect with marital adjustment (Porreca et al.).

We hope colleagues can appreciate our topic articles collection and the way in which it contributes to the evidence of the important role of parenting knowledge in psychological assessment and treatment in children.

We would like to thank all the authors and the reviewers who contribute to the present article collection, adding and sharing their knowledge, increasing a better comprehension of the parenting research and clinical field.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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ORIGINAL RESEARCH
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Parenting Stress, Mental Health, Dyadic Adjustment: A Structural Equation Model

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Objective: In the 1st year of the post-partum period, parenting stress, mental health, and dyadic adjustment are important for the wellbeing of both parents and the child. However, there are few studies that analyze the relationship among these three dimensions. The aim of this study is to investigate the relationships between parenting stress, mental health (depressive and anxiety symptoms), and dyadic adjustment among first-time parents.

Method: We studied 268 parents (134 couples) of healthy babies. At 12 months post-partum, both parents filled out, in a counterbalanced order, the Parenting Stress Index-Short Form, the Edinburgh Post-natal Depression Scale, the State-Trait Anxiety Inventory, and the Dyadic Adjustment Scale. Structural equation modeling was used to analyze the potential mediating effects of mental health on the relationship between parenting stress and dyadic adjustment.

Results: Results showed the full mediation effect of mental health between parenting stress and dyadic adjustment. A multi-group analysis further found that the paths did not differ across mothers and fathers.

Discussion: The results suggest that mental health is an important dimension that mediates the relationship between parenting stress and dyadic adjustment in the transition to parenthood.

Keywords: equation model, parenting stress, dyadic adjustment, parenthood, mental health, perinatal anxiety, post-natal depression

INTRODUCTION

Transition to parenthood is an important time in the lives of individuals, affecting their psychological wellbeing in many ways. Examples include high level of stress because of new parental role (Cornish et al., 2006; Leigh and Milgrom, 2008; Petch and Halford, 2008; Misri et al., 2010; Bornstein and Venuti, 2013; Trillingsgaard et al., 2014), problematic relationship adjustment

(Belsky, 1985; Belsky and Isabella, 1985; Belsky et al., 1985; Belsky and Rovine, 1990; Cobb et al., 2008; Lawrence et al., 2008; Garbarini, 2011; Velotti et al., 2011; Zerach and Magal, 2016), and the emergence of anxious and depressive symptoms (Soliday et al., 1999; Matthey et al., 2000; Skari et al., 2002; Buist et al., 2003; Condon et al., 2004; Glazebrook et al., 2004; Goodman, 2004; Edhborg et al., 2005; Schumacher et al., 2008; Figueiredo and Conde, 2011; Fisher et al., 2012; O'Hara and McCabe, 2013; O'Hara and Wisner, 2014; Mazzeschi et al., 2015; Anding et al., 2016; Della Vedova and Matthey, 2016; Prino et al., 2016; Vismara et al., 2016).

Although having a child is a joyful event, it is also characterized by new responsibility and exceptional demands on the new parents (Petch and Halford, 2008; Trillingsgaard et al., 2014). Sometimes the couple is overwhelmed by the changes and feels unable to cope with all the demands that the new role implies (Abidin, 1995; Petch and Halford, 2008; Trillingsgaard et al., 2014). According to Abidin (1995), parenting stress is the discrepancy between the resources required for the parental role and the perception of being able to cope with them. Parents' and children's characteristics and their relationship can also lead to parenting stress (Misri et al., 2010). Current literature identifies an association between mental health—defined as depressive and anxious symptoms (Kendig et al., 2017)—and parenting stress, confirming that parenting stress results in depression (Soliday et al., 1999; Leigh and Milgrom, 2008; Gray et al., 2012; Prino et al., 2016; Riva Crugnola et al., 2016; Vismara et al., 2016) and anxiety (Leigh and Milgrom, 2008; Prino et al., 2016; Riva Crugnola et al., 2016; Vismara et al., 2016).

Both mothers and fathers (O'Hara, 2009) can be affected by post-partum depression (PPD), which is the most common mood disorder during the perinatal period (American Psychiatric Association [APA], 2000, 2013). The incidence of PPD in mothers is reported to be in the range of 15–20% (Fisher et al., 2012; O'Hara and McCabe, 2013). According to DSM-5 (American Psychiatric Association [APA], 2013) PPD is typically experienced from 4 weeks to 6 months after delivery; however, in clinical practice and research, this period is known to stretch up to 12 months after the child's birth (O'Hara and McCabe, 2013). The percentage of incidence in fathers is from 1.2 to 25.5% (Goodman, 2004) but, unlike in mothers, PPD in fathers is delayed and it often follows the disorder in mothers (Matthey et al., 2000; Prino et al., 2016). Literature shows that parenting stress can influence the onset of PPD and vice versa (Soliday et al., 1999; Leigh and Milgrom, 2008; Gray et al., 2012; Prino et al., 2016; Vismara et al., 2016). Leigh and Milgrom (2008) note that PPD represents the most predictive factor of parenting stress. Soliday et al. (1999) consider parental stress the main risk factor in the development of PPD in both parents. Another factor is the presence of anxious symptoms, which are higher during the prenatal period and lower after birth (Buist et al., 2003; Condon et al., 2004; Heron et al., 2004; Andersson et al., 2006; Figueiredo and Conde, 2011). Anxious symptoms prevail on PPD during the entire perinatal period (Wenzel et al., 2005; Lee et al., 2007). Although most of the existing literature on PPD focuses on mothers (Field et al., 2006), the small number of studies on PPD in fathers suggest that mothers have higher levels of anxious symptoms than fathers (Matthey et al., 2000; Skari et al., 2002; Edhborg et al., 2005; Figueiredo and Conde, 2011; Candelori et al., 2015; Vismara et al., 2016). The link between anxious symptoms and parenting stress has been confirmed by reports (Cornish et al., 2006; Leigh and Milgrom, 2008; Misri et al., 2010; Prino et al., 2016). Anxiety at 3 months after child's birth is related to parenting stress reported at the same time (Prino et al., 2016). Parenting stress can not only influence both parents individually and predict post-natal depression symptomatology in both men and women, but it can also have adverse implications for couples' functioning (Soliday et al., 1999).

Transition to parenthood may lead to changes in the marital relationship of parents (Spanier, 1979; Hazan and Shaver, 1994; Darwiche et al., 2015), specifically regarding dyadic adjustment (Spanier, 1979), a construct characterized by dyadic cohesion (DAS-DC), troublesome dyadic differences, consensus on important issues related to dyadic functioning and dyadic satisfaction (DAS-DS). Current literature points to the bidirectional correlation between symptoms of depression and dyadic adjustment (Kurdek, 1999; Davila, 2001; Mamun et al., 2009). After the child's birth, parents may experience a decrease in dyadic adjustment (Mitnick et al., 2009; Darwiche et al., 2015). Studies also show that dyadic adjustment may be strongly associated with parenting stress (Horowitz and Damato, 1999; Ostberg and Hagekull, 2000; Ganiban et al., 2007; Salonen et al., 2010; Stapleton et al., 2012; Mazzeschi et al., 2015). The lack of partner support, lower dyadic adjustment, and the presence of conflict within the couple can also predict post-natal depressive and anxious symptoms (O'Hara et al., 1992; Cox et al., 1999; Whisman et al., 2011; Trillingsgaard et al., 2014; Darwiche et al., 2015).

To date, the relationship between parenting stress, anxious-depressive symptoms, and dyadic adjustment has been examined only in a single study (Gray et al., 2012). This work intends to deepen the knowledge on this relationship by analyzing a larger sample of mothers and their partners. The aim of this study is to investigate the relationships between parenting stress, mental health, and dyadic adjustment among first-time parents. We use structural equation modeling to examine the potential mediating effects of mental health on the relationship between parenting stress and dyadic adjustment. We hypothesize that higher levels of parenting stress are associated with poorer mental health and that both higher levels of parenting stress and poor mental health are associated with less dyadic adjustment. We also predict that mental health mediates the effects of parenting stress on dyadic adjustment. Multi-group analyses were conducted to determine whether the mediation model differed between mothers and fathers.

MATERIALS AND METHODS

Participants

The sample was composed of 268 parents (134 couples) and their 134 healthy 1-year old babies (61% boys and 39% girls). Participation was voluntary, and participants were recruited from

neonatology units and family healthcare services in Italy. Of the couples, 80% were married and 20% were cohabiting. In terms of socio-economic status, most parents belonged to the working Italian middle class. The design excluded subjects who had psychiatric or physical diagnoses as emerged through self-report screening and those whose babies presented genetic or organic problems.

Measures

The Parenting Stress Index—Short Form (PSI-SF; Abidin, 1995; Guarino et al., 2008)

Is a self-report instrument that measures stress specifically associated with parenting. The PSI-SF consists of 36 statements that refer to activities completed in the past week. All items are rated on a 5-point scale. The total stress score is a composite score of the subscale scores: parental distress (PSI-PD), parent–child dysfunctional interaction (PSI-PCD-I), and difficult child (PSI-DC). The PSI-PD measures the stress score of the individuals in relation to their parental role. The scale and subscale explore parenting competence, restrictions on life introduced by parenting, parental conflict, depression, and social support. The PSI-PCD-I analyzes the level of stress perceived by parents because of interactions with the child that seem frustrating. The last scale, PSI-DC, measures how a parent rates the child in terms of their relationship: easy or difficult. This scale is related to the child's temperament. In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.93$, and for the fathers, it was $\alpha = 0.93$.

The Edinburgh Post-natal Depression Scale (EPDS; Cox et al., 1987)

Is a self-report questionnaire that consists of 10 items addressing depression symptoms occurring within the previous 7 days. The total score is calculated by adding individual items on a 4-point Likert scale. In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.80$, and for the fathers, it was $\alpha = 0.73$.

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983; Pedrabissi and Santinello, 1989)

Is a commonly used self-report measure of trait and state anxiety. STAI has 20 items for assessing trait anxiety (STAI-T) and 20 for state anxiety (STAI-S). All items are rated on a 4-point scale (i.e., from "Almost Never" to "Almost Always"). In the current study, the internal consistency coefficient for STAI-S in the case of mothers was $\alpha = 0.94$, and for the fathers, it was $\alpha = 0.91$. The internal consistency coefficient for STAI-T in the case of mothers was $\alpha = 0.89$, and for the fathers, it was $\alpha = 0.86$.

The Dyadic Adjustment Scale (DAS; Spanier, 1979; Gentili et al., 2002)

Is a 32-item self-report instrument for assessing dyadic or marital adjustment. The total score is a composite score of the subscale scores: dyadic consensus (DAS-DCS), affectional expression (DAS-AE), DAS-DS, and DAS-DC in couples.

The DAS-DCS measures the level of agreement on what is considered important for the relationship, the DAS-AE assesses the level of expression of affection as well as the sexual relationship, the DAS-DS measures the level of satisfaction on the relationship, and the DAS-DC the level of closeness and shared activities between the partners. In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.77$, and for the fathers, it was $\alpha = 0.76$.

Procedure

The research was approved by university ethics committee. All participants signed the written informed consent form. Data were collected approximately at 12 months of the baby's age. Parents who met the selection criteria and agreed to participate completed the following independently at home: a set of questionnaires about demographics and the PSI-SF, EPDS, STAI, and DAS self-reports.

Data Analyses

Descriptive statistics (i.e., means, standard deviations, skewness, and kurtosis) were calculated for the psychological variables. One-way ANOVAs examined gender differences on the considered variables. Pearson's correlations were used to assess the associations between variables. The analysis of the hypothesized mediation model was based on the two-step procedure (Anderson and Gerbing, 1988): in the first step, confirmatory factor analysis (CFA) was used to construct a measurement model with an acceptable fit to the data. In the second step, the established structural model was verified. The hypothesized model comprised one supposed latent antecedent variable (parenting stress), one latent mediator variable (mental health), and one latent outcome variable (dyadic adjustment). The latent variable parenting stress was assessed using the three subscales of PSI (PSI-PD, PSI-PCD-I, and PSI-DC). The mental health latent variable was assessed from three sources: the EPDS, the STAI-S, and the STAI-T of STAI. The dyadic adjustment latent variable was assessed using the four subscales of DAS (DAS-DCS, DAS-AE, DAS-DS, and DAS-DC).

The evaluation of model fit was based on chi-squared plus recommended criteria for a set of fit indices. Comparative Fit Index [CFI] and Tucker Lewis Index [TLI] = 0.90, which indicate a reasonable fit of the model (Bentler, 1990; Schumacker and Lomax, 1996; Kline, 2005; Brown, 2006). The root mean square error of approximation (RMSEA) of 0.05 can be considered as a good fit; values between 0.05 and 0.08 indicated adequate fit (Browne and Cudeck, 1993; Hu and Bentler, 1999; Brown, 2006). The value of the Standardized Root Mean Square Residual (SRMR < 0.1) (Bentler, 1990) was also acceptable. Multi-group analyses were conducted to determine whether the hypothesized model performed equivalently across genders.

RESULTS

Preliminary Analysis

Descriptive statistics for the total sample and by gender are presented in **Table 1**. The mean, standard deviation, skewness, and kurtosis of the 10 observed variables were examined to check for normality of distribution. All the skewness and kurtosis values

TABLE 1 | Descriptive statistics for the total sample and by gender.

Variable	Total (*N* = 268)	Mothers (*N* = 134)	Fathers (*N* = 134)
Age			
Mean (SD)	36.6 (5.6)	35.1* (4.8)	38.2* (5.8)
Range	20–54	20–45	20–54
Education			
Frequency (%)			
Elementary school education	25 (9%)	5 (4%)**	20 (15%)**
High school diploma	117 (44%)	54 (40%)**	63 (47%)**
University degree	91 (34%)	56 (42%)**	35 (26%)**
Ph.D.	35 (13%)	19 (14%)**	16 (12%)**

**Age difference between mothers and fathers ($t = 4.78$, $p = 0.000$); **education difference between mothers and fathers ($\chi^2 = 14.80$, $p = 0.002$).*

of the 10 observed variables were less than 1.0, except for PCD-I, DC, and STAI-S. In general, the scores from this sample can be characterized as having a normal distribution. However, a square-root transformation was performed for the PCDI-I, DC, and STAI-S variables. Three variables were derived and named PCD-Is, DCs, and STAI-Ss. The skewness and kurtosis for the PCD-Is (1 and 0.57), for the DCs (0.98 and 0.42), and for STAI-Ss (0.68 and 0.53) indicated a normal distribution. The PCD-I and PCD-Is, the DC and DCs as well as the STAI-S and STAI-Ss were highly correlated ($r = 0.89$, $r = 0.99$, and $r = 0.99$, respectively). Thus, PCD-Is, DCs, and STAI-Ss transformed variables were used in subsequent analyses.

One-way ANOVAs revealed statistically significant gender differences on PSI-PD scores $F(1;267) = 7.86$, $p < 0.01$, partial $\eta^2 = 0.03$; EPDS scores $F(1;267) = 23.92$, $p < 0.001$, partial $\eta^2 = 0.08$; STAI-Ss scores $F(1;267) = 7.84$, $p < 0.01$, partial $\eta^2 = 0.03$; STAI-T $F(1;267) = 12.15$, $p < 0.01$, partial $\eta^2 = 0.04$, and DAS-DC $F(1;267) = 11.046$, $p < 0.01$, partial $\eta^2 = 0.04$. Mothers showed higher parental distress, higher scores on both depressive and anxiety symptomatology, and lower scores on DAS-DC compared to fathers. Means, standard deviations, skewness, and kurtosis for the 10 observed variables of the total sample and by gender are shown in **Table 2**. The correlation coefficients between age, education, and the 10 observed variables are shown in **Table 3**. No significant correlations were found between age or education and the observed variables.

Mediation Model

First Step: Measurement Model

The CFA considered the three latent variables and the 10 observed variables (**Figure 1**). All latent variables were agreed to correlate with one another. The measurement model was assessed using the maximum-likelihood method. A test of the measurement model indicated a highly satisfactory fit to the data: $\chi^2 = 59.80$, $df = 32$, $p = 0.002$, CFI = 0.97, TLI = 0.96, RMSEA = 0.06 (90% [CI]: 0.03 to 0.08), SRMR = 0.05. In addition, all the factor loadings were significant ($p < 0.001$), which confirmed the convergent validity of the indicators (Anderson and Gerbing, 1988). These results indicated that all the latent variables were well represented by their respective indicators (observed variables). In addition, the latent antecedent variable, the latent mediator variable, and the latent outcome variable were significantly correlated with each other ($p < 0.001$). Thus, the measurement model was used to test the hypothetical structural model.

Second Step: Structural Equation Model

The structural equation model was tested using the maximum-likelihood method. Testing for mediation effects in structural equation modeling involves the evaluation of three models (Holmbeck, 1997). First in Phase 1, a direct-effect model was used to assess the effect of the predictor (parenting stress) on the outcome variable (dyadic adjustment) in absence of the mediator (mental health). It is necessary to determine that there is a direct connection between the predictor and the outcome variables (parenting stress and dyadic adjustment, respectively). The direct path coefficient from parenting stress to dyadic adjustment was significant (-0.38, $p < 0.001$). Phase 2 involved testing a partial mediation structural model that estimated the direct relationship between parenting stress and dyadic adjustment and added paths from parenting stress to mental health and from mental health to dyadic adjustment. The partial mediation structural model was an appropriate fit: $\chi^2 = 59.80$, $df = 32$ $p = 0.002$, CFI = 0.97, TLI = 0.96, RMSEA = 0.06 (90% [CI]: 0.03 to 0.08), SRMR = 0.05.

In Phase 3, the partial mediation model was compared with a full mediation model in which the direct path from parenting stress to dyadic adjustment was constrained to zero. The fit indices for the full mediation model (**Figure 2**) indicated very good fit: $\chi^2 = 61.96$, $df = 33$, $p = 0.002$, CFI = 0.97, TLI = 0.96, RMSEA = 0.06 (90% CI: 0.04 to 0.08), SRMR = 0.06. Comparison of the chi-squared values indicated no significant difference between the partial and full mediation models, ($\Delta\chi^2 = 2.16$, $df = 1$, $p = 0.14$). It should also be observed that there was no significant direct effect of parenting stress on dyadic adjustment in the partial mediation model ($b = -0.13$, $p = 0.14$). Thus, in agreement with guidelines on parsimony (James et al., 2006), the full mediation model was identified as the better fitting model for these data. In summary, the results of this analysis showed that mental health fully mediated the association between parenting stress and dyadic adjustment.

Multi-Group Analyses

Multi-group analyses were performed to examine whether the full mediation structural equation model was similar for mothers and fathers. The first phase in these analyses involved assessing the hypothesized structural model with no constraints based on gender; all regression coefficients, correlations, and means were free to take different values for mothers and fathers. This unconstrained model was then compared to models in which various gender constraints were used. The results revealed that an unconstrained model was a slightly better fit to the data [$\chi^2 = 83.51$, $df = 66$, $p = 0.07$ CFI = 0.98, TLI = 0.98, RMSEA = 0.03 (90% CI = 0.0 to 0.05), SRMR = 0.06] than the constrained model [$\chi^2 = 97.41$, $df = 78$, $p = 0.07$,

TABLE 2 | Means, Standard Deviations, Skews, and Kurtosis for the 10 Observed Variables.

	Variable	*M*	*SD*	Skewness	Kurtosis	Cut-off scores
Total sample	PSI-PD	21.8	7.1	0.6	0.0	
	PSI-PCD-I	17.3	4.9	1.4	1.5	
	PSI-DC	19.2	6.3	1.3	1.5	
	TOT-PSI	58.2	15.9	0.9	0.5	>90
	EPDS	3.9	3.5	1.0	0.3	>9
	STAI-S	31.9	8.2	1.1	1.5	>40
	STAI-T	32.6	7.7	0.7	0.0	>40
	DAS-DCS	54.1	6.5	−0.5	0.0	
	DAS-AE	30.6	4.8	−0.3	−0.6	
	DAS-DS	9.4	1.9	−0.6	0.0	
	DAS-DC	16.5	3.2	−0.3	0.7	
	TOT-DAS	111	11.9	−0.4	0.4	<100
Mothers	PSI-PD	23	7.3	0.6	−0.2	
	PSI-PCD-I	17.1	4.9	1.5	1.9	
	PSI-DC	19.6	6.6	1.2	0.8	
	TOT-PSI	60	16.3	0.9	0.4	>90
	EPDS	4.9	3.8	0.6	−0.3	>9
	STAI-S	33.3	8.9	1.1	0.8	>40
	STAI-T	34.2	8.1	0.4	−0.5	>40
	DAS-DCS	54.2	6.4	−0.4	−0.3	
	DAS-AE	30.2	4.7	−0.6	−0.5	
	DAS-DS	9	2	−0.6	−0.3	
	DAS-DC	15.8	3.1	−0.5	0.1	
	TOT-DAS	110	11.8	−0.6	0.8	<100
Fathers	PSI-PD	20.6	6.7	0.6	0.2	
	PSI-PCD-I	17.4	4.9	1.2	1.3	
	PSI-DC	18.7	5.9	1.5	2.6	
	TOT-PSI	57	15.4	0.9	0.5	>90
	EPDS	2.9	2.9	1	0.9	>9
	STAI-S	30.5	7.3	1.2	2.6	>40
	STAI-T	31	7	0.9	1	>40
	DAS-DCS	53.9	6.7	−0.5	−0.2	
	DAS-AE	31.1	4.8	−0.2	−0.8	
	DAS-DS	9.5	1.8	−0.6	−0.1	
	DAS-DC	17.1	3.2	−0.2	−0.1	
	TOT-DAS	112	12.1	0.2	0.4	<100

PSI-PD, parental distress; PSI-PCD-I, parent–child dysfunctional interaction; PSI-DC, difficult child; TOT-PSI, total stress scores; EDPS, total scores of the EPDS scale; STAI-S, state anxiety; STAI-T, trait anxiety; DAS-DCS, dyadic consensus; DAS-AE, affectional expression; DAS-DS, dyadic satisfaction; DAS-DC, dyadic cohesion; TOT-DAS, total score of the DAS scale.

CFI = 0.98, TLI = 0.98, RMSEA = 0.03 (90% CI = 0.0 to 0.05), SRMR = 0.08]. Comparison of the models revealed no differences between the unconstrained and the constrained models ($\Delta\chi^2 = 13.90$, $df = 12$, $p = 0.31$), implying that the hypothesized model functioned equivalently for both mothers and fathers.

DISCUSSION

In the last decades, many researchers have analyzed depressive and anxious symptoms during the perinatal period in mother and fathers and their links to parenting stress; however, none seem to have considered these factors in relation to the dyadic adjustment of the couple (Doss et al., 2009; Mitnick et al., 2009; Darwiche et al., 2015). Various studies show that mothers tend to demonstrate sudden declines in relationship satisfaction after birth while fathers show more gradual declines that are not evident until 6 to 15 months after birth (e.g., Belsky and Hsieh, 1998; Grote and Clark, 2001). To understand the processes leading to such perceptions, it is crucial to evaluate such changes against a complex interplay of several variables that may impact the marital relationship, in the course of transition to parenthood.

In line with previous studies, our findings confirm that the level of parental distress and anxious and depressive symptoms appear to be higher in mothers than in fathers (Kim and Swain, 2007; Paulson and Bazemore, 2010; Vismara et al., 2016).

TABLE 3 | Correlations between the demographic variables and the 10 observed variables.

	1	2	3	4	5	6	7	8	9	10	11	12
(1) AGE	–											
(2) EDUCATION	0.18**	–										
(3) PSI-PD	0.01	0.00	–									
(4) PSI-PCD-I	−0.00	−0.09	0.61**	–								
(5) PSI-DC	0.03	0.04	0.62**	0.69**	–							
(6) EPDS	0.05	0.06	0.46**	0.28**	0.35**	–						
(7) STAI-S	−0.01	0.12	0.39**	0.32**	0.33**	0.65**	–					
(8) STAI-T	0.01	0.07	0.45**	0.30**	0.32**	0.66**	0.72**	–				
(9) DAS-DCS	−0.04	0.03	−0.33**	−0.15*	−0.20**	−0.30**	−0.29**	−0.41**	–			
(10) DAS-AE	0.00	0.03	−0.27**	−0.21**	−0.25**	−0.230**	−0.26**	−0.29**	0.30**	–		
(11) DAS-DS	0.08	−0.07	−0.25**	−0.15*	−0.18**	−0.262**	−0.31**	−0.32**	0.51**	0.22**	–	
(12) DAS-DC	−0.08	−0.08	−0.24**	−0.16**	−0.16*	−0.28**	−0.26**	−0.28**	0.38**	0.21**	0.40**	–

*$p < 0.05$; **$p < 0.01$.

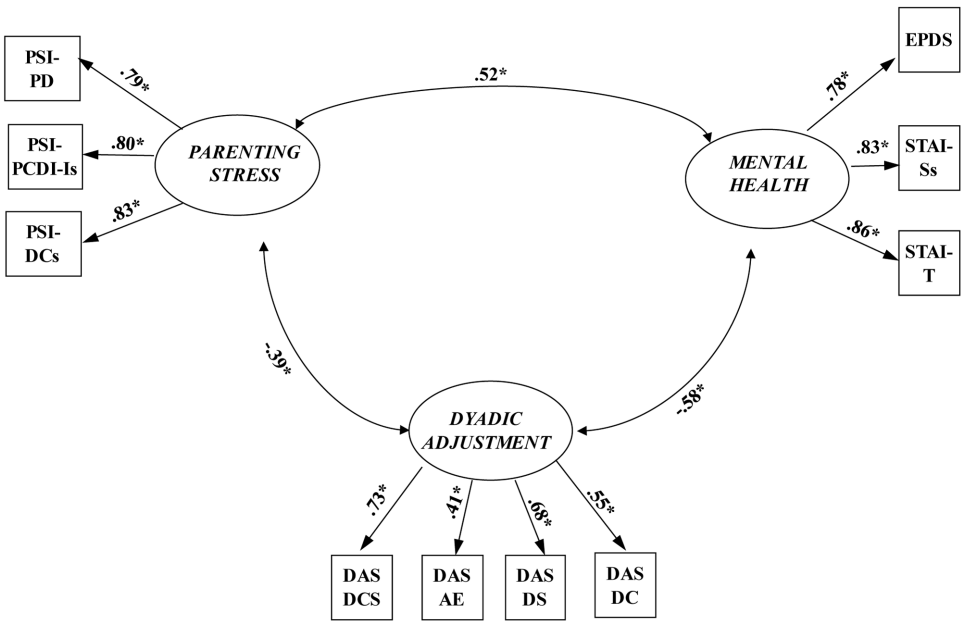

FIGURE 1 | The measurement model (*N* = 268). PSI-PD, parental distress; PSI-PCD-Is, parent–child dysfunctional interaction (after transformation); PSI-DCs, difficult child (after transformation); EDPS: total scores of the EPDS scale; STAI-Ss, state anxiety (after transformation); STAI-T, trait anxiety; DAS-DCS, dyadic consensus; DAS-AE, affectional expression; DAS-DS, dyadic satisfaction; DAS-DC, dyadic cohesion; *$p < 0.001$.

Our research shows how mental health—in terms of depressive and anxious symptoms—could be a mediator between parenting stress and dyadic adjustment. The results offered satisfactory confirmation for the hypothesized structural model. Indices of fit indicated that overall the model was a very good fit to the data.

Earlier research has shown linear relationships between parenting stress and dyadic adjustment (Mazzeschi et al., 2015; Prino et al., 2016); however, our results indicate that parenting stress indirectly influences dyadic adjustment through mental health. It has also been shown that the onset of depressive symptoms in both mothers and fathers is influenced by their own levels of anxiety and parenting stress as well as by the presence of depression in their partners (Vismara et al., 2016). In sum, our findings indicate that mental health acts as a mediator of the relationship between parenting stress and dyadic adjustment in both mothers and fathers. In fact, the results offered satisfactory confirmation for the hypothesized structural model. Indices of fit indicated that overall the model was a very good fit to the data.

The results suggest, also, that the relationship between parenting stress and dyadic adjustment is not simply a direct, linear relationship; rather, mental health results to be an important dimension that plays a mediating role.

Our findings highlight the need to consider the complex array of interacting risk as well as protective variables of different nature that may contribute to the development of specific

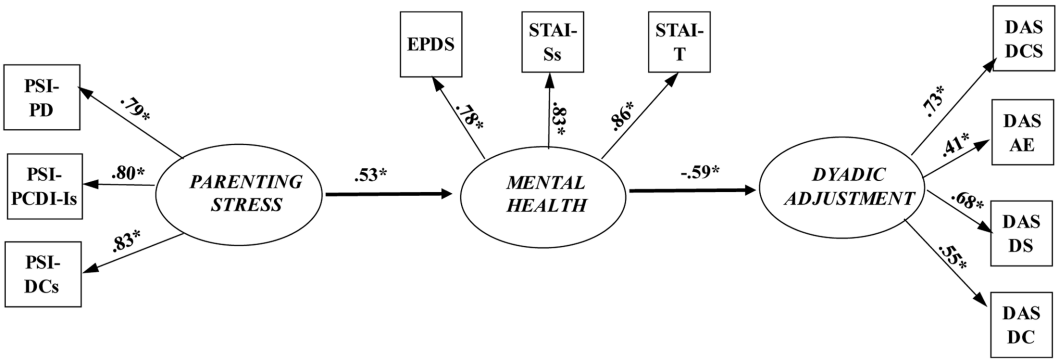

FIGURE 2 | Fully mediated structural equation model. PSI-PD, parental distress; PSI-PCD-Is, parent–child dysfunctional interaction (after transformation); PSI-DCs, difficult child (after transformation); EDPS: total scores of the EPDS scale; STAI-Ss, state anxiety (after transformation); STAI-T, trait anxiety; DAS-DCS, dyadic consensus; DAS-AE, affectional expression; DAS-DS, dyadic satisfaction; DAS-DC, dyadic cohesion; $*p < 0.001$.

relational and parenting vulnerabilities within each family configuration. Such knowledge can offer targeted indications for more efficacious and family-specific interventions. As is well known, identifying the malfunctioning features in a marital relationship are important because they can impact and be a risk factor for the child's development (Prior et al., 2000; Gray et al., 2012). In light of this, low dyadic adjustment—characterized by low levels of consensus, DAS-AE, satisfaction, and cohesion—is an indication of malfunction in the couple. To achieve a functional level of dyadic adjustment, our model suggests that is important not only to work on the stress perceived, but also on the anxious and depressive symptoms for both mothers and fathers.

However, the results of the present study should be considered in the context of its limitations. First, we have no data on the couples' mental health and relationship before birth, which may have had an influence on their parenting stress, mental health, marital satisfaction, or dyadic adjustment after birth. Secondly, the data may not be generalizable: the sample mainly belonged to a medium to high socio-economic status and was non-refereed. We do not know how such variables may interact within different psycho-social contexts. Thirdly, in this study, we used only self-reported tools that are associated with limitations such as inaccurate reporting and social desirability bias. Finally, the participation in the study was voluntary, and the sample may not represent the characteristics of the general population.

Future studies should examine and consider, from a longitudinal perspective, the relation between mental health—in terms of anxiety, depression and other biological or psychological risk factors—and dyadic adjustment and individual perception of parental stress starting with pregnancy. It would be interesting to include an evaluation of protective factors such as the resilience in mothers and fathers. It would also be worthwhile to analyze in depth the relationship between mental health, dyadic adjustment, and parenting stress, focusing on couples receiving group therapy on coping strategies and self-couple perception.

Despite its limitations, the current research increases significantly our understanding of the underlying mechanisms between parenting stress and dyadic adjustment in first-time parents. The study findings present meaningful evidence for the external validity of the mental health-mediated model in Italy. Moreover, the significant path from parenting stress through mental health to dyadic adjustment sheds further light on the complex relationships among these variables. It is likely that mental health improvement programs and training on coping abilities may help the functioning of couples if provided by supporting services to first-time parents.

ETHICS STATEMENT

The research project obtained the approval from University ethics committees in which the research has been conducted (University of Torino, Cagliari, Bologna, Rome, Milano Cattolica, and Milano Bicocca). This study was carried out in accordance with the recommendations of 'Universities Ethical Committees' – as written above – with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

AUTHOR CONTRIBUTIONS

LR prepared the study design, organized the sample recruitment, collected data, and contributed to the writing of the manuscript's introduction, discussion, and references sections. LP prepared the study design, organized the sample recruitment, collected data, and contributed to the writing of the manuscript's introduction, discussion, and references sections. CS prepared the data set, performed statistical analysis, prepared the tables, and contributed to the writing of the methods and results sections. LV contributed to prepare the study design, to organize the recruitment of the sample, and to write all sections of the manuscript. EN, CP, AT, BV, SM, VFen, VFer, and EI contributed to the recruitment of the sample and to data collection. LL, FA, RT, ES, and CR contributed to prepare the study design and supervised data collection and the research team. PB contributed to prepare the

study design and supervised the research team and contributed to the writing of the manuscript's introduction and discussion. All authors reviewed and approved manuscript for publication.

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Infant Massage and Quality of Early Mother–Infant Interactions: Are There Associations with Maternal Psychological Wellbeing, Marital Quality, and Social Support?

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Infant massage programs have proved to be effective in enhancing post-natal development of highly risk infants, such as preterm newborns and drug or HIV exposed children. Less studies have focused on the role of infant massage in supporting the co-construction of early adult–child relationships. In line with this lack of literature, the present paper reports on a pilot study aimed at investigating longitudinally the quality of mother–child interactions, with specific reference to emotional availability (EA), in a group of mother–child pairs involved in infant massage classes. Moreover, associations between mother–child EA, maternal wellbeing, marital adjustment, and social support were also investigated, with the hypothesis to find a link between low maternal distress, high couple satisfaction and high perceived support and interactions of better quality in the dyads. The study involved 20 mothers and their children, aged between 2 and 7 months, who participated to infant massage classes. The assessment took place at three stages: at the beginning of massage course, at the end of it and at 1-month follow-up. At the first stage of assessment self-report questionnaires were administered to examine the presence of maternal psychiatric symptoms (SCL-90-R), perceived social support (MSPSS), and marital adjustment (Dyadic Adjustment Scale); dyadic interactions were observed and rated with the Emotional Availability Scales (Biringen, 2008) at each stage of data collection. The results showed a significant improvement in the quality of mother–child interactions, between the first and the last evaluation, parallel to the unfolding of the massage program, highlighting a general increase in maternal and child's EA. The presence of maternal psychological distress resulted associated with less optimal mother–child emotional exchanges, while the hypothesis regarding couple satisfaction and social support influence were not confirmed. These preliminary results, if replicated, seem to sustain the usefulness of infant massage and the importance of focusing on early mother–infant interactions.

Keywords: infant massage, mother–child interactions, child development, parenting, early relationships

THEORETICAL BACKGROUND

Infant Massage

The practice of infant massage represents a simple but effective way to enhance and strengthen healthy social and emotional relationships between adults and children in early infancy; this is true both from a relational and a practical point of view. On the one hand, in fact, massaging a baby requires and intensifies a series of multimodal and interactive competencies (such as emotional expression, eye-contact, physical touch, vocal communication, and turn-taking) that usually characterize adult–child daily repertoires; in this sense, it represents a privileged moment to cultivate and strengthen the relationship. On the other hand, instead, it is cost-saving and no contraindications were reported up to now; thus, it can be used frequently and without risk, accompanying and supporting a process existing per se, which is the one of adult–infant bonding.

Together with the practices of breastfeeding, baby carrying, and co-sleeping, infant massage is part of a wider "caretaking-package" which involves a set of behaviors necessary to satisfy the child's needs for contact, holding, communication, and feeding; these needs are simple and primitive but often unrecognized (Balsamo, 2007). A particular feature of these behaviors is that they specifically require tactile interactions with the infant and that they are able to convey a series of somatosensory messages about feelings, pressure, temperature, softness, or pain (Underdown, 2009). As already shown by the research on sensorial deprivation in early infancy, these experiences are fundamental for physical growth, neurological development and for the construction of healthy affective relationships (Robertson and Bowlby, 1952; Harlow and Zimmermann, 1958; Montagu, 1971; Blackwell, 2000; Kim et al., 2003).

From a neural-developmental point of view, touch is one of the first sensorial systems to be activated in the fetus during pregnancy, becoming, thus, one of the primary means of communication with the surrounding environment (Relier, 1994; Hernandez-Reif et al., 2007). After delivery, touch becomes an important channel of communication during mother–infant interactions (De Chateau, 1976; Tronick, 1995; Stack, 2004; Moszkowski and Stack, 2007; Jean and Stack, 2009; Stack et al., unpublished). It occurs more than the 55% of time and communicates security and tenderness, reducing infants' distress and promoting emotional regulation (Stack and Muir, 1990, 1992; Weiss et al., 2000; Jean et al., 2004; Jean and Stack, 2009). Empirical studies have widely stressed that sensitive caregiving allows the baby not to feel overwhelmed, moderating or accelerating his/her emotions and intervening at a neuro-physiological level on the reactivity of the hypothalamic-pituitary-adrenocortical (HPA) system (Tronick, 1989; Nelson and Bosquet, 2000; Beebe and Lachmann, 2002). In this sense, early experiences of touch represent one of the means through which the adult works as an external regulator for the baby, helping the co-regulation of his/her behavioral and emotional states and consequently preventing him/her from experiencing developmental difficulties, such as sleep and feeding problems (De Chateau, 1976; Koniak-Griffin and Ludington-Hoe, 1988; Brazelton, 1990; Underdown, 2009).

Infant touching and infant massage are also part of a "high-" or "proximal-contact" model of caretaking (Stork, 1986; Balsamo, 2002), that promotes intense physical and psychological contact between mother and child, with the aim to hold the child and to protect him/her from dangers. From this point of view, and given the relational and developmental influences of early experiences of touch, infant massage appears a useful technique to support parenting by promoting sensitivity and enhancing the construction of healthy affective bonds between adults and children (Bozza, unpublished).

Research on infant massage as intervention has been applied especially to preterm infants. In this particular population the exposure to infant massage sessions resulted in an improvement in several health indexes, such as weight-gain, increases in length, head circumference, bone density, and body temperature (Scafidi et al., 1986; Scafidi et al., 1990; Kuhn et al., 1991; Wheeden et al., 1993; Moyer Mileur et al., 1995; Jinon, 1996; Dieter et al., 2001, 2003; Ke et al., 2001; Duan et al., 2002; Ferber et al., 2002; Liu, 2005; Lu et al., 2005; Na et al., 2005; Diego et al., 2008).

Moreover, massage therapy resulted also capable of modifying the distribution of sleep/awake states, favoring longer periods of active alertness and reducing excitability (Scafidi et al., 1986, 1990; Field et al., 1987, 2004; Wheeden et al., 1993; Dieter et al., 2003).

As far as it concerns other groups at high-risk, infant massage sessions have worked successfully on HIV- and drug-exposed newborns, leading to fewer medical complications, less irritability and increased weight, and to an improvement in the performance on social and emotional scales (Scafidi et al., 1990; Wheeden et al., 1993; Scafidi and Field, 1996; Dieter et al., 2001).

Although most non-at-risk infants will receive adequate sensitive handling, the administration of infant massage with regular frequency can represent an useful way to support parenting and to promote caregivers' sensitive touch in early infancy (Underdown, 2009). Some authors emphasized the bidirectional effects of giving and receiving massage, supporting the use of the technique as a safe and cost-effective intervention for adult–child relationships (Feijò et al., 2006). Firstly, in fact, maternal resources can be enhanced by massage lessons through the promotion of a better knowledge of the infant's needs and characteristics; secondly, the child's features can be better modulated thanks to a more satisfying contact with the caregiver (Oswalt et al., 2009).

Massages can be given to children on a daily basis and they are economically saving when parents are enrolled as therapists (Field, 2002). The massage of infants promotes a general sense of wellbeing in the adult, helping the parent to feel close to the baby, and less fearful of touching and handling him/her. Moreover mothers who massaged their infants, both preterm and full term, reported less anxiety, less depressed mood, and improved mother–child interactions (Onozawa et al., 2001; Ferber et al., 2005; Feijò et al., 2006). Teaching parents to massage their infants, especially in risk conditions, often lowers anxiety levels related to the feelings of helplessness (Field, 2002). As far as it concerns the child, infant massage reduces and balances cortisol,

epinephrine, and norepinephrine hormones which control stress levels (Acolet et al., 1993; Field et al., 1996). As a consequence, this practice could be considered as a facilitator of the normal development of these catecholamines that characterize early stages of life (Kuhn et al., 1991).

Promoting infant massage lessons may represent an ideal way to support parenting and to support early emotional and social relationships between adults and children, useful both for high- and low-risk groups (Underdown, 2009). This technique offers a perspective which is simple but very useful, since it combines a behavioral intervention (i.e., the physical manipulation of the baby) with a profoundly emotional dimension (i.e., the close psychological and emotional proximity that massage enhances). Moreover, participating to massage classes constitutes an opportunity to meet other adults that are living the same experience, to share and compare different points of view, to create new bonds (Adamson, 1996).

Parenting and Early Interactions from a Multi-Determined Point of View

Parenting encompasses a broad range of nurturing and care-taking actions performed by caregivers toward the child. The actual behaviors that parents provide are among the most salient aspects of parenting, since the most of the experience of infants stems directly from interactions with caregivers occurring daily (Bornstein, 2002). Recently, increasing attention has been given to the emotional features that accompany parenting routines; more specifically, an important contribution to the investigation of parenting has been given by the theoretical frame of Emotional Availability (EA), which has pointed out the importance to create an emotional connection and to be able to share a wide range of affects during caretaking behaviors (Biringen, 2008; Biringen and Easterbrooks, 2012). As pointed out above, infant massage can be considered as a component of care-taking behaviors, that offers a valuable interactive context to parents, who can involve in pleasant and rewarding exchanges with their babies. Thanks to Belsky's work on parenting (1984), nowadays it is well acknowledged that parenting, in all its components, is a multi-determined construct, encompassing both contextual variables and baby's and parents' individual characteristics. Empirical evidence attests that some of these factors are of particular relevance, such as the quality of marital relationship, maternal psychological wellbeing, and perceived social support.

The transition to parenthood is an event of the family life cycle that asks the couple to face potentially stressful changes and challenges (Belsky and Rovine, 1990; Cowan and Cowan, 2000) both at an inner and behavioral level (Cowan and Hetherington, 2001), in order to meet child's need and develop parenting competences. In these terms, it is a critical period for marital satisfaction, which goes through a small but reliable decline, persisting at least until the preschool age as reported by several studies on dyadic satisfaction (Belsky et al., 1983; Terry et al., 1991; Favez et al., 2012; Kohn et al., 2012; Trillingsgaard et al., 2014). Women seem to experience a steeper and more precipitous drop in marital quality (Shapiro et al., 2000; Twenge et al., 2003; Bower et al., 2013), especially when they are scarcely satisfied with the division of labor and they manage a greater amount of childcare activities (Belsky, 1986; Gjerdingen and Center, 2005; Dew and Wilcox, 2011; Chong and Mickelson, 2013). However, other studies indicate that mothers and fathers share similar perception of post-birth relationship functioning (Lawrence et al., 2008; Doss et al., 2009; Jackson et al., 2014).

The transition toward parenthood is a very critical and stressful stage that may lead to serious psychological distress symptoms in pregnant women and women that recently gave birth to their offsprings, ranging from 4.8% (Glasheen et al., 2015) to 19% (Czarnocka and Slade, 2000; Saurel-Cubizolles et al., 2007; Gavin et al., 2011). Maternal psychological distress appears to be enduring (Horwitz et al., 2007) and, given that the early postpartum months are especially important for the establishment of a satisfactory dyadic relationship and for infant development (Hay and Kumar, 1995; Murray et al., 2015), it may negatively affect child outcomes (Goodman et al., 2011), mother–infant interactions (Singer et al., 2003), conjugal and family relationships (Whisman, 2001; Sutter-Dallay, 2006). Some studies highlight that marital conflict shows the most significant association with maternal distress in women who have recently given birth (Stemp et al., 1986).

Depression represents one of the most frequent distress conditions in the context of the transition to motherhood; review and meta-analytic studies have demonstrated that depression is linked to a range of adverse behavioral and emotional outcomes for the child, in terms of psychopathology and negative affects and behaviors, especially for younger children (Goodman, 2007; Goodman et al., 2011). Maternal depression is linked with impaired mother–infant interactive patterns since early age (i.e., 4 months) in both partners, especially concerning self- and interactive contingency (Beebe et al., 2012; Murray et al., 2015); depressed mothers are described by Weinberg and Tronick (1997) as intrusive or withdrawn. Notably, improving maternal depression does not imply per se an enhancement of the quality of mother–infant interaction, indicating the importance of targeting not merely mother's depression and adopting instead a broader approach (Forman et al., 2007). A pilot study (Onozawa et al., 2001) reports that depressed mothers beneficiate from attending a massage class, attenuating depression symptoms and learning to interact better with their babies, leading in turn to an improvement in dyadic interaction (maternal attitudes and behaviors toward the child and infants' responses), more than mothers in a support group did. Another study (O'Higgins et al., 2008) attests a clinically significant reduction in depression for the majority of mothers, even though scores remained high.

In a wider perspective, parenting and child development inextricably take place in the context of social relationships. Social support can be defined as the amount of advice received and personal needs fulfilled through the presence and interaction with significant others, within or outside the family, such as partners, relatives, or friends (Kaplan et al., 1977). Social support has been widely linked to individual wellbeing and positive mental health at an individual level (Mitchell and Trickett, 1980); in particular, women are more likely to give social support, draw on socially supportive networks in times of stress and, more importantly, benefit from it (Taylor, 2011).

Moreover, according to Belsky's (1984) model, social support is a key determinant of parenting quality; it plays a role (as mediator, moderator or as a direct influence), in influencing parent–child interactions (Jennings et al., 1991), attitudes about parenting, parenting behaviors and, in turn, child outcomes (Feiring et al., 1987; Melson et al., 1993; Bender and Losel, 1998). Pregnant women that can rely on others for support show better outcomes for stress, depression and anxiety (Glazier et al., 2004). As regards mothers, the advantages of social support, especially if it is provided from one's own mother, can be detected in the domains mental health, reducing the risk of postpartum depression, and of marital satisfaction (Findler et al., 2008); in fact, social support is important for the couple too, being associated to partners' cohesion and intimacy (Cutrona, 1996). Nevertheless, support to mothers peaks in the first weeks after childbirth, but it appears to decrease in the following months (Pinelli, 2000; Rowe and Jones, 2010). If social support is typically considered as a positive influence on parenting, it is also important to note that it can exert an adverse influence, in terms of stressful or non-supportive relationships that lead to decreased wellbeing (Ingersoll-Dayton et al., 1997).

Interestingly, Herwig et al. (2004) have simultaneously considered maternal parenting and depression, couple satisfaction and social support in their associations with child outcomes, reporting the predictive role of maternal parenting and couple satisfaction and the indirect influence of depression and social support on child development.

AIMS AND HYPOTHESIS

To our knowledge, to date no studies have examined the quality of mother–infant interactions in the context of infant massage through the application of the Emotional Availability Scales (EAS; Biringen, 2008), nor have adopted a longitudinal approach. The present preliminary research aimed to investigate mother–child EA during infant massage classes. EA refers to the capacity of a dyad to share an emotionally healthy relationship and has been widely used in research to assess the quality of parenting and of adult–child relationships. Moreover, we adopted a longitudinal perspective, in order to verify whether EA changed or remained stable during the unfolding of infant massage lessons. Finally, according to the extant literature that highlights the role of multiple factors in shaping the quality of early parenting practices, we investigated whether EA was associated to mothers' perception of couple adjustment, social support and psychological wellbeing. An increase in dyadic EA was expected and we hypothesized that more optimal adult–child interactions would be associated with a lower degree of maternal psychological distress, and with a higher level of couple satisfaction and perceived social support.

MATERIALS AND METHODS

The present study adopted a descriptive and correlational design for providing preliminary data on the longitudinal investigation of mother–infant EA during massage classes.

Participants[1]

The sample of the study was composed of 20 mother–child pairs selected from a larger group of participants enrolled in an infant massage course. The children's (10 boys and 10 girls) age ranged from 2 to 7 months ($M = 2.6$, $SD = 1.392$). Sixty-five percent of the subjects could be assessed longitudinally. The remaining subjects (35%) were not tested longitudinally due to obstacles preventing mothers from attending the scheduled lessons. The mothers were all Caucasian; their age ranged from 27 to 38 years old ($M = 31.75$, $SD = 2.751$). Inclusion criteria for the study included: being primiparous, being subject to the first experience of infant massage, having attended all massage classes with the same conductor, absence of infant pathology.

Socio-demographic information regarding different domains such as level of education and occupation was collected through a self-report questionnaire. Twenty percent of the mothers reported to be an only child, while the others reported one (40%) or more (40%) siblings. Concerning education, the 10% of the group declared to have a middle school certificate, while the others reported to have an high school diploma (35%) or an academic degree (50%). As far as it regards work, 15% of the mothers reported to be unemployed, while the remaining declared to have a job in the working class (10%), as employees (45%) or in other forms (30%).

Procedure and Instruments

Massage courses were presented during childbirth classes in different Venetian sanitary districts. Once enrolled the women were contacted after delivery and invited to participate to the course. Participation was free. The dyads were divided randomly in groups of 5, each of these represented a massage class. At the beginning of the course each mother was given a battery of self-report questionnaires to fill in at home, aimed at investigating socio-demographic information, maternal psychological well being, marital relationships and perceived social support (see the section Quality of Mother–Child Interactions during Massage Lessons). The participants were told that they would have been videotaped three times during the cycle of massage classes (during T1, T3, and T4). Informed consent was asked to both parents before videotaping the baby. **Figure 1** resumes the research design, and the variables assessed during the different times of measurement.

The Infant Massage Program

The dyads were offered a cycle of four weekly lessons on infant massage. Each encounter lasted about an hour and a half. Massage courses were provided by a trained psychotherapist. During the course each room was warm and quiet in its atmosphere. Cameras were located in different angles of the room at a distance that allowed to capture the most salient aspects of each dyad's interaction without interfering with the appropriate atmosphere.

Every mother was told to bring a cushion big enough to contain the baby and some natural oil. Activities took place on the

[1]This study was carried out in accordance with the recommendations of the Code of Ethics approved by the General Assembly of the Italian Association of Psychology held on March 27, 2015 with written informed consent from all subjects.

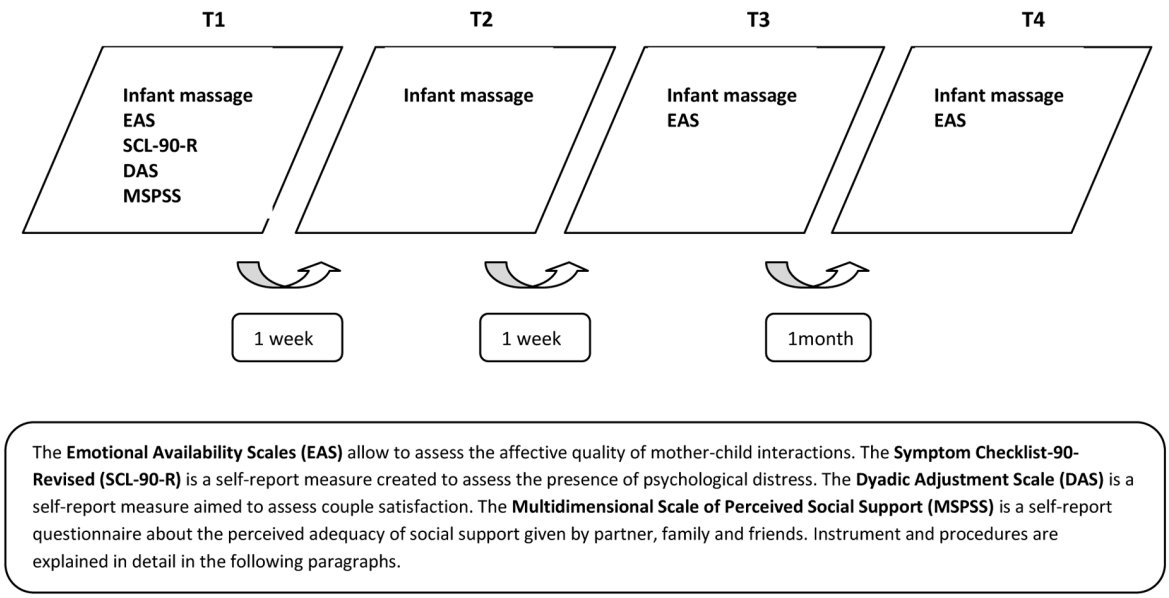

FIGURE 1 | Times of measurement, intervention, and variables assessed.

floor, sitting in circle on wickers, in front of their babies, holding cushions firm with their legs. This condition allowed the mothers to hold their babies and to enhance visual contact with them. The conductor sit in the center of the circle in order to be visible for all the participants, and reproduced on a doll the various techniques taught during each encounter. In this way, the conductor did not touch the babies but only showed the participants how to massage.

The first lesson (T1) concerned an initial introduction to the massage course and to the research project. After a brief presentation of the equipe, the mothers were given notions in order to experience in the best way possible the encounters: they were invited to pay attention and to follow their children's needs, to wait for optimal moments before beginning massage sessions, to feed their babies or to let them sleep whether necessary, to calm them down as they were used to. After a brief moment of relaxation, the mothers were invited to undress their infants from waist down, in order to be able to massage their legs and their abdomen. Instructions focused on how to handle the baby and how to touch, on how to pay attention and to become aware of the baby's signals. The mothers were lead through a group discussion on massage benefits and they were invited to repeat the procedure at home. The first encounter was video-recorded.

During the second lesson (T2) the conductor introduced another sequence of massage procedures, focusing on face, superior arts, and chest. Alternative positions to use massage were presented and parents were positively reinforced during their efforts. Moreover, the mothers were given the possibility to share their feelings about maternity with the group. The conductor stressed the fact that the massage represents a technique with a particular focus on mother–child relationship, a relationship that can be improved dedicating more time to practice at home and, in turn, to the relationship.

The third lesson (T3) concerned the repetition of the entire sequence applied to the frontal body, also adding some suggestions on how to approach the back during massage. Again, some space during this encounter was left to allow the mothers to talk about their experience of the postpartum period. A bibliography was suggested to acquire more knowledge regarding the themes emerged during the cycle of lessons. This encounter was video-recorded.

After a month the group met again for a so-called moment of reinforce and of review of the techniques previously learned. This session was videotaped (T4) and considered as a follow-up.

Quality of Mother–Child Interactions during Massage Lessons

The first (T1), the third (T3), and the fourth (T4) lessons were videotaped. For every dyad 20 min of mother–child interaction were recorded during each episode. The interactions were coded using the fourth version of the EAS (Biringen, 2008). The coding system is composed of six scales/dimensions, four for the adult (sensitivity, structuring, non-intrusiveness, and non-hostility) and two aimed at evaluating the child's contribution (responsiveness, involvement of the adult).

Adult sensitivity refers to quality of adult affects, clarity of perceptions and appropriate responsiveness, awareness of timing, flexibility, variety and creativity during play, acceptance of the child, amount of interactions, and adequate resolution of conflicts.

Adult structuring concerns the use of proactive guidance, the success of attempts, the amount of guidance, the ability to set limits and to remain firm in the face of pressure, the use of both verbal and non-verbal suggestions and the ability to assume an adult role rather than a peer one.

Adult non-intrusiveness refers to the ability to follow the child's lead, to the use of non-interruptive ports of entry into interaction, to the modest use of commands and directives, to the appropriateness of teaching and adult talking, to the absence of interferences and of child's signals that indicate that the adult is perceived as intrusive.

Adult non-hostility refers to the lack of negativity in face or voice and to the lack of ridiculing or other disrespectful behaviors toward the child. A non-hostile adult does not threat to separate, is not frightening, maintains cool during challenging situations and does not use threats of hostile play themes during interactions.

Child responsiveness takes into account quality of child's affects and organization of behaviors, the ability and the willingness to respond to the adult's bids without anxiety or role reversal. It also considers positive physical positioning, concentration on task and the presence of avoidance or of over responsiveness and role reversal.

Child involvement of the adult concerns the use of simple and elaborative initiative to involve the adult, the affective use of the adult (rather than instrumental), the lack of negative/over involving behaviors, and the use of verbal and non-verbal channels.

Each EA dimension is given a global score on a 7-point scale, with higher ratings referring to more optimal features. Scores between 5 and 7 are considered adequate and index of a healthy relationship. Scores around 4 indicate inconsistency, (i.e., behaviors that are appropriate in some way but that are not fully healthy). Scores of 3 or below indicate less optimal interactions were problematic behaviors might arise (scores of 1 or 2). The coding refers to the global quality of the interaction observed rather than on specific behaviors. To get a more specific profile of the adult–child relationship, the EA assessment system provides the coders also a Clinical-Screener that allows to attribute each member of the dyad to one of four "zones" (according to the scores given to maternal sensitivity and child responsiveness), which represent four possible categories of EA: the Emotionally Available zone, the Complicated zone, the Detached zone and the Problematic zone. Mother–child interactions were coded by two independent raters previously trained on the EA coding system in order to reach satisfactory reliability with the Biringen's lab. Inter-rater reliability was calculated on the 20% of the videos using ICCs which ranged from 0.80 to 0.95.

Self-report Measures

At the beginning of the massage course the mothers were given a battery of self-report questionnaires to fill in at home before the second lesson. The instruments aimed to assess socio-demographic information, maternal psychological wellbeing, marital relationships and perceived social support.

The *Symptom Checklist-90 Revised* (*SCL-90-R*; Derogatis, 1977; Italian version by Sarno et al., 2011) is a brief questionnaire designed to evaluate the presence of psychological distress and a range of psychopathological symptoms. It consists of 90 items and yields nine scores along primary symptom dimensions and three scores that refer to global distress indexes. The primary assessed symptom dimensions are somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The three global indexes refer to global psychological distress status (Global Severity Index – GSI), to the total number of symptoms reported (Positive Symptom Total – PST) and to the intensity of reported distress (Positive Symptom Distress Index – PSDI). According to T-scores, each item can be interpreted as below average scores, within the median range, above average scores and definitely above the average scores of the normative sample (thus indicating severe symptomatology).

The *Dyadic Adjustment Scale* (*DAS*; Spanier, 1976; Italian version by Gentili et al., 2002) is a multidimensional tool that allows to assess conjugal adjustment. The sum of the 32 items lead to four dimension of conjugal adjustment (Dyadic Consensus, Dyadic Satisfaction, Dyadic Cohesion, and Affective Expression) and to a global score (Total Adjustment Score) that represents the degree of conjugal adjustment perceived by the partners.

The *Multidimensional Scale on Perceived Social Support* (*MSPSS*; Zimet et al., 1988; Italian version by Prezza and Principato, 2002) is a self-report questionnaire about the perceived adequacy of support given by the partner, family and friends. The 12 items are given a score on a 7-point Likert Scale and their sum leads to three dimensions concerning support received by the family, by friends and by a significant other.

RESULTS

Data were analyzed using IBM SPSS statistics vers. 23. Firstly, descriptive statistics (frequencies, mean scores, and percentages) were examined. Secondly, non-parametric tests were applied; more specifically, we adopted the Friedman and Wilcoxon signed-rank and the Spearman's Rho to test for any associations between the different instruments adopted in the research design.

Preliminary Analysis

During preliminary analysis, Cronbach's alpha coefficient was used to assess the reliability of the instruments. Descriptive statistics (average scores, frequencies, and percentages) were examined.

Mother–Child Interactions during Massage Lessons

The application of Cronbach's alpha coefficient, to all the three periods considered, reported good reliability for EA maternal scales ($0.85 \leq \alpha \leq 0.89$), for the EA child's scales ($0.73 \leq \alpha \leq 0.80$) and for all the six scales considered globally ($0.87 \leq \alpha \leq 0.90$). **Tables 1** and **2** report average scores, standard deviations and the distribution of the dyads assessed through the EAS and the EA clinical screener. As it is possible to observe from **Table 1**, regarding the EA Scales, during T1 the dyads reported on average score 4 (indicating inconsistency) in two maternal dimensions and in both child dimensions, while scores on the other dimensions resulted adequate ($\geq$5). During T3 and T4 average scores resulted adequate ($\geq$5) for all of the six dimensions. As far as it concerns the distribution of the dyads in the zones of the EA clinical screener, as it is possible to see

in **Table 2** during the periods considered a progressively larger amount of dyads fell in the Emotionally Available (EA) zone, while the "lower" zones were progressively less represented.

Psychological Distress

As far as it concerns psychological distress, Cronbach's alpha was applied to the SCL-90-R symptom dimensions and to the global distress indexes. Good internal consistency was reported for obsessive-compulsive (0.82), interpersonal sensitivity (0.72), social phobia (0.72), paranoid ideation (0.78), psychoticism (0.80), and for the total of the items (0.90). Reliability was acceptable for somatization (0.67) and depression (0.70), poor for anxiety (0.56) and unacceptable for hostility ($\leq$0.50), which was excluded from subsequent analysis. **Table 3** reports average scores, standard deviations and the distribution among normative cut-offs for the SCL-90-R scores. As it is possible to see, the majority of the subjects fell within the SCL-90-R normative cut-off values while a smaller percentage of mothers reported values above the norm, suggesting the presence of significant psychological distress.

Couple Adjustment

Regarding couple adjustment, Cronbach's alpha coefficient reported good internal consistency for the DAS total score (0.77) and for the subscales concerning Dyadic Consensus (0.69) and Dyadic Satisfaction (0.68). Reliability was unacceptable as far as it concerns Dyadic Cohesion and Affective Expression ($\alpha \leq 0.50$). Thus, these subscales were excluded from subsequent analysis. Normative cut-offs were computed from average scores and standard deviations reported in the article of the Italian validation of the DAS (Gentili et al., 2002). All the mothers in the present study reported scores that fell in the normative range (**Table 4**).

Perceived Social Support

The Cronbach's alpha coefficient reported very good reliability for all the scales of the MSPSS, considering both the different subscales and the whole scale ($0.76 \leq \alpha \leq 0.97$). **Table 5** reports average scores and standard deviations for the MSPSS. Normative cut-offs were extracted from the validation study by Prezza and Principato (2002). As it is possible to see, the majority of the subjects reported the perception of satisfactory support provided by family, friends and a significant other.

As it is possible to see from the data above, from a descriptive point of view at the beginning of the massage course all the mothers seemed to be able to rely on satisfactory couple adjustment, showing scores within the normative range in all the DAS scales. A similar consideration could be made for social support; although few subjects reported MSPSS scores below average, the majority of the participants seemed to experience a sufficient amount of support provided by family, friends and a significant other. As far as it concerns psychological wellbeing, although the majority of the subjects reported scores that fell into the SCL-90-R normative range, some mothers reported the presence of significant psychological distress as well. It is noteworthy, however, that rarely this perception reached the clinical cut-off. Finally, considering mother–child interactions, it is possible to see how, during T1, most of the mother–child dyads fell in the complicated zone of EA, indicating the presence of an emotional connection but the existence of difficulties as well. The complicated zone, and the zones below were progressively less represented during the ongoing of massage classes. During the follow up (T4), all the dyads that completed the program fell in the emotional available zone.

TABLE 1 | Average scores and standard deviations of the Emotional Availability Scales (EAS) applied during T1, T3, and T4.

	M (*SD*)		
Variables	**T1 (*N* = 20)**	**T3 (*N* = 19)**	**T4 (*N* = 13)**
Sensitivity	5.15 (1.07)	6.03 (1.06)	6.85 (0.38)
Structuring	4.93 (0.98)	5.76 (1.02)	6.73 (0.44)
Non-intrusiveness	4.73 (0.82)	5.79 (0.75)	6.54 (0.63)
Non-hostility	6.05 (0.94)	6.53 (0.79)	7.00 (0.00)
Ch. Responsiveness	4.68 (1.05)	5.58 (0.95)	6.50 (0.50)
Ch. Involvement	4.15 (1.09)	5.05 (1.04)	6.00 (0.79)

Change vs. Stability in Quality of Mother–Child Interactions

To assess change vs. stability of EA during the infant-massage course the Friedman test was applied. This non-parametric statistical test can be considered a valid alternative of the parametric repeated measures ANOVA. The results reported a statistically significant increase in maternal sensitivity ($X^2 = 18.650$, $p = 0.001$), structuring ($X^2 = 17.190$, $p = 0.001$), non-intrusiveness ($X^2 = 15.864$, $p = 0.001$), and non-hostility ($X^2 = 7.400$, $p = 0.025$), just as in child responsiveness ($X^2 = 15.650$, $p = 0.001$) and involvement ($X^2 = 15.476$, $p = 0.001$), indicating thus an improvement in all the EA dimensions during the massage course. To investigate the specific patterns of change in the scales, the Wilcoxon signed-rank test was applied to compare the different periods of infant massage course. This non-parametric statistical hypothesis test can be considered as an alternative to the paired Student's *t*-test and can be used to compare repeated measures on a single sample to assess differences in the population mean ranks. The results reported a statistically significant increase in maternal sensitivity ($Z = -2.553$, $p = 0.011$), structuring ($Z = -2.335$, $p = 0.020$), non-intrusiveness ($Z = -3.357$, $p = 0.001$), just as in child responsiveness ($Z = -2.626$, $p = 0.009$), and involvement ($Z = -2.120$, $p = 0.034$) from T1 to T3. Regarding the transition from T3 to T4, statistically significant improvements were highlighted for maternal sensitivity ($Z = -2.070$), structuring ($Z = -2.384$, $p = 0.017$), non-intrusiveness ($Z = -2.059$, $p = 0.040$) and in child responsiveness ($Z = -2.121$, $p = 0.034$).

Associations between Emotional Availability and Psychological Distress

To test for associations between quality of mother–child interactions and maternal psychological distress, the Spearman's Rho coefficient was applied to the SCL-90-R reliable scores (obsessive-compulsive, interpersonal sensitivity, social phobia, paranoid ideation, psychoticism, somatization, depression,

TABLE 2 | Distribution of the dyads on the zones of the emotional availability (EA) clinical screener during T1, T3, and T4.

	T1 (*N* = 20)		T3 (*N* = 19)		T4 (*N* = 13)	
	Mother	Child	Mother	Child	Mother	Child
EA Zone	7 (35%)	5 (25%)	15 (78.95%)	14 (73.68%)	13 (100%)	13 (100%)
Complicated Zone	11 (55%)	10 (50%)	4 (21.05%)	5 (26.32%)	–	–
Detached Zone	2 (10%)	4 (20%)	–	–	–	–
Problematic Zone	–	1 (5%)	–	–	–	–

anxiety, GSI, PST, and PSDI) and to the scores obtained through the EAS during T1, T3, and T4. **Table 6** reports associations between EA and psychological distress. As it is possible to observe, regarding T1, correlations were found between maternal non-intrusiveness and psychoticicsm. During T3, negative correlations were found between psychoticism, maternal structuring, non-intrusiveness, non-hostility, and for child responsiveness. Moreover, anxiety resulted negatively associated with maternal non-intrusiveness and child responsiveness. As far it concerns T4, statistically significant inverse associations were found between maternal sensitivity and obsessive-compulsive, the GSI, and the PSDI.

TABLE 3 | Average scores, standard deviations, and distribution of the mothers in the SCL-90-R.

N = 20	*M* (*SD*)	Norm *N* (%)	Clinical *N* (%)
Somatization	746.40 (5.49)	18 (90)	2 (10)
Obsessive-compulsive	49.40 (9.52)	15 (75)	5 (25)
Interpersonal-Sensitivity	47.65 (6.95)	15 (75)	5 (25)
Depression	46.80 (5.19)	18 (90)	2 (10)
Anxiety	45.85 (4.83)	18 (90)	2 (10)
Phobic	45.95 (3.94)	19 (95)	1 (5)
Paranoid Ideation	46.50 (8.15)	17 (85)	3 (15)
Psychoticism	47.85 (7.57)	17 (85)	3 (15)
GSI	46.30 (5.60)	18 (90)	2 (10)
PST	45.48 (6.57)	19 (95)	1 (5)
PSDI	48.90 (6.69)	15 (75)	5 (25)

TABLE 4 | Average scores, standard deviations, and distribution of the mothers' scores in the DAS.

N = 18	*M* (*SD*)	<Norm *N* (%)	≥Norm *N* (%)
Dyadic Consensus (DC)	54.39 (4.79)	–	18 (100)
Dyadic Satisfaction (DS)	42.44 (4.33)	–	18 (100)
Dyadic Adjustment_TOT	123.72 (9.47)	–	18 (100)

TABLE 5 | Average scores, standard deviations, and distribution of the mothers in the MSPSS.

N = 20	*M* (*SD*)	≥Norm *N* (%)	<Norm *N* (%)
Support by a significant other	5.43 (0.65)	19 (95)	1 (5)
Support by family	5.16 (1.18)	16 (80)	4 (20)
Support by friends	4.46 (1.06)	17 (85)	3 (15)
Perceived social support_ TOT	5.03 (0.81)	18 (90)	2 (10)

Associations between Emotional Availability and Couple Adjustment

To test for associations between quality of mother–child interactions and couple adjustment, the Spearman's Rho coefficient was applied to the DAS reliable scores (Dyadic Consensus – DC, Dyadic Satisfaction – DS, and DAS total scores) and to the scores obtained through the EAS during T1, T3, and T4. **Table 7** reports associations between EA, couple adjustment and perceived social support. As it is possible to see, regarding T1, statistically significant inverse correlations were reported between maternal sensitivity, Dyadic Consensus and the DAS total score, and between maternal structuring and Dyadic Satisfaction. During T3, significant negative correlations were reported between maternal structuring, Dyadic Consensus and the DAS total score, and between maternal non-intrusiveness, Dyadic Consensus and the DAS total score. No statistically significant associations between Couple adjustment and EAS scores during T4 were found.

Associations between Emotional Availability and Perceived Social Support

To test for associations between quality of mother–child interactions and the dimensions of perceived social support the Spearman's Rho coefficient was applied to the scores of the MSPSS and to the EAS during T1, T3, and T4. As it is possible to observe in **Table 7**, regarding T1, negative associations were found between maternal non-hostility, the social support received by a significant other, and the total score of the MSPSS. No associations were found between EAS during T3 and T4 and the perceived social support.

Associations between Psychological Distress, Couple Adjustment, and Perceived Social Support

Spearman's Rho was applied to test for associations between perceived social support, couple adjustment, and psychological distress. No statistically significant associations were found between couple adjustment and perceived social support, neither between couple adjustment and psychological distress. With respect to psychological distress and perceived social support, statistically significant correlations were found between paranoid ideation and the support received by a significant other

($r = -0.492$, $p = 0.027$), the total score of the MSPSS ($r = -0.512$, $p = 0.021$).

Associations between Improvements in Emotional Availability, Psychological Distress, Couple Adjustment, and Perceived Social Support

In order to assess whether there were associations between EA improvements among the three different timepoints and the other measures, the variance score of EA between timepoints (i.e., from T1 to T3, from T3 to T4, and from T1 to T4) was calculated subtracting the scores at later stages with scores at previous stages. Subsequently, Spearman's Rho correlations were run between the variance scores of EA and the other measures (i.e., psychological distress, perceived dyadic satisfaction, and perceived social support). Some associations were detected for SCL-90-R, namely a negative relationship between higher psychological distress at three scales of the SCL-90-R (assessed at time 1) and lower variance scores between T1

TABLE 6 | Associations between EA and psychological distress.

		Som	*OC*	*I-S*	*Dep*	*Anx*	*Phob*	*Par*	*Psy*	*GSI*	*PST*	*PSDI*
Sens	*T1*	−0.113	0.168	0.014	−0.198	−0.367	−0.197	−0.129	−0.134	−0.037	−0.029	−0.111
	T3	−0.123	0.227	−0.313	0.102	−0.201	−0.378	−0.108	−0.452	0.026	−0.118	0.127
	T4	−0.342	−0.628*	−0.401	−0.516	−0.468	0.139	−0.314	−0.301	−0.627*	−0.514	−0.628*
Struct	*T1*	0.058	−0.038	0.051	−0.029	−0.320	−0.098	0.020	−0.311	−0.061	−0.071	−0.050
	T3	−0.048	0.173	−0.369	−0.053	−0.323	−0.101	−0.111	−0.621**	−0.091	−0.233	0.079
	T4	0.007	−0.247	0.116	−0.211	−0.264	0.215	0.034	−0.029	−0.210	−0.034	−0.420
Nonint	*T1*	0.108	0.157	0.073	0.123	−0.249	−0.020	−0.038	−0.451*	0.102	−0.030	0.179
	T3	−0.222	0.053	−0.371	−0.240	−0.506*	0.088	−0.237	−0.591**	−0.252	−0.358	−0.084
	T4	0.027	−0.435	−0.234	−0.283	−0.130	0.463	−0.314	−0.175	−0.348	−0.247	−0.418
Nonhos	*T1*	0.060	0.035	0.177	−0.200	−0.201	−0.329	0.150	−0.189	−0.031	0.035	−0.129
	T3	−0.253	0.079	−0.413	−0.086	−0.337	−0.088	−0.280	−0.582**	−0.220	−0.392	0.047
	T4	–	–	–	–	–	–	–	–	–	–	–
Ch. Resp	*T1*	0.023	0.195	0.330	0.282	0.207	−0.061	0.237	0.050	0.248	0.302	0.086
	T3	−0.260	0.088	−0.352	−0.088	−0.495*	−0.281	−0.201	−0.599**	−0.152	−0.282	0.020
	T4	0.386	−0.407	−0.237	−0.215	−0.022	0.418	−0.451	−0.350	−0.257	−0.236	−0.257
Ch. Involv	*T1*	0.226	−0.051	0.145	0.139	−0.018	0.071	0.088	0.053	0.081	0.039	0.112
	T3	−0.127	0.242	0.030	0.089	−0.298	−0.510	0.047	−0.367	0.051	−0.015	0.016
	T4	0.222	−0.168	−0.046	0.029	−0.184	0.330	−0.334	−0.250	−0.125	−0.125	−0.086

*Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed).

TABLE 7 | Associations between EA, couple adjustment, and perceived social support.

		DAS_DC	*DAS_DS*	*DAS_Tot*	*MSPSS Other*	*MSPSS Family*	*MSPSS Friends*	*MSPSS*
Sens	*T1*	−0.578*	−0.306	−0.558*	0.027	0.207	−0.016	0.094
	T3	−0.443	−0.034	−0.387	−0.031	0.081	0.229	0.187
	T4	−0.543	−0.259	−0.402	0.059	0.321	−0.433	0.029
Struct	*T1*	−0.355	−0.477*	−0.449	−0.177	0.098	−0.183	−0.116
	T3	−0.539*	−0.171	−0.511	0.039	−0.045	−0.036	0.009
	T4	−0.112	−0.202	−0.027	0.087	0.446	−0.532	0.044
Nonint	*T1*	−0.270	−0.306	−0.250	0.122	0.364	0.079	0.238
	T3	−0.668**	−0.351	−0.630	0.113	−0.009	−0.103	−0.015
	T4	−0.255	−0.353	−0.182	0.231	0.178	−0.473	0.025
Nonhos	*T1*	−0.265	−0.359	−0.379	−0.473*	−0.214	−0.382	−0.460*
	T3	−0.291	−0.086	−0.313	0.185	0.056	0.112	0.102
	T4	–	–	–	–	–	–	–
Ch. Resp	*T1*	−0.211	−0.275	−0.255	−0.309	−0.054	0.092	−0.042
	T3	−0.378	−0.099	−0.374	0.088	0.049	0.086	0.049
	T4	0.107	−0.302	0.022	0.110	−0.066	−0.325	−0.097
Ch. Involv	*T1*	−0.354	−0.636**	−0.421	−0.110	0.033	0.088	0.029
	T2	−0.338	−0.153	−0.324	−0.001	0.049	0.288	0.092
	T3	0.039	−0.374	−0.062	0.459	0.464	−0.189	0.258

*Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed).

and T4. More specifically, a negative relationship was detected between Interpersonal Sensitivity and variance score of Child Responsiveness ($r = -537^*$, $p < 0.05$), Social Phobia and variance score of Child Involvement ($r = -519^*$, $p < 0.05$), Psychoticism and variance score of Child Responsiveness ($r = -531^*$, $p < 0.05$). Taken together, these results indicate that the higher psychological distress mothers experience at T1, the less their interaction quality improved during massage lessons.

DISCUSSION

The first aim of the present study was to investigate EA during infant massage classes and to observe if an improvement in mother–child interactions occurred. Up to date, only few studies applied the EAS in the context of infant massage (Hays, 2014) and, at least to our knowledge, none to unselected populations. Secondly, according to the literature that highlights the intervention of multiple factors in determining the quality of parenting practices (Belsky, 1984; Feiring et al., 1987; Jennings et al., 1991; Melson et al., 1993; Bender and Losel, 1998; Singer et al., 2003; Favez et al., 2006), we aimed to test whether aspects such as the maternal perception of couple adjustment, social support and psychological wellbeing were associated to mother–child EA. At the beginning of the courses, the dyads showed scores that ranged from adequate to complicated EA. However, the results reported an increase in all the six dimensions concurrently with the ongoing of the infant massage course. Mothers enrolled in the courses seemed to gradually become more sensitive and responsive toward their children's bids, as well as more able to provide adequate scaffolding during the lessons. At the same time, they seemed also to become less intrusive, providing more space to the interactions and being less interfering, both psychologically and physically, although the specific setting of infant massage explicitly requires tactile stimulation and the physical manipulation of the infant's body. Simultaneously, a significant increase in child responsiveness was recorded, suggesting an improvement in the ability to find an adequate balance between self- and interactive-regulation and in the possibility to organize affects and behaviors in a coordinated way in order to respond to the caregiver's bids. This parallel increase of maternal sensitivity and child responsiveness, the major dimensions indicative of the adult's and the child's EA, seems to support the hypothesis of bi-directionality and reciprocity within adult–child relationships (Sander, 1977; Tronick, 1989; Beebe and Lachmann, 2002). Although these improvements are not directly attributable to the course of infant massage, also due to the absence of a control group, this seems a plausible hypothesis, especially considering the literature concerning short-term stability of EA (Robinson et al., 1993; Biringen et al., 1995; Bornstein et al., 2006). Moreover, several studies report a positive influence on adult–child relationships exerted by infant massage (Onozawa et al., 2001; Lee, 2006). More research is needed in future in order to discern more clearly how these improvements in adult–child interactions might be affected by the massage course itself, by developmental processes or by the progressive mutual adjustment that the dyad reaches after delivery.

As far as it concerns maternal psychological wellbeing, as expected, a higher degree of adult psychopathology resulted associated with less optimal mother–child interactions, supporting the hypothesis that experiencing some kind of psychological distress might affect different domains of life, including the one of everyday interactions with one's own child (Rogosch et al., 1992; Tronick and Weinberg, 1997; Anke, 2012). In particular, in our study, the major symptomatic scales negatively associated with the quality of mother–child exchanges were anxiety and psychoticism, considered as a graduated continuum from mild interpersonal alienation to first-rank symptoms of psychosis (Derogatis, 1977). Given the preliminary nature of this study, self-report measures were administered only during the first period considered; it would be interesting, in the future, to administer them also at the end of the massage course, in order to see whether an improvement in maternal psychological wellbeing occurs parallel to the improvement of mother–child interactions.

Our hypotheses were not confirmed as far as it concerns the associations between mother–child interactions, couple adjustment and social support. The lack of associations seems to reflect in part the non-univocal results reported by the literature. In fact, although several studies reported the presence of associations between marital quality and parenting (Erel and Burman, 1995) the nature of these associations was not always clear (Grych, 2002). Sometimes they appeared positive (Carneiro et al., 2006), sometimes they were negative (Favez et al., 2006), in other cases they were absent (Barnett et al., 2008; Favez et al., 2013). This incongruence could be due to many methodological reasons, such as different samples, the different periods when the measures were administered as well to the use of different kinds of measures (observational vs. self-report). Moreover it is possible that the "spill over" effect (Engfer, 1988; Katz and Gottman, 1996) expected from marital quality and perceived social support toward adult–child interactions might differ according to the family system investigated (i.e., parental-dyadic vs. co-parental-dyadic) (McHale et al., 2000; Johnson, 2001; Lindsey and Caldera, 2006; Stroud et al., 2015). It is important to note that, differently from what it is often reported in the literature, all our mothers held satisfactory couple relationships. Maybe they were still experiencing the so-called "baby honeymoon" (Hobbs, 1965; Wallace and Gotlib, 1990) or maybe they were part of that portion of couples that do not face a decline in marital satisfaction after delivery (Holmes et al., 2013). Anyway, further analysis will be required in future, also expanding and improving research designs, in order to confirm or disconfirm these associations and to examine in depth their nature.

The present study shows a series of limitations that might offer useful suggestions for future research. The first limit regards the sample; the small amount of the participants and the absence of a non-treated control group, in fact, prevent us to generalize the obtained results. A larger sample would allow to adopt more sound statistical analysis, while the presence of a control group would allow to compare the development of mother–child interactions between dyads that undergo infant massage

courses and dyads without intervention, thus leading to a better explanation of the effective influence of infant massage upon the establishment of early adult–child interactions.

Another limit regards the absence of a baseline assessment of mother–child interactions. Videotaping the dyads during massage lessons might have influenced the nature of mother–child interactions both in positive or in negative. On one side, in fact, the massage context might have acted as a buffering factor, preventing the mothers from enacting dysfunctional behaviors that otherwise could have been adopted; on the other hand, instead, finding themselves in a new situation and being asked to do something new (massaging their babies while being videotaped) might have made interactions more challenging for these women. In this sense, including a baseline assessment in future would favor a better control of the different intervening variables. Moreover, it should be taken into account that our study only included mothers and did not involve fathers. Expanding the research design in this direction in future would lead to two major consequences: first of all, the possibility to support and sustain also paternal functioning during the postpartum period; secondly the opportunity to increase and to deepen the comprehension of family processes.

Finally, some considerations should be dedicated to the clinical implications of our study. These preliminary findings, in fact, seem to suggest the usefulness of infant massage for the strengthening and the enhancement of early healthy adult–child interactions. This cost-saving technique could provide a simple but effective way to favor the construction of early affective bonds; in this way, it could accompany a process existing per se and sustain the dyad during expected developmental challenges, whether necessary. Especially in a delicate interval such as the post-partum period this practice could become extremely important, since it could help the dyad to face the need of mutual adjustment, facilitating regulatory processes and the establishment of sleep-wake cycles. Moreover, a "guided" emotionally intense approach toward the infant could reassure the mothers, who often perceive the newborns as fragile and are afraid to touch them, making them more confident when handling their babies. From this perspective, infant massage constitutes a precious resource in terms of primary prevention, i.e., in terms of those interventions aimed at sustaining and enhancing the existing resources within the family system, since it can be offered as an enriching support also in the absence of adult psychopathology. A replication of these results in larger samples would thus encourage the diffusion of this non-invasive technique in terms both of relational support and enhancement of parenting abilities.

ETHICS STATEMENT

The study was carried out in accordance with the recommendations of the Code of Ethics approved by the General Assembly of the Italian Association of Psychology held on March 27, 2015. Written consent was obtained from the participants.

AUTHOR CONTRIBUTIONS

AS prepared the study design and supervised the research team; GB carried out the massage courses and recruited the sample. SF collected data and prepared data set. AP and MP wrote the introduction section of the manuscript, performed statistical analyses, and prepared tables and figures. AS, MP, and AP wrote the discussions section of the manuscript. All authors reviewed the manuscript.

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Perinatal Parenting Stress, Anxiety, and Depression Outcomes in First-Time Mothers and Fathers: A 3- to 6-Months Postpartum Follow-Up Study

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Objective: Although there is an established link between parenting stress, postnatal depression, and anxiety, no study has yet investigated this link in first-time parental couples. The specific aims of this study were 1) to investigate whether there were any differences between first-time fathers' and mothers' postnatal parenting stress, anxiety, and depression symptoms and to see their evolution between three and 6 months after their child's birth; and 2) to explore how each parent's parenting stress and anxiety levels and the anxiety levels and depressive symptoms of their partners contributed to parental postnatal depression.

Method: The sample included 362 parents (181 couples; mothers' $M_{\text{Age}} = 35.03$, $SD = 4.7$; fathers' $M_{\text{Age}} = 37.9$, $SD = 5.6$) of healthy babies. At three (T1) and 6 months (T2) postpartum, both parents filled out, in a counterbalanced order, the Parenting Stress Index-Short Form, the Edinburgh Postnatal Depression Scale, and the State-Trait Anxiety Inventory.

Results: The analyses showed that compared to fathers, mothers reported higher scores on postpartum anxiety, depression, and parenting stress. The scores for all measures for both mothers and fathers decreased from T1 to T2. However, a path analysis suggested that the persistence of both maternal and paternal postnatal depression was directly influenced by the parent's own levels of anxiety and parenting stress and by the presence of depression in his/her partner.

Discussion: This study highlights the relevant impact and effects of both maternal and paternal stress, anxiety, and depression symptoms during the transition to parenthood. Therefore, to provide efficacious, targeted, early interventions, perinatal screening should be directed at both parents.

Keywords: transition to parenthood, mothers, fathers, parenting stress, perinatal anxiety, postnatal depression, follow-up study

INTRODUCTION

In both men and women, the transition to parenthood involves physical, hormonal, neurochemical, and neurobiological shifts (Wisner et al., 2006; Feldman, 2007; Slade et al., 2009; Kim et al., 2010); psychological changes concerning identity, affect, representations, and cognition (Stern, 1995; Ammaniti et al., 2014); and socio-relational adjustments (Cowan and Cowan, 1995, 2000; Bost et al., 2002). The involved personal and family changes may lead to increased vulnerability to psychological distress (Epifanio et al., 2015). In this context, postnatal depression (PND) is a major parental mental health issue (Miller, 2002; Rollè et al., 2011; Parfitt and Ayers, 2014). PND occurs in about 15–20% of mothers in Western countries and may have severe consequences on maternal and family wellbeing, along with affecting child development (O'Hara and Wisner, 2014; Tambelli et al., 2014a).

In the past two decades, several studies have shown that fathers also experience postpartum symptomatology, particularly perinatal depression (Condon et al., 2004; Paulson and Bazemore, 2010); a recent study found the prevalence of paternal perinatal depression to be 10.4% between the beginning of first trimester of pregnancy and the end of the first postpartum year, with an increase to 25% between three and 6 months after birth (Paulson and Bazemore, 2010). Paternal perinatal depression can lead to inadequate parental functioning (Wilson and Durbin, 2010) and negative child outcomes (Ramchandani et al., 2005, 2008; Tambelli et al., 2014b). In addition, fathers seem to follow their partners' mood and emotional states, increasing the possibility of negative outcomes for children (Deater-Deckard, 1998; Nishimura and Ohashi, 2010).

This body of evidence thus highlights the need for research focused on identifying the factors that play a role in the onset and chronicity of PND in both mothers and fathers. Anxiety disorder has been shown to increase the risk of developing or triggering depression (Iliadis et al., 2015). In particular, perinatal anxiety, a frequent psychopathological condition in mothers (Teixeira et al., 2009; O'Hara and Wisner, 2014; Martini et al., 2015), has been identified as a relevant risk factor for perinatal depression (Norhayati et al., 2015). Worries, preoccupations, generalized anxiety, and/or specific phobias (e.g., tocophobia) can persist during pregnancy and in the postnatal period (Fenaroli and Saita, 2013). Perinatal anxiety in men has been analyzed in a limited number of studies; however, throughout the perinatal period, compared to mothers, fathers appear to have lower levels of anxiety (Matthey et al., 2000, 2003; Figueiredo and Conde, 2011; Candelori et al., 2015).

A consistent association between PND and parenting stress has also been identified by several studies (Yim et al., 2015). Anding et al. (2016) found that perceived parental stress was the strongest predictor of depressive symptoms in both mothers and fathers at 2 weeks postpartum; perceived stress in fathers at 6 weeks postpartum was found to be a predictor of paternal postpartum depression at 12 weeks in a study by Kamalifard et al. (2014). Parenting stress may involve how fathers and mothers experience their parental role, parental perceptions of how difficult the infant is, and the quality of parent–child interactions. Stress associated with the parental domain has shown to be linked to depressive symptoms, whereas findings regarding child and parent–child interactions are inconsistent (Thomason et al., 2014). The clinical relevance of parenting stress with regard to its implications on parental behavior and child outcomes make it a crucial variable requiring deeper investigation.

To our knowledge, only a few studies have examined the relationship between PND, anxiety, and parenting stress in the first few months after birth, and if and how these variables may contribute to higher levels of PND in mothers and fathers. In a correlational longitudinal study on maternal stress, depressive symptoms, and anxiety, Liou et al. (2014) found a low to high degree of correlation in maternal stress, depressive symptoms and anxiety in pregnancy and postpartum. In addition, the three types of maternal distress had different courses: levels of depressive symptoms remained unchanged; anxiety levels increased as gestation advanced but declined after birth, and stress decreased gradually during pregnancy but increased after birth. In fathers, Wee et al. (2015) explored the relationship among the three variables during pregnancy and found that high levels of anxiety early in pregnancy predicted high levels of depression and stress in late pregnancy. At 2- to 3-months postpartum, Goodman (2008) showed that maternal PND was associated with increased paternal depression and higher paternal parenting stress and that depressed women's partners had less optimal interactions with their infants, indicating that fathers do not compensate for the negative effects of maternal depression on the child. We also know that in the offspring of depressed parents, a second parent with emotional problems is likely to increase the risk of emotional disorders (Landman-Peeters et al., 2008); thus, it is important to include partners' mental health when exploring parental PND and to consider the couple as a whole.

These links suggest the need for a better understanding of the reciprocal influences among mothers, fathers, and their infants in the perinatal period. A longitudinal approach may provide further information on the relationships between anxiety, parenting stress, and PND in the postpartum period. Based on the above empirical and clinical evidence, the present longitudinal study had the following aims:

- To examine whether there are any differences and relationships between fathers' and mothers' levels of parenting stress, anxiety, and depression symptoms and to evaluate their evolution from three to 6 months after their child's birth.
- To explore, through a path model, whether the persistence of PND could be a response to the parent's own parenting stress and anxiety levels and the anxiety levels and depressive symptoms of his/her partner.

This study was part of a larger, ongoing longitudinal study on maternal and paternal depression in first-time parents and the development of their children's affective regulation. In this paper, we present data concerning parents who completed the

first (Time 1) and second step (Time 2) of the assessment at the third and sixth month after the child's birth.

MATERIAL AND METHODS

Participants

The study participants were 362 parents (181 couples) and their healthy 208 babies (55.8% boys, 44.2% girls). Of these, 70% were married couples and 30% were cohabiting; 6% of the mothers and 12% of the fathers had an elementary school qualification, 34% of the mothers and 45% of the fathers had a high-school qualification, 47% of the mothers and 38% of the fathers a college degree, and 13% of the mothers and 5% of the fathers had a PhD. Mothers' mean age ranged from 20 to 49 years ($M_{\text{Age}} = 35.03$ years, $SD = 4.7$ years), and fathers' mean age ranged from 20 to 54 years ($M_{\text{Age}} = 37.9$ years, $SD = 5.6$ years). The median income of the parents belonged to the Italian middle working class and socio-economic status as assessed by a detailed questionnaire and according to ISTAT classification (Istituto Nazionale di Statistica [ISTAT], 2013). No participant was undergoing medical/psychological treatment at the time of assessment.

Measures

The Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987) is a self-report questionnaire including 10-items addressing depression symptoms occurring within the previous seven days. The total score is calculated by adding the individual items on a 4-point likert scale. There were two adopted cut-off scores: 8/9, as suggested in the EPDS Italian validation (Benvenuti et al., 1999), and 12/13, as suggested by Cox et al. (1987) to identify more severe depression. In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.84$ at 3 months and $\alpha = 0.81$ at 6 months; for the fathers, it was $\alpha = 0.81$ at 3 months and $\alpha = 0.78$ at 6 months.

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983; Pedrabissi and Santinello, 1989) is a commonly used self-report measure of trait and state anxiety. STAI has 20 items for assessing trait anxiety (STAI-T) and 20 for state anxiety (STAI-S). All items are rated on a 4-point scale (i.e., from "Almost Never" to "Almost Always"). The adopted cut-off score was > 40, as suggested by the Italian validated version (Pedrabissi and Santinello, 1989). In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.95$ at 3 months and $\alpha = 0.94$ at 6 months; for the fathers, it was $\alpha = 0.95$ at 3 months and $\alpha = 0.94$ at 6 months.

The Parenting Stress Index—Short Form (PSI-SF; Abidin, 1995; Guarino et al., 2008) is a self-report instrument that measures stress specifically associated with parenting. The PSI-SF consists of 36 statements referring to the past week. All items are rated on a 5-point scale. Parents who obtain a total stress score above the 90th percentile or a raw score of 90 are considered to experience clinically significant parenting stress, as indicated by the Italian validation (Guarino et al., 2008). The total stress score is a composite score of the subscale scores: parental distress, parent–child dysfunctional interaction, and difficult child. In the current study, the internal consistency coefficient for the mothers was $\alpha = 0.94$ at 3 months and $\alpha = 0.92$ at 6 months; for the fathers, it was $\alpha = 0.92$ at 3 months and $\alpha = 0.94$ at 6 months.

Procedure

The research project obtained approval from the hospital and university ethics committees. All participants signed a written informed consent form.

Time 1 data were collected approximately 3 months after birth, while Time 2 data were collected approximately 6 months after birth. Parents who met selection criteria and agreed to participate independently completed at home a demographics questionnaire, the EPDS, STAI, and PSI-SF at both Time 1 and Time 2.

Data Analysis

Data analysis was conducted with IBM SPSS Version 21 and IBM SPSS Amos 21. Since the mother and father in each couple were considered as dependent, all comparisons between mothers and fathers used statistical methods for paired data. Descriptive statistics were calculated on the assessed psychological variables, reporting frequencies, percentages, mean values, and standard deviation.

To analyze changes over time and to analyze the differences between mothers and fathers in anxiety, depression, and parenting stress scores, we used a paired sample *t*-test, marginal homogeneity (Agresti, 1990), and McNemar's exact test. Pearson's correlations were used to assess the association between maternal and paternal scores and Time 1 and Time 2 scores.

An exploratory model of maternal and paternal PND was tested by path analysis. Specifically, by taking into account the proven impact of parenting stress and partner support on the onset of PND, we tested whether parenting stress and anxiety and the anxiety levels and depressive symptoms of partners had direct effects on PND.

Evaluation of model fit was based on a χ^2 test, with a statistical significance level of less than 0.05 indicating inadequate fit (Allison, 2003), along with the recommended minimal set of fit indices, including the Tucker–Lewis Index (TLI ≥ 0.95) the comparative fit index (CFI ≥ 0.95), the root mean square error of approximation (RMSEA ≤ 0.06), and the standardized root mean square residual (SRMR < 0.1; Allison, 2003; Tabachnick and Fidell, 2007).

RESULTS

Comparisons between Mothers and Fathers

Frequency, mean values, and standard deviation were calculated for each considered variable.

The results from the non-parametric tests (**Table 1**) indicate that the mothers were more likely to experience depression and anxiety than their partners. Specifically, the marginal homogeneity test for EPDS, which analyzed data regarding normal functioning (EPDS < 9), borderline (EPDS total 9–12), and depressed (EPDS total ≥ 13) parents, showed a difference between the mothers and fathers within each couple, showing

that the mothers were more depressed than their partners. McNemar's exact test for STAI, which analyzed data regarding normal functioning (STAI < 40) and anxious (STAI > 40) parents, revealed that the mothers were more anxious than their partners. Similarly, a paired sample *t*-test showed differences between EPDS and STAI mean scores for the mothers and fathers in each couple (**Table 1**), with women showing higher scores than men.

As concerns PSI, McNemar's exact test for total stress, which analyzed data regarding normal functioning (total stress <90) and clinically stressed (total stress >90) parents, did not reveal any statistically differences between the mothers and fathers in each couple. Instead, differences between the mothers and fathers within each couple were found at Time 1 with respect to the parental distress and difficult child subscales, showing that compared to their partners, the mothers reported higher levels of psychological distress and perceived their children as being more difficult.

Time 1 versus Time 2 Evaluations

Because the psychological variables differed between the mothers and fathers, we investigated the main effect of time on each parent separately. Results are reported in **Table 1**. Significant differences emerged between Time 1 and Time 2 regarding specific psychological variables, mostly within the mothers. In particular, the marginal homogeneity test showed that the number of depressed mothers decreased from Time 1 to Time 2 ($p < 0.001$). Similarly, McNemar's exact test showed that the mothers' state anxiety decreased from Time 1 to Time 2 ($p = 0.014$).

Among the mothers, the mean EPDS, STAI-S, and STAI-T scores decreased from Time 1 to Time 2: t (180) = 5.14 and $p < 0.001$, t (180) = 3.98 and $p < 0.001$, and t (180) = 2.65 and $p = 0.009$, respectively. With respect to maternal PSI, McNemar's exact test showed that the mothers' clinical stress decreased from Time 1 to 3.8% Time 2 ($p < 0.001$). Both mean total stress and parental distress (PD) subscale scores decreased from Time 1 to Time 2: t (207) = 2.62 and $p < 0.001$, and t (207) = 4.21 and $p < 0.001$, respectively.

Among the fathers, EPDS, STAI-S, and STAI-T categorical scores did not show any significant differences across time. Regarding mean scores, only the mean STAI-T score decreased from Time 1 to Time 2: t (180) = 3.21 and $p = 0.002$. With respect to paternal PSI, McNemar's exact test showed that the fathers' clinical stress decreased from Time 1 to Time 2 ($p = 0.001$). The mean total stress and parent–child dysfunctional interaction (P-CDI) subscale scores decreased from Time 1 to Time 2: t (207) = 2.53 and $p = 0.012$, and t (207) = 2.47 and $p = 0.014$, respectively.

Association between Parenting Stress, Anxiety, and Depression

The Pearson correlation coefficients between the EPDS, STAI-S, STAI-T, and PSI scores during the third month after the child's

TABLE 1 | Distribution of outcomes by mother and father couples.

	Time 1 (3 Months)				Time 2 (6 Months)			
	Mothers	**Fathers**	***t***	***p*-value**	**Mothers**	**Fathers**	***t***	***p*-value**
EPDS								
Mean score (*SD*)	7.8 (5.6)	4.8 (4.5)	9.04	<0.001[a]	5.9 (4.3)	4.3 (3.6)	5.4	<0.001[a]
Normal (<9) *N (%)*	114 (63%)	152 (84%)			143 (79%)	156 (86.2%)		
Borderline (9–12) *N* (%)	36 (19.9%)	17 (9.4%)		<0.001	21 (11.6%)	21 (11.6%)		
Depressed (>13) *N* (%)	31 (17.1%)	12 (6.6%)			17 (9.4%)	4 (2.2%)		0.002[b]
STAI								
STAI – State								
Mean score (*SD*)	38.8 (11.1)	34.9 (9.4)	6.59	0.000[a]	35.2 (9.8)	33.6 (9.3)	2.65	0.01[a]
Normal (<40) *N* (%)	111 (61.3%)	135 (74.6%)		<0.001[c]	131 (72.4%)	139 (76.8%)		0.256[c]
Anxious (>40) *N* (%)	70 (38.7%)	46 (25.4%)			50 (27.6%)	42 (23.2%)		
STAI – Trait								
Mean score (*SD*)	39.2 (11)	35.1 (9.4)	6.07	<0.001[a]	37 (9)	32.9 (8.4)	6.80	<0.001[a]
Normal (<40) *N* (%)	102 (56.4%)	134 (74%)		<0.001[c]	117 (64.6%)	145 (80.1%)		<0.001[c]
Anxious (>40) *N* (%)	79 (43.6%)	47 (26%)			64 (35.4%)	36 (19.9%)		
PSI								
PD Mean score (*SD*)	24.3 (7.9)	22.1 (8)	4.73	<0.001[a]	22.41 (7.4)	21.6 (7.3)	0.48	0.629[a]
PD Mean score (*SD*)	19 (7.3)	19.3 (7.4)	−0.77	0.443[a]	18.2 (5.9)	18.1 (6)	0.34	0.732[a]
DC Mean score (*SD*)	21.7 (7.5)	22.4 (7)	−2.17	0.031[a]	21.3 (7.2)	20.9 (7)	0.93	0.353[a]
Total stress								
Mean score (*SD*)	65 (20.3)	63.8 (20.5)	1.10	0.271[a]	61.9 (17.1)	60.6 (17.8)	1.27	0.205[b]
Normal (<90) *N* (%)	177 (85.1%)	175 (84.1%)		0.791[c]	200 (96.2%)	195 (93.8%)		0.227[c]
Clinical stress (>90) *N* (%)	31 (14.9%)	33 (15.9%)			8 (3.8%)	13 (6.3%)		

EPDS, Edinburgh Postnatal Depression Scale; STAI, State and Trait Anxiety Inventory; PSI, Parenting Stress Index—Short Form; PD, Parental Distress; P-CDI, Parent–Child Dysfunctional Interaction; DC, Difficult Child. [a]*Paired t-test,* [b]*marginal homogeneity test, and* [c]*McNemar's exact test.*

birth were positively correlated with the EPDS, STAI-S, STAI-T, and PSI scores at 6 months postpartum.

Association between Mothers' and Fathers' Parenting Stress, Anxiety, and Depression Scores

The Pearson correlation coefficients between the maternal and paternal scores are reported in **Table 2**. The EPDS, STAI-S, STAI-T, and PSI maternal scores were strongly positively correlated with the EPDS, STAI-S, STAI-T, and PSI paternal scores at both Time 1 and Time 2.

Path Models

The next step was to analyze two hypothesized path models for mothers and fathers, respectively. The basic strategy involved constructing two separate conceptual models based on theoretical evidence that a parent's own parenting stress and anxiety levels (at Time 1 and Time 2) and the anxiety levels and depressive symptoms of his/her partner (at Time 1 and Time 2) precede postpartum depression (at Time 1 and Time 2). The two models contained four exogenous variables (own parenting stress and anxiety levels and partner's anxiety and depressive symptoms at Time 1), which were assumed to be correlated.

The conceptual model for mothers yielded a poor fit: $\chi^2 = 181{,}818$ $df = 18$ $p < 0.001$, CFI = 0.810, TLI = 0.619, RMSEA = 0.210, and SRMR = 0.123. To develop a parsimonious model, we deleted any non-significant statistically paths (the weakest paths were deleted first) until all paths were significant (MacCallum, 1986). Deleting the non-significant statistically paths resulted in a significantly improved model: $\chi^2 = 6.215$, $df = 6$ $p = 0.400$, CFI = 0.973, TLI = 0.999, RMSEA = 0.01, and SRMR = 0.023.

The final model (**Figure 1**) for mothers found Parenting Stress at Time 1, Anxiety at Time 1, and Partner Depression at Time 1 all serving as exogenous variables that were correlated with each other. Both own parenting stress and trait anxiety levels and the depressive symptoms of the partner at Time 1 had a direct effect on own postpartum depression at Time 1 and indirect effect on own postpartum depression at Time 2. Own parenting stress at Time 1 had a direct effect on parenting stress at Time 2. Finally, in turn, Parenting Stress at Time 2 and postpartum depression at Time 1 had a direct effect on own postpartum depression at Time 2. There was no direct relationship between postpartum depression at Time 1 and own parenting stress at Time 2.

Similarly, the conceptual model for fathers yielded a poor fit: $\chi^2 = 247.729$ $df = 26$ $p < 0.001$, CFI = 0.761, TLI = 0.586, RMSEA = 0.203, and SRMR = 0.162. Any non-significant statistically pathways were removed one after another, with the least significant pathway being removed at each step to refine the model. This process continued until all paths were significant. Deleting the non-significant statistically paths resulted in considerably improved fit statistics: $\chi^2 = 5.121$, $df = 6$, $p = 0.528$, CFI = 0.999, TLI = 0.999, RMSEA = 0.000, and SRMR = 0.021.

The final model for fathers (**Figure 2**) found Parenting Stress at Time 1, Anxiety at Time 1, and Partner Depression at Time 1 all serving as exogenous variables that were correlated with each other.

Both own trait anxiety levels and the depressive symptoms of the partner at Time 1 had a direct effect on own postpartum depression at Time 1 and indirect effect on own postpartum depression at Time 2. Both own trait anxiety levels and the depressive symptoms of the partner at Time 1 had an indirect effect on Parenting Stress at Time 2.

Finally, own parenting stress at Time 1 had a direct effect on parenting stress at Time 2 and indirect effect on postpartum depression at Time 2.

Table 3 show the estimates of indirect effects and 95% bias-corrected confidence interval (CI) for mothers and fathers models. All indirect pathways were significant in each model.

Our results thus suggest that both maternal and paternal postpartum depression were influenced directly and indirectly by a parent's own levels of anxiety and parenting stress as well as by the presence of depression in his/her partner. Although the two models are similar, they differ with respect to the role of parenting

TABLE 2 | Bivariate correlation between mothers' and fathers' parenting stress, anxiety, and depression scores at Time 1 and Time 2

	Mothers							
Fathers	**EPDS 3**	**STAI-S 3**	**STAI-T 3**	**STRESS 3**	**EPDS 6**	**STAI-S 6**	**STAI-T 6**	**STRESS 6**
EPDS 3	0.54**	0.33**	0.28**	0.33**	0.23**	0.28**	0.26**	0.22**
STAI-S 3	0.40**	0.47**	0.38**	0.52**	0.21**	0.30**	0.28**	0.29**
STAI-T 3	0.36**	0.41**	0.38**	0.49**	0.19**	0.24**	0.22**	0.19**
STRESS 3	0.38**	0.33**	0.29**	0.74**	0.30**	0.34**	0.34**	0.51**
EPDS 6	0.27**	0.07	0.08	0.21**	0.44**	0.39**	0.32**	0.34**
STAI-S 6	0.29**	0.18**	0.18**	0.25**	0.40**	0.53**	0.50**	0.41**
STAI-T 6	0.32**	0.11*	0.11*	0.29**	0.44**	0.50**	0.49**	0.46**
STRESS 6	0.21**	0.12*	0.10	0.35**	0.35**	0.45**	0.48**	0.60**

*EPDS3, Edinburgh Postnatal Depression scores at 3 months after the child's birth; STAI-S 3, State Anxiety Inventory scores at 3 months after the child's birth; STAI-T 3, Trait Anxiety Inventory scores at 3 months after the child's birth; STRESS 3, Parenting Stress Index Total Stress scores at 3 months after the child's birth; EPDS 6, Edinburgh Postnatal Depression scores at 6 months after the child's birth; STAI-S 6, State Anxiety Inventory scores at 6 months after the child's birth; STAI-T 6, Trait Anxiety Inventory scores at 6 months after the child's birth; STRESS 3, Parenting Stress Index Total Stress scores at 6 months after the child's birth. *$p < -0.05$; **$p < 0.01$*

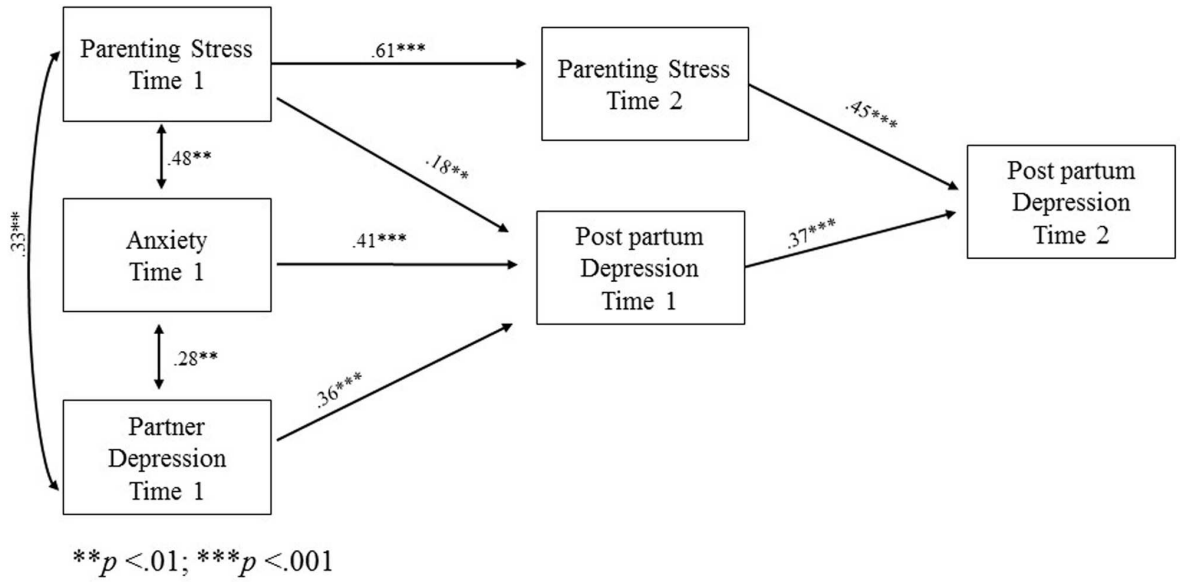

FIGURE 1 | Path model with statistically significant beta standardized coefficients for mothers.

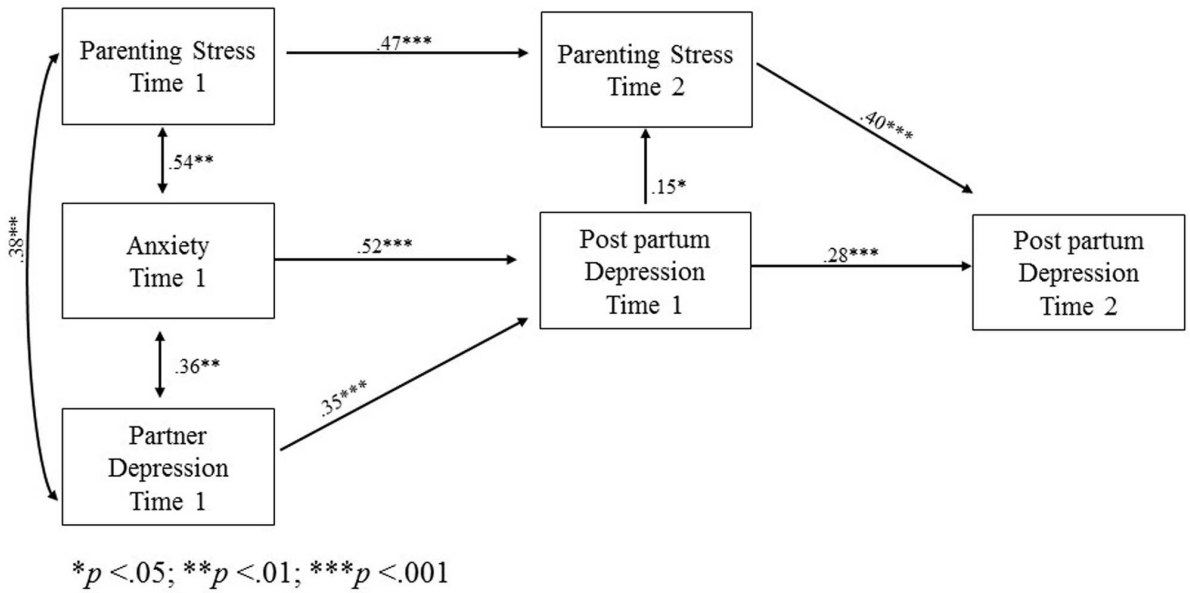

FIGURE 2 | Path model with statistically significant beta standardized coefficients for fathers.

stress. The latter was shown to have an effect on maternal postpartum depression at 3 months postpartum, whereas it only influences paternal postpartum depression 6 months after the child's birth.

DISCUSSION

This study provides an analysis of men's and women's emotional experiences connected to the transition to parenthood and their mental health in the first few months after the birth of their first child. In particular, our study had two main aims: to investigate the differences and relationships between fathers' and mothers' parenting stress, anxiety, and depression symptoms and to explore, through a path model, whether the persistence of postpartum depression could be linked to a parent's own parenting stress and anxiety levels and his/her partner's anxiety levels and depressive symptoms.

The predominant focus of postnatal research in both women and men has been on depression (Brustia et al., 2009; Yelland

et al., 2010). Nevertheless, there is growing evidence that anxiety is also present among first-time mothers (Reck et al., 2008; Rowe et al., 2008; Fisher et al., 2010; Matthey et al., 2013), and some data suggest the same is true for men (Matthey et al., 2000; Matthey et al., 2003). Parenting stress is also associated to PND (Gelfand et al., 1992; Cornish et al., 2006; Sidor et al., 2011). The strength of this study is its exploration of parenting stress, depressive and anxiety symptoms in first-time parental couples and their causal relationship across time.

With respect to the study's first aim, compared to the fathers, the mothers in our research had higher scores of depression and anxiety at three and 6 months postpartum. These results confirm the data from the literature, highlighting how women, compared to men, seem more vulnerable to emotional difficulties throughout the perinatal period (Matthey et al., 2000; Matthey et al., 2003; Figueiredo and Conde, 2011; O'Hara and Wisner, 2014). The mothers showed positive changes between three and 6 months postpartum, with decreased depression and anxiety, whereas in this same period, only the trait anxiety scores decreased in fathers. Both perinatal depressive and anxiety symptoms tend to decrease after birth; therefore, our results seem to confirm the findings of other studies (Figueiredo and Conde, 2011; Agrati et al., 2015).

Moreover, when looking at the PSI scores across time, the total stress score decreased for both parents between three and 6 months after birth. Differences emerged with respect to the subscales; specifically, the mothers showed a decrease in the parental distress subscale, whereas fathers showed a decrease in the parent–child dysfunctional interaction subscale. Such findings are in line with those of Seah and Morawska (2016), who analyzed the levels of parenting distress in both parents within the first 6 months of life. Such results may be due to the fact that, compared to fathers, mothers are more involved in caring for the baby straight away; this may represent a specific stressor that distinguishes mothers from fathers in the aftermath of birth.

TABLE 3 | Specific indirect effects and confidence intervals of the path models for mothers and fathers.

	Indirect effect	Bias-corrected 95% CI
Path for mothers		
PS T1 → PS T2 → PPD T2	0.28**	0.21–0.36
PS T1 → PPD T1→ PPD T2	0.07**	0.02–0.14
ANX T1→ PPD T1→ PPD T2	0.15**	0.09–0.22
PD T1→ PPD T1→ PPD T2	0.14**	0.07–0.21
Path for fathers		
PS T1 → PS T2 → PPD T2	0.19**	0.10–0.29
ANX T1→ PPD T1→ PPD T2	0.15**	0.06–0.23
PD T1→ PPD T1→ PPD T2	0.10**	0.04–0.17
ANX T1→ PPD T1→ PS T2→PPD T2	0.04*	0.01–0.07
PD T1→ PPD T1→ PS T2→ PPD T2	0.03*	0.00–0.06
ANX T1→ PPD T1→ PS T2	0.08*	0.02–0.13
PD T1→ PPD T1→ PS T2	0.05*	0.01–0.11
PD T1→ PPD T1→ PPD T2	0.12**	0.06–0.19

*Table values are standardized coefficients. T1, Time 1; T2, Time 2; PS, Parenting stress; PPD, Postpartum depression; ANX, Anxiety; PD, Partner depression. *Significant indirect effect for $p < 0.05$. **Significant indirect effect for $p < 0.01$.*

Our outcomes also showed that for both parents, the scores at 3 months postpartum were correlated to those at 6 months, which may suggest how maternal and paternal emotional experiences are connected and influence each other, as previously highlighted by several studies (Matthey et al., 2000, 2003; Baldoni et al., 2009; Paulson and Bazemore, 2010). These results may have important clinical implications for optimal PND prevention and care programs. Thus, accurate assessments of depression in both parents, not just mothers, should be developed and implemented to take into account the possible reciprocal influence on mood and symptomatology.

To summarize, in our research, and in line with previous studies (Kim and Swain, 2007; Paulson and Bazemore, 2010; Figueiredo and Conde, 2011; Don and Mickelson, 2012), compared to fathers, mothers have higher scores on all self-report measures of parenting stress, anxiety, and depression, and all measures decrease from the third to the sixth month after childbirth. In addition, the focus on the mothers and fathers of the same child, as measured through statistical methods for paired data, highlighted that rather than considering mothers and fathers independently, it is important to acknowledge the interplay of partners' psychological status within a parental couple in order to provide successful interventions.

With respect to the study's second aim, the findings indicate that the onset of depressive symptoms in both mothers and in fathers was influenced by their own levels of anxiety and parenting stress as well as by the presence of depression in their partners. With respect to anxiety, the literature shows that it is a relevant risk factor for PND in both first-time mothers (Robertson et al., 2004; Grant et al., 2008; Coelho et al., 2011) and first-time fathers (Ferketich and Mercer, 1995; Robertson et al., 2004; Wee et al., 2011). Our results are in line with previous studies finding that in the postpartum period, high levels of anxiety and stress are the strongest predictors of elevated depressive symptoms in men. Anxiety might also challenge parents' ability to initiate and maintain positive affective interactions with their children and partners. For this reason, our findings highlight the need to screen both mothers' and father' psychological status.

With regard to parenting stress, we embraced Abidin's (1995) definition, which states that parenting stress is the gap between the demands associated with the parenting role and the perceived availability of resources for dealing with those demands; therefore, total parenting stress is explained by both parent and child characteristics and situational variables. Feeling overwhelmed, feeling unconfident in the parenting role, and feeling unsatisfied with one's relationship with a difficult child can all be indicators of parenting stress. With the recent involvement of fathers in the daily care of their children, parenting stress may become a common experience for men, particularly if parenting constitutes a key feature in the development of their full sense of self (Pasley et al., 2002). Moreover, for fathers, increased societal expectations, demands, and responsibilities during the postpartum period create stressors (Kim and Swain, 2007).

In our study, parenting stress was shown to have an effect on maternal postpartum depression starting from the child's third month, whereas it influences paternal postpartum depression only 6 months after postpartum. We hypothesize that this result reflects how fathers' engagement with their infants becomes more active across time, as compared to mothers. This outcome shows the importance of following parents longitudinally and the necessity of considering the impact of fathers' psychological distress in the postnatal period when planning efficacious interventions. Interestingly, we also found that fathers' depression at 3 months had a direct impact on their level of parenting stress at 6 months, while this did not hold for mothers. Such a result further supports the importance of including both fathers and mothers in early assessments of depression in order to promote child and family well-being.

With respect to partner's depression, a lack of partner support has been found to strongly predict perinatal depression, both antenatally (Agostini et al., 2015) and postnatally (Milgrom et al., 2008). Conversely, closeness; a lack of a conflictual relationship; shared interests, concerns, and connection with others; partner encouragement to obtain help when needed; and partner agreement regarding infant care may be all considered as protective factors (Dennis and Ross, 2006). In sum, reliable and active support from one's partner may improve his/her psychological and relational satisfaction and gratification, thus enhancing parenting ability.

We must acknowledge some limitations of this study. First, based on previous empirical and clinical findings, we used an exploratory approach aimed at searching for the most parsimonious explanation of PND. Thus, it is possible that alternative models may provide a better explanation of the data. For instance, we did not include partner's stress in the model because we could find no studies specifically showing the effect of a partner's parenting stress on one's own depression. Nevertheless, we believe that such variable should be included in future studies. The literature has demonstrated the impact of low couple satisfaction on maternal depression, and it is likely that couple adjustment would be associated with parenting stress. Therefore, future research should continue to explore other unidirectional and bidirectional models. Second, because all measures in this study were based on self-reports, and some of them specifically referred to experiences from the last week, we may have captured some transient emotional states that do not necessarily refer to clinical conditions. Third, participation in the study was voluntary; therefore, the recruited sample may not be representative of the community population.

In future, it would be useful to extend the longitudinal perspective to delineate any possible differing trajectories of maternal and paternal mood. Indeed, we have no data related to pregnancy that could shed light on the onset of parental mental health (Ammaniti et al., 2006). However, future results from our wider longitudinal study will include assessments at both nine and 12 months, in addition to the evaluation of couple dyadic adjustment. These data will help us to better understand parental emotional states.

It is thus relevant to improve the early detection of mothers and fathers at risk for perinatal symptomatology in order to provide preventive and efficacious interventions. The link between parenting distress, PND, and anxiety in both parents may increase awareness in clinicians and perinatal staff regarding the relevance of promoting support for parenthood and healthy triadic relationships.

AUTHOR CONTRIBUTIONS

LV contributed to prepare the study design, to organize the recruitment of the sample, and to write all sections of the manuscript. LR contributed to organize the recruitment of the sample, and to write the manuscript's introduction, discussion, and references sections. FA contributed to organize the recruitment of the sample, and to write the introduction and discussion sections of the manuscript. CS contributed to prepare the study design, prepared data set, performed statistical analyses, prepared tables and figures, and contributed to write the method and results sections. VF, SM, and EN contributed to the recruitment of the sample and to data collection. LP contributed to organize the recruitment of the sample, and to write the manuscript's discussion section. FO, AT, and CP contributed to the recruitment of the sample and to data collection. PB contributed to prepare the study design and supervised the research team. LL contributed to prepare the study design, to organize the recruitment of the sample, supervised data collection and the research team. FM, ES, and RT contributed to prepare the study design and supervised the research team. All authors reviewed and approved manuscript for publication

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Mothers and Fathers with Binge Eating Disorder and Their 18–36 Months Old Children: A Longitudinal Study on Parent–Infant Interactions and Offspring's Emotional–Behavioral Profiles

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Maternal Binge Eating Disorder (BED) has been suggested to be associated with poor parent–infant interactions during feeding and with children's emotional and behavioral problems during infancy (Blissett and Haycraft, 2011). The role of fathers has received increasing consideration in recent years, yet the research has not focused on interactional patterns between fathers with BED and their children. The present study aimed to longitudinally investigate the influence of BED diagnosis, in one or both parents, on parent–infant feeding interactions and on children's emotional–behavioral functioning. 612 subjects (408 parents; 204 children), recruited in mental health services and pre-schools in Central Italy, were divided into four groups: Group 1 included families with both parents diagnosed with BED, Group 2 and 3 included families with one parent diagnosed with BED, Group 0 was a healthy control. The assessment took place at T1 (18 months of age of children) and T2 (36 months of age of children): feeding interactions were assessed through the Scale for the Assessment of Feeding Interactions (SVIA) while child emotional–behavioral functioning was evaluated with the Child Behavior Check-List (CBCL). When compared to healthy controls, the groups with one or both parents diagnosed with BED showed higher scores on the SVIA and on the CBCL internalizing and externalizing scales, indicating poorer adult–child feeding interactions and higher emotional–behavioral difficulties. A direct influence of parental psychiatric diagnosis on the quality of mother–infant and father–infant interactions was also found, both at T1 and T2. Moreover, dyadic feeding interactions mediated the influence of parental diagnosis on children's psychological functioning. The presence of BED diagnosis in one or both parents seems to influence the severity of maladaptive parent–infant exchanges during feeding and offspring's emotional–behavioral problems over time, consequently affecting different areas of children's psychological functioning. This is the first study to demonstrate the specific effects of maternal and paternal BED on infant development. These results could inform prevention and intervention programs in families with one or both parents diagnosed with BED.

Keywords: Binge Eating Disorder, parent–infant interactions, emotional–behavioral profiles, child-development, fathers

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INTRODUCTION

Binge Eating Disorder (BED) has recently been included in the DSM-5 classification system (American Psychiatric Association, 2013) and its lifetime prevalence has been estimated ∼2% in adults. Although several authors have addressed BED clinical manifestations, its correlated psychopathological symptoms, and possible treatment approaches, there is a dearth of longitudinal research on mothers and fathers with BED and on the possible weight of this disorder on their children's emotional–behavioral functioning in their first years of life (Cimino et al., 2015; de Barse et al., 2015). The Developmental Psychopathology theoretical framework considers psychopathology transmission from parents to children as mediated by individual and relational, genetic and environmental factors, and also emphasizes the role of the quality of parent–infant interactions in shaping offspring's mental health (Bifulco et al., 2002; Davies and Cicchetti, 2004). Moreover, seminal studies of (Bifulco et al., 2014a,b) have shown that not only parental psychiatric disorders, but also other adverse attachment experiences may lead children to atypical development (Schimmenti and Bifulco, 2015). Strober et al. (2000) have demonstrated that children of parents with Eating Disorders are liable to homotypical or heterotypical syndromes, whereas other authors have underlined the association between maternal Anorexia and Bulimia (Taborelli et al., 2015) and offspring's maladaptive psychological profiles. Though the role of maternal psychiatric disorders on offspring's psychological functioning has been widely assessed (Teti et al., 1995; Riahi et al., 2012; Paciello et al., 2013; Tambelli et al., 2015a,b) and, more recently, paternal psychopathological risk has been also considered as an adjunct problematic factor associated with children's internalizing and externalizing symptoms (Lamb, 2010; Cimino et al., 2013), only a few studies have focused on the observation of interactive patterns during feeding in families of children in their first 3 years of life where both parents were diagnosed for BED. The observation of children's interactions with ED diagnosed parents has shown exchanges characterized by asynchrony, scarce involvement, and a lack of sharing positive affective bonds (Beebe et al., 2012). It has been suggested that the quality of these interactions may vary over time (end especially during the first 3 years of life of the child), and can improve due to parents' adjustment to their offspring characteristics (e.g., child's difficult temperament), increased family and/or marital support, remission of psychopathological symptoms in the parents, or it can worsen (e.g., for adjunct risk factors, inefficacy of psychological or psychiatric interventions, etc.). Neurobiological studies have also suggested that early disruptions of the mother–infant relationship may have a negative impact on offspring's brain plasticity, with important implications for their psychopathology (Cirulli et al., 2003). Thus, it has been underlined that longitudinal studies are needed in this field and in samples with psychiatrically diagnosed parents to assess the stability and change both of the quality of parent–infant interactions and of their offspring's psychological internalizing and externalizing difficulties (Halligan et al., 2013).

Notwithstanding the above studies, to our knowledge the specific weight of the quality of interactive exchanges during feeding between parents with BED and their offspring in predicting children's psychopathology has not been specifically studied.

Based on the above premises, we recruited for a longitudinal study (Time 1: 18 months of age of the child; Time 2: 36 months of age of the child) a sample of families where both parents (Group 1), only the mother (Group 2), only the father (Group 3) were diagnosed for BED and a healthy control group (Group 0) aiming to:

(1) Assess mother–child's and father–child's interactions during feeding at T1 and T2, verifying possible significant differences between the four groups;
(2) Assess stability and change of internalizing and externalizing symptoms of the children at T1 and T2;
(3) Assess the possible role of the quality of parent–infant interactions during feeding in predicting offspring's internalizing and externalizing symptoms in Groups 1–3.

MATERIALS AND METHODS

Subjects and Procedure

The study involved 208 families ($N_{tot} = 416$) who attended, over a 1-year period, a network of public consultants in Central Italy for the assessment of BED in adults. We excluded families if the mother and the father were not personally handling personally the child's care and nutrition (for example delegating the child's feeding to grandparents because mothers and fathers are at work during the day; $N = 32$). In the remaining sample group ($N = 176$ mothers and $N = 176$ fathers), 162 mothers and 153 fathers were diagnosed with BED without comorbidity by psychiatrists from the various consultant offices, according to DSM-5 criteria (American Psychiatric Association, 2013). $N = 21$ parents received a different diagnosis ($N = 8$ anxiety disorder; $N = 6$ borderline personality disorder; $N = 7$ BED with a comorbid anxiety disorder) and were suggested to follow protocols that were not included in this study. $N = 16$ subjects were excluded from the study due to the following criteria: parents referred medical or psychiatric diagnosis of the child, parents and/or children were pursuing medication-based treatment, parents and/or children were pursuing psychiatric or psychological treatment. Three groups were composed on the basis of the presence of BED diagnosis in both parents (Group 1; parents: $N = 102$; offspring: $N = 51$), only in mothers (Group 2; parents: $N = 104$; offspring: $N = 52$), or only in fathers (Group 3; parents: $N = 100$; offspring: $N = 50$). This sample was paired with a healthy control (Group 0; parents: $N = 102$; offspring: $N = 51$), comparable for socio-demographic characteristics and randomly chosen among a wider sample recruited from collaborating primary schools in Central Italy. **Table 1** reports the characteristics of the participants. Each group was balanced with respect to the children's gender and age. Most of the children were first-born (85%), and all were natural children of

TABLE 1 | Characteristics of the subjects of the study at Time 1.

	Group 0	Group 1	Group 2	Goup 3
N	**51**	**51**	**52**	**50**
Children's gender	24 (47,1%) m	27 (52,9%) m	25 (48,1%) m	26 (52%) m
	27 (52,9%) f	24 (47,1 %) f	27 (51,9%) f	24 (48%) f
Children's age (months)	20.02 (2.86)	19.59 (2.40)	19.23 (2.30)	19.26 (2.28)
Mothers' age (years)	32.47 (2.75)	33.04 (3.77)	32.33 (2.98)	32.16 (3.05)
Fathers' age (years)	35.45 (4.75)	35.31 (5.07)	36.00 (4.36)	35.60 (4.81)

Group 0, control; Group 1, both parents diagnosed with BED; Group 2, mother diagnosed with BED; Group 3, father diagnosed with BED.

their parents. Ninety-one percent of children belonged to intact families.

The groups were evaluated with the tools described below at two time points with an inter-evaluation interval of ∼18 months. The first time point (T1) was when the children were 18 months old, and the second time point (T2) was when they were 36 months old. The clinical equipe was composed of six psychologists within the public health care system specifically trained in the use of the tools used in the study. The research described here was approved by the Ethical Committee of the Psychology Faculty at Sapienza, University of Rome, before the start of the study and in accordance with the Declaration of Helsinki. Written informed consent was obtained from each of the study participants.

Tools

Mother–infant and father–infant interactions during feeding were assessed through the Scale for the Assessment of Feeding Interactions (Scala di Valutazione Interazioni Alimentari – SVIA). The tool was administered separately for mother–child and father–child dyads during a main meal at their home. Moreover, parents completed the Child Behavior Checklist (CBCL 1½–5), described below, at T1, T2, and independently.

Scale for the Assessment of Feeding Interactions (SVIA)

The SVIA is the Italian adaptation of the Feeding Scale (Chatoor et al., 1997) that can be applied to children between the ages of 12–36 months old. It measures interactive behaviors and identifies normal and/or risky relational modes between a parent and child during feeding exchanges (Lucarelli et al., 2002). Parent–infant interactions during feeding are recorded for at least 20 min, and then a wide range of interactive mother–infant behaviors are coded and evaluated. The SVIA consists of 41 items distributed among four subscales: (1) Parent's affective states (index of the parent's affective states); (2) Interactive conflict (index of interactions characterized by conflictual, non-collaborative, and non-empathetic communication); (3) Food refusal behavior (habits associated with challenged status regulation during meals and with limited food consumption); and (4) Dyad's affective state (index of the extent to which the infant's feeding patterns are, or are not, the result of an interactive regulation to which both partners contribute). The scores, measured on 4-point a Likert Scale ranging from 0 to 3 (none, a little, quite a bit, a lot). Inter-evaluator agreement for SVIA items is generally good to excellent (Pearson r values, 0.7–1.0 for group of 182 normal infants and 0.9–1.0 for a group of 182 infants with nutritional disorders). And the instrument shows good reliability, in terms of internal consistency (Cronbach's α, 0.79–0.96).

Child Behavior Check-List

The CBCL is a questionnaire filled out by parents and caregivers with the purpose of assessing the child's abilities and his/her specific behavioral/emotional characteristics. The CBCL 1½–5 (Achenbach and Rescorla, 2001) is composed of 100 items that lead to two summary scales. The Internalizing Problems Scale consists of four syndrome subscales: Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn. The Externalizing Problems Scale is composed of two syndrome subscales: Attention Problems and Aggressive Behavior. The CBCL 1½–5 has high test–retest reliability and high internal consistency (Achenbach and Rescorla, 2001). The criterion-related validity of both versions of the CBCL is supported by the ability of the CBCL's quantitative scale scores to discriminate between demographically matched, referred, and non-referred children (Kim et al., 2012). In the present study, we used the Italian validated versions and the Italian cut-off values (Frigerio et al., 2006).

RESULTS

Data were analyzed using IBM SPSS statistics version 23 and LISREL 8.80 (Jöreskog and Sörbom, 2006). Both qualitative and quantitative analyses were performed on data obtained. The qualitative analyses were run using descriptive statistics (reliability of the measures, frequencies, mean scores and percentages). Mixed ANOVAs were conducted on data concerning the SVIA and the CBCL, considering the Group as the between-subjects factor (0 vs. 1 vs. 2 vs. 3) and Time as the within-subject factor (T1 vs. T2). Later, data were analyzed considering the presence/absence of maternal/paternal diagnosis of BED. In this case, Pearson's product-moment correlation analysis was used to test the relationship between parental BED diagnoses, quality of feeding interactions and the presence of internalizing or externalizing symptoms during T2. Finally,

Structural Equation Modeling (SEM) was used to test the causal assumptions made about the structural relations of the measures.

Preliminary Analysis

In the preliminary analysis Cronbach's alpha coefficient was used to assess the reliability of the instruments. A qualitative analysis was also run, using descriptive statistics (average scores, frequencies, and percentages).

Mother–Child and Father–Child Feeding Interactions

The Cronbach's alpha coefficient indicated excellent reliability for the SVIA subscales concerning both mother–child ($0.941 \leq \alpha \leq 0.959$) and father–child ($0.945 \leq \alpha \leq 0.963$) feeding interactions. **Tables 2** and **3** report average scores and standard deviations of the SVIA subscales concerning, respectively, mother–child and father–child exchanges.

Child's Internalizing and Externalizing Symptoms

The application of Cronbach's alpha coefficient to the CBCL items indicated excellent reliability of the instrument both during T1 ($\alpha = 0.938$) and T2 ($\alpha = 0.942$). **Table 4** reports average scores and standard deviations for the CBCL summary scales concerning Externalizing and Internalizing problems. **Table 5** reports the distribution of the four groups of subjects in the ranges (Normative, Border, Clinical) yielded by the scoring procedure of the CBCL with respect to the summary scales.

As it is possible to see from the table, with respect to Internalizing symptoms, during T1 Group 1 showed the highest scores. During T2, instead, the highest scores on internalizing

TABLE 2 | Average scores and standard deviations of the SVIA subscales applied during mother–child feeding interactions.

		Group 0	Group 1	Group 2	Group 3
		M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Mother's Affective state	T1	9.83 (4.52)	24.16 (2.01)	17.54 (5.83)	11.58 (4.05)
	T2	2.74 (1.14)	23.86 (2.55)	16.40 (3.65)	9.63 (3.02)
Interactive conflict	T1	7.97 (4.30)	22.14 (2.01)	16.60 (5.50)	10.76 (3.67)
	T2	2.44 (1.07)	21.24 (2.35)	15.24 (2.89)	10.43 (2.60)
Food refusal behavior	T1	5.24 (2.18)	13.02 (1.45)	9.68 (2.70)	5.94 (2.35)
	T2	1.47 (0.67)	12.14 (1.74)	9.03 (2.04)	5.39 (1.37)
Dyad's Affective state	T1	4.30 (2.64)	15.13 (1.62)	9.95 (3.52)	6.35 (2.40)
	T2	1.47 (0.75)	13.70 (1.83)	9.12 (2.09)	5.70 (1.39)

Group 0, control; Group 1, both parents diagnosed with BED; Group 2, mother diagnosed with BED; Group 3, father diagnosed with BED.

TABLE 3 | Average scores and standard deviations of the SVIA subscales applied during father–child feeding interactions.

		Group 0	Group 1	Group 2	Group 3
		M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Father's Affective state	T1	9.84 (4.43)	24.85 (2.93)	12.15 (4.45)	18.58 (5.85)
	T2	2.78 (1.09)	22.87 (2.55)	9.92 (2.64)	20.16 (2.06)
Interactive conflict	T1	7.96 (4.28)	22.19 (2.47)	11.34 (4.26)	17.04 (5.09)
	T2	2.45 (1.06)	20.21 (2.40)	11.13 (2.36)	18.08 (1.94)
Food refusal behavior	T1	5.26 (2.20)	12.86 (1.85)	6.29 (2.51)	10.09 (2.79)
	T2	1.51 (0.62)	12.35 (1.90)	5.53 (1.43)	10.92 (1.23)
Dyad's Affective state	T1	4.27 (2.60)	14.97 (1.75)	6.97 (2.40)	10.39 (3.48)
	T2	1.45 (0.70)	13.02 (1.80)	6.07 (1.37)	11.82 (1.05)

Group 0, control; Group 1, both parents diagnosed with BED; Group 2, mother diagnosed with BED; Group 3, father diagnosed with BED.

TABLE 4 | Average scores and standard deviations of the CBCL syndrome scales, the summary scales and of the CBCL total score.

		Group 0	Group 1	Group 2	Group 3
		M (SD)	*M (SD)*	*M (SD)*	*M (SD)*
Internalizing	T1	12.75 (9.82)	33.47 (5.18)	23.81 (6.97)	29.72 (10.54)
	T2	9.43 (4.00)	27.31 (6.83)	26.10 (6.85)	34.28 (5.29)
Externalizing	T1	8.45 (5.46)	22.20 (4.03)	12.19 (5.09)	19.40 (5.32)
	T2	5.47 (1.93)	22.61 (3.62)	15.98 (4.52)	21.74 (3.30)

Group 0, control; Group 1, both parents diagnosed with BED; Group 2, mother diagnosed with BED; Group 3, father diagnosed with BED.

TABLE 5 | Distribution of the subjects within the Normative, the Border, and the Clinical range with respect to the CBCL summary scales.

		Internalizing		Externalizing	
		T1	T2	T1	T2
		N (%)	*N* (%)	*N* (%)	*N* (%)
Group 0	Norm	40 (78,4%)	51 (100%)	51 (100%)	51 (100%)
N = 51	Border	1 (2%)	–	–	–
	Clinical	10 (19,6%)	–	–	–
Group 1	Norm	–	8 (15,7%)	38 (74,5%)	38 (74,5%)
N = 51	Border	5 (9,8%)	8 (15,7%)	13 (25,5%)	13 (25,5%)
	Clinical	46 (90,2%)	35 (68,6%)	–	–
Group 2	Norm	14 (26,9%)	6 (11,5%)	51 (98%)	50 (96,2%)
N = 52	Border	20 (38,5%)	23 (44,2%)	1 (2%)	2 (3,8%)
	Clinical	18 (34,6%)	23 (44,2%)	–	–
Group 3	Norm	10 (20%)	–	45 (90%)	43 (86%)
N = 50	Border	2 (4%)	3 (6%)	5 (10%)	7 (14%)
	Clinical	38 (76%)	47 (94%)	–	–

Group 0, control; Group 1, both parents diagnosed with BED; Group 2, mother diagnosed with BED; Group 3, father diagnosed with BED.

symptoms were the ones concerning Group 3 (the one with the father diagnosed with BED). When considering the change from T1 to T2, there was a slight decrease in Group 0, Group 1 and Group 2's Internalizing symptoms, whereas Group 3 showed an increase in those scores. Moreover, with respect to Externalizing symptoms, Group 1 (where both parents were diagnosed with BED) showed higher scores both during T1 and T2. When considering the change between the two periods, it was possible to see a decrease in Group 0's scores, while the groups characterized by one (Group 2 and 3) or both (Group 1) parents diagnosed with BED seemed to experience an increase in the perception of children's externalizing symptoms.

Mother–Child Feeding Interactions: Differences between Groups and Changes in Time

In order to investigate the presence of differences between the four groups in the quality of mother–child feeding interactions and the presence of changes in time of such interactions, a mixed ANOVA was conducted on the data collected, with Group as between-subjects factor (0 vs. 1 vs. 2 vs. 3) and Time as within-subject factor (T1 vs. T2), considering each SVIA subscale during mother–child feeding interactions as dependent variable.

Multivariate tests highlighted a significant effect played by Group (Wilks's Lambda = 0.087, $F_{12,521.51} = 66.08$, $p = 0.000$), Time (Wilks's Lambda = 0.737, $F_{4,197} = 17.58$, $p = 0.000$) and by the interaction between Group and Time (Wilks's Lambda = 0.620, $F_{12,521.51} = 8.62$, $p = 0.000$).

As far as it concerns the Group variable, univariate tests reported a statistically significant effect on all the SVIA subscales, i.e., on Maternal Affective State ($F_{3,200} = 438.63$, $p = 0.000$), on Interactive Conflict ($F_{3,200} = 431.42$, $p = 0.000$), on Food Refusal Behavior ($F_{3,200} = 391.31$, $p = 0.000$) and on Dyad's Affective State ($F_{3,200} = 457.79$, $p = 0.000$). More specifically, Bonferroni *post hoc* testing revealed significant lower scores ($p < 0.05$) for Group 0 on all the SVIA subscales with respect to the other groups, whereas it reported significant higher scores ($p < 0.05$) four Group 1. As expected, Group 2 (the one with the mother diagnosed with BED) reported higher scores in all the SVIA subscales with respect to Group 3 ($p < 0.05$). Globally, Group 1 seemed to experience more difficulties during mother–child feeding interactions, followed, respectively, by Group 2, Group 3 and Group 0.

In regard to the variable Time, univariate tests reported a significant influence played on Maternal Affective State ($F_{1,200} = 55.92$, $p = 0.000$), on Interactive Conflict ($F_{1,200} = 41.09$, $p = 0.000$), on Food Refusal Behavior ($F_{1,200} = 63.84$, $p = 0.000$) and on Dyad's Affective State ($F_{1,200} = 51.48$, $p = 0.000$). More specifically, Bonferroni *post hoc* testing revealed a significant decrease ($p < 0.05$) in all the SVIA subscales during the transition from T1 to T2. Thus, the passing of time seemed to contribute in reducing difficulties during mother–child feeding interactions.

Finally, with respect to the interaction between Group and Time, univariate tests reported a significant effect on all the SVIA subscales, thus influencing the Maternal Affective State ($F_{3,2} = 19.02$, $p = 0.000$), the presence of Interactive Conflict ($F_{3,2} = 13.93$, $p = 0.000$) or of Food Refusal Behaviors ($F_{3,2} = 17.88$, $p = 0.000$), and the Dyad's Affective State ($F_{3,2} = 6.12$, $p = 0.001$). More specifically, Bonferroni *post hoc* testing revealed specific changes for each group: Group 0 reported a significant decrease ($p < 0.05$) in all the SVIA subscales; Group 1 (both parents diagnosed with BED) reported a significant decrease ($p < 0.05$) in Food Refusal Behavior and Dyad's Affective State; Group 2 (mother diagnosed with BED) showed a significant decrease ($p < 0.05$) in Interactive Conflict and in Dyadic Affective State; finally, Group 3 (father diagnosed with BED) showed a significant decrease ($p < 0.05$) in Maternal Affective State.

As regards mother–child feeding interactions, all the groups seemed to experience a significant decrease in the score of at least one SVIA subscale. Significant increases were never observed.

Father–Child Feeding Interactions: Differences between Groups and Changes in Time

In order to investigate the presence of differences between the four groups in the quality of father–child feeding interactions and the presence of changes in time of such interactions, a mixed ANOVA was conducted on these data, with Group as between-subjects factor (0 vs. 1 vs. 2 vs. 3) and Time as within-subject factor (T1 vs. T2), considering each SVIA subscale during father–child feeding interactions as dependent variable.

Multivariate tests highlighted a significant effect played by Group (Wilks's Lambda = 0.078, $F_{12,521.51} = 70.27$, $p = 0.000$), by Time (Wilks's Lambda = 0.781, $F_{4,197} = 13.79$, $p = 0.000$) and by the interaction between Group and Time (Wilks's Lambda = 0.514, $F_{12,521.51} = 12.41$, $p = 0.000$).

In regard to the variable Group, univariate tests reported a statistically significant effect on all the SVIA subscales, i.e., on Father's Affective State ($F_{3,200} = 455.03$, $p = 0.000$), on Interactive Conflict ($F_{3,200} = 416.69$, $p = 0.000$), on Food Refusal Behavior ($F_{3,200} = 416.56$, $p = 0.000$) and on Dyad's Affective State ($F_{3,200} = 537.21$, $p = 0.000$). More specifically, Bonferroni *post hoc* testing revealed for Group 0 significant lower scores ($p < 0.05$) in all the SVIA subscales, with respect to the other groups, and reported for Group 1 significant higher scores ($p < 0.05$) on all the dimensions. With respect to Group 2 (mother diagnosed with BED), Group 3 (father diagnosed with BED) showed significant higher scores ($p < 0.05$) on all the SVIA subscales. In this sense, as expected, Group 0 was the one experiencing less difficulties during father–child feeding interactions, whereas such exchanges appeared more challenging in families where both parents or the father were diagnosed with BED.

In regard to the variable Time, univariate tests highlighted a statistically significant effect played on Father's Affective State ($F_{1,200} = 53.75$, $p = 0.000$), on the presence of Interactive Conflict ($F_{1,200} = 31.46$, $p = 0.000$) and of Food Refusal ($F_{1,200} = 35.70$, $p = 0.000$), and on Dyadic Affective State ($F_{1,200} = 28.61$, $p = 0.000$). More specifically, Bonferroni *post hoc* testing reported a significant decrease ($p < 0.05$) in all the SVIA subscales concerning father–child feeding interactions during the transition from T1 to T2.

Finally, with respect to the effect played by the interaction of Group and Time, univariate tests reported a statistically significant influence on Father's Affective State ($F_{3,200} = 28.60$, $p = 0.000$), Interactive Conflict ($F_{3,200} = 23.04$, $p = 0.000$), Food Refusal Behavior ($F_{3,200} = 30.27$, $p = 0.000$) and Dyad's Affective State ($F_{3,200} = 21.24$, $p = 0.001$). More specifically, Bonferroni *post hoc* testing revealed specific changes for each group: Group 0 (control) showed a significant decrease ($p < 0.05$) in all the SVIA subscales; Group 1 (both parents diagnosed with BED) showed a significant decrease ($p < 0.05$) in Father's Affective State, Interactive Conflict and Dyadic Affective State; Group 2 exhibited a significant decrease ($p < 0.05$) in Father's Affective State, Food Refusal and Dyadic Affective State; finally, for Group 3, a statistically significant increase ($p < 0.05$) was reported for Father's Affective State, Food Refusal and Dyadic Affective State.

Child's Externalizing and Internalizing Symptoms: Differences between Groups and Changes in Time

In order to investigate the presence of differences between the four groups with respect to child's symptoms and the presence of changes in time of such symptoms, mixed ANOVAs were conducted on these data, with Group as between-subjects factor (o vs. 1 vs. 2 vs. 3) and Time as within-subject factor (T1 vs. T2), considering the CBCL scores relative to the Externalizing and Internalizing symptomatology as dependent variables.

Multivariate tests reported a statistically significant effect played by Group (Wilks's Lambda = 0.160, $F_{6,398} = 99.71$, $p = 0.000$), Time (Wilks's Lambda = 0.944, $F_{2,199} = 5.92$, $p = 0.000$) and by the interaction between Group and Time (Wilks's Lambda = 0.725, $F_{6,398} = 11.57$, $p = 0.000$) on the summary scales.

In regard to the Group variable, univariate tests reported a statistically significant effect both on Internalizing ($F_{3,200} = 166.57$, $p = 0.000$) and Externalizing Symptoms ($F_{3,200} = 248.08$, $p = 0.000$).

Bonferroni *post hoc* testing highlighted for Group 0 (control) significantly lower scores both on the Internalizing and the Externalizing CBCL summary scales, when compared to the other groups. In regards to Internalizing Symptoms, no differences between Group 1 and Group 3 were found; in other words, children in the group where only the father was diagnosed with BED seemed to experience the same internalizing difficulties as shown by children whose both parents have been diagnosed with BED.

Regarding Externalizing Symptoms, Group 1 reported the highest scores ($p < 0.05$), followed by Group 3 ($p < 0.05$) and by Group 2 ($p < 0.05$). In this sense, children whose parents or whose father were diagnosed with BED seemed to exhibit a higher degree of externalizing difficulties.

In regards to the effect of the variable Time, univariate tests reported a significant influence only regarding Externalizing Symptoms ($F_{1,200} = 80.77$, $p = 0.030$). More specifically, Bonferroni *post hoc* testing revealed a significant increase of externalizing symptomatology ($p < 0.05$) during the transition from T1 to T2.

Finally, with respect to the interaction between Group and Time, univariate tests reported a statistically significant effect both on Internalizing ($F_{3,200} = 12.44$, $p = 0.000$) and Externalizing Symptoms ($F_{3,200} = 12.93$, $p = 0.000$).

More specifically, in regard to Internalizing Symptoms, Bonferroni *post hoc* testing revealed a significant decrease ($p < 0.05$) for Group 0 and Group 1, the absence of changes in Group 2 ($p > 0.05$) and a significant increase ($p < 0.05$) in the scores of Group 3. Regarding Externalizing

Symptoms, Bonferroni *post hoc* testing reported a significant decrease ($p < 0.05$) in the scores of Group 0 and the absence of change in Group 1 ($p > 0.05$), whereas significant increases in externalizing scores were highlighted both for Group 2 and Group 3. In this sense, it appears that children with only one parent diagnosed with BED were more likely to display an increase in externalizing difficulties during the passing of time, while children of unselected populations or with both parents diagnosed with BED, instead, respectively, showed a decrease or stable level of externalizing symptoms.

Model Assessment

The Pearson's product-moment correlation coefficient was applied to maternal/paternal diagnosis (considered as present or absent), to the SVIA subscales during T1 and T2 and to the Internalizing and the Externalizing CBCL summary scales at T2 in order to test for associations between the presence of BED diagnosis in one of the parents, quality of feeding interactions and the intensity of internalizing and externalizing symptoms. **Table 6** reports the correlation matrix. Parental diagnosis of BED was correlated with all the measures considered. All the correlations were positive, indicating a direct association between the presence of diagnosis in one parent and the intensity of difficulties experienced during feeding interactions and regarding the children's socio-emotional adjustment.

Given the presence of such associations a path analysis model was created in order to investigate the role played by feeding interactions (both with the mother and with the father) as mediators on the effect of parental diagnosis on the child's socio-emotional adjustment. The model was tested using LISREL 8.80 (Jöreskog and Sörbom, 2006), which introduces the possibility to consider complex sets of relationships in a simultaneous fashion. The procedure provides path coefficients as part of the model results, i.e., parameter estimates of the relative effect of one variable on another. Standardized regression weights β indicate the strength of the linear relation and imply a direct relation between changes in the connected variables. Moreover, to assess the overall fit of the data to the model, the LISREL procedure also provides chi-square values, goodness-of-fit indices and squared multiple correlations. The chi-square assessment of fit refers to the possibility for a hypothesized model to adequately fit the data. Goodness-of-fit indices range from 0 to 1 with values close to 1 indicating good fit. Squared multiple correlations are indications of the amount of variability accounted for by the given equation.

The chi-square value for the entire model was 270.45 (df = 96, $p = 0.01$) which was an acceptable result (Schermelleh-Engel et al., 2003). Regarding the goodness-of-fit indices, the Non-normed Fit index (NNFI) and the Comparative Fit Index (CFI) were 0.97 and 0.99, respectively. The high level of both indices indicated good fit of the model to the actual data. The value for the Root Mean Square Error of Approximation (RMSEA) instead was higher than expected (RMSEA = 0.095). Usually, in fact, criteria in the range [0.01–0.8] have been proposed to indicate an excellent to acceptable fits (Schermelleh-Engel et al., 2003). Other authors have suggested the value 0.1 as

TABLE 6 | Correlations between parental diagnosis, feeding interactions, and child's internalizing/externalizing symptoms.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Mother diagnosed with BED	–																			
2. Father diagnosed with BED	0.000	–																		
3. Maternal affective state (T1)	0.716**	0.298**	–																	
4. Interactive conflict (T1)	0.736**	0.308**	0.948**	–																
5. Ch. Food refusal (T1)	0.744**	0.263**	0.936**	0.928**	–															
6. Dyadic affective state (T1)	0.739**	0.373**	0.956**	0.952**	0.938**	–														
7. Father's affective state (T1)	0.290**	0.728**	0.525**	0.522**	0.480**	0.566**	–													
8. Interactive conflict (T1)	0.313**	0.733**	0.537**	0.545**	0.489**	0.572**	0.937**	–												
9. Ch. Food refusal (T1)	0.247**	0.745**	0.489**	0.474**	0.452**	0.519**	0.932**	0.923**	–											
10. Dyadic affective state (T1)	0.380**	0.741**	0.572**	0.575**	0.536**	0.626**	0.943**	0.933**	0.923**	–										
11. Maternal affective state (T2)	0.840**	0.432**	0.744**	0.770**	0.764**	0.794**	0.564**	0.576**	0.536**	0.642**	–									
12. Interactive conflict (T2)	0.814**	0.481**	0.732**	0.756**	0.749**	0.790**	0.566**	0.593**	0.540**	0.651**	0.960**	–								
13. Ch. Food refusal (T2)	0.837**	0.411**	0.736**	0.753**	0.749**	0.779**	0.553**	0.575**	0.529**	0.631**	0.943**	0.944**	–							
14. Dyadic affective state (T2)	0.822**	0.463**	0.758**	0.774**	0.771**	0.812**	0.596**	0.601**	0.557**	0.671**	0.948**	0.940**	0.948**	–						
15. Father's affective state (T2)	0.297**	0.910**	0.462**	0.494**	0.453**	0.544**	0.754**	0.779**	0.765**	0.788**	0.642**	0.700**	0.637**	0.667**	–					
16. Interactive conflict (T2)	0.377**	0.854**	0.480**	0.517**	0.461**	0.561**	0.736**	0.761**	0.741**	0.782**	0.681**	0.733**	0.684**	0.715**	0.956**	–				
17. Ch. Food refusal (T2)	0.302**	0.894**	0.462**	0.493**	0.451**	0.539**	0.748**	0.768**	0.758**	0.788**	0.646**	0.698**	0.634**	0.679**	0.955**	0.955**	–			
18. Dyadic affective state (T2)	0.304**	0.897**	0.457**	0.486**	0.437**	0.536**	0.739**	0.761**	0.749**	0.776**	0.638**	0.700**	0.640**	0.661**	0.963**	0.947**	0.956**	–		
19. Internalizing symptoms (T2)	0.230**	0.598**	0.266**	0.308**	0.232**	0.312**	0.431**	0.480**	0.466**	0.490**	0.474**	0.535**	0.484**	0.468**	0.689**	0.716**	0.710**	0.728**	–	
20. Externalizing symptoms (T2)	0.375**	0.746**	0.457**	0.464**	0.417**	0.495**	0.613**	0.641**	0.627**	0.648**	0.646**	0.688**	0.652**	0.653**	0.822**	0.850**	0.828**	0.843**	0.776**	–

***Correlation is significant at the 0.01 level (2-tailed).*

the higher cut-off to employ a certain model (Browne and Cudeck, 1992). Moreover, recent literature criticized the use of fixed cut-off points in RMSEA test statistics on the basis of their lack of empirical support (Chen et al., 2008). Given these reasons, and also considering the acceptability of the other indices, the model was judged globally adequate to fit the data. **Figure 1** gives the statistically significant standardized structural parameter estimates for the model, suggesting the direct and indirect effects of maternal and paternal diagnosis of BED on the child's internalizing and externalizing symptoms. As it is possible to see, having a parent (either the mother or the father) diagnosed with BED significantly affected feeding interactions, with both parents during the two periods considered ($p < 0.05$). This influence was direct, and it involved all the SVIA variables both during T1 and T2. Moreover, the model confirmed the presence of an indirect effect played by the parental diagnosis of BED on child socio-emotional adjustment. During mother–child feeding interactions this indirect effect seemed to act through the Mother's affective state, both during T1 and T2; more specifically, the Mother's affective state during T1 ($\beta = 0.46$, $p < 0.05$) and during T2 ($\beta = 0.18$, $p < 0.05$) played a statistically significant effect on Externalizing symptoms, whereas the child's Food refusal behaviors during T1 mediated the effect played by parental diagnosis on Internalizing symptoms ($\beta = -0.30$, $p < 0.05$). On the other hand, during father–child interactions, the effect of parental diagnosis on Externalizing symptoms was mediated by the Interactive conflict during T2 ($\beta = 0.47$, $p < 0.05$) and the Dyad's affective state during T2 ($\beta = 0.43$, $p < 0.05$). Finally, the Dyad's affective state during T2 also acted as a mediator on the effect of BED diagnosis on Internalizing symptoms ($\beta = 0.55$, $p < 0.05$).

Given the numerous variables, in order to achieve a clearer view of the mediated effects of parental diagnosis, a **Figure 2** was inserted containing only the significant indirect paths linking maternal/paternal diagnosis to the child's Internalizing/Externalizing symptoms. As it is possible to see, the most important mediator during mother–child interactions was Maternal affective state, which was significant both during T1 and T2, whereas for father–child interactions the indirect effect

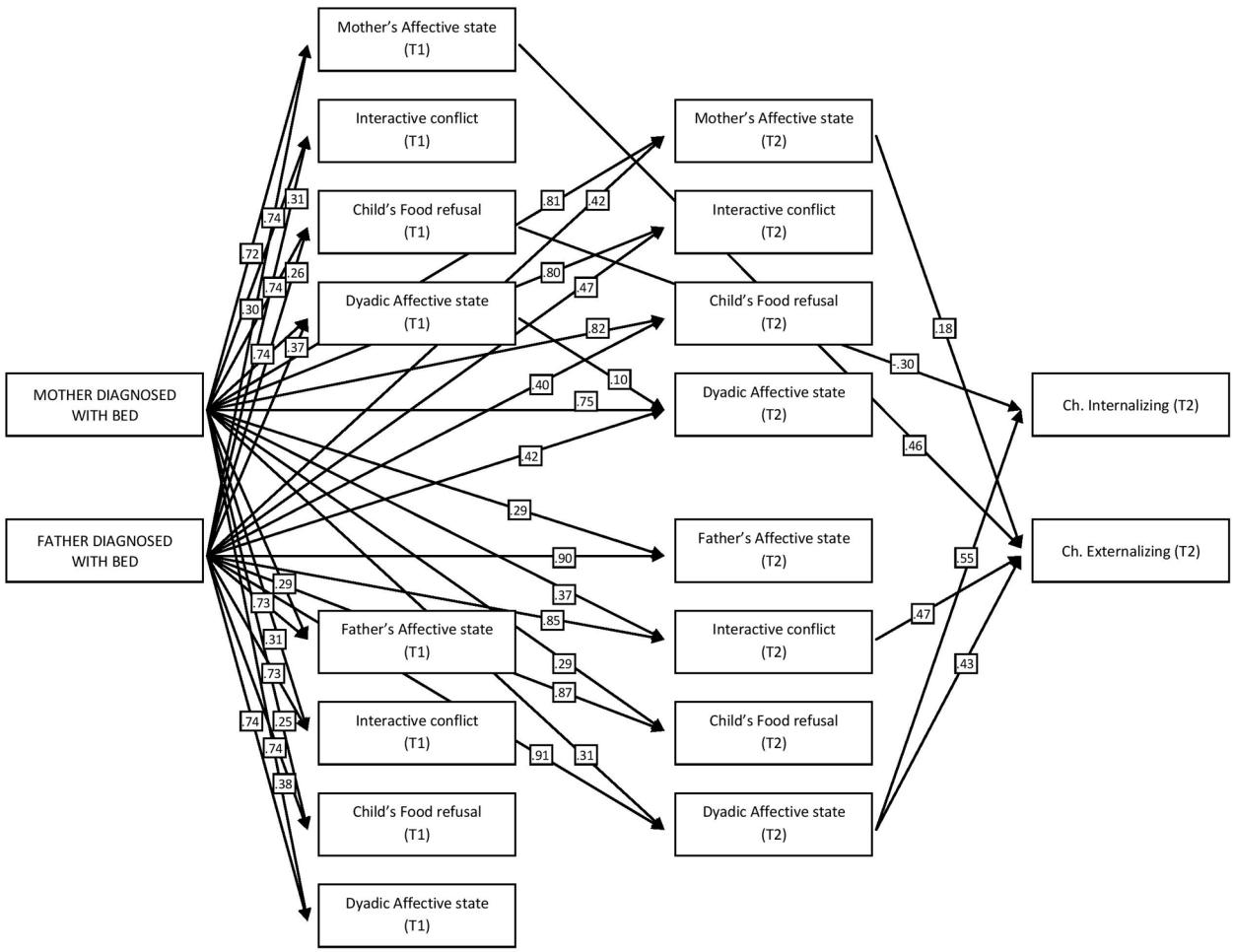

FIGURE 1 | Path model significant parameter estimates for the effects of parental diagnosis on feeding interactions and on the child's internalizing and externalizing symptoms (significant $p < 0.05$).

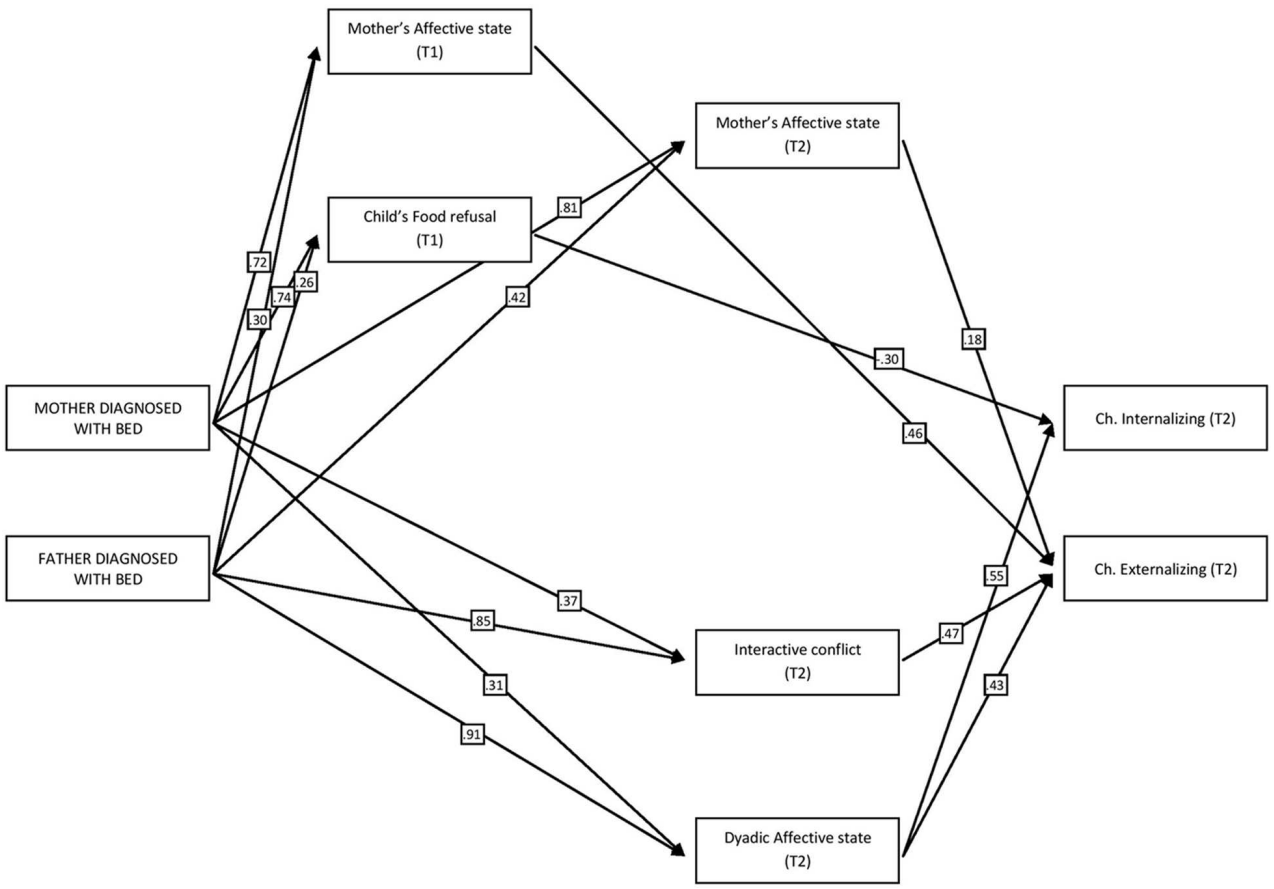

FIGURE 2 | Significant indirect paths linking parental diagnosis to the child's internalizing/externalizing symptoms (Significant $p < 0.05$).

of parental diagnosis seemed to begin later in time (T2) and was mainly conveyed through more interactive variables, such as Interactive conflicts and the Dyad's affective state. Furthermore, the indirect effect of paternal diagnosis was higher both for Internalizing ($\beta = 0.64$, $p < 0.05$) and Externalizing symptoms ($\beta = 0.73$, $p < 0.05$) with respect to the effect of maternal diagnosis ($\beta = 0.24$, $p < 0.05$ for internalizing symptoms and $\beta = 0.38$, $p < 0.05$ for externalizing symptoms).

DISCUSSION

The main aim of this paper was to assess whether the quality of interactive exchanges during feeding between parents with BED and their children might affect the expression of offspring's internalizing and externalizing symptoms. Through an observation procedure (SVIA), we longitudinally studied mother–infant and father–infant interactions during feeding at 18 (T1) and 36 months of the child (T2) verifying possible significant differences in four groups: Group 0 consisted of healthy controls; Group 1 included both parents diagnosed with BED, Group 2 had mothers diagnosed with BED, Group 3 contained fathers diagnosed with BED.

Overall, Group 1 showed significantly higher scores than all others at SVIA. Our data indicate that, in this group, both mothers and fathers presented more maladaptive relational exchanges with their offspring during feeding, as compared to other groups. This result indicates that the moment of feeding for parents with BED and their children is particularly challenging, and the dyads (both mother–child and father–child) are characterized by unattuned interactions, lack of parental sensitivity, and a general negative emotional climate. Previous literature in the field had demonstrated that mothers with eating disorders and their children show problematic interactions during feeding (Stein et al., 2013). Yet, this study adds to previous studies because it addresses the specific effects of BED in parents and the characteristics of father–infant exchanges. Moreover, it does so using an observational measure, whereas self-report or report-form questionnaires filled-out by parents have largely been used in previous studies (Cerniglia et al., 2014a). It is noteworthy that group 1 scores at SVIA remained significantly higher than those of other groups at the second assessment point (T2), indicating that, consistent with Fassino et al.'s (2009) studies in a sample without treatment, their risk of relational difficulties do not spontaneously reduce over time.

The groups where only one parent were diagnosed for BED (Group 2 and Group 3) showed more maladaptive scores at SVIA than the control group. This result suggests that, while the presence of both parents with BED is highly associated with the development of problematic mother–child and father–child exchanges during feeding, the families where only one parent was diagnosed were still at significantly higher risk of being characterized by difficulties in undertaking fluent feeding routines with their offspring.

Though, as stated above, maladaptive interactions remain higher over time whereas group 0, 2, and 3, maternal SVIA scores decrease in all groups from T1 (18 months of the child) to T2 (36 months of the child). That is to say that while families with both parents diagnosed with BED maintain the highest risk of having problematic interactions with their children, these difficulties decrease in mother–infant dyads if the whole sample is considered. The dyads with fathers with BED (group 3) do not show reduced maladaptive relational patterns at T2.

Further studies, which must also consider attachment experiences as possible predictors of adaptive or maladaptive development in children, are needed to clarify this point, but we make the hypothesis that there may be a reciprocal adjustment operated by the child to the mother's psychopathology and relational difficulties (which impact on the quality of interactional patterns during feeding; Cimino et al., 2016) and by the mothers to possible individual problematic characteristics of the child, such as, for example, difficult temperament or specific sensory aversion to some foods (Romano et al., 2015). These two adaptation processes are probably reinforced by the improved individual capacities of the child of eating without being fed by the mother (at T2; 36 months of age of the child), which may reduce her emotional overload. These processes seem not to occur in families where only the fathers were diagnosed with BED (Group 3). It is possible that as emotional pressures reduce for mothers, this is experienced as increasingly burdensome for fathers, during this period of child development that appears to be associated with a general increase in paternal involvement in offspring feeding (Lamb and Lewis, 2013).

After assessing parent–infant interactions during feeding, we studied the presence and the stability or change of internalizing and externalizing symptoms of the children at T1 and T2 in the four groups.

We found that children in group 1 (both parents with BED) showed significantly higher internalizing and externalizing symptoms, when compared to offspring in other groups and group 0 showed significantly lower scores than all others both at T1 and T2. Over time, externalizing problems significantly increased in children belonging to groups where only the mother or only the father had BED. Offspring of fathers with BED showed increased internalizing symptoms from T1 to T2. Although other studies have widely demonstrated that internalizing or externalizing problems in children of psychiatrically diagnosed parents tend to increase over time, in the absence of any treatment (Shanahan et al., 2014), this is the first research to report detailed results, specifically for children of fathers and mothers with BED. While the presence of both parents with BED diagnosis was a factor associated with more maladaptive feeding interactions, this "double risk" seems not to affect the severity of children's internalizing or externalizing symptoms.

Our further aim was to assess the possible role of the quality of parent–infant interactions during feeding in predicting offspring's internalizing and externalizing symptoms in Groups 1–3.

Consistent with the Development Psychopathology theoretical framework (Davies and Cicchetti, 2004), according to which the transmission of psychopathological risk is regulated from parents to children both by individual and interactional factors, we created a predictive model aimed at assessing the specific role of the quality of feeding interactions as mediators of the effects of parental BED diagnosis on their offspring's internalizing and externalizing symptoms. Our model confirmed a direct influence of parental psychiatric diagnosis on the quality of mother–infant and father–infant interactions, both at T1 and T2. Moreover, our results confirmed that dyadic feeding interactions mediate the influence of parental diagnosis on children's psychological functioning.

It is noteworthy that our data show different subscales of SVIA (that is different dimensions composing the general quality of parent–child feeding interactions) to mediate the effect of parental diagnoses. Maternal Affective State mediates the effect of mothers' diagnosis on children's externalizing problems (both at T1 and T2), whereas child's Food Refusal Behavior mediates the influence of mothers' BED on their offspring's internalizing symptoms. In the case of fathers, however, the mediating effect of the quality of feeding interactions is specifically expressed in the characteristics of Dyadic Affective State and Interactive Conflict at T2. These results indicate that while the direct weight of parental diagnosis is strong in predicting maladaptive outcomes in children, the quality of interactions during routine activities, which include affective and behavioral exchanges is crucial in shaping specific psychological profiles in children (i.e., the expression of internalizing or externalizing symptoms) and their development over time. Moreover, our results suggest that the quality of interactions with their fathers during feeding assumes a mediating role only at 36 months of age of the children. This is consistent with Trautmann-Villalba et al.'s (2006) studies, which demonstrated how the quality of mother–child interactions in the first months of life is an essential predictor of offspring's adaptive or problematic psychological functioning, whereas the characteristics of father–child exchanges appear to influence offspring functioning (Cerniglia et al., 2014b).

This study has some limitations. First, we used report-form questionnaire to assess internalizing and externalizing children's symptoms. Observational and/or more objective measures are needed to minimize the risk of distortions in parents' perception of their offspring's psychological functioning. Second, we did not evaluate the severity of parental psychopathology, which could influence the severity and form of children's symptoms. Third, the homogeneity of the sample, in terms of cultural, geographical, and socio-economic status, limits replication of the study in other countries or cultures. Finally, statistical controls were not applied for potential confounders such as child abuse or neglect.

Notwithstanding the above limitations, the present study adds to the previous literature in several ways.

This is the first study, to our knowledge, to recruit families where both parents showed the same psychiatric diagnosis (and specifically the BED diagnosis, which has only recently been included in DSM-5), giving detailed results on how maternal and paternal diagnoses (or the conjunct risk of the presence of both parents' diagnoses) differently influence their offspring's internalizing and externalizing symptoms.

Further, the quality of parent–child interactions was assessed through an observational method, administered by mental health clinicians specifically trained in the use of the measure and for the aims of this study. Lastly, this was a longitudinal study, which investigated both continuity and change in variables across two assessment points (18 and 36 months of age) for families with parents with BED, thereby representing an important development in the field.

AUTHOR CONTRIBUTIONS

SC prepared the study design and supervised the research team; LC wrote the introduction section of the manuscript and recruited the sample; AP prepared data set, performed statistical analyses and prepared tables and figures; AS wrote the discussions section of the manuscript; LR performed path analyses and supervised statistical analyses; GB recruited the sample and wrote the references. All authors reviewed the manuscript.

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Attachment Representations and Early Interactions in Drug Addicted Mothers: A Case Study of Four Women with Distinct Adult Attachment Interview Classifications

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Drug addiction is considered a major risk factor that can influence maternal functioning at multiple levels, leading to less optimal parental qualities and less positive interactive exchanges in mother-child dyads. Moreover, drug abusers often report negative or traumatic attachment representations regarding their own childhood. These representations might affect, to some extent, later relational and developmental outcomes of their children. This study explored whether the development of dyadic interactions in addicted women differed based on attachment status. The longitudinal ongoing of mother-child emotional exchanges was assessed among four mothers with four different attachment statuses (F-autonomous, E-preoccupied, Ds-dismissing, and U-unresolved/with losses). Attachment representations were assessed using the Adult Attachment Interview (George et al., 1985), while mother-child interactions were evaluated longitudinally during videotaped play sessions, through the Emotional Availability Scales (Biringen, 2008). As expected, the dyad with the autonomous mother showed better interactive functioning during play despite the condition of drug-abuse; the mother proved to be more affectively positive, sensitive, and responsive, while her baby showed a better organization of affects and behaviors. On the other side, insecure mothers seemed to experience more difficulties when interacting with their children showing inconsistency in the ability to perceive and respond to their babies' signals. Finally, children of insecure mothers showed less clear affects and signals. While differences between secure and insecure dyads appeared clear, differences between insecure patterns where less linear, suggesting a possible mediating role played by other factors. Clinical implications and suggestions for future research are discussed.

Keywords: parenting, attachment representations, mother-child interactions, drug addiction, child development

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INTRODUCTION

The Complex System of Parenting

Parenting could be defined as a complex function, determined by multiple aspects, which has to do with the ability to take care of someone else, to provide them nurturance and to interpret correctly their needs and accept their subjectivity under different conditions (Belsky, 1984; Fava Vizziello, 2003; Simonelli, 2009, 2014). This ability is influenced both by past experiences (through mental

representations and expectations built during childhood) and by actual experiences with the baby (lived in everyday interactions).

From an attachment perspective, parenting could be conceptualized as an organized behavioral system, goal corrected and maintained through internal working models (Bowlby, 1988; Solomon and George, 1996). Part of these processing systems are based on the individuals' evaluation of their childhood experiences which are thought to be organized in "states of mind" relatively stable with respect to attachment (Main et al., 1985). These representations regulate affects in a predictable manner and determine the adults' sensitivity and responsiveness to infant signals, shaping the quality of adult-child attachment (Kaplan, 1984; Main et al., 1985; Bretherton et al., 1990; Solomon et al., 1995; Van Ijzendoorn, 1995; George and Solomon, 1996). It has been shown that sensitive parents are more likely to have children with secure attachments while non-sensitive or non-responsive parents are more likely to have children insecurely attached to them (Ainsworth et al., 1978; Smith and Pederson, 1988; Isabella and Belsky, 1991; Isabella, 1993; Van Ijzendoorn et al., 1995).

The link between adult attachment representations, parental sensitivity and attachment security resulted moderate anyway, suggesting a "gap" in the intergenerational transmission of attachment and the consequent need to take into account other relational features in order to better understand parental functioning and the nature of early adult-child relationships (Van Ijzendoorn, 1995; van Ijzendoorn and Bakermans-Kranenburg, 1999; Biringen et al., 2014; Porreca et al., 2015).

As an expansion upon the original conceptualization of the parent-child attachment relationship, emotional availability appears a particularly useful concept in this sense (Biringen and Robinson, 1991; Biringen et al., 1994; Saunders et al., 2015); in fact, it recalls in part sensitivity as referred to by attachment theorists but at the same time adopts a wider perspective, emphasizing the "emotional features" of adult child-interactions, intended both as the ability of the parent to adequately signal and to correctly perceive infant emotional bids (Biringen et al., 2000, 2014; Biringen and Easterbrooks, 2012). Beyond sensitivity, emotional availability focuses on other aspects of adult behaviors (structuring, non-intrusiveness and non-hostility) and gives equal importance to the child's contribution, considering his/her ability to respond to the parent and to appropriately involve him/her during interactions (Biringen and Easterbrooks, 2012). Each of these aspects is read in a dyadic way, keeping in mind contextual aspects.

Drug Addiction and Parenting

Drug addiction and substance abuse constitute severe risk factors for maternal functioning and for the child's psychological and physical health (Klee et al., 2002; Barnard and McKeganey, 2004; Berlin et al., 2008). The prolonged use of substances during pregnancy and the often associated avoid of the required medical screenings increase the risk for prematurity and reduced growth measures at delivery (Di Cagno et al., 1985; Zuckerman et al., 1989; Zuckerman and Bresnahan, 1991; Mayes et al., 1992; Malagoli Togliatti and Mazzoni, 1993; Hunter and Powis, 1996; Fava Vizziello et al., 1997; Bona and Zaffaroni, 2003).

Once babies are born these women appear less sensitive, responsive and more likely to show negative affectivity during interactions (Wellisch and Steinberg, 1980; Bauman and Dougherty, 1983; Fitzgerald et al., 1990; Burns et al., 1991, 1997; Rodning et al., 1991; Kelleher et al., 1994; Mayes et al., 1995; Chaffin et al., 1996; Ball et al., 1997; Swanson et al., 2000; Pajulo et al., 2001; Ukeje et al., 2001; Fraser et al., 2010; Salo et al., 2010; Eiden et al., 2011). Moreover, they appear less guiding and structuring (Blackwell et al., 1999; Pajulo et al., 2001; Salo et al., 2010), highly intrusive and intensely hostile (Rodning et al., 1991; Swanson et al., 2000; Johnson et al., 2002; Salo et al., 2009, 2010), showing, thus, difficulties in the main domains of adult emotional availability (Flykt et al., 2012). On the "younger" side, children of addicted mothers often show higher levels of irritability and difficulties in arousal regulation, which might compromise responsiveness to and involvement of the adult (Jeremy and Hans, 1985; Jacobson et al., 1996; Karmel et al., 1996; Mayes et al., 1996).

Considering "addicted parenting" from a transactional perspective (Sameroff and Fiese, 2000) it is possible to hypothesize that the child's difficulties might be exacerbated by a reduced capacity of the mother to function adequately as an interactive partner and as an external emotion regulator (Fogel, 1993; Lester and Tronick, 1994). This would lead to a subtle alteration of emotional processes and of the organization of mother-child interactions (Tronick et al., 2005). On the other hand, problems in emotion regulation might in turn interfere with the adult's ability to provide adequate caretaking.

Finally, a specific issue concerns the role of representational aspects on adult behaviors; it could be argued, in fact, that dysfunctional parenting practices might constitute a re-enactment of past life experiences. This hypothesis seems supported by the fact that these women often report histories of infantile trauma and abuse and frequently show high percentages of insecure or unresolved attachment representations (Simonelli and Vizziello, 2002; Caspers et al., 2006; Bakermans-Kranenburg and van Ijzendoorn, 2009; Stocco et al., 2012; Cassibba et al., 2013).

Aim and Hypothesis

The aim of this study was to monitor longitudinally parental abilities in four addicted women who presented four distinct patterns of adult attachment representations. More specifically, we aimed to investigate whether the development of dyadic patterns of interaction with their children varied on the basis of maternal attachment representations. The longitudinal perspective was included in order to focus more specifically on the processes underlining parental functioning and the organization of adult-child interactions. According to extant literature we hypothesized that:

(a) secure attachment representations in the mother would be associated with higher maternal sensitivity while insecure and unresolved attachment representations would be associated with lower maternal sensitivity.
(b) secure attachment representations in the mother would lead to better and more stable emotional exchanges, while mothers with insecure or unresolved attachment statuses

would experience more difficulties and more changes during interactions with their children.

Moreover, we investigated whether there were specific indexes able to differentiate patterns of parenting between the two insecure mothers and the unresolved mother.

MATERIALS AND METHODS

Participants[1]

The study examined longitudinally four addicted women (*M* age = 19.75 years, *SD* = 5.12) and their children (two girls two boys) aged from 9 to 14 months (*M* = 11.25 months, *SD* = 2.22) at the beginning of the research. The subjects where extracted from a larger group of women following a rehabilitative program in a venetian Therapeutic Community (TC)[2] specifically according to their attachment status and to the age of their children. All the subjects presented double diagnosis with borderline personality disorder.

Regarding substance abuse history, all mothers during the 12 months period before entrance in community showed a pathological pattern of abuse or use of substances which lead to a significant impairment or distress: for all of them, the main substance of abuse was heroin (4/4), followed by cocaine (4/4), cannabis (4/4), chemical drugs (3/4), methadone (3/4), hallucinogens (3/4), and medicines (1/4). The beginning of the rehabilitative program was partly chosen freely (2/4) partly consequence of a Juvenile Court decree (2/4). In all the cases the reason for entrance in TC was drug-addiction[3]. The mean age for the onset of the dependence was 13.75 years (*SD* = 0.479), whereas the intoxication period lasted on average 8.75 years (*SD* = 1.50). The onset of substance use was due partly to the escape of personal or familiar problems (3/4) and partly to the identification with the partner or the group of pairs (3/4). When the study took place all the women were subject to substitutive opioid treatment. Regarding their past life experiences only one subject reported familiarity for drug-abuse disorder. At admission only one woman still attended school, while the others had previously interrupted studies due to low socioeconomic status (1/4) or to substance abuse (2/4). At entrance all the mothers where unemployed. Some of them (2/4) experienced important losses or traumatic experiences (2/4) concerning physical, sexual or psychological maltreatment. Two of them were engaged in prostitution acts. With respect to pregnancy and motherhood, only one subject declared to have wished pregnancy. Two of them reported a continuative use of drugs during pregnancy. Regarding newborn's medical status at delivery, mean values were 38.75 weeks (*SD* = 1.258) for gestational age, 3.05 kilograms (*SD* = 0.385) for weight, 34 cm (*SD* = 1.155) for cranial circumference and 50.63 cm for length. Apgar scores at 1′ and 5′ ranged all between 9 and 10. Only one child showed signs of Neonatal Abstinence Syndrome (NAS) at delivery. As far as it concerns maternal medical history, three mothers presented Hepatitis C virus at admission.

Procedure and Instruments

Maternal Attachment Representations

Maternal attachment representations were assessed at entrance in TC with the Adult Attachment Interview (AAI—George et al., 1985). This semistructured interview aims to elicit information concerning an individual's current representation of his/her childhood experiences with the attachment figures. The interview consists of questions through which the participant is asked to recall and to reflect upon memories related to his/her attachment experiences with his/her caregivers during childhood. The AAI coding system allows to classify the individual into one of four attachment categories concerning adult attachment status: secure/autonomous (F), Dismissing (Ds), Entangled-Preoccupied (E), Unresolved with respect to a Loss and/or a Trauma (U). Individuals are classified as autonomous or secure (F) when they show coherence during the narration of their past attachment experiences, whether they were supportive or not. The dismissing (Ds) category is attributed when past experiences are described as too positive when compared to the actual content of narration. Dismissing individuals often complain that they are not able to recall past attachment-related memories. Individuals are classified as preoccupied (E) at the AAI when they show confused, angry or passive preoccupation with respect to their attachment figures. The excessive preoccupation given to their past memories may lead to the consequence that, when attending the interview, these subjects lose the focus from the context of discourse. Both dismissing and preoccupied subjects are considered insecure with respect to adult attachment representations. Moreover, individuals can be classified as unresolved/disorganized (U) regarding potentially traumatic experiences that concern loss or abuse. Indexes of non-resolved trauma are reflected through the momentary loss of the ability to monitor reasoning or the discourse. The interviews of the subjects had been previously independently rated by two raters who were unfamiliar with the sample and who had no access to demographic and psychiatric information. Both raters had been trained in conducting the coding and had substantial experience with the instrument. Inter-rater agreement was found to be excellent, with kappa ranging between 0.87 and 0.92.

Quality of Mother-Child Interactions

Each 3 months during the stay in TC the dyads where observed and videotaped during 20-min free play sessions. The dyads of the study were observed for a total of seven

[1]This study was carried out in accordance with the recommendations of the Code of Ethics approved by the General Assembly of the Italian Association of Psychology held on March 2015 the 27th. The data presented in this paper constitute part of a larger research project approved in July 2014 by the Ethical Committee of the University of Padua (code. 1444).

[2]Therapeutic Community for drug-addicted women and their children offers residential care to the mother-child dyad and provide a comprehensive rehabilitation program, which takes place during a 2-year stay. The access in the community for addicted mothers and their children is applied by a decree of the Juvenile Court and implies a coercive intervention for the mother; the risk is to be immediately separated from her child (Stevens et al., 1989; National Institute on Drug Abuse). As for the intervention methods, a combined treatment (i.e., for both parent and child together) is carried out on an intensive basis (the dyads are in residential care): TCs typically offer a therapeutic program, which is centered on the individual-parent-child system taken as a whole (Meisels et al., 1993).

[3]Sometimes the rehabilitative program might be an alternative from jail or due to psychiatric status.

periods (i.e., a longitudinal frame of observation that covers 21 months of stay in TC). Mother-child interactions where coded using the fourth version of the Emotional Availability Scales (EAS—Biringen, 2008). The construct refers to the ability of emotional sharing by taking part and contributing to a healthy and mutually fulfilling relationship (Biringen and Easterbrooks, 2012). It is composed of six scales/dimensions, four for the adult (sensitivity, structuring, non-intrusiveness, non-hostiliy) and two aimed at evaluating child behaviors (responsiveness, involvement of the adult). Each scale is composed of seven subscales.

Adult sensitivity refers to quality of adult affects, clarity of perceptions and appropriate responsiveness, awareness of timing, flexibility, variety and creativity during play, acceptance of the child, amount of interactions and adequate resolution of conflicts.

Adult structuring concerns the use of proactive guidance, the success of attempts, the amount of guidance, the ability to set limits and to remain firm in the face of pressure, the use of both verbal and non-verbal suggestions and the ability to assume an adult role rather than a peer one.

Adult non-intrusiveness refers to the ability to follow the child's lead, to the use of non-interruptive ports of entry into interaction, to the modest use of commands and directives, to the appropriateness of teaching and adult talking, to the absence of interferences and of child's signals that indicate that the adult is perceived as intrusive.

Adult non-hostility refers to the lack of negativity in face or voice and to the lack of ridiculing or other disrespectful behaviors toward the child. A non-hostile adult does not threat to separate, is not frightening, maintains cool during challenging situations and does not use threats of hostile play themes during interactions.

Child responsiveness takes into account quality of child's affects and organization of behaviors, the ability and the willingness to respond to the adult's bids without anxiety or role reversal. It also considers positive physical positioning, concentration on task and the presence of avoidance or of over responsiveness and role reversal.

Child involvement of the adult concerns the use of simple and elaborative initiative to involve the adult, the affective use of the adult (rather than instrumental), the lack of negative/over involving behaviors and the use of verbal and non-verbal channels.

Each EA dimension is given a global score on a 7 point scale, where higher ratings stand for more optimal features. Values between 5 and 7 are representative of an emotionally available dyad and considered index of a healthy relationship. Scores around 4 indicate complicated emotional availability, that is behaviors that are appropriate in some ways but that are not fully healthy (for example a mother apparently sensitive or inconsistent in structuring). Scores around 3 indicate less optimal aspects (for example a caregiver who is somewhat insensitive, intrusive or slightly overtly hostile) while the range between 1 and 2 concerns more problematic behaviors (i.e., a mother extremely insensitive, withdrawn or aggressive, extreme role reversal or the presence of disorganization in child's affects and behaviors)[4]. To get a more detailed profile of the interaction, the observer can also attribute a score to the seven subscales of each dimension. The first two subscales get scores from 1 to 7, while the other five a score between 1 and 3. According to the EA coding system (Biringen, 2008), scores are considered adequate when they are above the mid-point of the scale, inconsistent when they coincide with it, and inadequate when they are below it. The interactions were rated by two coders trained on the EAS system who were blind with respect to the attachment status of the participants.

RESULTS

Adult Attachment Representations and Patterns of Mother-Child Interactions

As previously said, the mothers were extracted from a larger group in accordance with their adult attachment status, in order to compare the four main AAI categories with respect to the evolution in time of mother child-interactions.

Table 1 shows average scores and standard deviations for each dyad on the 6 EA dimensions. With respect to adult scales, the autonomous (F) and the dismissing (Ds) mother are the subjects that presented better parenting qualities, reporting average scores above the mid-point on each EA adult dimension. The preoccupied (E) and the unresolved (U) mother instead seemed to experience more difficulties during mother-child interactions; they appeared less sensitive and less able to structure and to guide emotional exchanges. Moreover, the unresolved (U) mother resulted more intrusive and less able to regulate tensions and negative emotions, reporting scores below 4 also on the scales of non-intrusiveness and non-hostility. Considering the child variables, again children of the secure (F) and of the dismissing (Ds) mother appeared to enjoy more positively interactions with their caregivers, showing scores above average both on child responsiveness and on child involvement of the adult. On the other side, children of the preoccupied (E) and of the unresolved (U) mother, seemed to experience more difficulties. While the latter one seemed to oscillate around average, reporting scores around 4, the first one exhibited more difficulties, resulting more avoiding and less engaged in emotional exchanges with his mother.

Figure 1A shows the longitudinal ongoing of maternal sensitivity in the four dyads considered. As it is possible to see, during all the episodes taken into account the secure (F) mother proved to be adequately sensitive and responsive toward her child's cues, showing a good and spontaneous quality of affects. The dismissing (Ds) mother, instead, seemed initially to

[4]When referring to the global scores, the term "around" is used to indicate the different clinical shades that a certain score might assume. The scoring system, in fact, offers specific anchor points (i.e., 3; 4; 5; and so on) with prototypical descriptions, but allows at the same time to use half points to emphasize specific features of the observed interaction (for example, a score of 3, 5 could be used to indicate an interaction lacking of emotional warmth and mother who is mechanical and somewhat insensitive but that, at the same time, shows a lot of efforts to succeed with the child; in this sense, the mother would be equally considered as somewhat insensitive, getting indeed a score "around 3," but the half point would allow to keep in mind that the quantity of efforts done, although not enough to increase the score to a full 4, are higher than a typical 3.

TABLE 1 | Average scores and standard deviations of mother-child interactions assessed with the Emotional Availability Scales (EAS).

EA dimension		Secure (F) *M (SD)*	Dismissing (Ds) *M (SD)*	Preoccupied (E) *M (SD)*	Unresolved (U) *M (SD)*
Sensitivity	Global score	6.36 (0.476)	4.29 (1.075)	3.71 (0.393)**	3.929 (0.189)**
	Affects	6.57 (0.535)	4.14 (1.029)	3.64 (0.378)**	4.00 (0.000)*
	Perception e Responses	6.43 (0.535)	4.50 (1.658)	3.79 (0.699)**	3.64 (0.556)**
	Timing	2.86 (0.378)	2.36 (0.441)	1.86 (0.244)**	1.93 (0.283)**
	Flexibility	2.79 (0.393)	2.36 (0.441)	1.86 (0.244)**	2.07 (0.450)
	Acceptance	3.00 (0.000)	2.14 (0.408)	2.57 (0.627)	1.57 (0.463)**
	Amount of interaction	3.00 (0.000)	2.50 (0.408)	2.36 (0.627)	2.71 (0.488)
	Conflicts	2.71 (0.488)	2.86 (0.378)	2.57 (0.787)	2.29 (0.488)
Structuring	Global score	5.86 (0.748)	4.71 (1.577)	3.71 (0.488)**	3.86 (0.378)**
	Guidance	6.21 (0.698)	4.50 (1.555)	3.79 (0.393)**	3.93 (0.476)**
	Success	6.14 (1.069)	5.07 (1.835)	3.57 (0.976)**	3.86 (0.476)**
	Amount of structure	2.86 (0.378)	2.29 (0.393)	2.14 (0.378)	2.86 (0.378)
	Limit setting	2.57 (0.535)	2.57 (0.535)	2.14 (0.378)	2.00 (0.000)*
	Remaining firm	2.86 (0.378)	3.00 (0.000)	2.29 (0.756)	2.29 (0.488)
	Verbal vs. non-verbal	2.86 (0.378)	2.43 (0.535)	2.00 (0.577)*	2.50 (0.627)
	Peer vs. adult role	2.64 (0.476)	2.29 (0.393)	1.93 (0.189)**	1.79 (0.636)**
Non-intrusiveness	Global score	5.07 (0.838)	5.71 (1.150)	4.00 (0.957)*	2.86 (0.852)**
	Following child's lead	5.00 (0.816)	5.71 (0.951)	4.07 (0.951)	3.36 (0.951)**
	Ports of entry	5.43 (0.535)	6.00 (1.414)	3.86 (1.069)	2.57 (0.787)**
	Commands	2.64 (0.476)	2.43 (0.535)	2.00 (0.289)*	1.79 (0.393)**
	Talking	2.71 (0.488)	2.86 (0.378)	2.29 (0.488)	2.43 (0.535)
	Teaching	2.00 (0.000)*	2.71 (0.488)	2.07 (0.450)	2.00 (0.577)*
	Interferences	2.57 (0.535)	2.64 (0.748)	2.14 (0.900)	1.14 (0.378)**
	Child's feedback	2.86 (0.378)	2.86 (0.378)	2.29 (0.756)	1.93 (0.607)**
Non-hostility	Global score	6.43 (0.732)	5.36 (1.029)	5.29 (1.075)	3.71 (0.951)**
	Negativity	6.29 (0.756)	5.14 (1.345)	5.29 (1.113)	3.50 (1.000)**
	Ridiculing	6.86 (0.378)	6.00 (1.155)	5.57 (1.272)	3.71 (0.951)**
	Threats of separation	3.00 (0.000)	3.00 (0.000)	3.00 (0.000)	2.86 (0.378)
	Lose cool	2.71 (0.488)	2.71 (0.488)	2.29 (0.488)	1.79 (0.267)**
	Frightening	3.00 (0.000)	2.50 (0.500)	3.00 (0.000)	2.71 (0.488)
	Silence	3.00 (0.000)	2.50 (0.500)	3.00 (0.000)	2.86 (0.378)
	Hostile play themes	3.00 (0.000)	2.93 (0.189)	3.00 (0.000)	3.00 (0.000)
Child Responsiveness	Global score	6.07 (1.170)	5.00 (1.225)	3.29 (0.567)**	4.00 (0.500)*
	Affects	6.14 (1.215)	5.14 (1.376)	3.00 (0.707)**	4.00 (0.500)*
	Responsiveness	5.86 (1.676)	5.29 (1.254)	3.50 (0.408)**	3.93 (0.607)**
	Autonomy	2.86 (0.378)	2.43 (0.535)	1.79 (0.636)**	2.29 (0.488)
	Physical positioning	2.57 (0.787)	2.43 (0.607)	1.64 (0.476)**	2.29 (0.488)
	Role reversal	3.00 (0.000)	2.71 (0.488)	3.00 (0.000)	3.00 (0.000)
	Avoidance	2.86 (0.378)	2.79 (0.576)	1.79 (0.393)**	2.43 (0.535)
	Task orientation	2.93 (0.189)	2.57 (0.607)	1.71 (0.393)**	2.00 (0.000)*
Child Involvement	Global score	5.86 (1.180)	5.14 (1.215)	3.29 (0.809)**	3.86 (0.476)**
	Simple initiative	6.00 (1.414)	5.50 (1.190)	3.36 (0.748)**	4.00 (0.577)*
	Elaborative initiative	5.86 (1.215)	4.71 (1.254)	3.14 (0.900)**	3.57 (0.787)**
	Use of adult	3.00 (0.000)	2.86 (0.378)	1.71 (0.488)**	2.29 (0.488)
	Over-involvement	2.43 (0.535)	2.71 (0.488)	2.21 (0.994)	2.07 (0.732)
	Eye contact	2.86 (0.378)	2.57 (0.535)	1.93 (0.189)**	2.43 (0.535)
	Body positioning	2.86 (0.378)	2.71 (0.488)	2.14 (0.627)	2.57 (0.535)
	Verbal involvement	3.00 (0.000)	2.86 (0.378)	2.07 (0.732)	2.71 (0.488)

**Scores on the mid-point of the scale (i.e., inconsistent).*
***Scores below the mid-point of the scale (i.e., at risk).*

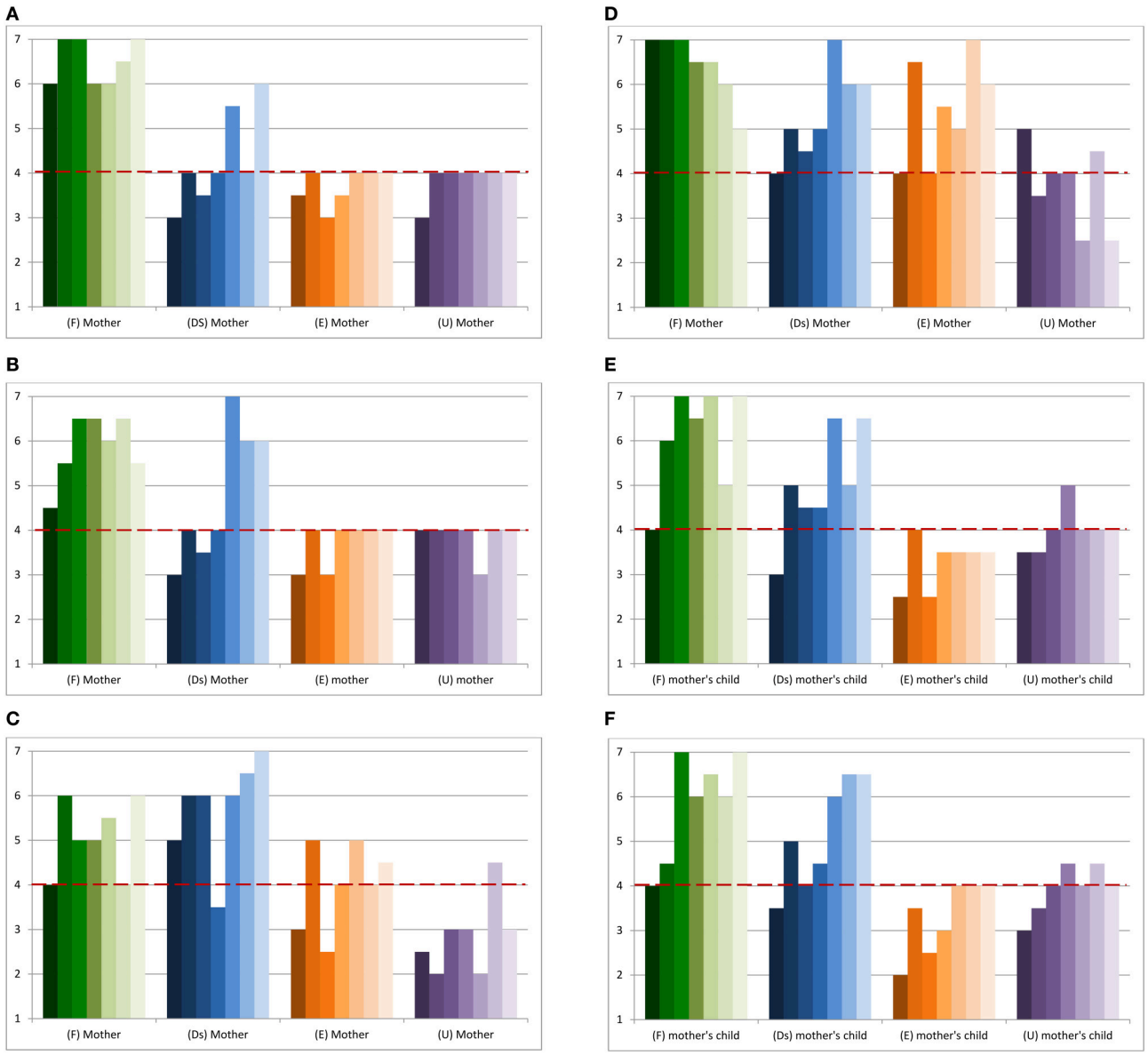

FIGURE 1 | (A) Longitudinal ongoing of maternal sensitivity in the four dyads. **(B)** Longitudinal ongoing of maternal structuring in the four dyads. **(C)** Longitudinal ongoing of maternal non-intrusiveness. **(D)** Longitudinal ongoing of maternal non-hostility. **(E)** Longitudinal ongoing of child responsiveness. **(F)** Longitudinal ongoing of child involvement of the adult. The dotted red lines on the mid-point of the scale discriminate between the optimal and the non-optimal zone in the EA dimension considered.

get scores on the mid-point (T2, T4) or below it (T1, T3) while showing later an increase in the scores (T5, T7),alternated with a periodical way back on the mid-point (T6). As far as it concerns the preoccupied (E) mother, the woman oscillated from being inconsistently sensitive (T2, T5, T6, T7) to being moderately insensitive toward her child's cues (T1, T3, T4). Finally, with the exception of the first episode (T1), the unresolved (U) mother appeared inconsistently sensitive, getting always scores around four on this dimension.

Figure 1B represents the longitudinal ongoing of maternal structuring. As shown by the graphs, the secure mother (F) proved to be successful in guiding interactions during all the periods considered, whereas the preoccupied (E) and the unresolved (U) mother never got scores above average; in other words, these women seemed to make a lot of attempts in trying to guide that however were not successful, maybe because they were not tuned on the children's interests or maybe because the attempts were too much and somehow they "lost" their children, speaking in terms of affectively and attentively sharing. Regarding the dismissing (Ds) dyad, initially the mother tended to get scores on the mid-point or below, while from T4 this ability seemed to grow.

Figure 1C reports the longitudinal ongoing of maternal non-intrusiveness during the periods considered. As it is possible to

notice from the graphs, with the exception of some cases where she appeared benignly intrusive (T4 and T6), the secure (F) mother resulted able to leave enough space to the child without interfering with her activities during mother-child interactions. The same considerations can be made regarding the dismissing (Ds) mother who, globally, did not appear intrusive during the sessions considered, with the exception of one episode (T4). As happened for structuring, the preoccupied (E) mother seemed to oscillate in non-intrusiveness too; in this case she alternated moments where she appeared non-intrusive, i.e., able to leave enough space to the child (T2, T5), and moments where she resulted moderately intrusive (T4, T6) or definitely intrusive (T1, T3) toward the child's activities. Finally, with the exception of an episode (T6), the unresolved (U) mother appeared constantly over-suggestive and interfering during free play interactions with her child.

Figure 1D reports the longitudinal ongoing of maternal non-hostility. As shown by the graphs the mothers with secure (F), dismissing (Ds) and preoccupied (E) attachment statuses appeared globally non-hostile; with the exclusion of few episodes where signs of covert hostility were noticed, these women appeared consistently able to downregulate their negative affectivity (i.e., the scores on this scale never got below the mid-point). In the unresolved (U) dyad, instead, it is possible to notice different times where the adult did not show optimal modulation of negative affects (T2, T5, T7), expressing overt hostility during play with her child.

Figure 1E shows longitudinally patterns of child responsiveness in the four dyads. A first consideration can be made on the child of the secure (F) mother; as reported by the figure, except for an initial moment (T1) where she seemed to show some slight difficulties in responding to her mother's bids, from the second period on the scores in this scale increased, indicating thus the reach of an adequate organization of affects and responding behaviors. Concerning the dismissing (Ds) dyad, at the beginning of the program the child showed non-optimal responsiveness, whereas this feature increased later in time. As it is observable, the child of the preoccupied (E) mother did not show optimal responsiveness during interactions, appearing rather avoiding and getting, with few exceptions, scores below the mid-point of the scale. Finally, the child of the unresolved (U) mother seemed to move from non-optimal (T1, T2) to complicated responsiveness (T5, T6, T7) with a slight increase in the scores during T4.

Finally, **Figure 1F** represents the longitudinal ongoing of child involvement of the adult. As reported from the graphs, after some initial difficulties, the child of the secure (F) and of the dismissing (Ds) mother seemed able to and successful in involving their parents during free play interactions, receiving almost every time scores above the mid-point. The other two dyads showed more difficulties on this EA dimension, especially the child of the preoccupied (E) mother, who initially appeared consistently avoidant during videotaped sessions. The child of the unresolved (U) mother, instead, showed more frequently scores around, or slightly above, the mid-point of the scale.

DISCUSSION

This study aimed to assess parenting of drug addicted mothers longitudinally, from different perspectives. Two of the main components of parental functioning were considered: maternal representations with respect to early attachment experiences and actual parenting behaviors enacted during adult-child interactions. To assess adult attachment representations we adopted the AAI (George et al., 1985) while mother-child interactions were evaluated through the EAS (Biringen, 2008), a tool that originated in part from attachment theory but that also tried to enlarge the focus of investigation integrating contributions from emotion, systemic and transactional theories. In this sense we tried to enrich the attachment perspective with an interactive and relational one, in order to understand more deeply how parenting and adult-child relationships might influence each other. Moreover, adult-child interactions were assessed longitudinally, during the first 21 month of stay in the facility; in this sense, the inclusion of a longitudinal perspective allowed to expand knowledge on the dynamic processes underlying parental functioning and the organization of adult-child interactions, rather than to rely on a single and more static evaluation of them. The four mothers were chosen according to their adult attachment status assessed at admission in TC, in order to collect one subject for each of the four AAI main categories, that is secure/autonomous (F), dismissing (Ds), entangled-preoccupied (E) and unresolved with respect to trauma and/or losses (U). Quality of mother-child interactions, instead, was considered longitudinally and assessed each 3 months during the first 21 months of stay in the facility.

We hypothesized secure attachment representations in the mother to be associated (a) with higher maternal sensitivity and (b) with more stable emotional exchanges if compared to the insecure or the unresolved ones. As expected, the results highlighted marked differences in interactive competencies in the secure vs. insecure/unresolved mothers. More specifically the dyad with the secure (F) mother presented interactions of better quality, with the mother being more sensitive and responsive toward her child's cues and the child showing more optimal and positive responsiveness and involvement of the adult; moreover, these results appeared predictable over time (i.e., the scores always remained in the optimal range or above the mid-point of the scales). On the other side, the insecure (Ds) (E) dyads and the one with the unresolved (U) mother presented more changeable patterns of interactions and more difficulties during the periods observed, with the mothers resulting inconsistent in the ability to adequately perceive and respond to their infants' signals.

In this sense, with respect to our initial hypothesis we can conclude that:

(a) secure attachment representations in the mother resulted associated with higher maternal sensitivity during mother-child interactions while mothers with insecure and unresolved attachment representations presented lower degrees of maternal sensitivity.
(b) the dyad with the secure mother experienced better emotional exchanges, that appeared more stable in time (i.e.,

always above the mid-point of the scale) while the dyads with the insecure mothers or with the unresolved mother showed more difficulties and more "jagged" patterns of mother-child interactions.

A first consideration about our study concerns the particular group of subjects taken into account, that is drug addicted women following a therapeutic rehabilitation program in a residential community. On one side, in fact, these women presented the typical risk factors often associated with drug dependence (i.e., past experiences of traumas and losses, low socioeconomic status and low levels of education). Moreover, all the subjects presented double diagnosis with borderline personality disorder, a condition often associated with particularly detrimental interactive features on the maternal side, such as rapid changes from sensitive to punishing responses (the so-called "*oscillations in parenting*"), emotion dysregulation and general distress (Fruzzetti, 2012; Stepp et al., 2012). On the other hand these mothers also benefited, at least in part, from the therapeutic and the educational interventions offered by the community staff, which could have worked as protective factors for parenting and interactions instead. In this sense, when discussing the results of our study it is important to keep in mind both the risk factors associated with the condition of drug addiction and the moderating role played by TC as a "buffer" on the quality of caregiving.

Another consideration should be addressed specifically to the need of assuming a multi-level perspective when assessing parenting (De Palo et al., 2014). One of the major aspects emphasized by attachment theorists, in fact, concerns maternal sensitivity and responsivity, the two main ingredients considered as necessary to fulfill a secure attachment relationship (Ainsworth, 1969; Bowlby, 1984). It has been hypothesized that maternal sensitivity could work as a mediating factor between parental attachment representations and internal working models of their children (van Ijzendoorn and Bakermans-Kranenburg, 1999). It has been suggested that parents secure with respect to past attachment experiences would be more likely to enhance secure relationships with their children, thanks to their ability to correctly read and interpret infant signaling (Main, 1990). On the other hand, past experiences of insecure parents might compromise somehow their opennes to infant bids, interfering with the quality of emotional interactions (van Ijzendoorn and Bakermans-Kranenburg, 1999). These hypothesis have been in part confirmed by empirical research (Aviezer et al., 1999, 2003; Ziv et al., 2000; Sagi et al., 2002; Biringen et al., 2005; Aviezer, 2008; Easterbrooks et al., 2012), although sometimes the results were less clear and linear (Aviezer et al., 1999, 2003; Biringen et al., 2005, 2014). The modest effect size found for the link between adult attachment status determined by the AAI and sensitivity, and for the link between the latter and the quality of child attachment, suggested a "transmission gap," where other variables could intervene in determining the intergenerational transmission of attachment (Sagi et al., 1994; Van Ijzendoorn, 1995; van Ijzendoorn and Bakermans-Kranenburg, 1999; Martins et al., 2012; Van den Dries et al., 2012; Biringen et al., 2014). Multidimensional observational and assessment tools appear thus particularly useful, since they combine the assessment of sensitivity with the focus on other aspects of adult behavior, allowing to reach a more comprehensive vision of parental functioning. Effectively, considering our results (but also keeping in mind that our work concerned a "special" population), we may say that sensitivity seemed only sufficient to differentiate parenting of the secure mother from the parenting of the insecure and the unresolved mothers considered as a group (i.e., the insecure and the unresolved mothers did not show marked differences from each other in this EA dimension). As a consequence we did not find a clear pattern of adult sensitivity specifically related to each adult attachment status and able to discriminate between non-secure AAI categories.

The same considerations could be made on adult structuring, given that both the insecure mothers and the unresolved one showed general difficulties in adequately guiding and scaffolding their children during mother-child interactions without presenting a specific and predictable pattern of inconsistency.

Differently from the secure and the dismissing mother, the preoccupied and the unresolved mother appeared rather intrusive during the periods considered. Women with this AAI status have been previously described as over-involved, over-stimulating, unpredictable and affectively deregulated toward their infants (De Palo et al., 2014). Moreover, intrusive behaviors have been often reported as a specific feature that characterizes parenting of addicted women (Rodning et al., 1991; Johnson et al., 2002; Salo et al., 2009, 2010). In other studies maternal intrusiveness showed higher associations with avoidant and disorganized patterns of attachment (Swanson et al., 2000). Maternal intrusiveness seemed thus to constitute here a better discriminating factor, since it appeared specific of only two AAI non-secure categories.

Finally, maternal non-hostility appeared to be the only dimension of our study able to differentiate between the interactive pattern of the unresolved mother and the others (the secure and the insecure ones). This woman, in fact, showed persistent difficulties in modulating negative affectivity during the interactions with her child. Negative affectivity and hostility have been pointed out in the literature as particularly adverse factors with respect to child development and mother-child interactions. Some authors (Main and Hesse, 1990) suggested frightening maternal behaviors to be more likely to lead to a disorganization of the attachment strategies in the child, due to the paradox of searching for protection from fear into a fearful adult. Other authors (Beebe and Lachmann, 2002), instead, focused more specifically on the detrimental effects of continuous interactive-ruptures not followed by repair, that in our case might be determined by the continuous expressions of negative affect from the mother.

Resuming our results, we can conclude that, in part, in our study we have noticed some of the difficulties that the literature has often associated to parenting of addicted mothers. On the other hand we have also observed, as already reported in different studies, that, despite the condition of drug addiction, having secure attachment representations is more likely to be associated

with more positive adult-child emotional exchanges. Globally, these results seem to direct us toward the road of complexity when assessing parental functioning, underlining the need to consider different and less "traditional" aspects of the caregiver besides the more studied ones, and to integrate them in a more comprehensive vision of the individual considered as a caregiver (Espinet et al., 2013). Furthermore, this study can be considered part of a more general effort made to enhance the integration of research and clinical thinking, in order to create relational profiles specific for each dyad, considering both individual and dyadic functioning, with the purpose to establish personalized and targeted interventions. In line with this, recently some authors highlighted the importance of integrating an attachment-relational perspective with a multi-level assessment of individual functioning when planning interventions for parents in clinical or at-risk populations, in order to reduce the risks of failure (De Palo et al., 2014).

Of course the data presented in this paper cannot be generalized to the wider population, especially given the case study nature of our work. First of all this is due to the particular group of subjects considered; the fact that the TC might intervene as a buffering factor could exert a confounding effect, preventing us from asserting with certainty that the difficulties found in our dyads are the same that other dyads with addicted parents non-under treatment might experience (the latter in fact might be more severe). The same could be said concerning the change in time of emotional availability (for example, it is not said that any other individual with dismissing adult attachment representations would undergo the same improvements that the (Ds) mother of our study experienced). Secondly, a generalization of these results is not possible given the small amount of subjects considered and the absence of a control group; on one hand, in fact, the absence of a comparison croup does not allow to control the eventuality that the attachment style and the condition of drug addiction interacted together creating a unique style of mother-infant interaction; moreover, the presence of gender differences in each dyad might have somehow influenced the relational style, so that absolute conclusions cannot be drawn from the comparison of the four attachment styles. Anyway, despite these limits, these data seem to be in line with a large amount of theoretical and empirical literature on attachment, parenting, and early mother-child interactions, confirming in part the differences expected between dyads with secure mothers and dyads with insecure or unresolved mothers (van Ijzendoorn and Bakermans-Kranenburg, 1999; Ziv et al., 2000; Sagi et al., 2002; Aviezer, 2008; Easterbrooks et al., 2012). From this point of view they appear a promising starting point for future research; in fact, more standardized research designs applied to larger samples, and with comparisons between clinical and non-clinical-subjects, would allow a better comprehension of common or specific/individual trajectories regarding both parenting and child development in risk- and non-risk groups. Moreover, the comparison between dyads in treatment and without treatment would lead to a deeper understanding of the intervening mechanisms with respect to efficacy of therapeutic programs; this in fact is an aspect that our study did not take enough in consideration. Finally, an objective for future research should be a greater focus on the contribution of children and of their intrinsic features. It appears in fact always more clear how the child could intervene as an active partner in shaping the quality of the relationship and the development of parental functioning, especially in the presence of peculiar features that are present since from delivery.

AUTHOR CONTRIBUTIONS

AS prepared the study design, supervised the research team, and wrote the discussions section of the manuscript; NC organized the recruitment of the sample and supervised data collection; AP and FD wrote the introduction section and the references, prepared data set, performed statistical analyses and prepared tables and figures; All authors reviewed the manuscript.

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Effectiveness of an Attachment-Based Intervention Program in Promoting Emotion Regulation and Attachment in Adolescent Mothers and their Infants: A Pilot Study

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This pilot study examined the effectiveness of an attachment-based intervention program, PRERAYMI, based on video technique, psychological counseling and developmental guidance in improving the style of interaction and emotion regulation of adolescent mothers and their infants after 3 and 6 months of intervention. Analyses revealed that adolescent mothers who participated in the intervention (vs. control group adolescent mothers) increased their Sensitivity and reduced their Controlling style after both 3 and 6 months of treatment. Infants who participated in the intervention (vs. control group infants) increased their Cooperative style and reduced their Passive style from 3 to 9 months. Moreover, the intervention group dyads (vs. control group dyads) increased the amount of time spent in affective positive coordination states (matches), decreased the amount of time spent in affective mismatches, and had a greater ability to repair mismatches from 3 to 9 months. Furthermore, the intervention group dyads (vs. control group dyads) increased the amount of time spent in reciprocal involvement in play with objects from 3 to 9 months. The quality of maternal attachment did not affect the intervention effect.

Keywords: adolescent mother, mother-infant interaction, dyadic affective coordination, maternal attachment, video intervention

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INTRODUCTION

Early motherhood is considered a significant risk factor for the establishment of an adequate relationship between mother and infant (Osofsky et al., 1993; Pomerleau et al., 2003) and for the subsequent developmental trajectories of both mothers and infants. Adolescent mothers' management of their parental role is, in fact, interfered with by problems relating to their transition to adulthood, involving processes of individuation from parent figures (Fraiberg, 1978; Aiello and Lancaster, 2007). This developmental task can easily conflict with their taking on a parental role. The newly born's strong need for physical and emotional care competes with the adolescent mother's needs (Reid and Meadows-Oliver, 2007). This may create strong conflict in the young mother between her need for autonomy and the infant's intense dependency on her, giving rise

to depression, parenting stress and low self-esteem and affecting her ways of relating to the infant (Osofsky et al., 1993; Reid and Meadows-Oliver, 2007; Secco et al., 2007). Moreover, an adolescent mother's cognitive and neurophysiological development still has to be completed (Giedd, 2005). Mothers under 20 are less cognitively competent with regard to taking on their parental role (cognitive readiness to parent) and to knowledge of the stages of development of their infants (Whitman et al., 2001).

Furthermore, motherhood in adolescence is often associated with other risk factors correlated to poor parenting, such as low socio-economic status (SES) and educational attainment. However, a number of studies have shown that, even when the effect of such variables is controlled, adolescence is still, *per se*, a high risk factor for a mother's parenting skills (Bornstein et al., 2006; Rafferty et al., 2011). Other risk factors in the post-partum period may also be associated with being an adolescent mother, such as post-natal depression—50% more adolescent mothers are depressed than adult mothers—(Brown et al., 2012) and being a single mother (Logsdon et al., 2005). A further important risk factor for mother-infant interaction (Riva Crugnola et al., 2013a) and for the development of secure attachment in the infant (Main, 1995) is that adolescent mothers are more likely to have insecure attachment models than adult mothers (Madigan et al., 2006; Riva Crugnola et al., 2014) and to have experienced physical and sexual abuse in their lives (Madigan et al., 2012).

The concurrence of various risk factors for parenthood together with the conflict between different developmental tasks makes the adolescent mother-infant relationship difficult right from the very beginning. In caring for their infants adolescent mothers use more instrumental behavior (Krpan et al., 2005) and are more intrusive toward their children, displaying poor emotional availability compared to adult mothers (Easterbrooks et al., 2005). Dyadic emotional regulation is also less adequate than it is between adult mothers and infants, related to the difficulty of the mothers in regulating the negative emotions of their infants (Riva Crugnola et al., 2014). Compared to adult mothers, adolescent mothers show both poorer ability to scaffold the activity of their infants (Easterbrooks et al., 2005) and are lower in mind-mindedness (Demers et al., 2010).

These characteristics of the relationship between adolescent mothers and their infants, together with the above risk factors, linked to early parenthood leads to problematic outcomes for both in the short and long term. In the short term the infants may display delays both in their psychomotor development (Jahromi et al., 2012) and in their cognitive development (Bolton, 1990; Morinis et al., 2013). They also show a greater tendency to construct insecure avoidant and disorganized attachment ties than do the children of adult mothers (Broussard, 1995; Lounds et al., 2005) and have a greater probability of suffering abuse by their young mothers. Furthermore, in adolescence and adulthood they display a range of adverse outcomes, such as poor academic achievement, behavior problems, early parenthood, and violent offending (Jaffee et al., 2001; Hoffman and Maynard, 2008). Early motherhood, at the same time, limits the subsequent life opportunities of young women (Jaffee et al., 2001), leading them to attain only low levels of education and to have a higher probability of suffering depression and social isolation (Horwitz et al., 1996; Boden et al., 2008).

The Intervention Program

Aims and Methods

The difficulties inherent in initial relations between young mothers and their infants and the impact of this experience on the developmental trajectories of both led us to design an attachment-based intervention program for adolescent mothers and their infants, entitled "Promoting responsiveness, emotion regulation and attachment in young mothers and infants" (PRERAYMI; Riva Crugnola et al., 2013b).

There have been various programs aimed at making the relationship between adolescent mothers and infants more adequate (Savio Beers and Hollo, 2009). Some of these programs are specifically attachment-based, i.e., aimed at increasing the responsiveness of mothers and thus improving the quality of infant attachment. These include the pioneering program of Carter et al. (1991) "Speaking for the Baby," which uses video-feedback and aims to give a voice to infant communication, which is often either not understood or misunderstood by young mothers. Of particular interest is also the MTB (Minding the Baby) mentalization-based intervention which combines the home visiting approach with the use of video-feedback. Its main aims are to increase the sensitivity and reflective function of young mothers and to promote secure attachment in the infant (Slade et al., 2005b; Sadler et al., 2013). Moran et al. (2005) also devised a brief intervention program to promote adolescent mothers' sensitivity which is based on an integration of home visiting and video-feedback technique.

Our program draws inspiration from these attachment-based programs. The PRERAYMI is an attachment based medium-term intervention program for adolescent and young mothers (aged between 14 and 21), their partners and their infants. It is an academic community partnership program, the result of collaboration between the Infant Neuropsychiatric Unit of the San Paolo Hospital-University of Milan and the Department of Psychology of the University of Milan-Bicocca which guaranteed the scientific coordination of the project and the assessment of its efficacy. A pilot program was conducted from 2006 to 2011 involving a small number of cases. In 2011 a service for adolescent and young mothers was created and the PRERAYMI intervention protocol set up (Riva Crugnola et al., 2013b). The project availed itself of the collaboration of George Downing from Pitié-Salpêtrière Hospital in Paris for what concerns that part of the intervention which uses Video Intervention Therapy.

Its principal aim is to improve the mother-infant relationship in the first year of the infant's life, imcreasing maternal responsiveness and reflectivity and mother-infant dyadic emotional regulation, so as to establish secure attachment of the infant to the mother and other attachment figures. It is well known that secure infant attachment is predictive of adequate socio-emotional development and, at the same time, serves a protective function with respect to psychopathological risk in the subsequent stages of development (Sroufe et al., 2005). In the same way maternal sensitivity and the absence of intrusive or withdrawn styles of interaction toward the infant in the first

year have a long term impact on the infant's socio-emotional development (Mäntymaa et al., 2004; Lyons-Ruth et al., 2013). One role of particular importance in this regard is played by the styles of emotional regulation which the infant constructs with its caregivers in its first year, as such styles form the basis of infant attachment patterns (Cassidy, 1994; Riva Crugnola et al., 2011).

Its particularity with regard to the other intervention programs is that it systematically uses different methods of intervention in an interdisciplinary manner, integrating the video intervention technique with developmental guidance and psychological counseling. Its principal aim is to support the relationship between the adolescent mother and her child, but also, at the same time, to help the young mother to integrate her experience of maternity with her transition toward adulthood and with her frequent adverse childhood experiences. Compared to other programs, particular attention is also paid to mutual regulation between mother and infant, considered a key aspect of their relationship (Tronick et al., 2005).

The intervention is interdisciplinary and conducted by a team of psychologists, infant neuropsychiatrists and psychomotrists. These therapists all have specific experience within the context of parent and child early infancy prevention programs.

In order to achieve these objectives our intervention is based on three different approaches: video intervention, developmental guidance, and psychological counseling.

For what concerns video intervention the method is the Video Intervention Therapy (VIT; Downing, 2005; Downing et al., 2008), a modified form of cognitive behavioral therapy which also uses psychodynamic elements in its approach (Steele et al., 2014). It has long been used in mental health settings, such as in-patient parent-infant units where a psychiatrically disturbed parent and an infant can be hospitalized together (Downing et al., 2013). A specific protocol is followed for any session (Downing et al., 2013). In the session, the parent's initial observations about the interaction are discussed first. The therapist next highlights a certain number of specific positive events, commenting on what seems positive. Patient and therapist further reflect on these points. The therapist then also points out, in a respectful and supportive manner, a negative interactional pattern. A more extensive therapeutic investigation of this pattern is then undertaken. Through the use of VIT, the therapist can focus on either the "outer movie," i.e., the objective behavior seen in the video and the "inner movie," i.e., the thoughts, feelings, and body experience which were present in the mother during the interaction.

The specific aim of using VIT in our program is to analyze micro-analytically, through careful analysis of "micro-details" of the interaction conducted frame by frame by the therapist with the mother, her communication with her infant (Tronick et al., 1998; Beebe et al., 2010). This joint analysis takes place at the level of affective state coordination, supporting mother/infant positive engagement and the ability of the mother to regulate negative emotions (Riva Crugnola et al., 2013b). At the same time there is particular focus on supporting the mother in facilitating her infant's explorative activity and in increasing episodes of joint attention with him/her. Specific importance is also attributed in the intervention to exploring with the mother her feelings upon viewing the video in relation to both her own emotions and those attributed to her infant, the aim being to increase her ability to keep her infant in mind (Slade, 2005). Self-observation of their interaction with the infant by means of the video is a particularly strong stimulus for parents, allowing them in a short space of time to render otherwise unexpressed emotions and representations explicit and to thus activate specific resources (Downing, 2005; Steele et al., 2014). This proves to be particularly useful with adolescent mothers whose emotional awareness and ability to reflect are often limited and still in the course of development. At the same time the possibility of using information relating to the attachment models and reflective capacity of the young mothers drawn from the Adult Attachment Interview conducted with the adolescent mothers at the beginning of the intervention is also of particular importance in the video intervention (Downing, 2005; Moran et al., 2005).

The second aim of the intervention program is to foster in the mother the process of integrating her experience of maternity and her relationship with the infant with her transition toward adulthood. In those most at risk cases an adolescent mother may distance herself from her experience of maternity, perceiving it as extraneous to her existential and developmental condition, delegating care of the infant to others both physically and emotionally, with the infant being abandoned in the most problematic cases. This may be due to the fact that many adolescent mothers have had negative or traumatic experiences with their parents and caregivers which are reactivated by having to deal with their small infants and the intense emotions the infants suscitate in them. Just a few sessions of psychological counseling are held in less problematic cases and these are aimed at facilitating the mother's transition toward adulthood. However, counseling lasts longer and may be extended to the entire period of the intervention in cases (around 50%) in which the mothers have had traumatic experiences or are currently having problems with regard to their relationship with their infant, their family of origin or their partner. In such cases the mother is helped to reflect in depth upon conflictual aspects of her past and/or current relationships with her own parents, and upon how these now reflect her relationship with her infant (Lieberman and Pawl, 1993). The mother's elaboration of trauma is an important feature of the intervention, also in the light of studies which have shown that researchers have had difficulties in intervening, through attachment-based interventions, with adolescent mothers who are disorganized with respect to abuse they have suffered (Moran et al., 2005; Berthelot et al., 2015).

A third level of intervention provides mothers with developmental guidance (Papoušek et al., 2008). In monthly sessions the stages of development of the infant and its rhythms of regulation, which mothers are often little aware of, are illustrated. The meetings are led by a psychomotrist who focuses on developmental guidance (Papoušek et al., 2008). In this context the infant's motor and cognitive development is monitored using the Bayley Scales (2005) at 6 and 10 months. The results are discussed in specific meetings led by an infant neuropsychiatrist and a psychomotrist with the mothers and

fathers in order to identify with them both the developing skills of the infant and any problems.

The Intervention Protocol

The intervention takes place in a specially dedicated outpatient unit of the hospital. The aim is to provide young mothers with a protected area which they can inhabit as if it were their own. Adolescent mothers often find themselves living with their family of origin or with their partner's family in crowded conditions which offer them little chance to protect their individual relationship with the infant. Moreover, in order to ensure that a relationship between the young mother and the service is created which will act as a secure basis for her budding relationship with her infant, from the beginning to the end of the intervention the mothers are always followed by the same two therapists—a psychologist and a psychomotrist—during the meetings in order to ensure that they have a sense that the intervention is continuous.

Intervention starts when the infant is 2 months old and concludes at 9 months. There are around 15 meetings in all. The program begins with an initial meeting at infant 2 months with the mother. During this meeting an anamnestic form is compiled with the mother and risk and protection factors (socio-economic condition, relationship with the infant's father, social support, educational level, progression of pregnancy, and adverse experiences) with respect to her relationship with the baby are thus identified.

At infant 3 months, self-report questionnaires are used to assess levels of parental stress (PSI-SF; Abidin, 1995) and post-partum depression (PDSS; Beck and Gable, 2002). The "state of mind of the mother" with respect to attachment is also examined using the *Adult Attachment Interview* (Main et al., 2002).

When possible, infants' fathers are also included in the intervention protocol. They are, however, often unavailable because of work commitments or current lack of engagement. Nonetheless, in order to foster collaboration between mothers and fathers, the more informative meetings which focus on developmental guidance are conducted at times which are compatible with the fathers' working hours. In the course of the intervention we are also in contact with the parents of the adolescent mothers, albeit not systematically.

Video intervention begins at 3 months and is conducted monthly until infant 9 months (6 sessions). Meetings are led by a psychologist and a psychomotrist using the VIT method. During each meeting the mother and the infant are videorecorded for 5–10 min in free-play situations with suitable toys being available. In the following meeting, which occurs a few days after that of the videorecording, the recording is discussed with the mother.

The mothers are also given counseling sessions conducted by psychologists (an average of 6 sessions). As we stated above the aims of the sessions are to foster integration of their experience of becoming a mother with their transition toward adulthood or, in some more problematic cases, to tackle issues linked to their past or to difficult present relationships, such as with the partner or family of origin.

The developmental guidance is conducted monthly by a psychomotrist (an average of 6 sessions) as above.

There are two follow-ups after the conclusion of the intervention for the purposes of assessing its efficacy. The first takes place at infant 14 months in order to evaluate the type of attachment developed by the infant to the mother assessed using the *Strange Situation Procedure* (Ainsworth et al., 1978). The second follow-up is carried out at infant 24 months when mothers are given the *Child Behavior CheckList* (CBCL; Achenbach and Rescorla, 2001) in order to evaluate the efficacy of the intervention with regard to the infant's psycho-pathological risk.

Research Aims

For the purposes of assessing the effectiveness of the PRERAYMI intervention program a preliminary study was conducted which examined the effect of the intervention at an intermediate stage, i.e., 3 months after the start of the video intervention and in the final stage at 9 months. The aim of the study was to assess changes in interaction styles and dyadic emotion regulation after 3 and 6 months of intervention in the adolescent mother-infant dyads who had used the intervention, comparing them with a control group made up of dyads which had not used the intervention. In relation to this aim we also asked ourselves, at an exploratory level, whether the attachment models and reflective capacity of the mothers assessed at the start of the intervention could have a moderating effect on its efficacy.

We formulated the following hypotheses with respect to these aims: (a) the adolescent mothers who use the intervention will increase their Sensitivity style and decrease their Controlling style and their infants will have more Cooperative and fewer Passive styles after 3 and 6 months of intervention compared to mothers and infants in the control group; (b) the dyads with adolescent mothers who use the intervention (vs. control group) will display an increase in the amount of time spent in match states and in positive match states, a decrease in the amount of time spent in negative match states and mismatch and a greater capacity to move from mismatch to match states (repair) compared to the dyads of the control group after 3 and 6 months of intervention; (c) the dyads with intervention will increase the amount of time spent in play with objects after 3 and 6 months compared to the dyads of the control group.

MATERIALS AND METHODS

Design

The dyads were recruited at the Obstetrics and Gynaecology Department of the San Paolo Hospital of Milan and at Family Counseling Services in the Province of Milan. A total of 48 adolescent mothers and their infants were enrolled in the pilot study. 32 dyads were assigned to the intervention group and 16 dyads were assigned to the treatment-as-usual control group. Inclusion criteria included: able to speak and understand the Italian language; 14–21 years old; and having a first child. The study protocol was approved by the institutional review board of the San Paolo Hospital of Milan. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Participants

In the adolescent mother-infant dyads of the intervention group, mothers had a mean age of 18.75 ($SD = 1.43$), SES was medium in 15% of cases and low in the remaining 85%, and 71% had left school at the age of 16. 72% lived with their parents and 28% lived with their partners. Sixty-five percent of the infants were the result of unwanted pregnancies, 90% of the adolescents had mothers who had also had early pregnancies and 46% had a history of abuse or neglect. In the control group, mothers had a mean age of 17.94 ($SD = 1.94$), SES was high in 15% of cases and low in the remaining 85%, and 85% had left school at the age of 16. 50% lived with their parents and 50% lived with their partners. Seventy-five percent of the infants were the result of unwanted pregnancies, 87% of the mothers had mothers who had also had early pregnancies, and 50% had a history of abuse or neglect. In both groups, the infants were all born full term, without organic pathologies.

Most of the adolescent mothers of both groups were Italian. The rest were European or Latin American who knew the Italian language and were integrated into the Italian cultural context. In the intervention group 26 mothers were Italian, 2 European and 4 Latin American and in the control group 14 were Italian and 2 Latin American.

At infant 9 months, the number of participants was much smaller: 18 in the intervention group and 10 in the control group because some dyads dropped out of the program after 3 months of treatment ($n = 16$) or the infant was not 9-months old yet ($n = 4$) at the time of the post-intervention assessment.

Procedure and Program Implementation

At infant 3, 6, and 9 months, mother-infant interactions were video-recorded and coded with the Care-Index (Crittenden, 1998) and a modified version of Infant and Caregiver Engagement Phases (Weinberg and Tronick, 1999; Riva Crugnola et al., 2013a) in order to evaluate the changes in interactions and emotion regulation of the mother and infant after 3 and 6 months in the intervention group and in the control group.

The Adult Attachment Interview (George et al., 1985) was also administered to the mothers at infant 3 months to evaluate maternal attachment representations and reflective functioning (Fonagy et al., 1998).

As previously described in the intervention group intervention began at 3 months (risk having been identified at 2 months) with video intervention sessions every month. The mean number of video intervention sessions was 2.3 after 3 months of treatment and 4.1 after 6 months of treatment.

Counseling sessions were also conducted each month. In the intervention group the mean number of counseling sessions was 3.5 after 3 months of intervention and 5.5 after 6 months of intervention.

Developmental guidance sessions were also conducted monthly. In the intervention group the mean number of developmental guidance sessions was 3.7 after 3 months of intervention and 5.2 after 6 months of intervention.

The control group did not follow the intervention program, but did receive routine postnatal well-woman health visits and well-baby healthcare visits.

Measures

Adult Attachment Interview (AAI; George et al., 1985)

The AAI is a semi-structured interview which explores the interviewees' relations with their parents as children, including early separation and means of comfort-seeking. According to the Main coding system (Main et al., 2002), based on 9-point scales, each interview was assessed for the following categories: Secure/Autonomous (F), Dismissing (Ds), Preoccupied (E), Unresolved/Disorganized (U). The interviews assigned to the U category received a secondary score of Secure/Autonomous, Dismissing or Preoccupied. According to this system, autonomous secure attachment involves consistent and objective narration of attachment experiences and their assessment; dismissing attachment involves inconsistent narration of attachment experiences with idealization of attachment figures, distinguished by generally positive descriptions of the latter which are not supported and/or are contradicted by specific episodes, difficulty in remembering and underestimation of these experiences; preoccupied attachment involves inconsistent narration characterized by vagueness and prolixity together with worry and/or anger being expressed toward attachment figures; unresolved/disorganized attachment involves failure to process traumatic episodes (maltreatment, abuse, etc.) and mourning; lastly unclassifiable attachment involves the co-presence of contradictory mental states with regard to attachment.

The interviews were scored by the first author, who is trained and reliable with the AAI coding system. The second judge, also trained and reliable with the AAI coding system, rated 20% of the interviews. Concordance between the two coders for the four way classifications was 85% ($k = 0.70$) and for the two way classifications (secure vs. insecure) 100% ($k = 1.00$).

Reflective Functioning Scales

The reflective functioning scale (*Reflective Functioning*, *RF*; Fonagy et al., 1998) applied to the Adult Attachment Interview allows assessment of the mentalization of the interviewee, understood as the capacity to give meaning to one's own and others' experiences in terms of mental states and emotions. Reflective function is assessed by means of a scale from −1 to 9. The category *Negative RF (-1)* covers interviewees who are confused or hostile and refuse all attempts on the part of the interviewer to get them to begin any reflection; the category *Lacking in RF (1)* covers interviewees in whom the reflective function is totally or almost totally absent. They may mention mental states occasionally with respect to themselves or others, but such mentioning is not connected to feelings underlying the behavior of the interviewee; the category *Questionable or Low RF (3)* covers interviewees who display some evidence of awareness of mental states, albeit at a fairly rudimentary level. The category *Ordinary RF (5)*covers interviewees who possess some type of model of the mind of attachment figures and of their own mind which is relatively consistent if simple; the category *Marked RF (7)* covers interviewees who demonstrate awareness of the nature of mental states for the entire interview and express efforts to reflect on the mental states underlying behavior; the category *Exceptional RF (9)* covers interviewees who are exceptionally sophisticated and surprising, adopting causal reasoning in which

mental states are used. Reliability between coders was calculated on 20% of the interviews through the intraclass correlation coefficient and was ICC = 0.82.

Both coders (the first and second authors) were trained and reliable for the RF scales.

Care-Index

The Child-Adult Relationship Experimental Index (Care-Index; Crittenden, 1998) is a coding instrument for caregiver-infant interaction from 0 to 15 months. There are three scales which measure the behavior of the adult: *Sensitivity*, covers responsive behavior, involvement which is positive and in harmony with the emotions of the infant and his activities; *Controlling*, covers directive behavior characterized by open or implicit hostility (pseudo-sensitive) and interference with the activity of the infant, such as excessive handling of the infant's body, raised tone of voice and hyperstimulation; *Unresponsiveness*, covers behavior marked by physical and emotional detachment from the infant, such as silence, failure to offer play, little or no involvement. The infant's behavior is assessed according to four scales: *Cooperative*, covers behavior associated with the expression of positive emotions, centered on undertaking actions and accepting those offered by the caregiver; *Compliant-Compulsive*, covers cautious and inhibited behavior with an indirect and compliant approach toward the mother; *Difficult*, covers behavior which is explicitly resistant to proposals of the mother, such as avoiding gaze, crying, throwing objects and negative vocalization; *Passive*, covers behavior aimed at reducing physical and emotional contact with the mother, such as failure to vocalize and looking at surroundings. For all scales the scores vary from 0 to 14. With respect to the scores given to maternal sensitivity and infant cooperativeness, the range of scores 0–4 is considered high risk and indicates poor sensitivity of a problematic type requiring therapeutic intervention, the range of scores 5–6 is the range within which intervention is considered necessary as maternal sensitivity is only marginally adequate, 7–10 indicates adequate sensitivity and 11–14 indicates very good sensitivity.

Reliability between observers was calculated on 20% of the observations of the dyads through the intraclass correlation coefficient and was ICC = 0.88 for maternal behavior and ICC = 0.83 for infant behavior. The two coders were blind to the classification of maternal attachment and reflective function scores.

Infant and Caregiver Engagement Phases

The interactions were also coded by the Infant Caregiver and Engagement Phases (ICEP; Weinberg and Tronick, 1999), which we modified to analyze the interaction between mother and infant concerning objects (Riva Crugnola et al., 2013a). This is a system which evaluates the behavior of mother and infant during face-to-face play on the basis of emotions expressed, gaze direction, vocalization, and verbalization. Since the original coding system was created to evaluate mother and infant interaction in the Still Face paradigm, which does not involve the use of objects, we introduced new categories with the aim of exploring the way in which infants and their mothers direct attention to objects during play. These categories differentiate between (1) the infant's attention to objects offered by his/her mother, or chosen by him/herself and (2) the mother's involvement with an object chosen by the infant, or an object chosen by the mother, as shown in **Table 1**.

Maternal and infant behaviors were analyzed second by second, using the Noldus Observer XT system. Coding was continuous and occurred for every instance of a behavior. Maternal and infant behaviors were analyzed second by second. The codes were mutually exclusive. Infant and maternal behavior was coded separately, and at different times, by the same researcher. It was decided to use the same coder given the interactive characteristic of many codes (e.g., those regarding play with objects). It was therefore important that in coding one member of the dyad the researcher also bore in mind the behavior of the other.

In order to evaluate matched and mismatched states, we combined the second-by-second codes according to the "Global States" they represented, using three categories: neutral, positive, and negative, via the GSEQ program (Bakeman and Quera, 1995) as presented in **Table 2**. The Sleeps, Observes Stranger and Unscorable categories of the infant and the Unscorable category of the mother were not included in the behavior analysis or in the grouping of affective states since they were low frequency and not relevant for the assessment of individual and dyadic emotional regulation.

The concept of match and mismatch used by Tronick et al. (2005) was adopted to investigate the capacity to coordinate affective states at dyadic level of mother and infant. Coordinated affective states are defined as "match" and correspond to moments in which mother and infant share and express the same affective states at the same time, whether they be positive, negative or neutral. Non-coordinated affective states are defined as "mismatch" and correspond to moments in which mother and infant have a different affective state at the same time. We then calculated the relative duration of different coordinated affective states (positive match, negative match, neutral match) and of non-coordinated affective states (mismatch; Infant positive/Mother negative, Infant positive/Mother neutral, Infant negative/Mother positive, Infant negative/Mother neutral, Infant neutral/Mother positive, Infant neutral/Mother negative). In calculating total matches we considered the sum of the duration of Infant positive/Mother positive and Infant neutral/Mother neutral matches. The Infant negative/Mother negative was not, however, included because it could not be considered an adequate state of affective coordination (Reck et al., 2011). Total mismatches correspond to the sum of all six different states of mismatch (see **Table 2**). Lastly, we also calculated repair (Tronick et al., 2005), i.e., the dyadic capacity for repair of mismatches according to frequency per minute of passage from mismatch to positive or neutral match (see **Table 2**).

The coder evaluated the behavior of both mother and infant. A second coder operating independently of the first also coded the behavior of the mothers and infants of 20% of the dyads. Inter-rater agreement in the second-by-second codes calculated by Cohen's Kappa coefficient (Cohen, 1960) was 0.89 for the observation of maternal behavior and 0.88 for the observation of

TABLE 1 | Infant and mother behavioral codes.

Infant codes	Negative engagement	Infant is negative, protesting with facial expressions of anger, annoyance, often with crying or withdrawn/passive and minimally engaged with the mother and the environment.
	Social positive engagement	Infant is displaying facial expressions of joy, astonishment and smiles. SPE is considered play with or without objects, but social play.
	Orientation to objects offered by the mother*	Infant is looking, touching, playing with objects offered by the mother.
	Orientation to objects not offered by the mother*	Infant is looking, touching, playing with objects not offered by the mother.
	Orientation to environment	Infant is visually exploring the setting without focalizing attention on any specific object.
	Social monitor	Infant's attention is directed toward mother's face. He/she is looking at her. ward mother's face. He/she is looking at her.
	Allows comforting*	Infant lets the mother comfort him/her when he/she is upset (e.g., she rocks the infant).
	Allows caretaking*	Infant lets the mother provide caregiving (position him, blow his/her nose).
	Unscorable	Infant's face is obscured (e.g., his/her face is covered by the mother's body or is outside the view of the camera) or the infant is asleep.
Mother codes	Negative engagement	Mother is negative, intrusive toward the infant's physical space, activities and objects, hostile or withdrawn (minimally engaged with the infant's activities).
	Social positive engagement	Mother is interacting with the infant through facial expressions of joy and interest, with positive vocalizations, motherese and social play.
	Involvement in play*	Mother joins in the game with the object chosen by the infant.
	Offer of object*	Mother is offering a new object chosen by her to the infant.
	Social monitor	Mother is looking at the infant and his/her activities.
	Comforting*	Mother is comforting the infant when he/she is upset (e.g., he/she cries).
	Caretaking*	Mother is caregiving the infant, positioning him, blowing his/her nose.
	Non-infant focused	Mother is not attending to the infant or to the infant's activities.
	Call for infant's attention*	Mother is trying to draw the infant's attention to her or to an object (e.g., calling the infant, shaking the object, making noises).
	Unscorable	Mother's face is obscured (e.g., her face is covered).

This coding system is an elaboration of ICEP (Weinberg and Tronick, 1999). Categories with an asterisk were not provided in the ICEP, being introduced for the purposes of our studies (Riva Crugnola et al., 2013a).

TABLE 2 | Definition of affective states: positive, neutral, negative.

Affective states	Codes
Infant positive	Social positive engagement, orientation to objects not offered by the mother, orientation to objects offered by the mother
Infant neutral	Social monitor, orientation to the environment, allows caretaking, allows comforting
Infant negative	Negative engagement
Mother positive	Social positive engagement, offer of object, involvement in play
Mother neutral	Social monitor, call for infant's attention, non-infant focused, caretaking, comfort
Mother negative	Negative engagement

infant behavior. The two coders were blind to the classification of maternal attachment and the scores of reflective function.

Data Analysis

The SPSS Statistic 21 package was used for all analyses. Descriptive statistics and comparisons were calculated between intervention and control groups with respect to demographic characteristics and baseline measures to determine the equivalence of the two groups; *t*-tests for the continuous variables and Chi-square test (or Fisher's exact tests) for nominal variables were applied.

To evaluate the effects of intervention on mother-infant interaction, Generalized Linear Mixed Models (GLMMs) with fixed effects including group, time and interaction between group and time and subject level random intercepts were used to analyze group differences and changes in mother-infant interaction from 3 to 9 months between the two different groups. In particular, the effect of interaction between group and time was used to evaluate the effectiveness of the intervention, i.e., whether the intervention group improved more than the control group over time. GLMM procedure for correlations between repeated measures within subjects allows analyzing both fixed and time-varying covariates and automatically handles missing data.

Maternal attachment representations (secure vs. insecure) were used as an additional factor which was tested in separate GLMMs. It was decided to use only maternal attachment as a possible moderating factor on the effectiveness of the intervention, given that there was a high multicollinearity relationship between maternal attachment and scores of reflective functioning.

RESULTS

Socio-Demographic Characteristics

Table 3 shows the comparison made of the intervention and control groups with respect to socio-demographic variables and

TABLE 3 | Socio-demographic characteristics.

	Intervention group (*N* = 32)	Control group (*N* = 16)	Intervention vs. control
MOTHER			
Age Mean (SD; range)	18.75 (1.43; 15–21)	17.94 (1.94; 15–21)	ns
Marital Stastus			
Single	21 (65%)	14 (87%)	ns
Married	11 (35%)	2 (13%)	
Living Arrangements			
With a partner	9 (28%)	8 (50%)	ns
With a parents	23 (72%)	8 (50%)	
Education			
No school degree	0 (0%)	1 (6%)	
Less than secondary education	25 (78%)	14 (88%)	ns
Higher degree	7 (22%)	1 (6%)	
SES (Mean; SD)	19.79 (5.36)	21 (5.99)	ns
History of parenthood at a young age	29 (90%)	14 (87%)	ns
Trauma	15 (46%)	8 (50%)	ns
Unwanted pregnancy	21 (65%)	12 (75%)	ns
INFANT			
Sex			
Female	20 (62%)	10 (62%)	ns
Male	12 (38%)	6 (38%)	

Number of subjects (N), standard deviation (SD), level of significance (p), and non-significance (ns).

risk factors with the Chi-square test (or Fisher's exact test) and the *t*-test according to whether the variables were nominal or continuous in order to determine the equivalence of the two groups. The results did not indicate any significant differences between the intervention and control groups at the baseline stage of infant 3 months.

Maternal Representation of Attachment and Reflective Functioning

In the intervention group, 12 adolescent mothers had secure attachment and 20 mothers insecure attachment of whom 8 Dismissing, 5 Preoccupied, 5 Unresolved/Disorganized, and 2 Cannot Classified; 3 mothers of the control group had secure attachment and 10 insecure attachment of whom 3 Dismissing, 4 Preoccupied and 3 Unresolved/Disorganized. Three mothers (18.7%) of the control group did not take part in the interview.

In both intervention and control groups, 60% of adolescent mothers had an insecure attachment model, with a distribution similar to that of clinical and at risk samples (Bakermans-Kranenburg and van IJzendoorn, 2009). The distribution of attachment groups did not significantly differ between the intervention and control groups (Fisher's exact test = 0.86; *ns*).

In both groups the adolescent mothers also had a low score in reflective functioning. In particular the mothers of the intervention group had an average score of 2.84 and the mothers of the control group an average of 2.23. The difference in the averages of scores on reflective functioning between the two groups was not significant [$t_{(43)} = 1.08$, *ns*].

Mother-Infant Interaction

Interaction styles at 3 months, at the baseline pre-intervention stage, were analyzed first of all to see whether there were any differences between intervention and control groups. Analysis conducted with the *t*-test did not indicate any significant differences between the two groups at 3 months with regard to either mother or infant styles. At the pre-intervention assessment, following the Care-Index coding scheme, the average scores in the range of sensitivity of the dyads was 5 for the mothers of both groups and 3.2 for the infants of the control group and 4.3 for the infants of the intervention group. This band is considered by Crittenden (1998) to be at risk and in need of "future intervention."

Analysis with the Generalized Linear Mixed Models indicated that there was a significant main effect of group [$F_{(1, 46)} = 14.08$, $p = 0.000$] and a significant interaction effect of group × time for the Sensitivity style of the mother [$F_{(2, 74)} = 10.87$, $p = 0.000$; see **Figure 1A**]. The adolescent mothers of the intervention group showed an increase in Sensitivity style compared to the control group after both 3 months of intervention [$b = 3.43$, $t_{(70)} = 3.83$, $p = 0.000$] and 6 months of intervention [$b = 4.31$, $t_{(76)} = 4.01$, $p = 0.000$]. Furthermore, the effect of intervention was greater from 3 to 6 months than from 6 to 9 months [$b = 0.88$, $t_{(76)} = 0.82$, *ns*].

There were also significant main effects of group [$F_{(1, 47)} = 8.75$, $p = 0.005$] and time [$F_{(2, 75)} = 10.42$, $p = 0.000$] and an interaction effect of group × time for Controlling style [$F_{(2, 75)} = 4.44$, $p = 0.015$]. The adolescent mothers of the intervention group compared to the mothers of the control group showed a greater decrease in Controlling style after both 3 months of intervention [$b = -2.78$, $t_{(71)} = -2.80$, $p = 0.006$] and 6 months of intervention [$b = -2.46$, $t_{(77)} = -2.07$, $p = 0.041$]. Furthermore, the effect of intervention was greater from 3 to 6 months than from 6 to 9 months [$b = 0.31$, $t_{(77)} = 0.26$, *ns;* see **Figure 1B**]. However, the mothers of the control group differed in that they showed a decrease in Sensitivity style and maintained a high Controlling style from 3 to 9 months. There were no significant main effects of group [$F_{(1, 48)} = 0.85$, *ns*] and time [$F_{(2, 77)} = 3.10$, *ns*] or interaction effect [$F_{(2, 77)} = 3.06$, *ns*] for the Unresponsiveness style of the mother.

Analysis also indicated that there were significant main effects of group [$F_{(1, 46)} = 15.32$, $p = 0.000$] and time [$F_{(2, 75)} = 5.28$, $p = 0.007$] and a significant interaction effect of group × time for the Cooperative style of the infant [$F_{(2, 75)} = 4.54$, $p = 0.014$]. The infants of the intervention group compared to the infants of the control group had an increase in scores of the Cooperative style after both 3 months of intervention [$b = 2.34$, $t_{(71)} = 2.17$, $p = 0.033$] and 6 months of intervention [$b = 3.60$, $t_{(78)} = 2.80$, $p = 0.006$]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 1.26$, $t_{(78)} = 0.98$, *ns;* see **Figure 1C**]. There was also a significant interaction effect of group × time for the Passive style of the infant [$F_{(2, 77)} = 3.14$, $p = 0.049$] and there was no significant main effect of group

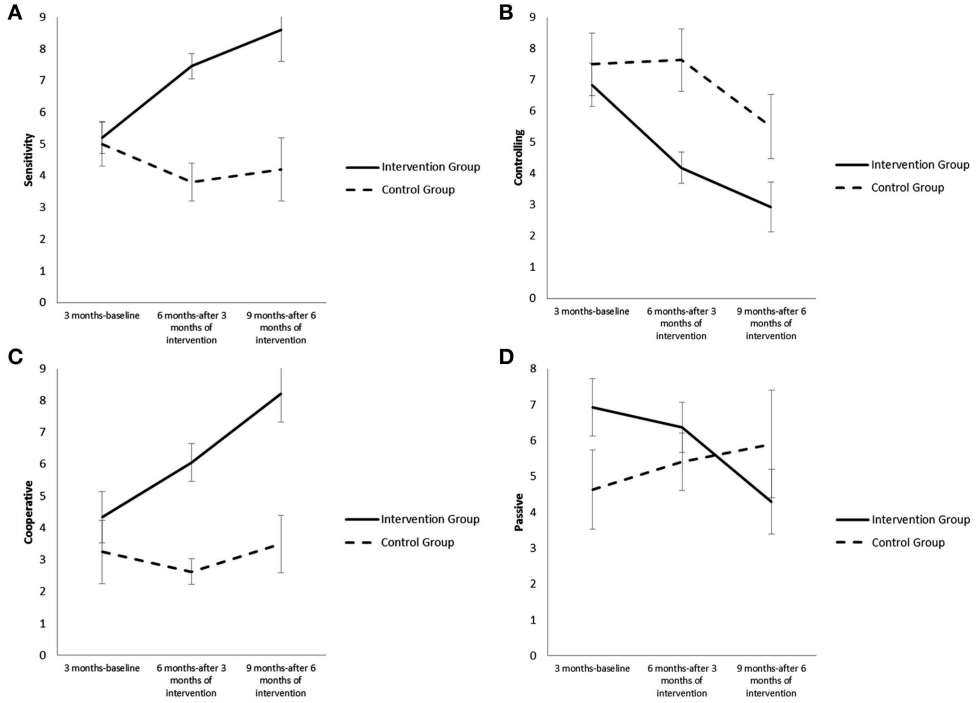

FIGURE 1 | (A) Differences in Sensitivity style for the mothers who participated in the intervention and for the mothers of the control group from 3 to 9 months. **(B)** Differences in Control style for the mothers who participated in the intervention and for the mothers of the control group from 3 to 9 months. **(C)** Differences in Cooperative style for the infants who participated in the intervention and for the infants of the control group from 3 to 9 months. **(D)** Differences in Passive style for the infants who participated in the intervention and for the infants of the control group from 3 to 9 months.

[$F_{(1,\ 47)} = 0.37$, *ns*] and time [$F_{(2,\ 77)} = 0.55$, *ns*]. The infants of the intervention group had a decrease in scores in Passive style at 9 months after 6 months of intervention compared to the infants of the control group [$b = -3.95$, $t_{(80)} = -2.50$, $p = 0.014$] while the effect was not yet significant at 6 months after 3 months of intervention [$b = -1.37$, $t_{(72)} = -1.03$, *ns;* see **Figure 1D**]. The infants of the control group differed in that Cooperative style at 9 months did not change with respect to 3 months, and there was a decrease at 6 months, and Passive style increased from 3 to 9 months. There was, however, no significant main effect of time [$F_{(2,\ 73)} = 1.23$, *ns*] or interaction effect [$F_{(2,\ 73)} = 1.64$, *ns*] for Compliant-Compulsive style and there were no significant main effects of group [$F_{(1,\ 48)} = 3.86$, *ns*] and time [$F_{(2,\ 77)} = 0.49$, *ns*] or interaction effect [$F_{(2,\ 77)} = 0.96$, *ns*] for infant Difficult style.

At the post-intervention assessment by the Care-Index, the intervention group at 9 months reached an average score of 8.6 for mothers and 8.2 for infants, which according to Crittenden (1998) indicates an adequate quality of mother and infant interaction, while the control group went down to an average score of 4.0 for the mothers and 3.5 for the infants, remaining in the "in need of further intervention" category.

Play with Objects and Affective States Coordination

Firstly, we analyzed the individual behaviors of mother and infant in relation to play with objects and affective coordination and repair assessed with ICEP at 3 months at the pre-intervention baseline stage in order to see whether there were any differences between intervention and control groups. Analysis conducted with the *t*-test did not indicate any significant differences between the two groups at 3 months.

We present hereunder the results for the individual categories of behavior as per ICEP concerning play with objects. For the other categories we present the results for dyadic affective coordination, basing ourselves on the grouping of the categories into global affective states (positive, negative, and neutral).

Analysis with the Generalized Linear Mixed Models indicated that there was a significant main effect of time [$F_{(2,\ 84)} = 9.16$, $p = 0.000$] and a significant interaction effect of group × time for "Orientation to Object Offered by the Mother" behavior of the infant [$F_{(2,\ 84)} = 3.23$, $p = 0.044$]. At 9 months compared to 3 months, the infants of the intervention group showed a greater increase than did the infants of the control group in the amount of time spent in "Orientation to Object Offered by the Mother" behavior [$b = 0.17$, $t_{(90)} = 2.50$, $p = 0.014$], while there was not as yet any significant difference at 6 months [$b = 0.08$, $t_{(76)} = 1.45$, *ns;* see **Figure 2A**]. There was also a significant main effect of time for "Orientation to Objects not offered by the Mother" behavior of the infant [$F_{(2,\ 78)} = 42.75$, $p = 0.000$] which indicated an increase from 3 to 9 months in both groups. However, the main effect of group [$F_{(1,\ 46)} = 1.44$, *ns*] and the interaction effect of group × time [$F_{(2,\ 78)} = 2.22$, *ns*] for this behavior were not significant.

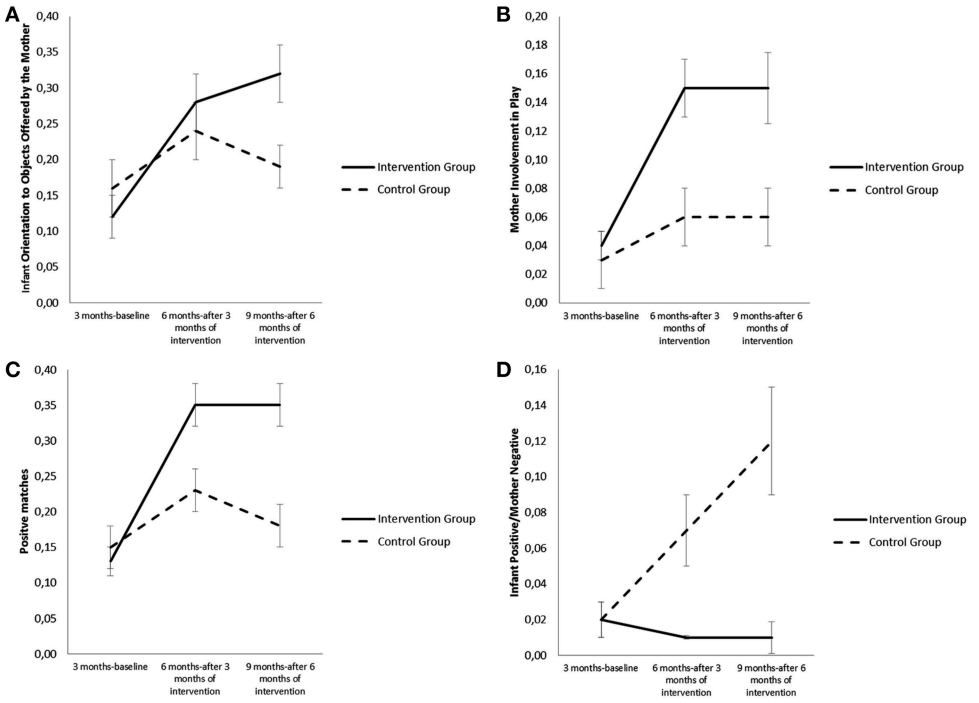

FIGURE 2 | (A) Differences in Infant Orientation to Objects Offered by Mother for the infants who participated in the intervention and for the infants of the control group from 3 to 9 months. **(B)** Differences in Mother Involvement in Play for the mothers who participated in the intervention and for the mothers of the control group from 3 to 9 months. **(C)** Differences in Positive Matches for the dyads who participated in the intervention and for the dyads of the control group from 3 to 9 months. **(D)**. Differences in Infant Positive/Mother Negative Mismatches for the dyads who participated in the intervention and for the dyads of the control group from 3 to 9 months.

With respect to maternal behavior of play with objects, there were significant main effects of group [$F_{(1, 46)} = 10.14$, $p = 0.003$] and time [$F_{(2, 76)} = 11.98$, $p = 0.000$], and a significant interaction effect of group × time for the maternal behavior of "Involvement in Play" [$F_{(2, 69)} = 5.18$, $p = 0.008$]. The adolescent mothers of the intervention group compared to the mothers of the control group had a greater increase in the amount of time spent in "Involvement in Play" behavior after both 3 months of intervention [$b = 0.09$, $t_{(70)} = 3.04$, $p = 0.003$] and 6 months of intervention [$b = 0.08$, $t_{(81)} = 2.24$, $p = 0.027$; see **Figure 2B**]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 0.01$, $t_{(80)} = 0.32$, *ns*]. There were no significant main effects of group [$F_{(1, 45)} = 0.03$, *ns*] and time [$F_{(2, 80)} = 1.88$, *ns*] or interaction effect [$F_{(2, 80)} = 0.97$, *ns*] for the mother's behavior of "Offer of Object."

For what concerns affective state coordination, the results showed that there were significant main effects of group [$F_{(1, 44)} = 10.28$, $p = 0.002$] and time [$F_{(2, 78)} = 14.32$, $p = 0.000$] and a significant interaction effect of group × time for positive matches [$F_{(2, 78)} = 4.82$, $p = 0.011$]. The dyads of the intervention group compared to the dyads of the control group showed a greater increase in the amount of time spent in states of positive match after both 3 months of intervention [$b = 0.14$, $t_{(71)} = 2.55$, $p = 0.013$] and 6 months [$b = 0.17$, $t_{(84)} = 2.69$, $p = 0.008$]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 0.03$, $t_{(84)} = 0.50$, *ns;* see **Figure 2C**].

However, there were no significant interaction effects on negative matches [$F_{(2, 84)} = 0.93$, $p = ns$] and neutral matches [$F_{(2, 76)} = 0.15$, *ns*]. There was, however, a significant main effect of time for neutral matches [$F_{(2, 76)} = 19.42$, $p = 0.000$] which indicated a decrease from 3 to 9 months in both groups.

Compared to individual mismatches, there were significant main effects of time [$F_{(2, 85)} = 4.23$, $p = 0.018$] and group [$F_{(1, 53)} = 16.66$, $p = 0.000$] and a significant interaction effect of group × time [$F_{(2, 85)} = 6.69$, $p = 0.002$] for the mismatch "Infant positive/Mother negative." In the dyads of the intervention group compared to the dyads of the control group there was a decrease in the amount of time spent in mismatch "Infant positive/Mother negative" after both 3 months of intervention [$b = -0.60$, $t_{(79)} = -2.45$, $p = 0.016$] and 6 months[$b = -0.10$, $t_{(89)} = -3.50$, $p = 0.001$]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = -0.04$, $t_{(89)} = -0.1.40$, *ns*]. However, in the dyads of the control group there was an increase in the mismatch "Infant positive/Mother negative" from 3 to 9 months (see **Figure 2D**). Lastly, there were no significant interaction effects for the other individual mismatches.

Analysis also indicated that there was a significant main effect of group [$F_{(1, 42)} = 6.82$, $p = 0.012$] and a significant interaction effect of group × time for all matches [$F_{(2, 73)} = 3.92$, $p =$

0.024]. The dyads of the intervention group spent more time than the control group in states of match after both 3 months of intervention [$b = 0.11$, $t_{(67)} = 2.11$, $p = 0.039$] and 6 months [$b = 0.16$, $t_{(77)} = 2.56$, $p = 0.012$]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 0.04$, $t_{(77)} = 0.77$, *ns;* see **Figure 3A**].

There was also a significant main effect of group [$F_{(1, 42)} = 6.97$, $p = 0.011$] and a significant interaction effect of group × time for all mismatches [$F_{(2, 73)} = 3.70$, $p = 0.029$]. The dyads of the intervention group spent less time in states of mismatch from 3 to 9 months after both 3 months of intervention [$b = -0.11$, $t_{(67)} = -2.04$, $p = 0.045$] and 6 months of intervention than the control group[$b = -0.16$, $t_{(78)} = -2.49$, $p = 0.015$]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 0.04$, $t_{(78)} = 0.75$, *ns*; see **Figure 3B**].

Finally, for what concerns capacity for repair, i.e., moving from states of mismatch to states of match, there were significant main effects of group [$F_{(1, 44)} = 14.16$, $p = 0.000$] and time [$F_{(1, 77)} = 3.82$, $p = 0.026$] and a significant interaction effect of group × time [$F_{(2, 77)} = 8.19$, $p = 0.001$]. The dyads of the intervention group compared to the dyads of the control group showed from 3 to 9 months an increase in the frequency of repair after both 3 months of intervention [$b = 1.74$, $t_{(70)} = 3.08$, $p = 0.003$] and 6 months [$b = 2.44$, $t_{(82)} = 3.68$, $p = 0.000$; see **Figure 3C**]. Furthermore, the effect was greater from 3 to 6 months than from 6 to 9 months [$b = 0.70$, $t_{(72)} = 1.05$, *ns*].

The profile of the control group was the converse of that of the intervention group since it showed an increase in the amount of time spent in states of mismatch and a decrease both in the amount of time spent in states of match and in the frequency of repair from mismatch to match from 3 to 9 months.

The Moderating Effect of Maternal Attachment Representations and Reflective Functioning on the Effectiveness of Intervention

Given that the scores of maternal reflective functioning were strongly associated to the type of maternal attachment (Fisher's exact test = 30.98; $p = 0.000$), in that the adolescent mothers with secure attachment had higher scores of reflective functioning than did the adolescent mothers with insecure attachment [$t_{(43)} = 6.85$; $p = 0.000$], it was decided to use only one of the two variables, the attachment model, as a possible moderator of the effectiveness of intervention.

To investigate whether the factor of maternal attachment representation was moderating the effect of the intervention, GLMMs were conducted that used AAI status (secure vs. insecure), group (intervention vs. control) and time as fixed effects. In particular, to evaluate the moderating effect of maternal attachment representations, the effect of interaction between group, time and quality of attachment were considered. Complete

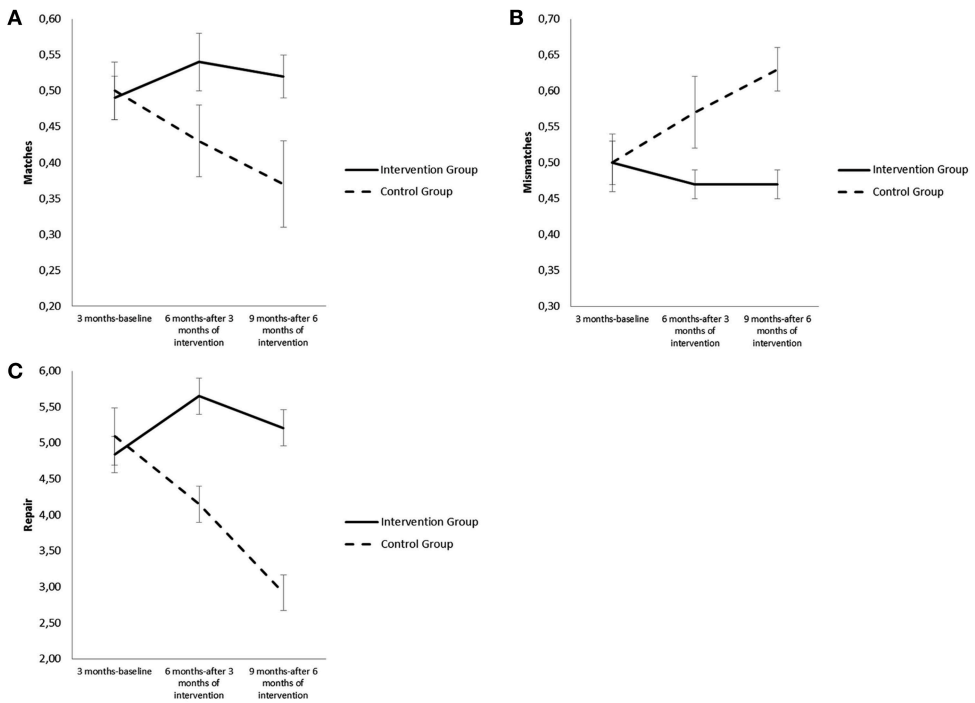

FIGURE 3 | (A) Differences in Matches, for the dyads who participated in the intervention and for the dyads of the control group from 3 to 9 months. **(B)** Differences in Mismatches for the dyads who participated in the intervention and for the dyads of the control group from 3 to 9 months. **(C)** Differences in Repair for the dyads who participated in the intervention and for the dyads of the control group from 3 to 9 months.

analysis was only possible for participants who did the AAI ($n = 45$).

Analysis indicated that there were no significant interaction effects between the effect of intervention and the quality of the maternal attachment model either for mother or infant styles measured with the Care-Index, for play with objects, affective coordination and repair evaluated with ICEP (see **Table 4**).

A Case History

To illustrate our way of working, we shall here describe in brief the intervention with a mother-infant couple. Sofia was 20 when she arrived at our service with her 2-month old infant, Marco. Sofia's condition was characterized by multiple risk factors due to her family history. Her parents divorced when she was young and in the following period her mother was imprisoned and her father abused her physicaly and psychologically. She then went to live with her maternal grandparents and four younger siblings. From that moment on Sofia had to take the place of her mother in looking after her siblings, often suffering anxiety when caring for them. After the birth of Marco, Sofia went to live with her partner and decided to stop looking after her siblings. This decision, however, gave rise to a strong sense of guilt which she struggled with.

Of particular use in understanding how Sofia had processed these events was the AAI conducted with her at infant 3 months. Sofia's attachment model was preoccupied with aspects of anger both toward her parents (E2; Main et al., 2002), even though Sophia displayed some awareness of her adverse experiences. In this context Marco's birth had particular significance for Sofia: she could at last look after her own needs and not those of her siblings. However, this desire clashed immediately with Marco's needs and the anxiety which Sofia experienced with her siblings emerged anew.

In the first video session the interaction between Sofia and Marco immediately seemed problematic. A style of interaction prevailed which oscillated between intrusive and non-responsive, while Marco expressed distress by crying and avoiding contact with his mother. Sofia also expressed difficulty in interacting with Marco by playing and sharing positive emotions. In the video interventions the team worked with Sofia both on the meaning of Marco's crying and on his attempts at communication. In the second 6 months, Sofia seemed to find it difficult to support Marco's desire to explore and to share activities with her. Thanks to the video sessions triadic interaction improved significantly.

The assessment conducted with the Care-Index and the ICEP before the intervention (2 months) and at the end (9 months) showed, for Sofia, a significant increase in sensitivity and a

TABLE 4 | Main and interaction effects of the attachment model and effectiveness of intervention.

		Maternal attachment			Maternal attachment × Time × Group		
		F	*df*	*p*	*F*	*df*	*p*
Care-index	Sensitivity	1.03	40	0.31	0.52	66	0.59
	Controlling	0.19	41	0.65	0.02	66	0.97
	Unresponsiveness	1.59	41	0.21	0.29	68	0.74
	Cooperative	0.42	40	0.51	1.24	67	0.29
	Compliant-compulsive	1.04	41	0.35	0.64	66	0.52
	Difficult	0.44	41	0.50	1.91	65	0.15
	Passive	0.53	40	0.46	1.27	66	0.28
ICEP	Infant orientation to objects offered by the mother	0.03	42	0.84	0.40	74	0.67
	Infant orientation to objects not offered by the mother	0.49	40	0.48	0.56	69	0.57
	Mother involvment in play	0.59	40	0.44	0.94	69	0.39
	Mother offer of object	0.03	39	0.84	0.25	69	0.77
	Infant positive-mother positive	0.74	39	0.39	0.38	70	0.68
	Infant negative-mother negative	0.66	44	0.41	0.63	75	0.53
	Infant neutral-mother neutral	1.16	37	0.29	0.15	68	0.85
	Infant positive-mother negative	1.60	46	0.21	1.01	76	0.36
	Infant positive-mother neutral	0.00	41	0.94	0.39	68	0.67
	Infant negative-mother positive	0.40	39	0.53	0.08	72	0.92
	Infant negative-mother neutral	0.14	39	0.70	1.21	72	0.30
	Infant neutral-mother positive	0.32	40	0.57	0.29	70	0.74
	Infant neutral-mother negative	1.47	34	0.23	1.94	62	0.15
	Match	3.73	35	0.06	0.12	65	0.88
	Mismatch	3.87	36	0.05	0.10	66	0.90
	Repair	0.40	39	0.52	0.02	69	0.97

Degrees of freedom (df) and level of significance (p).

decrease in unresponsiveness and controlling style and, for Marco, an increase in cooperative style and a decrease in passive and difficult style. There had also been a fall in negative matches and an increase in positive matches and in the capacity for repair.

The counseling conducted with Sofia in parallel with the video intervention allowed her to address the sense of solitude that she had experienced with respect to being neglected by her mother and the anger she felt toward her. At the same time Sofia managed to make sense of the acute anxiety she had felt looking after her siblings and which she now felt from time to time caring for Marco.

At the end of the intervention Sofia began to make plans for herself and to consolidate the relationship with her partner who constantly supported her during the intervention. At 16 months Marco's attachment to his mother, assessed with the Strange Situation Procedure (Ainsworth et al., 1978), was secure, unlike that of Sofia which was insecure preoccupied at the beginning of the intervention. The chain of intergenerational transmission of attachment had therefore been broken. Likewise the absence of neglect and abuse in Sofia's caring for Marco bear witness to the fact that there had been no transmission to Marco of the adverse experiences suffered by Sofia.

The intervention thus achieved both aims of our program: to support the mother-infant relationship and to protect the growth of the adolescent mother. In this regard the relationship of trust which formed between Sofia and the two therapists (a psychologist and a psychomotrist) who followed her was very important, serving as secure base for her budding relationship with Marco.

DISCUSSION

The pilot study confirms the initial hypotheses, showing that after 3 and 6 months of intervention the PRERAYMI program, based on three strategies, video intervention, psychological counseling and developmental guidance, is effective both considering at a global level, the sensitivity of the mother and the cooperation of the infant, and considering at micro-analytic level, the affective coordination of the adolescent mother-infant dyads.

Analysis of styles of interaction between mother and infant assessed at a global level with the Care-Index scales shows that in the group of dyads with intervention the sensitivity of the mothers increases significantly both after 3 and 6 months of intervention, while there is a decrease in their Controlling style. On the contrary, in the control group there is a decrease in maternal Sensitivity style already after 3 months, while Controlling style remains high. Likewise, the Cooperative style of the infants of the intervention group increases significantly after 3 and 6 months and their Passive style decreases after 6 months, unlike the infants of the control group in which the Cooperative style remains stable and the Passive style increases after 6 months.

Furthermore, the intervention group at 9 months reaches an average score of 8.6 of sensitivity for the mothers and 8.2 of cooperativity for the infants, which indicates, according to Crittenden (1998), an adequate quality of mother and infant interaction, moving from the band of risk observed at the start of intervention to the band of adequacy at the end of intervention. In the control group, however, there was a decrease in sensitivity toward an average score of 4.0 for mothers and a decrease in cooperation toward an average score of 3.5 for infants. The control group dyads remain, therefore, in the same area of risk with respect to quality of interaction, defined by Crittenden as a band in "need of further intervention" (Crittenden, 1998), as that observed at infant 3 months.

This data indicates that intervention may be considered effective, given that it has been demonstrated that maternal sensitivity and low hostility are correlated with a positive outcome for the development of the infant at the level of both the quality of his attachment and psychopathological risk, while an association between low maternal sensitivity and control or hostility and psychopathological risk has been shown (Cumberland-Li et al., 2003; Mäntymaa et al., 2004; Lorber and Egeland, 2009; Haltigan et al., 2013). Furthermore, the increase in infant cooperation, understood as the capacity to interact with the mother and the decrease in passivity, understood as poor involvement and withdrawal from interaction, may be considered indicators of effectiveness. A number of studies have shown a correlation between maternal sensitivity and infant cooperation (Crittenden, 2008) and a positive association between infant cooperation and low psychopathological risk (Riva Crugnola et al., 2013a).

An increase in dyadic affective coordination was also observed in the intervention group. In the dyads with intervention after 3 and 6 months affective coordination increased both at the level of amount of time spent in states of affective coordination and amount of time spent in positive match. The amount of time spent in states of mismatch decreased. Lastly, there was an increase in capacity for repair. In the control group we see the contrary happening, with an increase in amount of time spent in states of mismatch and a decrease in amount of time spent in states of match; at the same time the frequency of repair decreases. The increase in affective coordination in the intervention dyads must be considered a key piece of data with respect to the effectiveness of intervention in that it is held by various researchers to be a particularly significant indicator with regard to the adequacy of the mother/infant relationship. See, in particular, the model of Tronick (2007) on mutual parent/infant regulation, which considers affective coordination and the capacity to repair errors in communication to be a central aspect of the functioning of a parent/infant dyad. Various studies show, in this regard, that in conditions of risk for parenthood (Riva Crugnola et al., 2013a), including maternal perinatal depression (Reck et al., 2011), there is less of this coordination than is the case with dyads without conditions of risk.

For what concerns individual mismatches, in the intervention dyads we see a decrease in the mismatch "Infant positive/Mother negative," a mismatch which increases in the control group. The decrease is an indicator of effectiveness, given that this type of mismatch, involving negative states in the mother in the co-presence of positive states in the infant, is considered to be an expression of dysfunctional mother/infant communication (Lyons-Ruth, 2006).

The intervention was also effective for what concerns triadic involvement in play with objects by the mother/infant dyads who

used the intervention. In the mothers after 3 and 6 months and in the infants after 6 months there was a greater increase in amount of time spent in mutual involvement in play than in the control group. This may also be considered an indicator of effectiveness since it indicates that at 9 months the infants of the intervention group showed that they had achieved to a greater extent than the control group the mother/infant/object triadic coordination typical of secondary intersubjectivity, demonstrated by the increase in the behavior "Orientation to Objects Offered by Mother." This achievement may be connected to the increased capacity of the mothers of the intervention group to carry out a scaffolding function, demonstrated by the greater increase in these mothers in the behavior "Involvement in Play" of the infant, an increase which is lower in the mothers of the control group.

To sum up, the program has proven to be effective both at the level of mother/infant styles of interaction and at the level of mother/infant affective and play coordination. We may hypothesize that the use of different techniques—video intervention, counseling and developmental guidance—aimed at increasing the sensitivity of the mother, her capacity to regulate the infant's emotions and her capacity to reflect on her own mental states and on those of the infant may explain this efficacy. Indeed, it is known that maternal sensitivity and reflective capacity are correlated (Slade et al., 2005a).

Finally, for what concerns comparison of the results after 3 and 6 months of intervention it is interesting to note that the majority of the variables change for the better already after 3 months of intervention and this increase is greater in that period than it is in the subsequent 3 months. See in particular, in this regard, at an individual level, maternal sensitivity and control and infant cooperation and at dyadic level, the amount of time spent in states of affective coordination and in states of positive match, the amount of time spent in mismatch Infant positive/Mother negative and the capacity for repair. These data indicate the importance of beginning intervention with adolescent mothers in the first months after birth. It may be hypothesized in this regard that, by acting early and intensively with different strategies, the intervention has an effect right from the first months, helping to change inadequate parental behaviors, increasing infant cooperation and improving dyadic affective coordination. These changes remain stable also after 3 months right to the end of intervention. Recent meta-analyses (Geeraert et al., 2004; Nievar et al., 2010) have demonstrated that intervention programs which provide for very frequent meetings in the first months of intervention are twice as effective as programs with less frequent meetings.

Our results are also in line with studies that have showed that attachment-based programs for adolescent mothers which use video-feedback are effective in improving the quality of maternal parenting (Moran et al., 2005; Slade et al., 2005b; McDonald et al., 2009), as well as with studies on the use of video-feedback in attachment-based intervention for at risk parents (Steele et al., 2010).

It is important to stress, however, that our study is more exhaustive than previous studies. It assesses the effectiveness of intervention not only with respect to maternal sensitivity but to the cooperative contribution of the infant too. Furthermore, it also considers dyadic affective coordination as an outcome variable. Our study, therefore, demonstrates the effectiveness of intervention since it helps increase not only maternal sensitivity but also infant cooperation, at the same time influencing both partners' capacity for mutual emotion regulation. Only one attachment-based study for adolescent mothers (Mayers et al., 2008) has assessed infant as well as maternal contribution and no study has considered dyadic emotion regulation.

Another important result is that there were no significant differences with respect to the effectiveness of intervention in relation to maternal attachment models. In other conditions of risk for the parent/infant relationship, such as that of insecure maternal representations, the program therefore maintained its effectiveness. In fact it is well-known that insecure maternal attachment models are associated with a lower level of adequacy in the mother/infant relationship, at the level of emotional attunement (Haft and Slade, 1989; De Oliveira et al., 2005), emotional availability (Biringen et al., 2000) and dyadic emotion regulation (Riva Crugnola et al., 2013a). In other attachment-based programs maternal disorganization with respect to attachment (Moran et al., 2005) was shown to be a factor which made intervention ineffective. Our data, however, are in line with a recent study which showed that an attachment-based intervention program for high-risk dyads was effective with both secure and insecure mothers (Pillhofer et al., 2014).

Our study has a number of limits. One of these is that it is a pilot study which therefore examined the effectiveness of intervention only at its conclusion, without there yet being sufficient data on the two follow-up stages, relating to assessment of infant attachment at 14 months and assessment of their possible psychopathological risk at 24 months. The small number of participants also reduces the possibility of generalizing the results. Another limit is the non-randomized assignment of participants to the intervention and control groups. It must, however, be considered that at the beginning of the intervention the participants did not differ significantly either socio-demographically or in their styles of interaction and regulation measured with the Care-Index and ICEP.

Future objectives of the study, in addition to that of continuing with the follow up stages, will be (by increasing the number of participants) to study other variables which may affect outcome. Variables of particular interest could be a previous history of abuse, something which is very frequent in the adolescent mothers we follow, and symptoms of perinatal depression in the mothers for whom the intervention is intended. A further objective could be to assess any variations in the mothers' capacity of reflective functioning, measuring it pre and post-intervention.

AUTHOR CONTRIBUTIONS

All authors listed, have made substantial, direct and intellectual contribution to the work, and approved it for publication.

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CASE REPORT
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Pediatricians, Well-Baby Visits, and Video Intervention Therapy: Feasibility of a Video-Feedback Infant Mental Health Support Intervention in a Pediatric Primary Health Care Setting

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This case series study evaluated the feasibility and acceptability of a behavioral/cognitive psychological intervention in a pediatric primary health care setting during standard well-baby visits. The aim of the intervention was to support caregivers' sensitivity and mentalization in order to promote infant mental health (IMH). Four neonates from birth to 8 months were consecutively enrolled to test a short video-feedback intervention (Primary Care – Video Intervention Therapy, an adaptation of George Downing's Video Intervention Therapy to primary care) conducted by a pediatrician. The 5 min interaction recording and the video-feedback session were performed during the same well-baby visit and in the same pediatrician's office where the physical examination was conducted. During the study period, six video-feedback sessions were performed for each baby at different ages (1, 2, 3, 4, 6, 8 months). A series of different interactional situations were filmed and discussed: touch, cry, affective matching, descriptive language, feeding, separation and autonomy. The intervention was easily accepted and much appreciated by all four families enrolled. This study aimed to answer a dilemma which pediatric providers generally face: if the provider wishes to respond not only to physical but also IMH issues, how on a practical level can this be done? This case series study indicates that Primary Care – Video Intervention Therapy can be a promising new tool for such a purpose.

Keywords: infant mental health, primary care, pediatrician, prevention, video-feedback, parenting, attachment

Abbreviations: IMH, infant mental health; PC-VIT, Primary Care – Video Intervention Therapy; PPCP, pediatric primary care provider; VIT, Video Intervention Therapy; WBV, well-baby visit.

INTRODUCTION

Integrating Mental Health and Primary Care

The prevention of mental illness and physical disorders and the promotion of mental health and physical health are inseparable (Blount et al., 2007; Lake and Chan, 2014). Internationally there is currently widespread support to improve health care systems by effectively integrating mental health and primary care (Hunter et al., 2009; Zeneah and Gleason, 2009).

For many reasons, the integration of infant mental health (IMH) within primary health provider services seems especially strategic (Committee on Psychosocial Aspects of Child and Family Health and Task Force on Mental Health, 2009; Shonkoff et al., 2009; Kaplan-Sanoff et al., 2012; World Health Organization [WHO], 2013). First, in the developed world, virtually all young children are seen regularly from birth throughout the early years in primary health care settings. Therefore, universal approaches to screening and intervention can be applied to large populations of infants and toddlers (Shonkoff, 2003; Garner et al., 2012). Second, common problems in young children, such as sleep or feeding disturbances, aggressive behavior problems and emotional disturbances are often presented first to health care professionals. Third, most families value the relationship with their primary care providers and are comfortable in openly discussing concerns. Most families initially seek help for mental health concerns in the primary care setting. This is especially true for families from culturally, economically and ethnically diverse communities. Fourth, a number of preventive interventions have been developed using health care practitioners as providers (Lester and Sparrow, 2010; Hornstein, 2014). For all of these reasons, interest in how to apply principles of IMH to practice in primary care has grown.

IMH and Pediatric Primary Care: Focus on Relationship

Current pediatric practice in many developed countries emphasizes the need for behavioral and developmental surveillance as part of preventive health care, which typically takes place within the context of "well-child" health visits (Weitzman and Wegner, 2015). Pediatric primary care providers (PPCPs) see young children and their families more frequently than any other health professional. Observations of parent-infant interactions during pediatric health care visits are a rich source of information regarding the relationship between the parent and infant. Such observations also provide opportunities for intervention. If the pediatrician is able give a useful form of brief, immediate help for the relationship, this could be valuable for a large number of families. Naturally in some cases, further assessment and intervention by a mental health professional would be indicated, but for these cases too, the pediatrician's early detection of such problems would play an important role in aiding a parent to seek further help (Talmi et al., 2009).

Extensive research has demonstrated that responsive relationships with primary caregivers play a critical role in healthy social-emotional development (Tronik, 2007). The growing recognition of this significance of the parent–child relationship represents a paradigm shift for most pediatric health care professionals (Gorski, 2001).

The Use of Video Feedback in Attachment-Based Interventions

Video-feedback is a powerful tool that is increasingly being used across a number of therapeutic modalities (Marvin et al., 2002; Dozier et al., 2006; Rusconi-Serpa et al., 2009; Bernard et al., 2012; Juffer and Steele, 2014; Steele et al., 2014). Attachment-based interventions, especially those with infants and young children, which incorporate the use of video-feedback are gaining an evidence base (Bakermans-Kranenburg et al., 2005; Fukkink, 2008). There are a number of ways in which video can be used (Guedeney and Guedeney, 2010). Usually video-feedback is part of a multimodal approach also including instruction, therapeutic counseling and other forms of parental support. Some approaches use a short series of sessions with specific themes designated for each session (Juffer et al., 2008; Cassidy et al., 2011; Powell et al., 2013). Other approaches base the choice of each session theme upon the particular case and how it is evolving (Beebe, 2003; Papousek et al., 2004; Downing, 2008; Papousek, 2011; Beebe and Steele, 2013). A meta-analysis of 81 studies, including 51 randomized controlled trials of interventions to improve maternal sensitivity, showed that even a few video-aided behavioral interventions with parents tend to be highly effective (Bakermans-Kranenburg et al., 2003).

Video-feedback can be used for simultaneous important purposes. It can greatly aid a parent to better notice and identify children's cues. It can allow the parent to view and perhaps challenge her or his own behavior. It can help the parent better hypothesize the motivational roots of the child's behavior, a set of abilities called mentalization (or reflective functioning). Mentalization capacity has been shown in itself to be a powerful predictor of infant–parent attachment security (Fonagy et al., 1991; Fonagy and Target, 2005; Slade, 2005a,b; Schechter et al., 2006; Salder et al., 2008; Steele and Steele, 2008; Berthelot et al., 2015).

Video Intervention Therapy

Video Intervention Therapy (VIT) is a mentalization-based, cognitive-behavioral methodology (Downing, 2008). In addition to classical cognitive behavioral techniques it draws on mentalization and other techniques developed within VIT itself (Reck et al., 2004; Downing et al., 2008; Downing, 2015; Riva Crugnola et al., 2015).

A video of a parent–child interaction is filmed which is relevant to the problems the parent is having and the age of the child. The video can record the parent and child involved in playing, nursing or feeding, a bath, a diaper change, mealtime, a conflict or boundary-setting situation, and so on. The video is usually 5–10 min in length, and can be filmed in the practice setting or in the family home.

In the VIT session, one or both parents look at and reflect upon the video with the therapist. A six-step protocol is followed. As a session unfolds, two general types of therapeutic focus

become possible (Downing, 2005; Downing et al., 2014). One is focusing on what in VIT is called the "outer movie"—that is, the visible behavior of both parent and child. The other is on the "inner movie" —that is, what the parent subjectively experienced during the interaction, and/or what the child perhaps subjectively experienced (the latter is reflected upon using mentalization techniques). Some attention is always given to the outer movie. Depending on circumstances (e.g., the goals of the session, the availability of the parent) the work with the inner movie may be woven in as well. Therapists also learn a specific set of categories, a "scanning map," to look at a video in preparation for a session.

Typically in the session, in Step 1, the therapist shows a selected part of the video, and the patient is asked to comment. The patient or patients (e.g., a parental couple) are encouraged to share what they have found of interest in the video. Discussion based on these remarks may follow. In Step 2, the therapist points out a series of visible positive moments in the interaction seen in the video, and shares his or her reasons for regarding them as positive. Some additional discussion may take place. In Step 3, the therapist turns to and offers diplomatic, non-confrontative language for a negative pattern in the interaction. Most often only one pattern is selected. In Step 4, the negative pattern just highlighted is explored. When VIT is being done in a psychotherapy mode, this exploration is carried out in some depth. When it is being done in a coaching mode, the exploration is briefer. In Step 5, the therapist and the patient reflect together on one or more new actions that the patient can make at home. In other words, the focus moves now to the when, where, and how of behavioral change. In Step 6, the therapist summarizes the main points elaborated in the session.

Not every session proceeds in exactly this way. VIT is meant to be genuinely collaborative, with the patient's input and thinking central to the process. As a result, a patient's ideas now and then take a creative turn, and the therapeutic exchange veers away from its planned direction.

BACKGROUND

Approach to the Case Series

Our case series study aimed to evaluate a community-based IMH preventive intervention named Primary Care – Video Intervention Therapy (PC-VIT). The key to the intervention was the use of a protocol from VIT (Downing, 2005). VIT can be employed either as psychotherapy, or, in a more limited manner, as mental health coaching (Tiffany, 1982; Jordan and Livingstone, 2013; Barnett et al., 2014; Whittaker et al., 2014). In this study a simplified, manualized coaching form was used. The preferential work with positive interactions during VIT session was chosen in order to facilitate its use by diverse health care professionals. The use of steps 1, 2, 5, and 6 of the VIT protocol are easier and are normally the first recommended way to start training in the VIT procedure. Moreover many other video-feedback interventions work only on positive patterns. The focus on negative patterns is not avoided in PC-VIT but provided only when parents see them and are willing to discuss such patterns. The more expert the professional is in VIT the more he or she can work on negative interactional patterns seen in the video recordings. To our knowledge this is the first study assessing a video-feedback intervention to support IMH in a primary care setting conducted by a pediatrician (the first author). We also did not find any other description in the literature of a video-feedback intervention to promote IMH core topics in a community pediatric primary care service.

Such an approach has the great advantage of allowing universal access to a preventive IMH service to all newborns attending the pediatric primary care office. Often parents of a newborn or infant, even if in great distress, do not recognize their needy condition and do not actively ask for help (Felitti et al., 1998; Lyons-Ruth et al., 2005; Shonkoff and Garner, 2012; Murphy et al., 2014). The active offer of a support intervention by a physician in a trustful setting could bypass such an obstacle. In addition, because PC-VIT is integrated into pediatric primary care and does not require home visits, it is economically quite inexpensive (Knapp et al., 2005).

In addition to the video-feedback technique, this approach was unusual in being done by a pediatrician trained in counseling techniques, psychotherapy, and VIT. In principle, however, the integration could just as well be accomplished, in the same setting, with two different health care providers. For example, a pediatric nurse practitioner (Freed et al., 2010), a developmental specialist (Mendelsohn et al., 2007), or IMH professional (Briggs et al., 2007), could carry out the video-feedback component during the same visit.

Feasibility and acceptability were the main endpoints (primary outcome) of this study: evaluating how this preventive IMH intervention could be embedded in a busy pediatric primary care service, how parents would accept and react to it, whether and how much parents would appreciate it, and what kind of drop-out rate might occur (i.e., if any family would refuse to continue with the video-feedback sessions while still continuing with the WBVs).

The intervention was offered to both primary caregivers (mother and father) with the intent to keep fathers engaged in the whole process (Scourfield et al., 2014), as usually fathers do not attend WBVs (Garfield and Isacco, 2006). Hence another endpoint was to measure how many times fathers attended the WBV sessions.

No formal assessment of therapeutic efficacy was done in this case series study. We collected only personal feedback from parents enrolled in the study. The evaluation of the effects of this intervention on the infant–caregiver relationship, on the parental mental states related to parenting, or on the infant attachment style was not an assessment goal.

Many models for using pediatric primary health care to promote child development and literacy have proven to be efficacious despite their low intensity and cost (Zuckerman, 2009). Furthermore many intervention protocols on child–caregiver relationship with video-feedback in normal and high risk populations have supported the efficacy of such approaches (Green et al., 2015; Hoivik et al., 2015). We therefore based this intervention on quite promising premises. However, a formal evaluation of the efficacy of the approach is the goal of another, separate study: one involving an appropriate number of infants

with appropriate assessment scales and measures, currently underway with the collaboration of the University of Padova (Italy).

Participants

The intervention was implemented with normal population families attending a pediatric primary care community office that was part of a larger primary care pediatric center serving more than 3000 children and their families. This pediatric group practice is part of the Italian National Health Service and provides free of charge care to children from birth up to 14 years of age.

Three pediatricians, two secretaries and two pediatric nurses work in the center. Each pediatrician serves a child population ranging from 900 to 1200 children, and each child is assigned to a specific pediatrician. Each pediatrician sees a mean of 250 sick children per month. The group practice receives 1200 phone calls each month.

Participants were enrolled during the first visit with the pediatrician and an infant ranging in age from 15 to 30 days. The first four babies registered with the pediatric service, after the beginning date of the study, were successfully enrolled in the study. All four cases were enrolled within a 30-day period between June and July 2014.

The intervention was offered to whichever family members initially came to the pediatrician's office in order to register their newborn. Both parents (or primary caregivers) were then offered the 18-month long intervention. It was explained that the intervention would be intended to support the infant's physical as well as psychological and relational development with video-feedback as a specific tool.

No family refused the intervention. Informed consent was obtained for filming infant–caregiver interaction and video-feedback sessions. Baseline data and medical histories of both parents and infant were obtained during the first visit. As the aim of the study was to assess feasibility and acceptability but not efficacy, no psychometric measures where obtained at the beginning or during the course of the intervention. Since high quality film recording was done at every WBV, in principle a further evaluation of the infant–caregiver relationship quality pre- and post-intervention could be done at some future moment.

One of the principal aims of the study was also to assess the practical issues involved in embedding a video-feedback intervention in a busy pediatric primary care office: how to record infant–caregiver interactions, for how long, when and how to show the film clip recorded for the video-feedback session, who to keep in the office during the session (i.e., parent with or without the infant). The following were also evaluated: the parents' acceptance of the intervention; their reaction to the double professional role of the pediatrician (physician plus mental health practitioner); the number of intervention dropouts; and the number of times the couple attended the WBV together. Finally, we evaluated if this type of enhanced WBV reduced the total number of doctor's or nurse's primary care center access (i.e., reduced the quantity of visits for any reason: medical problems, queries about infant development, maternal anxiety, etc.).

Intervention

The PC-VIT manualized protocol (unpublished document) was derived from the VIT standard procedure. The routinely scheduled WBVs in Italy occur at 1, 3, 6, 8, 12, 18, and 24 months. In support of an early relationship, for the purpose of PC-VIT intervention, two more WBVs were added at 2 and 4 months.

During every WBV there was a 15–20 min medical visit (for the physical examination, evaluation and discussion of medical problems) and a 40–45 min video-feedback intervention. In the 15–20 min medical visit a video clip (5 min) appropriate to the WBV (the setting and theme of the video recording changed with the age of the baby as explained later) was recorded (**Table 1**). The 5 min recording of interaction and the video-feedback session were performed during the same WBV and in the same pediatrician's office where the medical examination was conducted.

Every video-feedback session was performed for each baby at different ages (1, 2, 3, 4, 6, 8, 12, 18 months). A series of different interactional situations (touch, cry, and needy behaviors, affective matching, descriptive language, feeding, separation and autonomy, book reading, limit setting) were filmed and discussed. The whole process was recorded as well: both the medical visit and the VIT procedure (for the pediatrician self-evaluation see Fukkink et al., 2011 and other assessment/analysis purposes see Meade et al., 2014). Each session had a fixed set of questions that were asked. However, the sequencing of these questions was left open, so that they could be adapted to the natural flow of the intervention.

The categories of the fixed set of questions were: (1) attachment based interaction observations and relevant probe questions, and (2) theme-specific probe questions designed to promote reflective functioning. Regardless of what was seen in the video clip these points had to be addressed. No written learning materials or pamphlets were given to families at visits to take home. Input given to the parents was limited to the discussions in the WBV sessions themselves.

As already mentioned, a helpful aspect of this intervention was providing both medical and mental health advice and support by the same practitioner, in addition to the trustful atmosphere this tends to create. Often enough, during the first years of infancy, issues concerning relationship and emotional regulation can be closely intertwined with medical issues. A frequent and typical example is the 1–3 month "infant colic." Many parents confuse frequent infant crying as a physical issue: they imagine the crying is being caused by, e.g., "tummy ache" or "food intolerance." And

TABLE 1 | Brief scheme of single WBV plus PC-VIT session.

Minutes	Medical examination	Video recording	PC-VIT
0–20	x	x (5 min)	
20–40			x
40–60	x		x

Medical examination, includes physical examination in the first part and recommendations plus indications about psychomotor development and physical health promotion advice. WBV, well-baby visit. PC-VIT, Primary Care – Video Intervention Therapy.

at the same time they may consider the idea of soothing the baby, directly in the caregiver's arms, as a way of spoiling the newborn. In such instances the pediatrician has the opportunity to help them face at the same time, within the same session, both the physical issue (e.g., "infant colic") and any related relational aspects. In a short amount of time this can provide clarification and guidance for the family. The unique conditions and emotional climate of the WBVs seem to allow parents to take such information quite rapidly, and to profit from it on a practical level, making shifts in both their thinking and their interactional behavior.

Case 2 Vignette: WBV 2 Months; PC-VIT Step 2

This was the first video-feedback session with this mother. She had attended a previous WBV together with her husband. This time she was accompanied by her own mother. This mother (of the infant) felt very uneasy with her infant's crying. She reported being unable to calm her baby down and was beginning to think her baby had a physical problem which was causing such inconsolable crying. She had many doubts as well about being a good mother, and often felt anxious and incompetent.

We report here verbatim the dialog between the pediatrician (P) and the mother (M). The video clip was registered after the pediatrician had induced the baby to cry (theme of the session) using the Ortolani maneuver: a standard procedure used to check congenital hip dislocation in newborns which is a bit distressing for infants and which always makes them cry.

After the infant started crying the pediatrician left the office, leaving the mother alone. After 5 min the pediatrician returned and, after a short interval, started the PC-VIT session. Together with the mother the pediatrician looked at the just-registered recording. He paused it after 90 s, and asked the mother what she found interesting in what they had seen (procedure step 1). After this brief discussion the pediatrician showed the mother an interaction of his choosing, as reported verbatim here (step 2).

P : Let's see another piece of the video . . ..

A brief (20 s) video-clip was shown where the mother picks up her crying infant, places her against her chest, and starts to swing softly while singing with a sweet tone of voice. After a few seconds the infant ceases to cry, opens her eyes and appears relaxed.

P: So this is very good. She is in distress and you are calm.
M: Mm, mm *(nodding her head, but still looking puzzled).*
P: Your tone of voice is calm, sweet. That is very good! This helps the baby to calm down.
M: Mm, mm *(nodding her head).*

The same sequence was shown again to the mother.

P: She is in distress, because something inside her is distressing her. But you have a calm tone of voice. This physical contact is also important *(the pediatrician shows this in the video to the mother)*, and the movement as well. These are two very good things you are doing.
M: Mm, mm and she likes (listening to my) singing.

The mother here became more relaxed and smiling while looking at the video clip.

P: Yes! And so little by little she is calming down. The distress could last a bit, but you are calm with her, and that is the main thing.

The same sequence, and a bit more, was shown again to the mother. The recording was stopped leaving on the screen an image of the mother singing with the infant clinging to her and looking at her with open eyes.

P: So, this experience of being distressed, and then being calmed down by you, her feeling this closeness with you, this must bring a sensation of wellness, of security inside her . . . and this is what will help her gradually learn to calm down by herself. Because she has had this good experience.
M: Yes, great. This is what I want to give her.

The mother was smiling and relaxed.

P: You are doing it very well. Yes.
M: I want to do the best for her.
P: You are doing very well and the crying, and the response to crying . . .. crying is like saying "help me, I don't know what to do, something is happening inside me and I don't know what . . . Help me to calm down." And you are doing it with her! So she has this good experience.
M: What I really appreciate is that you give me much security. This helps me a lot.

Case 1 Vignette: WBV 1 Month; PC-VIT Steps 1 and 2

Before this visit there had already been a 15 days extra-WBV and another office visit with both parents. This mother was quite anxious about the needy behaviors of her infant, thinking that if she gave her baby all she was asking for she would spoil her. For the mother it seemed also emotionally difficult to tolerate both the infant's cry and her need for body contact.

This was the first video-feedback session at the 1 month WBV. Only the mother (M) was present. The theme of the session was touch and body-to-body contact between caregiver and infant (X). For the recording, the pediatrician (P), before leaving the office, told the mother to hold her baby and to behave as she usually did at home. In the 5-min recorded film the infant first cried for 90 s on the examination table (the mother was seated beside it and the infant was lying on the table), then the mother took the infant on her lap and tried to distract her with some objects. Eventually she moved the infant to her chest, talking to her. Little by little the infant relaxed, even if not completely, with a few whimpers and body adjusting continuing. In the verbatim transcription below the pediatrician showed a 10 s interaction where the infant was beginning to relax.

P: Let's look again at this video clip . . .. she was just crying, and now she's got a few hiccups, but she is reducing her movements. She is not completely calm yet but she is relaxing little by little.
M: She's quieter.
P: She has calmed down.
M: Yes.
P: This contact, to stay there with her mum . . . she likes it.
M: Yes.
P: What do you think?
M: Yes, I agree with that.

P: Ok, it appears to me this . . .. here look . . .. she gets agitated and then she calms down, but here, to hold her in your arms in this way . . .. Eh that movement (*one visible in the video clip)*, ok, it appears that that contact helps her to calm down, do you agree?
M: Yes *(but hesitating, and looking not really convinced).*
P: I would like to ask you now . . . how does it feel to hold her in your arms? This body contact... how is it for you?
M: I like it very much, but after a while I get tired, I get tired...
P: Ok, let's talk more about the experience you have.
M: Ah, I would hold her all day long if only I could...
P: Yes?
M: Yes, yes I... when I have her against me it's wonderful.

As this was not evident by her manner of saying it, the mother didn't appear credible. Therefore instead of confirmation, some reflective questions followed.

P: Ok and . . . how do you know it? How do you understand it?
M: Eh, because I feel emotional, I cry, I look at her and I cry because my feelings . . .. that is, sometimes I look at her and say "have I made this baby?" and this really moves me to cry.
P: So what do these tears mean?
M: Eh, positive emotions . . . I don't know, a bit of distress from my side, being tired, but after I say "poor little creature, what does she have to do with this!" I don't know. . ..
P: Mm mm.
M: Sometimes I get angry, I rebuke her a bit. Sometimes she gets quiet and doesn't whine anymore, and some other times she starts...
P: Mm mm.
M: Sometimes the mother *(talking about herself)* says "I do not have to shout . . .. keep quiet, sit down there . . . because, in the end, it is useless . . ..".

For the pediatrician, he felt quite positive that the mother evidently felt trustful enough to move to talking about this negative side. These were obviously topics worth further investigation and reflection.

P: So we notice here that, when X *(infant's name)* is a bit like now *(in the video clip)* not calming down quickly, inside of you two different things happen: one is that you are happy to hold her, to feel this sensation that she is yours, that she is born, and is here.
M: Yes, yes.
P: The other is that sometimes partly you do not like it *(to hold her)*, that this does not work well for you.
M: And it is for this reason that I did not want to use the swaddling clothes . . . because I feel the need to separate from her.
P: Yes, mm.
M: Yes, the need that she stays for half an hour...
P: This is important for you, to feel this and being able to recognize your own needs, it's important.
M: I say to myself "take her with you now, I'm not able...I need to calm down a bit...." But soon after that I'm missing her again.
P: Mm mm, yes.
M: But often physically I just can't manage it.

The pediatrician further helped the mother to reflect on what was happening inside her. The still frame of the video clip was visible on the screen and both referred to it.

P: So here there are several things going on inside you.
M: Yes, I try not to fidget because I know it is bad for her, maybe she could feel it. I try but I do not always succeed.
P: I would like to show you again *(showing the video clip again)* here how this, this body-to-body contact that is happening here, this contact, and movement, are calming her.
M: She likes it very much. She likes it too when I massage her feet and tummy.

The pediatrician repeatedly emphasized the positive actions the mother made to calm her infant. To show resources and capabilities which are already present is fundamental with such fragile parents.

P: These movements we see here . . .. also the caressing you were doing before... we can see they calm her down, let's see it again...
M: Yes, yes.
P: Here you see, your sweet tone of voice, she likes this calm tone of voice very much. And this soft movement in your arms, she likes it. Receiving these things, for X, is very good, it creates inside her a sensation of being calm . . .. All this will eventually help her learn to calm herself, at least some of the time, when she needs it. Does this make sense to you?
M: Yes, yes
P: This experience produces in her the sensation: "ok, here with mum I can experience this nice sensation of being calm and secure."

These two case vignettes give an idea of how powerful the use of PC-VIT can be. Parents see themselves in the video clip, and they are immediately engaged. They are right away usually motivated to discuss what happens between them and their infant. Thanks to this, and together with the trusting relationship with the pediatrician, they are ready to reflect. They leave the session with clear images of their capabilities, as well as with concrete ideas about new steps they can take in their interaction with their infants.

In these two vignettes the focus was mainly on positive reinforcement and simple mentalization techniques. This is not the full picture, as other techniques, not described here, are used as well; but it should give a sense of the PC-VIT functions in a pediatrician's office.

DISCUSSION

Participants Characteristics

Four newborn babies and their families were enrolled within a 30 days period in June–July 2014 (**Table 2**). In all four cases the newborn was the first child. Only one mother had had a spontaneous abortion in the past. One baby was born by vaginal delivery and three by caesarian section. All four babies were born at term, with an APGAR score between 9 and 10 at the first minute, the mean birth weight was 3.2 kg.

TABLE 2 | Infant's characteristics.

	Gender	Previous pregnancy	Type of delivery	Gestational age	APGAR	Birth weight
Case 1	F	0	Caesarian section	38/52	10,10,10	3.05 kg
Case 2	F	0	Caesarian section	41/52	/	/
Case 3	M	0	Caesarian section	39/52	9,10,10	2.85 kg
Case 4	M	1 (abortion)	Normal vaginal	41/52	9,10,10	3.84 kg

All four couples were married. The mean age of the mother and the father was 36 years (**Table 3**). Considering the mean age of Italian parents at birth of the first child, 36 years is quite usual. In one couple, both partners were Italian, in the other three, one partner was Italian and the other from elsewhere in the European Union. Two parents had a university degree, four had a high school degree and one a middle school degree. All parents were employed in medium to high level jobs.

Intervention Feasibility

Technological requirements to implement PC-VIT intervention are easily available to primary care professionals. All that is needed is a personal computer, a screen and a web-cam. Every professional normally uses them already or can purchase the equipment with little expense. No specific expertise is required to use such machinery.

The total number of WBVs after enrollment, irrespective of case number and infant age, was 20. In all but two (18/20 = 90%) a VIT session was carried out (**Table 4**). On one occasion the recording was not made because of an equipment problem, and on the other occasion parents were so worried about a medical problem (infant's urinary tract infection) that the whole visit was dedicated to this issue. Video recordings were easily realized during WBVs in the pediatric office context.

The 5 min recording always provided sufficient interaction examples for a productive exploration during the VIT session, both positive and negative elements could easily be seen. For example, most of the time in the first 60 s of the recording there was a good example of a positive interaction which could be reflected on. It was rarely necessary to continue watching the recording for more than 2 min in order to find brief moments of interest.

It is important here to bear in mind also that the pediatrician himself, when working with the recording, was seeing it for the first time. This is an unusual prerequisite of this intervention, essential for the WBV setting. Normally in other forms of video-feedback intervention the video recording is made on one occasion, either by the practitioner or the family themselves, and then the intervention takes place on a second occasion. This allows the practitioner to have at some point a moment alone with it, for preparation. However, in this case series the need for the pediatrician to comment at once on the video, immediately after having seen it, was not a problem. Likely this, in part, reflects the reality that the types of interaction filmed are ones with which any pediatrician who does WBVs is highly familiar.

For all these reasons PC-VIT appears to be a feasible intervention in the primary care pediatrician's office. No major technological, time-consuming procedures or other obstacles seemed to jeopardize the intervention. Five minutes of video recording during WBV were well accepted by parents and provided good material for video-feedback.

TABLE 3 | Parent's characteristics.

	Age		Origin		Study title	
	M	F	M	F	M	F
Case 1	33	35	EU	IT	High school	High school
Case 2	/	36	EU	IT	University	University
Case 3	36	32	IT	EU	University	High school
Case 4	40	41	IT	EU	Middle school	High school
Mean	36	36	/	/	/	/

IT, Italy. EU, European Union.

TABLE 4 | Pediatrician's office access, WBV and PC-VIT sessions.

	Case 1	Case 2	Case 3	Case 4	Total
Total n° WBV	6	5	6	6	22
N° WBV after enrollment	5	4	6	5	20
N° PC-VIT session	5	3	5	5	18
Mother/Father	1	3	1	3	8
Mother/Grandparent	0	1	2	1	4
Mother	4	0	3	2	9
Doctor's office visits	2	2	3	2	9
Nurse's visits	3	0	1	0	4
Phone calls	3	2	5	1	11

WBV, well-baby visit. PC-VIT, Primary Care – Video Intervention Therapy.

Intervention Acceptability

All families to whom the intervention was offered accepted being enrolled in the study and signed the informed consent of the intervention protocol and a specific consent form for recordings (recruitment rate 100%). All families (at least one parent each WBV) attended all sessions (attendance rate 100%) and there were no drop-outs.

In 8/20 sessions (40%) the father was present; the main reason for fathers skipping the appointment was work obligations. In Italy maternity leave starts before delivery and lasts a minimum of 5 months; the majority of maternity leaves are taken by mothers even if fathers are allowed to take them as well.

The general approach of the pediatrician in observing the infant–caregiver interaction together with parents in order to "help the baby to develop" was easily accepted by parents without their seeming to feel under investigation or being judged. On the other side, even in this small case series sample, three out of eight

parents had to overcome an initial reluctance about looking at themselves in the video. In only one case (a father) was this a genuine obstacle to the VIT session. In the other two cases this sense of vulnerability was easily overcome, perhaps due to their comfortable relationship with the pediatrician.

The intervention seemed to be very well accepted by parents (high attendance rate and no drop-outs) and seemed to respond to an often unmet need of discussing with a professional about not only physical or developmental issues, but also about emotional and relational aspects of parenthood. In this regard PC-VIT appears to be an adoptable intervention by primary care services in response to this important parental need as shown during the final parental semi-structured interview about their PC-VIT experience.

Preliminary Outcomes

Considering the activity of the pediatric office as a whole for all four cases, during the 8 months of the study, nine physician examinations for medical issues (mean of two visits per infant), four nurse's visits, and eleven phone calls for advice from nurses were performed. This number of contact with the pediatric group practice appears to be less than average. This is the only measurable effect we can analyze based on the data available.

As already pointed out, no formal assessment of the VIT sessions' effect on infant–caregiver interaction, nor on parental mentalization, nor infant attachment style were carried out in this case series as this was not our aim. Many different aspects of the infant–parent relationship and of infant development could in principle be examined in this 0–18 month intervention design. We consider this a next step to be undertaken in a new project.

Final Parent's PC-VIT Evaluation

We here transcribe verbatim two short comments from mothers and fathers during the 8 months WBV after at least three PC-VIT sessions. Parents were asked to comment freely on what seemed different about using film recordings of themselves interacting with their infants.

Case 3 PC-VIT Protocol Evaluation: 8 Months WBV

Only the mother (M) was present. This family had had 5 PC-VIT sessions recorded, one of which the father was present, and in two of which the grandmother attended. The mother's comments here refer to the 8 months PC-VIT session where the theme was "separation and autonomy." In the recording that was used for video-feedback the infant (X) was seated in a high chair with mother directly facing him. The pediatrician left the office, leaving them interacting, then he knocked on the door and the mother went out of the room. The infant was thus left alone for 1 min, after which the mother reentered the room. This is our standard filmed activity for the 8 months WBV.

P: I would like to ask you something else. What we have done so far with the video . . . Do you see a difference between talking about X (*infant's name)* and what happens between you two, compared to watching what happens between you and talking about it?

M: Ehh, it is completely different!

P: Ok...

M: Because to look at oneself in this way, I mean when I am with him I see only him, I don't see anything else. Instead here *(in the video session)* I can see us together, eh, then you can pick up many different things like the complicity between our gaze, it was there, wasn't it? Instead you can take it for granted and not pause to reflect on the moment of reunion . . . no? Regarding the need for closeness... and it's nice to see that anyway you give him tranquility (comfort)... because here you see him when he's alone and how he behaves and then, when I come back in the room, you can see how he reacts and shows a different behavior, alone I would not have noticed it... in the video his reaction is very clear.

P: And . . . what we do here with the video, in this way, for half an hour . . . When you are back home, do you take something with you? I mean these images, and our discussions . . . do you bring these home with you, inside yourself, and do you use them a little back at home?

M: Yes, yes. Hee . . . obviously they make me reflect. Because, for example, when he cries "oh I'm fed up! Here he is again!" and you are finishing your duties, and then you understand and reflect that he is crying because . . .. because he needs contact, he needs contact to calm down, so, instead of letting him cry for 10 min alone, you go there a moment, try to calm him down, you try to think about it, try to calm him down and then you go and finish your duties.

P: So what you are saying now is that you are starting to better understand his point of view?

M: Yes *(with the video)* you understand his point of view more.

P: Yes, his state.

M: Yes.

P: Well, eh . . . I think this is relevant.

M: Yes, and also the fear. Last time we reflected on fears, why babies cry, because many times it seems like a whim to the parents, because "you are changed, you are clean, you have eaten, you are in your cute room softly laid down, but what more do you want? Leave your mother in peace for 5 min!" and instead he is afraid, to be left alone and so you think about it and this gives you . . ..

P: the motivation to go and calm him down, is it so?

M: Yes, yes . . . to me this thing *(video-feedback sessions)* has been very useful.

P: Nice to hear this from you.

Case 4 PC-VIT Protocol Evaluation: 8 Months WBV

Only the mother (M) attended this session. This family had 5 PC-VIT sessions, in three the father was present, and in one the maternal grandmother. This couple was very attuned; unfortunately the father, sensitive and caring, was, however, not present in this session to give his feedback.

P: According to you is there any difference between doing what we do here: looking at the video clip and talking about it, compared to talking about interaction and relationship without watching the film recordings?

M: Eh, quite a lot according to me, because by watching I understand more, I am able to see little moments, and to pick up little things, if we had not watched the video I would

not have been able to understand . . ..like I do now: the 2 s reactions...
P: Mm mm, ok.
M: . . . of sadness and then immediately after of joy . . .. I think it is very useful.
P: Ok and in what sense is it more useful according to you?
M: To help the mother to understand her behavior, if there really is a good relationship between mother and infant.
P: Mm mm, ok.
M: Things like that, I believe it is really . . .. Good.

CONCLUDING REMARKS

In many countries today WBVs now make a significant contribution to early physical health and development. What our experience with PC-VIT suggests is that this same setting offers an additional valuable opportunity (Dozier and Bick, 2007; Mendelsohn et al., 2011a,b; Buchholz and Talmi, 2012; Ordway et al., 2015). Parents can be assisted, in a gentle, supportive manner, to think in new ways about the parent–infant relationship and about their infants' inner life. Parents usually arrive at WBVs already wanting to receive information and help (Olson et al., 2004). Many of them openly show, with the pediatrician, an immediate level of trust which in other professional contexts (social work, day care, etc.) would typically take longer to emerge.

There is of course a second advantage in adding such an approach. In the event that any parent–infant dyad appears to have extreme difficulty, then this parent could be immediately encouraged to seek out more extensive therapeutic help (Weitzman and Wegner, 2015). As much developmental and clinical research has shown, the earlier such aid is provided, the better (Gilbert et al., 2009; MacMillan et al., 2009). However, finding such dyads, and motivating them to seek additional assistance, is only a secondary purpose for PC-VIT. Its primary purpose is preventive, as well as reaching a much larger number of families.

No doubt that the four families of the study strongly appreciated this intervention. There was an attendance rate of 100% and no dropouts. The attendance rate of fathers was also up to 40% of WBVs, more than the normal attendance rate of fathers at WBVs (an effect which perhaps could be strengthened further). Every parent answered a semi-structured interview evaluating their experience and perception of the intervention (Ayala and Elder, 2011). As depicted in the parents' final comments vignettes, the overall valuation of the WBVs with PC-VIT session was notably positive. All participants valued the intervention as useful to them in enhancing the ability to understand their behaviors and their infant's behaviors better. They reported feeling more confident as parents and more aware of their capabilities.

In regard to feasibility and adoptability of this intervention to other pediatricians, to different settings (not only pediatrician's office) and to a larger population some considerations can be proposed bearing in mind that only a new study can answer the many questions that this case study of four families raises.

PC-VIT approach requires a basic technological equipment, easily attainable and usable in the same office where WBVs take place. All the procedures are quite inexpensive. The practicality of this protocol did not show any major drawbacks during all the 20 video-feedback sessions performed during the study. The two main difficulties to translate in practice and disseminate (adoptability) this approach would seem to be: time expenditure and primary care professional's training.

If we consider, for example, the Italian National Health System, an average primary care pediatrician (completely funded by government) takes care of one thousand children. In such a case there will be a turnover of nearly ten children a month with ten new newborns registered. In this case series we considered all WBVs completed up to only the 8th month visit, as the study is not yet completed, but the complete intervention protocol includes WBVs up until the 18th month WBV. Providing each newborn nine PC-VIT sessions in the first 18 months could increase the pediatrician's workload by 1-2 h per day.

A way to reduce such a workload could be by cutting the total number of PC-VIT sessions (i.e., 2 and 4 months WBV). Selecting parents and families that need PC-VIT intervention with the use of questionnaires, for example, self-administered or professionally administered, might conceivably be one way of selecting who to target. Or one might envisage contexts in which PC-VIT might be used for specific problems and developmental issues, e.g., difficulties with breastfeeding and feeding, excessive crying, or the like. One to three PC-VIT sessions might perhaps serve as a first level of assistance, with a referral for more extensive help being made only when necessary. Again, the thought here is that WBVs provide the possibility to catch such problems early, offering an opportunity to prevent development of a worse or more chronic difficulty.

An alternative could be to add a mental health professional beside the pediatrician, in the same office. Both professionals could work as a team, each one with different objectives, but working together in the same office and at the same time. There is a long standing similar project, even if with different intervention targets, with a lot of research to support the efficacy (Mendelsohn et al., 2007, 2011a,b).

However there is currently insufficient evidence to determine the optimal timing and intensity of primary care interventions to promote IMH (Guedeney et al., 2011). Our expectation is that the small amount of extra time required for a video intervention will produce measurable positive results in interaction quality, parental mentalizing, and infant attachment (Bakermans-Kranenburg et al., 2003) as already proven in other video-feedback intervention projects. Our expectation is that these results will prove to be empirically measureable. As mentioned, research on PC-VIT currently underway at the University of Padova (Italy) will hopefully shed more light on these questions.

Structured home visiting programs are of course another means of providing early preventive help (Olds et al., 2007; Juffer et al., 2008), but obviously pediatric primary care interventions can be undertaken at a much lower economic cost. In any

case, data-supported cost-effectiveness analyses will be needed to better understand implications for public health policy (Robling et al., 2016). Likely such analyses will especially clarify whether pediatric interventions should be used for the population as a whole or for specific at-risk populations.

As for training of pediatricians or related professionals (e.g., pediatric nurses, IMH professionals, early childhood practitioners, health visitors, child care professionals), it is yet to be worked out how this can best be done (Korfmacher, 2014). We anticipate that such training can be relatively brief, since what must be taught is a simplified coaching variant of VIT, utilizing only several easily mastered techniques. Based on the third author's considerable experience teaching VIT coaching in other contexts, it seems reasonable to assume that PC-VIT can be quickly learned. Primary care professionals are today aware of the striking importance (Shonkoff, 2003; Shonkoff et al., 2009; Shonkoff and Garner, 2012) of early life preventing intervention targeting the infant's social environment and they seem interested and keen to train in this regard.

The methodology of Antoine Guedeney, creator of ADBB, the Alarm Distress Baby Scale (Guedeney and Fermanian, 2001) has inspired us. The ADBB is a screening system of observation for infant social behavior, designed to be taught to pediatricians and other PPCPs and to be utilized by them in WBVs (Puura et al., 2010; Burtchen et al., 2013). A quite limited instruction period (2 weekends) has proven sufficient for training pediatricians in the system. ADBB has now been adopted in a number of different countries. Extensive research has been carried out, showing that wherever it is taught, the number of referrals of troubled parent–infant dyads by PPCPs to mental health services noticeably increases (Dollberg et al., 2006; Guedeney et al., 2013; Matthey et al., 2013).

We find encouraging how Guedeney's results have demonstrated the rapidity with which PPCPs can learn a new mode of evaluating infant social behavior. The difference between the ADBB mode of live observation and our mode of video observation is quite small. Some other training projects for primary health care practitioners, aiming to teach how to support parent–infant interaction, have also required only limited amounts of training (Layiou-Lignos et al., 2005). Clearly optimism seems warranted in this regard.

The applicability of PC-VIT protocol to other primary care professionals needs to be further assessed. Here only one pediatrician tested PC-VIT in his office, but as many other similar video-feedback interventions in primary care demonstrate, they can be easily implemented in many different settings by professionals with different expertise.

The first author has already trained some pediatric primary care professionals of his region in the use of PC-VIT. No data are available but unstructured interviews with them showed their strong interest in implementing this procedure. Our anecdotal observation is also that some pediatricians that started integrating PC-VIT with WBVs: reported that once they have learned and started using PC-VIT, it also aided them during times when the video was not involved. On the one hand, they noticed much more with respect to the live parent–infant interactions taking place in the office; on the other hand, they felt they had a better repertoire of responses to parental questions and concerns, for example questions about touch on issues similar to those described above. These additional side effects also seem unsurprising, even if here too it does not reflect a primary purpose. The adoptability of the PC-VIT procedure by primary care professionals therefore seems promising.

Plenty of open questions remain. Should PC-VIT ideally be done with all parents, or with selected subgroups? And if with subgroups, then which ones and determined how? Concrete data about the tradeoffs of time cost vs. developmental benefit are needed. When benefits are found, for which types of parent and/or infant do they seem most prevalent, and with what effect sizes? What might this tell us about how wide a net should be cast? A lot more information is needed, but so far the prospect of adding PC-VIT to WBVs looks promising.

AUTHOR CONTRIBUTIONS

SF developed the project, the adaptation of Video Intervention Therapy to the Primary Care setting and was the only professional performing the video-feedback sessions (he is a pediatrician, psychotherapist and VIT teacher and supervisor). VM was responsible for the data collection/handling, the review of the literature and the drafting of the manuscript. GD supervised the design of the study, the development of the PC-VIT manual, and revised the content critically. He also supervised some PC-VIT sessions.

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Self-Perception of Parental Role, Family Functioning, and Familistic Beliefs in Italian Parents: Early Evidence

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Recent research has explored the relationships between family and cultural issues, claiming attention on the need to consider and evaluate cultural values and beliefs as useful factors to promote positive family adjustment and parenting outcomes (Cardoso and Thompson, 2010; Taylor et al., 2012). This paper explored self-perception of parental role, family maladjustment and cultural beliefs in a sample of Italian parents. More specifically, 204 mother and 204 fathers of adolescents (13–17 years old) filled self-report questionnaires about family system maladjustment (Family Assessment Measure-III), self-perception of parental role (Self-Perception of Parental Role), parents' beliefs and attitudes toward the family (Attitudinal Familism Scale), and parents' cultural values (Cultural Values Survey). Results showed that parents have a similar self-perception of family functioning and they share common cultural beliefs and values toward the family. However, fathers felt more satisfied and involved in parenting then mothers and they were more able to balance the different roles of their life. Mothers and fathers showed a similar path of correlations, in which greater level of satisfaction in parenting and better ability in role balancing correlated with a more positive family adjustment. Moreover, a higher perception of family maladjustment was associated to lower levels of family cohesion and cooperation. Furthermore, higher levels of satisfaction were associated to higher scores in family solidarity, equality among sexes and equality in decision takers. These results introduce important implications for family studies in Italian culture, and open to comparison with parenting in other cultures.

Keywords: parenting, family adjustment, cultural values, familism, Italian parents

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INTRODUCTION

The last two decades have been marked by a substantial attention to children's well-being that can be generally understood to encompass physical, social, and emotional health (Statham and Chase, 2010). Several authors suggest that family functioning and parenting practices have an enormous influence over the development, education, health, and well-being of their children (Brown, 2004; Amato, 2005; Armstrong et al., 2005; Nelson et al., 2014). More specifically, plenty of studies demonstrated that negative family functioning and unhealthy parenting are often linked to worse emotional and behavioral outcomes for a child, including more opportunities for conduct problems, peer problems, eating disorders, substance abuse, internalized problems (i.e., anxiety and

depression), and less positive outcomes such as diminished social competence and self-esteem later in life (Scaramella et al., 1999; Smetana et al., 2002; Barnes et al., 2006; Dishion et al., 2008; Abu-Rayya and Yang, 2012; Letourneau et al., 2013; Ferro and Boyle, 2014; Angley et al., 2015). Those findings claim for research in this area, particularly in Italy which was rated in the middle/bottom third of the rank in a recent report on well-being in European children (Bradshaw and Richardson, 2009).

Family functioning is defined as the interactions between -and reactions to- family members; it includes variables within the family such as members' roles and boundaries, degree of cohesion, adaptation, and resilience, as well as family values and beliefs (Winek, 2010). In other words, as stated in the final report about positive family functioning edited by the Australian Department of Families, Housing, Community Services and Indigenous Affairs (2010), family functions refers to a variety of characteristics encompassing several domains such as emotional attributes (e.g., closeness of parent–child relationships, warmth, sensitivity, perceived support, and safety), family governance issues (e.g., members' role, age appropriate rules), engagement and cognitive development, physical health habits, quality of intra-familial relationships (e.g., parent–child interactions, parent-parent relationships, spouse–spouse relationships), and social connectedness (e.g., relationships with the extended family, activities outside the family unit, members' role balance).

A good family adjustment provides a foundation for positive parenting (Newland, 2015). Parenting is a multidimensional challenging process that covers complex variables, not limited to caregiving activities (Bornstein, 2002). It is often assessed focusing on parents' perception of their ability to perform as parents (Waldman-Levi et al., 2015). Most of the research on self-perception of parenting were based on self-efficacy theory, stating that individuals who perceive themselves as competent and valuable, who are self-confident with their abilities, and who are able to envisage the likely effects of their actions, will, as parents, more probably act as positive and helpful partners for their children's development (Bandura, 1997; Bornstein et al., 2011b). Self-perception of parenting includes several possible characteristics such as feeling of competence experienced in the role of parent, involvement in caregiving, satisfaction from caregiving relationship, and ability to balance parenting with other role in life (Bornstein et al., 2003).

Recently, researchers have begun to claim attention on the need to consider and evaluate cultural values and beliefs as useful factors to promote positive family and parenting outcomes (Cardoso and Thompson, 2010; Taylor et al., 2012). Bornstein et al. (2011b) well motivated this issue, highlighting that "adults do not parent in isolation, but always do so in social and cultural context." Thus, parents and cultures are strictly related since parenting, among other things, is aimed to transmit the prevailing culture across generations and to transmit the existing culture to the next generation. Culture is here contextualized as a set of distinctive patterns of beliefs and behaviors that are shared by a group of people and that serve to regulate their daily living, including practices related to childrearing and child development (Bornstein et al., 2011a). An important cultural value that has been found positively related to family adjustment is familism, a cultural belief originally devised for Latino populations, describing the strong identification of individuals with their family (Sabogal et al., 1987). Familism emphasizes an ideal for family relationships to be warm, close, and supportive and that is considered one of the several family-related constructs that are prevalent in collectivist cultures that value prioritizing family over self (e.g., Lugo Steidel and Contreras, 2003; Campos et al., 2008; Abdou et al., 2010). Past research reported that familism is linked to positive familial relationships, high family cohesion and harmony (Roosa et al., 2005; Germán et al., 2009; Cardoso and Thompson, 2010). Moreover, familistic beliefs have been found to have a positive association with involvement in parenting (Coltrane et al., 2004; Romero and Ruiz, 2007; Taylor et al., 2012).

Furthermore, although theorists claimed the need to consider both fathers and mothers in research, there is a paucity of papers assessing fathers' beliefs, behaviors, and attitudes (Marsiglio et al., 2000; Campos, 2008) comparing to the ones devoted to mothers'. Although some studies have demonstrated similar parenting characteristics between mother and fathers (Pleck and Hofferth, 2008), others underlined the specific role of fathers for adolescents (e.g., separation–individuation process) (Pleck, 2007; McBride et al., 2009). For these reasons, we addressed this limitation by examining both parents. Thus, the current study was firstly aimed to compare genuine Italians mothers and fathers focusing mainly on their self-perception of parental role, such as family adjustment and cultural beliefs (e.g., identification of individuals with their family members, family solidarity), instead of on parenting beliefs and practices (Bornstein et al., 2001; Hsu and Lavelli, 2005; Vieno et al., 2009). Although a limited number of authors have already explored familistic values and family functions (Kumpfer et al., 2002; Germán et al., 2009; Taylor et al., 2012), none of them referred to Italian samples. It was hypothesized that mothers and fathers report small differences in cultural beliefs as well as perceiving family functioning (Ferrari, 2002; Svetina et al., 2011; Delvecchio et al., 2014; Laghezza et al., 2014). Moreover, we hypothesized fathers demonstrating to score higher on self-perception of parental role (Pleck, 2007; McBride et al., 2009).

A second purpose was to evaluate the possible link between family functioning, parenting self-perception, and cultural values in mothers and fathers, respectively. Significant positive correlations were expected between family functioning and self-perception of parental role in both parents (Bornstein et al., 2011b; Newland, 2015). Furthermore, parents' familistic values were expected to be associated with parenting satisfaction and family positive functioning (Cardoso and Thompson, 2010; Taylor et al., 2012).

MATERIALS AND METHODS

Participants

Participants were 408 mother–father dyads (50% mothers).[1] They were heterosexual couples of adolescents ($M_{age} = 16.61$, $SD = 1.91$, 41% males). Mothers' mean age was 47.46 ($SD = 4.22$) and fathers' 49.91 ($SD = 4.62$). All subjects were Caucasian and lived in urban and suburban areas of North and Central Italy. Parents' socio-economic level, measured by SES (Hollingshead, 1975), was middle to upper for 89% of families; 9% had a low socio-economic status and only 2% reported a very high level. Families were recruited through their children's schools, and met the following criteria: (a) both mothers and fathers agreed to participate, (b) all were regularly married couples, (c) all participants completed the entire assessment phase, (d) parents and children did not meet criteria for psychiatric diagnosis and were not under psychological treatment. Approximately 84% of the families who received the leaflet agreed to participate. Those who declined adduced reasons such as lack of interest and concerns about sharing personal information.

Procedures

This study was conducted in compliance with the ethical standards for research outlined in the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2010). Approval by the Ethical Local Committee for Psychological Research was obtained from Padua University (Prot. N. 1523, 2014). Participation in the study was solicited via leaflets. Parents written signed informed consents to participate in the study were obtained before data collection. They completed the questionnaires at home and returned them to the research team through their children. No incentives were awarded and voluntary participation was emphasized. Confidentiality was assured by replacing personal's information with a numeric code. A forward- and back-translation procedure was used to ensure the linguistic, conceptual, and cultural equivalence of the measures not yet validated in Italian (Peña, 2007; Erkut, 2010).

Measures

The *Self-Perception of Parental Role* (SPPR; MacPhee et al., 1986) is a 16 items tool developed to assess parental self-perception through four subscales: Investment (five items), Competence (six items), Satisfaction in parenting (five items), and Role Balance (six items). Investment refers to parent's involvement and commitment to children; Competence assesses parent's perception of his/her competence in child rearing; Satisfaction investigates how much a parent is satisfied in his/her role; Role balance assesses the way in which a parent balances the possible different roles of his/her life (e.g., parent, spouse, employee, . . .; Perry-Jenkins et al., 2000). In order to minimize the impact of social desirability, each item has a pair of statements with contrasting endpoints of the dimension in question. As example, one item for satisfaction states "Being a parent is a satisfying experience to some adults BUT for other parents, being a parent is not all that satisfying." The respondent chooses the statement that describes him/her best, and rated it on a four response items, weighted 1, 2, 4, and 5. The absence of a response indicating that the item was equally like and unlike the respondent was done in purpose. SPPR scales showed good internal reliability, construct validity, and test–retest reliability (MacPhee et al., 1986; Seybold et al., 1991). The Italian translation of the questionnaire was carried out following the guidelines suggested by Van de Vijver and Hambleton (1996). The Italian version was pilot-tested with 36 mothers and 36 fathers; no specific problems emerged. In the current sample, Cronbach's alphas ranged from 0.59 (competence) to 0.62 (role balance) for mothers, and from 0.52 (satisfaction) to 0.64 (role balance) for fathers.

The *Family Assessment Measure-III General Scale* (FAM-III; Skinner et al., 1983) is a 50-item self-report measure devoted to assess family maladjustment. Participants were asked to answer on a 4-point Likert scale ranging from 0 (completely disagree) to 3 (strongly agree). An example of item is "Family duties are fairly shared." The current study took into account only FAM-III Total score, which assesses family system shared values, norms, and goals. Higher scores indicate worse family functioning. FAM-III showed good psychometric properties (Skinner et al., 2000; Laghezza et al., 2014). In our study, Cronbach's alpha for mothers was 0.77 and 0.72 for fathers.

The *Attitudinal Familism Scale* (AFS; Lugo Steidel and Contreras, 2003) is a 18-item scale aimed at assessing beliefs and attitudes toward the family (Schwartz, 2007): Familial support indicated the idea that family members should engage in reciprocity to support each other; Interconnectedness is related to the belief that one should maintain a strong bond with family members; Honor subscale measures the belief that one must maintain family honor; Subjugation subscale measures the idea that one should sacrifice one's own needs for the family. The scale was developed specifically to capture the Latinos approach to familism. However, the Lugo Steidel and Contreras (2003) scale has been found to have an equivalent factor structure and associations to psychological well-being and distress in Latino, European, and Asian background samples (Schwartz et al., 2010). Participants are asked to answer on a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). A sample item of AFS is "Parents and grandparents should be treated with great respect regardless of their differences in views." Higher scores denote major levels of familism. AFS showed adequate reliability and validity (Lugo Steidel and Contreras, 2003; Schwartz, 2007). The Italian translation of the questionnaire was carried out following the guidelines suggested by Van de Vijver and Hambleton (1996). The Italian version was pilot-tested with 36 mothers and 36 fathers; no specific problems emerged. In the current sample AFS showed good internal consistency for mothers ($\alpha = 0.79$) and fathers ($\alpha = 0.80$).

The *Cultural Values Survey* (CVS; Chia et al., 1994) is a 45-items questionnaire assessing how important is each proposed issue regarding seven areas linked to family: Family Solidarity (eight items), Executive Male Attitude (eight), Conscience (eight items), Equality of Sexes (seven), Temporal Farsightedness (four

[1]Demographic information tapping personal and employment related questions was collected with questionnaires. A question referring to participant and his/her child's previous (within the past 6 months) and/or present psychiatric assessment and/or treatment was asked to both mothers and fathers.

items), Independence (six items), Spousal Employment (three items). Participants are asked to answer on a 5-point Likert scale ranging from 5 (extremely important/strongly agree) to 1 (not at all important/strongly disagree). Family solidarity indicates the sense of perceived cohesion and coherence in the family system; Executive Male reflects the attitude that men are decision makers and women are homemakers; high scores on this component express agreement for instance with the following beliefs: only girls and woman should do homework; only men could make the most important decision in the family, marriage and children are more important for a girl than a career. Conscience stresses the importance of the family to conform to traditional customs, moral and social standards, to perpetuate the ancestral line, being respected by the community, to respect for the authority. Temporal farsightedness measures the interest in the future compared with the past, and the willingness to delay gratification and finding a place for the family in the community and in relation to the past and the future. Independence indicates how much important are behaviors related to seek fun and excitement, shame from dependence on public welfare a secure and comfortable life, freedom (from parental and similar constraint) and the value of hard work. Finally, Spouse Employment scale measures the tendency to give importance to the opinion that each spouse should decide about her/his own job, not about her/his spouse job. An example of item of this measure is "How important is (. . .) a cohesive family?" Chia et al. (1994) reported adequate psychometric characteristics for CVS. The Italian translation of the questionnaire was carried out following the guidelines suggested by Van de Vijver and Hambleton (1996). The Italian version was pilot-tested with 36 mothers and 36 fathers; no specific problems emerged. In the current sample, CVS subscales showed adequate internal consistency ranging from 0.53 (independence) to 0.78 (equality of the sexes) for mothers and from 0.56 (temporal farsightedness) to 0.79 (family solidarity) for fathers.

Data Analysis

The Statistical Package for Social Sciences (SPSS.21) was used to compute descriptive statistics, correlations and paired *t*-tests to compare mothers and fathers medium scores on the selected scales and sub-scales. *T*-test was also used to assess possible gender influence between mothers and fathers' answers. When *t*-test was significant, effect size was calculated and classified according to Cohen's (1988) *d* criteria: small effect size, if the *t* ranged from 0.10 to 0.30; medium effect size if *t* ranged between 0.31 and 0.50; large effect size if *t* was higher than 0.50 and very large effect size if *t* was higher than 0.80. Correlations were calculated between self-perception and family perception scores and cultural values variables separately for mothers and fathers. Correlation effect size was classified according to Cohen (1988).

RESULTS

Table 1 shows descriptive statistics of all selected measures for mothers and fathers, respectively, and reports the results of paired *t*-tests used to compare their medium scores. Cohen's *d* value is reported only for statistically significant *t*-test. Furthermore, **Table 1** reported Person's *r* about correlations of each variable between parents: according to Cohen's suggestions their effect sizes were medium to high, suggesting a good agreement within the couples, along all variables.

In self-perception of parental role, both parents shared the same level of satisfaction, however, fathers supported that being a parent allows them to be more involved in different roles beside parenthood than mothers. Concerning parenting instead, both parents supported that satisfaction is a more important issue than role balance. Results show significant differences between fathers and mothers regarding the self-perception of parental role (see **Table 1**). Fathers felt more involved, competent and satisfied in parenting than mothers. Furthermore, they reported to be more able in balancing the different roles they take in their life.

Both parents share the same level of attachment to their family members (both nuclear and extended) and a similar sense of identification with those family members (Familism). Looking at the dimensions of the AFS, they share a high similar level of familism account for intense feelings of interconnectedness, that is parents underscored that family members must keep in close emotional relationship and physical contact with other family members. They also share a strong assumption of an obligation to support individual members and give them assistance. However, familism for them does not mean so much maintaining the family honor by behaving in ways that will be looked favorably by other members and/or outsiders (Lugo Steidel and Contreras, 2003), nor they belief that a person must be submissive and yield to the family willingly subordinating individual preferences for the benefit of family.

In respect with cultural values, both parents underscored above all the importance of equality of sex and family solidarity as compared with the other values assessed. They both stressed an agreement with statements that seem to minimize sexual stereotyping (e.g., married women have the right to continue their education, raise children is important for mothers and fathers, it is ok for a married woman with young children to have a job outside the home). They also both stressed the importance of a cohesive, cooperative and harmonious family, respect for elders, education and achievement. Fathers and mothers underscored Executive Male much more than the other values assessed. Instead, both parents did not give so much importance to Temporal Farsightedness, Independence, and Spouse Employment as compared with the other assessed values. Also independence was not too much stressed. Finally, they agreed not to give importance to the opinion that each spouse should decide about her/his own job, not about her/his spouse job. Additionally, four subscales of CVS showed significant results. However, with the exception of the Executive Male Attitude, Cohen's *d* effect sizes were small, suggesting trivial effects, mainly due to the large sample size. Thus, the only one interpretable result suggests that even mothers and fathers resulted quite similar in executive male attitude, and this is the lower scale in the entire sample. Men resulted significantly more conservative than women (Chia et al., 1994); this is simply

interpretable as the residual of the male/female Italian cultural stereotype.

To summarize, our results (**Table 1**) suggested that (a) fathers and mothers have a similar perception of family functioning, (b) share common cultural attitudes, beliefs and values toward the family, and (c) fathers have a better self-perception of parental role, in terms of investment, sense of competence, role balance, and satisfaction.

Mainly due to differences reported in self-perception of parenting between mothers and fathers, the Pearson product-moment correlations between parenting and cultural issues were carried out separately for mothers and fathers (**Table 2**). Only correlations with medium (>0.30) or large (>0.50) effect size were interpreted.

Correlations between SSPR and FAM-III showed that the attributions of parenting satisfaction and role balance in mothers and fathers were related with a positive perception of families. Parents resulted satisfied about their role and are able to balance between being a parent and other kind of role satisfaction; they showed a positive overall perception of being able to meet goals, and to performance a variety of maintenance, developmental, and crisis tasks in the family.

In respect with AFS, attribution of interconnectedness was related with a positive general perception of their family, with role balance and satisfaction in parenting just for fathers: as far as they feel family members must keep in close emotional and physical contact with other family members, they are more able to balance between their role as parents and other roles. Instead, for mothers, interconnectedness was significantly related with a positive perception of family.

Looking at CVS, attributions in Family Solidarity were significantly related to role satisfaction, role balance, and overall family perception for both mothers and fathers. Executive Male Attitude was negatively related with all role and family variables for both parents, except the role satisfaction for mothers; moreover, stronger was the stereotype more negative result family perception for both parents. Attributions of Equality were related with all role and family variables for both parents, except the role satisfaction for mothers. Lastly, just for fathers emerged an inverse correlation between spousal employment and parenting satisfaction, meaning that fathers with the opinion that each spouse should decide about his/her own job, and not about his/her spouse's job, reported higher levels of satisfaction in parenting. No other values were significantly correlated with role and family dimensions.

In general, although mothers and fathers showed a similar path of correlations, Cohen's effect sizes were higher in fathers, suggesting stronger relationships between parenting, family functioning, and cultural issues. In both parents, greater level of satisfaction in parenting and better ability in role balancing correlated with a more positive family adjustment. On the other hand, no significant correlations were found between family adjustment and self-perception of competence and investment in parenting.

TABLE 1 | Means, Standard Deviations, and Paired *t*-test for mothers and fathers for all the selected variables.

	Mothers (*n* = 204)		Fathers (*n* = 204)					
	M	*SD*	*M*	*SD*	$t_{(203)}$	sign	Cohen's *d*	Pearson's *r*
SPPR								
Investment	2.78	0.54	3.01	0.70	−3.74	< 0.001	−0.37*	0.12
Competence	3.11	0.71	3.70	0.84	−9.33	< 0.001	−0.76**	0.36*
Role Balance	3.56	0.72	4.06	0.89	−7.68	< 0.001	−0.62**	0.38*
Satisfaction	3.99	0.77	4.27	0.77	−4.85	< 0.001	−0.36*	0.43*
FAM-III								
Total score	39.18	10.97	39.39	10.97	−0.26	0.79		0.44*
AFS								
Total score	68.44	8.94	68.84	9.34	−0.63	0.52		0.52**
Support	18.71	3.27	18.76	3.19	−16	0.87		0.51**
Interconnectedness	17.54	2.41	16.91	2.79	3.02	0.003	0.23	0.36*
Honor	9.69	2.44	9.85	2.23	−0.93	0.35		0.31*
Subjugation	7.57	2.13	8.23	2.10	3.56	< 0.001	−0.31*	0.23
CVS								
Family solidarity	4.20	0.53	4.12	0.58	2.10	0.04	0.14	0.55**
Executive male attitude	2.13	0.58	2.33	0.61	−4.54	< 0.001	−0.34*	0.42*
Conscience	3.46	0.58	3.34	0.67	2.40	0.02	0.19	0.34*
Equality of sexes	4.29	0.60	4.13	0.69	3.66	< 0.001	0.25	0.53**
Independence	3.27	0.55	3.27	0.54	−0.10	0.92		0.36*
Temporal farsightedness	3.31	0.61	3.28	0.69	0.61	0.54		0.28
Spousal Employment	2.48	0.73	2.59	0.77	−1.56	0.12		0.20

*Effect size: smallbetween 0.10 and 0.30; *medium between 0.31 and 0.50; **large higher than 0.50.*

TABLE 2 | Correlations.

		SPPR Role Balance	*SPPR* Satisfaction	FAM-III Tot
FAM-III Tot	Mothers	–0.36*	–0.44*	
	Fathers	–0.41*	–0.55*	
AFS Tot	Mothers	0.12	0.16	–0.20
	Fathers	0.18	0.22	
Support	Mothers	0.14	0.20	–0.18
	Fathers	0.24	0.25	
Interconnectedness	Mothers	0.20	0.29	–0.30*
	Fathers	0.30*	0.42*	0.27*
Honor	Mothers	–0.12	0.20	
	Fathers			
Subjugation	Mothers		0.10	
	Fathers	–0.10	–0.15	0.17
CVS				
Family solidarity	Mothers	0.37*	0.35*	–0.43*
	Fathers	0.30*	0.51**	–0.38*
Executive male attitude	Mothers	–0.28	–0.36*	0.45*
	Fathers	–0.41*	–0.42*	0.41*
Conscience	Mothers	0.15	0.12	–0.12
	Fathers		0.13	–0.13
Equality of sexes	Mothers	0.24	0.37*	–0.42*
	Fathers	0.46*	0.63**	–0.48*
Independence	Mothers	0.16		–12
	Fathers	0.17	0.16	
Temporal farsightedness	Mothers	0.14		–0.10
	Fathers	0.23	0.21	
Spousal Employment	Mothers		–0.19	0.24
	Fathers	–0.22	–0.33*	0.27

*Effect size: small between 0.10 and 0.30; *medium between 0.31 and 0.50; **large higher than 0.50.*

CONCLUSION

Cross-cultural studies have often underscored how parenting self-perception and family perception may be related to parent's own cultural heritage. However, few empirical studies were carried out to assess specific information due to cultural differences attributed to countries. Literature seems limited to large distinction between Eastern and Western Countries, or between Latinos, Asian and Western/US countries. On the other hand, Triandis (2002) posited how cultural differences would overcome large cultural differences and also that different meaning had to be attributed to the measures of these differences.

Both levels of society, large community and close family group, give their own values to kids during their individual development, that gradually structure their system of belief and behavior, based on these teachings. At the community level, the institutions of which the child is part during his development (school, friends, sports teams, and cultural, etc.) pass on their values, influencing choices and believes about priorities and important aspects of life. The same process of values transmission occurs at the level of close social environment, the family, which, in everyday life, informs the child and then adolescent its own traditions and beliefs, educating him in accordance with these principles. The set of values and beliefs so transmitted at a social level, influence the importance the individual assigns to different elements of his life, specifically to the family, and, consequently, the way in which individuals manage family structure (such as married life, child care, the division of roles within the family, relationships and time spent with their children and other family members). The family structure, with its relationships between members, constitutes the primary environment in which the child grows becoming adolescent, and where he takes the instruments for his psychosocial adaptation. Also for these reasons, family group is therefore an important element of mediation between the cultural values transmitted at the level of extended community, and what actually the child and then the adolescent assimilate within their own cultural knowledge.

Drawing from conceptual links, we tested the hypothesis that familism and culture values about family contributes to parental role and family perception in parents. Parents and families represent a basic and indispensable way in which culture is transmitted to offsprings and this acquires an important role in a specific stage of development as is adolescence. This study was descriptive and exploratory. The aim was simply to have a picture of a limited number of parenting and family measures, to describe them in

a sample of Italian parents and to relate them to some cultural measures. All tools were used for the first time in a sample of Italian parents, with exception of FAM-III. Mothers and fathers showed a balanced profile of family functioning. They seem to have the same perspective regarding the quality of integration between family roles, and the willingness of family members to assume the assigned roles. This result was coherent with the literature on family relationships that reports small differences between fathers and mothers in perceiving family functioning (Svetina et al., 2011). It was also coherent with previous results in a large Italian sample of parents (Laghezza et al., 2014). However, it could be also due to the possibility to complete the questionnaires at home, where parents are free to discuss and compare their answers. Shifting to children's gender, in line with previous studies, this study confirmed that parents' perception of family functioning did not result to be affected by their children's gender, at least as it is measured by FAM-III (Tiffin et al., 2007).

Descriptively, results of all the other variables used in this study allow having the first "normative picture" of parenting and cultural variables in a non-clinical sample of Italian adolescents' parenting. However, the most interesting results concern some identified relationship between parenting and family perception and cultural variable.

Generally, parents who maintain benevolent relationships, common goals with others, social appropriateness, sociability and cooperation, are more satisfied of the role. They are more able to balance roles and show a more positive perception of family, in particular concerning overall positive perception of the family. About familism, only some dimensions, and in particular interconnectedness, influenced parenting and family perceptions. Also regarding family cultural values, only some of them influenced parenting and family perception. In respect with associations between self-perception of parental role and cultural beliefs, the first evidence was that, in both parents, the concepts measured by satisfaction in parenting and role balance subscales seem much more linked to cultural issues than the self-perception about parents' competence or involvement with the child. In specific, for both parents, higher levels of satisfaction were associated to higher values in family solidarity, equality among sexes and in decision takers. Looking at role balance subscale in mothers, higher scores in balancing the possible different role of life were associated only to higher levels of family solidarity. On the contrary, in fathers it positively correlated with higher scores in family solidarity, equality of the sexes, and equality in decision takers.

These results suggest the importance to study specific cultural variables besides overall general ones to better understand the complex context in which a family is framed. However, the most striking results were that attribution of these cultural variables were stronger related in fathers than mothers. A possible explanation is that fathers, in this specific phase of life, may better contribute to adolescents' individualization and separation from the family (Bögels and Phares, 2008).

The deepening knowledge of these cultural differences will promote greater awareness among operators, regardless of what the standard of management in families from different cultures, providing them with means of assessment and intervention for family systems, which is sensitive to the cultural background of family under consideration. In particular, it suggests how much important it is to make connection with fathers' (mostly positive) views as a contribution to family and parenting functioning. Such knowledge will also allow the assessment of the significance of the impact that certain family structures may have on adolescents, according to their own culture, and be a help in understanding the adaptation difficulties of boys from immigrant families.

This paper has many limitations. First, data are a merely description of a group of Italian adolescents' parents. No more complex statistical analyses were carried out to study relationships about the examined variables. Second, data were collected in intact and non-clinical medium socio-economic status parents of North and Central Italy. More data need to be collected for instance in southern Italy as well as considering divorced or dysfunctional families. Third, no comparison was done with results obtained in previous studies with the same tools in Italy neither in other Eastern or Western countries. Fourth, the paper took in consideration only parents of adolescents. Future studies need to consider parents of younger child in order to improve the generalizability of current results. In addition, another limitation arises from the use of self-report measures, that introduces issues of potential reporter-bias and shared method variance. Additional assessment modalities (e.g., structured interviews) together with self-report measures, can contribute to a more objective and accurate understanding of the phenomena. However, the results for the first time introduced empirical cultural data in connection with parenting and family perception in Italy, showing some important influences, which need to be taken into account in future study.

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Sex-Specific Automatic Responses to Infant Cries: TMS Reveals Greater Excitability in Females than Males in Motor Evoked Potentials

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Neuroimaging reveals that infant cries activate parts of the premotor cortical system. To validate this effect in a more direct way, we used event-related transcranial magnetic stimulation (TMS). Here, we investigated the presence and the time course of modulation of motor cortex excitability in young adults who listened to infant cries. Specifically, we recorded motor evoked potentials (MEPs) from the *biceps brachii* (BB) and *interosseus dorsalis primus* (ID1) muscles as produced by TMS delivered from 0 to 250 ms after sound onset in six steps of 50 ms in 10 females and 10 males. We observed an excitatory modulation of MEPs at 100 ms from the onset of infant cry specific to females and to the ID1 muscle. We regard this modulation as a response to natural cry sounds because it was attenuated to stimuli increasingly different from natural cry and absent in a separate group of females who listened to non-cry stimuli physically matched to natural infant cries. Furthermore, the 100-ms latency of this response is not compatible with a voluntary reaction to the stimulus but suggests an automatic, bottom-up audiomotor association. The brains of adult females appear to be tuned to respond to infant cries with automatic motor excitation.

Keywords: parenting, baby cries, MEPS, TMS, sex differences

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INTRODUCTION

Evolutionary theory posits that adults' responsiveness to infant-related stimuli plays a crucial role in offspring survival, and so enhances reproductive success (Darwin, 1872). In humans, responsiveness to infants ranks among the most biologically relevant and adaptive behaviors and constitutes a basis of parent-infant interaction; infant cries and caregiver responses to them are a foundation for the wholesome psychological development of the parent-child relationship and secure attachment in the individual (Bowlby, 1969; Ainsworth et al., 1978; Parsons et al., 2010). As infants command little in the way of agency, however, their cry is one of the earliest forms of communication (Zeifman, 2001; Soltis, 2004; Cecchini et al., 2007; Newman, 2007), and hearing an infant cry elicits caregiver behaviors aimed at increasing proximity with and care of the infant. Notable among such responses are motor behaviors, such as picking the infant up, applying tactile

and vestibular stimulation, and talking to the infant (Gustafson and Harris, 1990; Bornstein et al., 1992). Healthy human mothers are likely to pick-up and hold and to speak to their infants in response to their infant's cry, and this specific complex of motor responsiveness is known to calm an infant (Esposito et al., 2013a).

The high biological relevance of infant-related stimuli captures adult attention and automatically triggers physiological responses that prepare adults for action (Brosch et al., 2007). For example, infant cries modulate listeners' hormonal levels (Fleming et al., 2002; Swain and Ho, 2012) and autonomic activity, as measured by heart rate, blood pressure, and skin conductance (Frodi et al., 1981; Boukydis and Burgess, 1982). At the behavioral level, preparation for action in response to infant cries has been observed in increased hand grip force (Bakermans-Kranenburg et al., 2012) and the speed and accuracy in intentional movements (Parsons et al., 2012). This motor activation may reflect an adaptive "high-alert" state that prepares adults to react rapidly to infants' distress. In accord with "embodied simulation" theory (Gallese et al., 2007), the internal simulation of observed infant behaviors, mediated by mirror neurons, enables or promotes empathic understanding in adults. Thus, internal simulation activated by baby cries may mediate parental behavior and thereby help regulate infant distress, even if evidence suggests that motor activation in response to infant cry can sometimes have negative implications in irritation and harsh parenting (Frodi, 1985; Crouch et al., 2008).

Coordinate with the autonomic and behavioral literature, functional magnetic resonance imaging (fMRI) has revealed patterns of cerebral activity following exposure to infant distress vocalizations that are associated with approach behaviors and motivation to caregiver (Barrett and Fleming, 2011; Swain, 2011; Swain et al., 2011; Pechtel et al., 2013). Germane to the present study, activity in the premotor cortex, prominently in the supplementary motor area and the dorsal premotor cortex, increases in response to infant cries (Montoya et al., 2012; Musser et al., 2012; Venuti et al., 2012; De Pisapia et al., 2013). Activation in these areas, which are part of the mirror system (Rizzolatti et al., 2001; Rizzolatti and Craighero, 2004; Cattaneo and Rizzolatti, 2009), has been interpreted as obligatory preparation for motor responses to the expression of infant need. With regard to the involvement of mirror neurons in audition, mirror neuron theory has been invoked to explain the close interaction between perception and action, such as motor theory of speech (Liberman and Mattingly, 1985). Such theories reinforce the expected close interaction between cry perception and parental action.

Given the relatively protracted time-course of hemodynamic responses, however, on the sole basis of fMRI data it is not possible to determine whether preparation for motor responses is automatic. Furthermore, it is not possible to tell if fMRI-indicated excitability translates into motor preparation. To test hypotheses of rapid motor involvement and responsiveness to infant cry more directly, we investigated motor evoked potentials (MEPs) to infant cries via transcranial magnetic stimulation (TMS).

One physiological signature of automatic bottom-up responses is their rapid onset to stimulation. It has been shown in multiple domains of perception/action that automatic sensorimotor associations can be observed in the very earliest phases of stimulus processing, that is between 100 and 250 ms following stimulus onset (see below). Later appearing responses typically reflect the expression of top-down executive control on stimulus-response associations, as obtains for most domains of sensorimotor behavior, such as saccades performed during a visual search (Van Zoest and Donk, 2006), hand movements toward graspable objects (Goslin et al., 2012), spatially oriented movement (Michelet et al., 2010), action mirroring (Barchiesi and Cattaneo, 2013; Ubaldi et al., 2015), and phonological-articulatory matching to speech sounds (Roy et al., 2008).

The hypothesis that affiliative stimulation automatically evokes preparation for motor responses therefore calls for an empirical demonstration based on a method that has a high temporal resolution. Such an approach could also disentangle bottom-up automatic responses from top-down cognitively mediated ones. For example, evidence for automatic reactions to affiliative stimuli has been provided using event related brain potentials (ERPs; Maupin et al., 2015). The N100 differs in female participants listening to infant cries compared to control stimuli (Purhonen et al., 2001, 2008), and a difference emerges in midbrain local field potential only 49 ms after hearing infant vocalizations compared to control sounds (Parsons et al., 2014b). Cumulatively, this research points to specific, automatic activity in response to infant cries that may reflect the initiation of a state of alertness necessary to activate caregiving.

In the present experiments, we used event-related TMS, which can help to disentangle automatic responses from cognitively mediated ones because its temporal resolution in detecting changes of excitability within the motor cortex falls in the range of ms. At the same time, the spatial resolution of TMS allows specific localization of activation in brain areas involved in motor responses. ERP approaches are not so spatially accurate. Furthermore, TMS (*contra* ERP) is particularly well suited to testing motor responses, of specific interest here. Increased excitability of motor cortex in response to generic emotional stimuli has been reported in previous TMS studies, most using emotional pictures (Hajcak et al., 2007; Schutter et al., 2008; Coombes et al., 2009; van Loon et al., 2010; Borgomaneri et al., 2014). Very few studies have extended this paradigm to show increased excitability of motor cortex to auditory stimuli, such as emotional sounds (Komeilipoor et al., 2013), emotional music (Baumgartner et al., 2007), and emotional spoken scenarios (Baumert et al., 2011). To the best of our knowledge, our study is the first to investigate automatic preparation for motor responses to infant-related auditory stimuli.

We applied single-pulse TMS (spTMS) to participants' motor cortex, time-locked to the auditory presentation of infant cries, and we simultaneously recorded MEPs. MEP amplitude resulting from spTMS allows the quantification covert motor preparation. The extant literature indicates that frequent and universal responses to baby cries are picking up and holding, both motor patterns (Gustafson and Harris, 1990, p. 144). Therefore, we investigated proximal and a distal muscles involved in such behavioral responses: the interosseus dorsalis primus (ID1) and the biceps brachii (BB).

We developed several *a priori* hypotheses, which we tested in two companion experiments. Due to the biological relevance of such motor behavior, we first hypothesized that motor responses will be activated automatically by baby cries. On account of its fine temporal resolution, TMS allowed us to test this hypothesis by measuring and detecting changes in excitability within the motor cortex over very brief durations. With this aim, we recorded MEPs produced by TMS delivered from 0 (a baseline condition for MEPs at a moment when the brain could not yet have access to the auditory information) to 250 ms from sound onset. We did so in six steps of 50 ms to trace the time course of the MEP with enhanced accuracy.

Second, previous studies have provided mixed evidence on gender differences in responsiveness to infant cry. Boukydis and Burgess (1982) reported gender differences in perceptions of infant cry; Byrd-Craven et al. (2015) reported that infant crying is a more potent stressor and increases cortisol in women more than in men; Out et al. (2010) and Tkaczyszyn et al. (2013) reported that women listening to baby cry show differentpatterns of cardiac sensitivity compared to men; and in fMRI investigations, compared to males, females hearing baby cries show stronger activation in amygdala and anterior cingulate cortex (Sander et al., 2007), and decreased activity the medial prefrontal cortex, suggesting that baby cries interrupt their on-going mind-wandering (Seifritz et al., 2003; De Pisapia et al., 2013). Others have reported no gender differences in ratings of motivation and arousal levels in response to baby cries or valence of baby cries (Leger et al., 1996; Parsons et al., 2014a), suggesting that responsiveness to infant cries may be related to caregiving responsibilities that parents report they assume (Donate-Bartfield and Passman, 1985). To clarify this issue, we tested a hypothesis concerning the effect of gender on automatic responses to baby cries by comparing males and females.

Third, fundamental frequency (f0) is one of the most important acoustic characteristics of baby cry (Lester and La Gasse, 2008; Esposito and Venuti, 2010a,b), and it has been shown to govern caregiver perceptions and responses (LaGasse et al., 2005). Specifically, episodes of crying with higher f0 are perceived as more negative (Gustafson and Green, 1989; Zeifman, 2003), even by members of different ethnic groups (e.g., Japanese and European listeners; see Esposito et al., 2012, 2013b, 2015). Considering the importance of f0 as a prominent acoustic characteristic of baby cry, we hypothesized that automatic preparation for motor responses would be specific for f0. To evaluate this hypothesis, we tested preparation for motor responses while listening natural baby cries in comparison to acoustically modified baby cries (systematically varied in f0).

GENERAL METHODS

Participants

All participants were young healthy adults who gave written informed consent and were screened for contraindications to TMS (Rossi et al., 2009). The two experiments reported here were approved by the Ethical Committee of the University of Trento and conducted in compliance with the revised Helsinki declaration (World Medical Association General Assembly, 2004).

Procedures

With exception of the stimuli, the experimental procedures were identical in the two experiments.

Main Experiment: Participants and Experimental Design

Twenty healthy right-handed, participants (10 Females, 10 Males, *M* age females = 28.3 years, *M* age males = 32.1 years) took part in the main experiment. They were tested during a single 40-min session in which they listened passively to cry sounds that were periodically delivered through earphones. Single-pulse TMS was systematically delivered at different inter-stimulus intervals (ISIs) from the onset of each acoustic stimulus (0, 50, 100, 150, 200, and 250 ms). MEPs to spTMS were recorded and were the source of the main dependent variable after data processing. Each participant underwent 270 trials (6 ISIs × 3 cry types; see below). Each cell of the experimental design therefore contained 15 repeated trials. Power analysis showed that we could detect medium to large effects (effect size range = 0.5–0.8) employing F-test family statistics on independent groups with a *p*-value set at 0.05.

Main Experiment: Auditory Presentations

Acoustic stimuli were presented using E-Prime 2.0 software. They were recorded from natural baby cries generated from a digital audio file of the cries of a 6-month-old boy before a scheduled feeding. The infant was born term and showed no signs of any clinical conditions at birth or at age 3 years. Five 250-ms cries were cropped from the initial part of 5 different cry episode of the child and were selected for their typical rhythmic quality (natural cry segments). All cry stimuli were normalized for intensity, and the volume was kept constant for all the presentations for all the participants. A long-term average spectrum (LTAS) provided spectral information for each cry. For all 250-ms cry segments, f0 of the LTAS was obtained. Mean f0, the frequency value (in Hz) of the first amplitude peak across the LTAS, was 502.14 Hz (SD = 25.6) for natural cry segments. Subsequently, natural cry segments were experimentally manipulated employing Praat software for audio editing (Boersma, 2002, ver. 5.0.06). Two groups of five cry segments with f0 augmented 200 Hz (+200 Hz) and 400 Hz (+400 Hz) were produced. The three cry types (natural cry, +200 Hz, and +400 Hz) were then presented randomly, at irregular ISIs to avoid anticipatory responses. Each stimulus was presented 24 times.

Main Experiment: TMS

SpTMS was delivered with a biphasic Magstim Rapid (Magstim, Dyfed, UK) stimulator connected to a standard figure-of-eight coil with an outer winding diameter of 70 mm. The coil was positioned with the handle pointing backward at 45° from the midline over the optimum scalp location where MEPs with the maximal amplitude could be obtained from the BB and 1DI muscles at minimum stimulus intensity. Motor thresholds (Rossini et al., 1994) are commonly used to individually adjust

the intensities of TMS. In the main experiment, the topographic location on the cortex and the basal excitability of representations of the two muscles were so different that, rather than using a single muscle as a target for motor threshold determination, we opted for a stimulation intensity at which MEPs with amplitudes between 500 and 1500 uV were evoked from both muscles.

Main Experiment: Electromyographic Recording and Processing of MEPs

The EMG signal from each participant's right upper limb was collected by means of two pairs of surface Ag/AgCl electrodes positioned on the skin of the dominant arm overlying the belly and tendon of the *biceps brachii* (BB) and *interosseus dorsalis primus* (ID1) muscles and connected to two analog amplifier channels (CED 1902 unit—Cambridge Electronic Design, UK). The signal was amplified 1000x and digitized (4 KHz sampling rate) by means of a CED power 1401 analog-to-digital converter, controlled by the Signal software (Cambridge Electronic Design, UK). Recordings were digitally band-pass filtered between 20 Hz and 2 KHz with a notch filter at 50 Hz. We extracted the peak–peak amplitude of MEPs from each of the two EMG channels and used it to produce the main experimental dependent variable. We also collected minimum and maximum values of spontaneous activity in the 100 ms preceding the MEP to check for voluntary muscular activity defined as maximum–minimum activity exceeding 50 μV on either of the 2 EMG channels. Trials with voluntary activity were excluded from further analysis. Stimulation intensities determined in this way ranged between 43 and 72% of stimulator output. Voluntary activity in the pre-stimulus period over a 200-ms interval was assessed visually. Single trials with EMG activity exceeding 100μV were excluded from further analysis. On average across participants, 6% of trials were excluded.

As a *post hoc* control, we pooled recorded MEP amplitudes of all participants and found average values of 0.82 mu ($\pm$ 95% CI: 0.19) for the BB muscle and 1.22 mu ($\pm$ 95% CI: 0.37) for the ID1 muscle.

Data Analysis

Motor evoked potential amplitudes were calculated as positive peak-negative peak amplitudes. Raw MEP amplitudes from all participants in the main and control (see below) experiments were analyzed separately for the two muscles. First, raw MEP amplitudes were standardized within each muscle as z-scores by subtracting the grand-average of the MEPs from each MEP for that muscle and dividing the difference by the standard deviation of the population of MEPs from the same muscle. The *z*-scores were then averaged within each cell of the design so that each participant contributed 36 data cells (18 data cells for each of the two muscles). All variables were normally distributed. The data from the main experiment were analyzed as dependent variables in two ANOVAs (one for each of the 2 muscles) with one between-subjects factor, SEX (2 levels, male or female) and 2 within-subjects factors, ISI (6 levels: the 0, 50, 100, 150, 200, and 250 ms) and CRY (3 stimulus types; natural baby cries, +200 Hz, +400 Hz). Due to the repeated-measures design, the variable subject was included as a random effect.

The control experiment was performed *post hoc* to test the specificity of findings of the main experiment. It was analyzed separately from the main experiment because the grouping variables were not homogeneous. In the main experiment, participants were grouped according to sex. In the control experiment, participants were grouped according to the type of acoustic stimuli they heard. The data from the control group of 10 females listening to scrambled cries were therefore analyzed together with the group of 10 females in the main experiment. This was done by means of two ANOVAs (one for each of the 2 muscles) with one between-subjects factor, SOUND (2 levels, original cries or scrambled cries) and 2 within-subjects factors, ISI (6 levels: the 0, 50, 100, 150, 200, and 250 ms) and CRY (3 stimuli types; natural baby cries, +200 Hz, +400 Hz). Finally, in both experiments, significant effects were explored in planned comparisons consisting of pairwise *t*-tests between the data from the 0 ms ISI (baseline) and the other 5 ISIs.

RESULTS

Main Experiment

Univariate distributions of the dependent variables were examined for normality, homogeneity of variance, outliers, and influential cases; normality prevailed (Tabachnick and Fidell, 2001).

In the ID1 muscle, specific results emerged: only females (not males) listening to baby cries (not to control sounds) produced increases in MEP amplitudes, and only when the sound-TMS interval was 100 ms. A similar finding emerged with slightly delayed MEP increase (150 ms) when sounds were slightly modified (in the +200 Hz condition). The ANOVA on the ID1 muscle data showed a main effect of ISI, $F(5, 90) = 9.29$, $p = 0.0000004$, $\eta^2 = 0.15$, illustrated in **Figure 1A**, and a SEX × ISI × CRY 3-way interaction, $F(10, 180) = 2.80$, $p = 0.003$, $\eta^2 = 0.07$, illustrated in **Figure 2**. To investigate this interaction, the design was split into two ISI × CRY ANOVAs, each with data from one sex. The analysis of males yielded only a main effect of ISI, $F(5, 45) = 4.1570$, $p = 0.003$, $\eta^2 = 0.13$; type of stimulus was not significant, $F(2, 18) = 0.32$, $p = 0.73$. By contrast, the analysis performed on females showed a main effect of ISI, $F(5, 45) = 6.02$, $p = 0.0002$, $\eta^2 = 0.19$, and a 2-way ISI × CRY interaction $F(10, 90) = 5.23$, $p = 0.000005$, $\eta^2 = 0.21$. Three separate one-way ANOVAs for each of the 3 cry types for females showed significant effects for the natural cry, $F(5, 45) = 6.78$, $p = 0.00009$, $\eta^2 = 0.39$, and for the +200 Hz cry, $F(5, 45) = 9.22$, $p = 0.000004$, $\eta^2 = 0.47$, but not for the +400 Hz cry, $F(5, 45) = 1.95$, $p = 0.11$, $\eta^2 = 0.14$. Three significant results emerged from planned comparisons: significant deviations from baseline (0 ms ISI) at 100 ms ($p = 0.001$) and 200 ms ($p = 0.004$) ISIs for the natural cry data indicated, and a significant difference from baseline at 150 ms ISI ($p = 0.001$) for the +200 Hz cry.

In the BB muscle, no responses specific to baby cries were elicited in males, $F(2, 18) = 2.31$, $p = 0.13$, or females, $F(2, 18) = 1.23$, $p = 0.32$. Only a non-specific increase in MEP amplitude with increasing sound-TMS delays was found. The ANOVA on the BB muscle data showed only a main effect

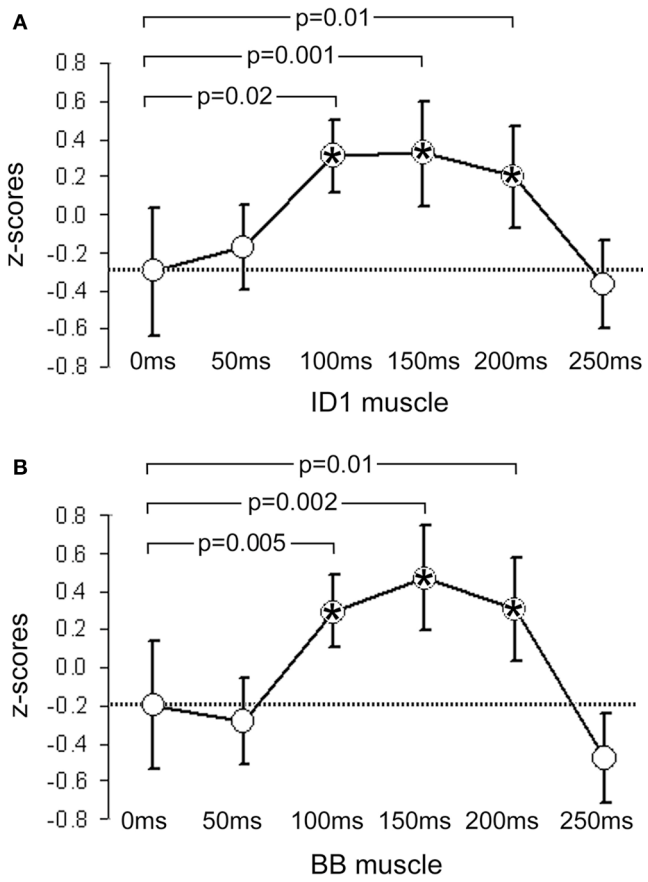

FIGURE 1 | Mean *z*-scores pooled from all participants and across all cry types. (A) shows data from the ID1 muscle and **(B)** data from the BB muscle. Bars indicate 95% CIs. The dashed line represents the mean value obtained at 0 ms (baseline). *P*-values indicate significant differences between the data obtained at 0 ms and the data obtained at the other 5 ISIs. Significant time-points are indicated with asterisks.

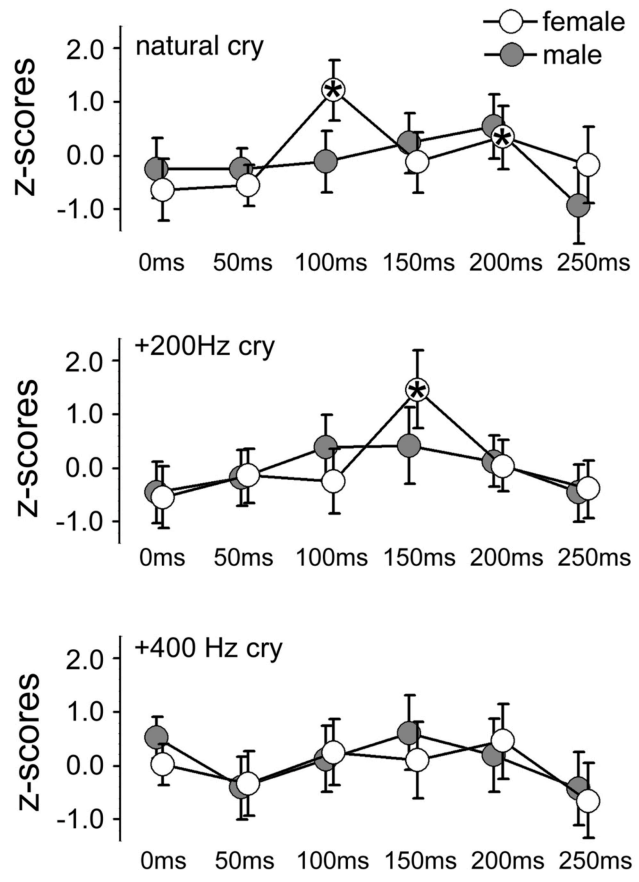

FIGURE 2 | Mean *z*-scores for each cry type and each ISI for females and males. Bars indicate 95% CIs. Asterisks indicate ISIs at which a significant difference was found with data obtained at 0 ms (baseline).

of ISI, $F(5, 90) = 5.34$, $p = 0.0002$, $\eta^2 = 0.09$, illustrated in **Figure 1B**, and no significant results emerged in the ISI × CRY interaction in either males, $F(10, 90) = 0.84$, $p = 0.59$, or females, $F(10, 90) = 0.55$, $p = 0.85$.

Control Experiment

To better control for the specificity of infant cries to elicit sex-specific automatic preparation for motor responses, we undertook a control experiment in which a different group of 10 healthy, right-handed females (*M* age = 27.7 years) were exposed to cry and control stimuli. The auditory control stimuli were obtained by scrambling the natural and pitch-modified baby cries used in the main experiment. Scrambling was realized following procedures proposed by Collignon et al. (2015) that maintain similar low-level physical features in original and scrambling sounds, inspite of scrambled sounds becoming completely unrecognizable (Collignon et al., 2015; Dormal et al., 2015). Scrambled versions of the sounds were performed in MATLAB (The MathWorks, Inc., Natick, MA, USA). Each sound was submitted to a fast Fourier transformation, and the resulting components were separated into frequency windows of ∼700 Hz based on their center frequency. Scrambling was then performed by randomly intermixing the magnitude and phase of each Fourier component within each frequency window separately. The inverse Fourier transform was then applied to the resulting signal. The output was a sound of the same length of the original sound with similar energy within each frequency band. Following standard practices, sounds and their scrambled versions were equalized in root mean square (RMS) level.

The ANOVA on data from the BB muscle showed only a main effect of ISI, $F(5, 90) = 5.31$, $p = 0.0003$, $\eta^2 = 0.08$. The ANOVA on data from the ID1 muscle yielded a significant main effect of ISI, $F(5, 90) = 5.76$, $p = 0.0001$, $\eta^2 = 0.09$, and a 3-way interaction of GROUP × ISI × CRY $F(10, 180) = 2.67$, $p = 0.005$, $\eta^2 = 0.08$, as illustrated in **Figure 3**. The same strategy as in the Main Experiment was used to analyze this interaction. A 2-way ISI × CRY ANOVA of women who listened to scrambled cries showed no significant interaction, $F(10, 90) = 0.76$, $p = 0.67$. Results for the women who listened to the original (un-scrambled) cries are reported in the Results of the main experiment.

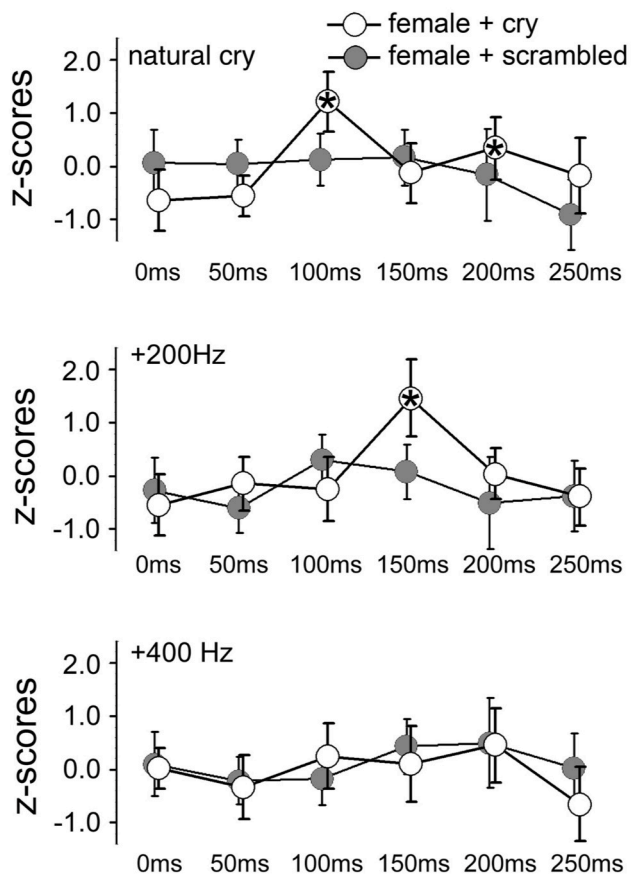

FIGURE 3 | Mean *z*-scores for each sound type and each ISI in the two groups of females (main and control experiments). Bars indicate 95% CIs. Asterisks indicate ISIs at which a significant difference was found with data obtained at 0 ms (baseline).

GENERAL DISCUSSION

In the present studies, we found that the corticospinal system of adults (non-parents) is modulated by exposure to the sound of infant cries. Specifically, in support of our first and second hypotheses, we observed rapid facilitatory effects in one of two recorded muscles, present only for natural infant cry sounds, and occurring only in females. To set these conclusions in context, it is useful first to describe the general non-specific response to any auditory stimulus that is normally detectable in both muscles of participants of both genders (**Figure 1**). The temporal characteristics of this response are compatible with facilitation of the TMS-evoked corticospinal volley by a concomitant auditory startle, known to appear in the biceps at latencies beyond 55–60 ms (Brown et al., 1991b). However, two factors indicate that the non-specific arousal response which we recorded is not attributable exclusively to classical auditory startle. First, the stimulation applied in the present study was sufficiently frequent to habituate a startle response within the first few trials (Brown et al., 1991a). Second, the auditory startle response is usually more evident in proximal than in distal muscles (Brown et al., 1991b), which was not the case in the present results.

As shown in **Figure 2**, we found preparation for motor responses that were specific to females and that were present as early as 100 ms following auditory stimulation by natural infant cries. What do these features of the audiomotor response tell us? First, its latency strongly implicates an automatic audiomotor association, considering that simple auditory reaction times in the distal upper limbs center around 200 ms (Ritter et al., 1972). Given the latency of 100 ms from the onset of auditory stimulation, it is not clear where the response originated. It could be mediated by a wholly subcortical circuit, as in the auditory startle response discussed above, or in orientation responses to auditory stimuli mediated by brainstem pathways passing through the tectal and pretectal regions. Another possible subcortical node that mediates such fast audiomotor associations is the amygdala, which is known to be involved in parental caregiving (Barrett et al., 2012) and is a subcortical center that mediates fast visuomotor associations in other affective domains (Sah et al., 2003). However, latencies on the order of 100 ms are compatible with an early transcortical response (Martin et al., 2007). These explanations are not mutually incompatible as subcortical and cortical contributions to the TMS response could coexist.

A second feature of our results is their specificity to natural infant cries. The earliest facilitatory peak we observed appeared at 100 ms in response to such cries, although a similar facilitatory peak was found in association with +200 Hz cry but at slightly longer (150 ms) latency (compare the top and middle panels of **Figure 2**). No peak at all was observed in response to the +400 Hz transformed cries. Therefore, in agreement with our third hypothesis, audiomotor effects were elicited specifically by baby cries around their natural frequency. With regard to the observation of a peak with longer latency in association with +200 Hz cry, a well-established association between pitch in infant cries and perceived distress (Donovan et al., 1998; Schuetze and Zeskind, 2001; Young et al., 2012) suggests that motor preparation is likely associated with an aversive response. Future studies might focus on this hypothesis comparing adult responses to baby cries with less dramatic manipulations of the natural frequency (in our study the +400 Hz transformed cries were clearly not perceived as a baby cries).

This finding could reflect non-specific startle effects of sounds in that particular frequency range. The control experiment on a separate group of women listening to the same sounds but scrambled by means of a procedure that keeps constant the frequency and intensity envelope of the sounds also showed an automatic response specific to natural baby cries.

A third feature of the audiomotor response described here is its sex-specificity and restriction to women. This specificity is unlikely to depend on general gender differences in response to emotional vocalization, because the latter have been reported to be small in extant literature (Belin et al., 2008; Parsons et al., 2014b). Thus, the present results point to a sex dimorphism specifically in response to infant cries. This interpretation is consistent with earlier studies that reported sex-differences in brain responses to baby cries (Seifritz et al., 2003; Sander et al.,

2007; De Pisapia et al., 2013). The absence of an early audiomotor response in male listeners in this experimental paradigm should not be taken as evidence of the absence of an infant-sensitive neural system in males, however. Other factors, such as a higher threshold or increased habituation to repeated stimuli in males versus females, could account for the present differential results (Andreano et al., 2014). These alternatives do not, however, negate the sex-specificity we found.

A fourth feature of the results that merits discussion is that the sex difference in responsiveness to baby cries we found should be considered in light of the non-parent status of the participants. Indeed, evidence for sex differences in preparation for motor responses to baby cries has been found in non-parents, whereas no sex differences have been found between male and female parents in some physiological measures, such as skin conductance and heart rate in response to baby cries (Frodi et al., 1978a,b). As our participants were not parents, the audiomotor responses we recorded were probably not the product of extensive associative experience with infant cries, as could be the case with parents (see Limitations below). Indeed, important behavioral, physiological, and endocrine changes occur in women and in men when they become parents (Storey et al., 2006; Delahunty et al., 2007; Bornstein, 2015), and sex differences in brain activation in response to baby cries have been found to change fundamentally with parental experience (Seifritz et al., 2003). Such changes are associated with social context variables, such as contact with children (Storey et al., 2011). Moreover, finding automatic responsiveness to baby cries in nullipara women lends further support to the idea of an "alloparental care" predisposition in females (Hrdy, 2007), but not in males, similar to several mammalian species which feature cooperation in infant care (Briga et al., 2012).

Last, the muscle specificity of the response we observed is more challenging to interpret because it requires the formulation of a hypothesis in which specific behavior is elicited in females that involves distal hand muscles more strongly than proximal ones. The data collected in this experiment also do not speak to a whole-body preparation for motor responses, because we recorded from only two muscles. One explanation might be that the muscular pattern we observed indicates a propensity to reach for the infant and so is expressed as an extensor (rather than a flexor) response. It could be that facilitatory responses recorded in the ID1 muscle are a biological marker of a stimulus-response association or an index of a specific motor pattern.

On the basis of human and animal studies investigating brain responses to infant signals, a neurological model of the parental brain has been advanced (Swain et al., 2014). In that model, cues specific to infants (e.g., cries, laughs, images, touch, or odors) activate subcortical structures that promote the salience of the sensory input (e.g., motivation and reward), trigger caregiving, regulate emotions, and stimulate cognitions (e.g., attention, empathy, etc.). That is, infant cues are processed at different levels, and brain reactions regulate infant care.

LIMITATIONS

The present experiments have several limitations. First, the small sample size is at the lower limit for between-subjects investigations of sex differences. Second, in the control experiment we used a different group of participants; for this reason we cannot draw certain conclusions regarding the specificity of female participants' responses to original baby cries and physically matched non-cry stimuli. Third, the sample was not homogeneous in terms of age (we considered participant age as a covariate in our analyses and found no significant effects of age). Fourth, we ruled out the possibility that some participants were professionally exposed to young children (kindergarten educators, teachers, professional baby-sitters), but we have no information on the other kinds of experience with children. Similarly, we have no information on other important variables that may influence responsiveness to baby cries, such as mood, empathy, or menstrual phase. A fifth limitation is the different influences on male versus female roles in society, where girls are generally prompted from a very early age to maternal roles and attitudes during play and social relationships. These cultural aspects do not allow us to draw strong conclusions about the biological versus cultural bases of the sex differences we observed. Finally, we had no behavioral characterization of the reflex response. Although we are inclined to interpret the MEPs to infant cry as indicating approach and protective behaviors toward an infant in distress, they could index any other (even aggressive) behavior. Further research is needed to clarify this issue.

CONCLUSION

Caregiving behaviors in response to infant distress vocalization, especially motor responses, are observed in a wide variety of mammalian species. The present experiments extend this observation by providing evidence for the automaticity of motor cortex excitability in adult humans exposed to infant cries.

This response may be considered specific to baby cries because it was attenuated in baby cries with an increased fundamental frequency and absent to non-cry stimuli physically matched to natural infant cries (although more studies should clarify this aspect using within-group comparisons).

Finally, the finding of gender differences in automatic motor responses to infant cries suggests that females may to be tuned to respond to infant cries. Considering the importance of mothers' reactions to distressing stimuli produced by infants in predicting child outcomes (McElwain and Booth-LaForce, 2006; Leerkes et al., 2011; Joosen et al., 2012), this result may begin to explicate processes that regulate the quality of the mother-infant interactions and thereby possibly improve interventions aimed to promote positive and sensitive caregiving.

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Implicit Attitude Toward Caregiving: The Moderating Role of Adult Attachment Styles

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Attachment and caregiving are separate motivational systems that share the common evolutionary purpose of favoring child security. In the goal of studying the processes underlying the transmission of attachment styles, this study focused on the role of adult attachment styles in shaping preferences toward particular styles of caregiving. We hypothesized a correspondence between attachment and caregiving styles: we expect an individual to show a preference for a caregiving behavior coherent with his/her own attachment style, in order to increase the chance of passing it on to offspring. We activated different representations of specific caregiving modalities in females, by using three videos in which mothers with different Adult Attachment states of mind played with their infants. Participants' facial expressions while watching were recorded and analyzed with FaceReader software. After each video, participants' attitudes toward the category "mother" were measured, both explicitly (semantic differential) and implicitly (single target-implicit association task, ST-IAT). Participants' adult attachment styles (experiences in close relationships revised) predicted attitudes scores, but only when measured implicitly. Participants scored higher on the ST-IAT after watching a video coherent with their attachment style. No effect was found on the facial expressions of disgust. These findings suggest a role of adult attachment styles in shaping implicit attitudes related to the caregiving system.

Keywords: adult attachment, implicit measure, caregiving, intergenerational transmission, internal working model

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ADULT ATTACHMENT STYLES AND IMPLICIT ATTITUDES TOWARD CAREGIVING STYLES

Attachment Theory

In the first formulations of attachment theory, Bowlby (1969/1982, 1980) postulated that children's need of their caregivers, in terms of proximity seeking, was indispensable for evolutionary adaptation. Children rely on caregivers for safety and resources, but attachment bonds have far-reaching implications since they are involved in shaping development. As Bowlby (1969/1982, p. 64) stated, "Not a single feature of a species' morphology, physiology, or behavior can be understood or even discussed intelligently except in relation to that species' environment of evolutionary adaptness (EEA)." This is consistent with the idea that less than optimal developments should be conceived as a sort of "over-adaptation" to a maladaptive environment rather than as mere failures in adaptation.

The evolutionary pressure that fosters mother-infant bonding lies at the core of adult social behaviors. Baumeister and Leary (1995) highlighted the benefits of forming and maintaining social bonds in terms of survival and reproduction, proposing that the need for interpersonal attachments constitutes a fundamental human motivation. Bowlby introduced the concept of internal working models (IWM), whose function is "to simulate happenings in the real world, thereby enabling the individual to plan his behavior with all the advantages of insight and foresight" (Bowlby, 1988). The IWMs are expectations aimed at the preservation of self-regulation and positive affect even in adverse environmental conditions (Sroufe and Jacobvitz, 1989; Schore, 1994). Main et al. (1985) went beyond the behavioral perspective by introducing a representational framework, in which IWMs are considered to be "a set of conscious and/or unconscious rules," organizing attachment-related memories, emotions and thought processes. (p. 66).

Social Cognition of Attachment

Westen (1991) proposed that attachment studies are one of the most productive fields in which psychodynamic and cognitive studies can be integrated. In his view, representations that underlie attachment-related processes constitute a key element in linking these two perspectives. In fact, Bowlby always underlined the primary role of beliefs and cognitive schemata in orienting attachment behaviors and expectations, but it is only after the reconceptualization of attachment theory in representational terms that social cognitive models and methods have effectively been implemented in this field (Bartholomew and Horowitz, 1991; Brennan et al., 1998; Brennan and Shaver, 2002; Mikulincer et al., 2005; Shaver and Mikulincer, 2013).

From a social cognition perspective, Baldwin et al. (1996) found that accessible memories of satisfying or unsatisfying attachment experiences play a role in shaping the perception of relationships. Moreover, they showed that mental schemas of attachment can have different accessibility depending on different contexts, in a similar way to the majority of cognitive structures. In particular, they asked the participant to visualize different kinds of relationships and this led them to react in different ways to interpersonal information and to show increased attraction toward potential dating partners with the same attachment orientation. This helped to improve our understanding of the IWMs moving forward from a definition based on personality traits to a more complex perspective based on a hierarchical structure of relationship specific attachment orientations (Bretherton, 1987, 1999). In the same perspective, Bartz and Lydon (2004) found the effect of manipulating close relationships on the working self-concept, in particular on agency and communion. Security priming of attachment leads to positive relationship expectations and affect (Rowe and Carnelley, 2003; Carnelley and Rowe, 2007; Gillath et al., 2008) and the effect seems stable across the life span and for different domains of social information processing (Dykas and Cassidy, 2011).

A social cognition perspective has been applied also to parenting behaviors. Atkinson et al. (2009) studied the interplay between emotional cognitive processes (selective attention in the Stroop task) and disorganized attachment in mothers and their children. They found an interesting interacting role of both attachment and loss of controlled attention that they interpret as a process of "threat tags." They conclude that IWMs role in risk for psychopathology can be fully appreciated only if research tries to explore different levels of analysis of attachment representations (cognitive and affective). In fact, Okagaki and Bingham (2005) had tried to drive the attention of researchers to the relevance of a better comprehension of the relation between social cognition and behavior in order to develop effective parent intervention programs. For instance, parental stress seems to be associated to both anxiety and avoidance of attachment, because of the difficulties they imply in coping with distress, but in different ways: more avoidant women attribute negative distress to a characteristic of the baby and not situational factors; more anxious women make more mistakes in recognizing fear and attribute distress to physical factors, then they could show an out of sync response to the babies' distress signs (Leerkes and Siepak, 2006; for a complete review of a social cognition approach to parenting processes and behaviors, see: Jones et al., 2015a,b).

Implicit Activation of Attachment Representations

Attachment research studied the role of implicit activation of attachment representations (Gawronski and Payne, 2011), starting from Bowlby's idea of the importance of automatic attachment schemata. For instance, there is evidence of individual differences in expressing avoidance or hypervigilance with respect to attachment threats: fearful avoidant individuals are in fact characterized by cognitive avoidance of all highly emotional stimuli (Dewitte et al., 2007). Baldwin et al. (1993) as well as Mikulincer (1998) presented priming sentences like "If I trust my partner my partner will…" (this example manipulates the variable trust). Subsequently, a word non-word task with attachment related words (representing good or negative outcomes) as priming cues was administered. In general, insecure individuals were quicker in the negative outcome condition while secure were quicker in the good outcome condition. This result can be interpreted as insecure participants expecting less supportive partners in stressful conditions: for them the negative outcome is more naturally consequent to angry feelings.

One of the most widely-used paradigms to study the automatic activation of representations is the implicit association task (IAT; Greenwald et al., 1998, 2003), which assesses implicit dimensions of psychological constructs such as attitudes and stereotypes (for a description, see the Materials paragraph).

From the perspective of attachment research, Zayas and Shoda (2005) found a relation between Mother-IATs and Partner-IATs and an explicit measure of adult attachment (ECR). Low negative correlations were found between the Mother-IAT scores, defined as an association between the dichotomies "pleasant/unpleasant" and "supportive/rejecting" and the ECR-subscale Avoidance. For the Partner-IAT scores, participants were asked to indicate words that were highly related and highly unrelated to their partners. These words were then used as stimulus words to be classified according to a dichotomy "name of the partner/not-name of the

partner." In this case, the correlation with ECR-Avoidance was negative, but considerably higher. This last finding was consistent with Banse and Kowalick's (2007) comparison between groups of women in different stressful conditions. It seems that positive representations of partners constitutes a resource for coping in stressful life situations. Dewitte et al. (2008, p. 282) used the IAT "as an index of the implicit attachment self-concept" and found that self-esteem and relational anxiety on the IAT were, in fact, correlated with attachment style, and able to predict strategies for successfully managing attachment-related stressful circumstances. The aim of the present study is to extend this work on implicit processes related to attachment. We hypothesize an effect of attachment styles in shaping the implicit representations of caregiving related perceptions. Because of the centrality of attachment in affecting individual development, we propose a role of attachment dependent schemata in structuring the implicit activation determined by parenting behavior.

Attachment and Caregiving Systems

The fundamental role of the caregiver in influencing children's attachment behaviors and representations lead to the study of the caregiving behavioral system (George and Solomon, 2008). Bowlby (1969/1982, 1988) proposed the existence of a behavioral structure in caregivers, which is reciprocal to the recipients' attachment behavior. Parenting entails moving from a position characterized by seeking protection and security to one which requires providing protection and care. The connection between the two systems is suggested by their shared evolutionary aim. In fact, Belsky et al. (1991, p. 172) proposed a definition of attachment as an evolved psychological mechanism, through which the parents' experiences during childhood and adolescence are transmitted "probabilistically" to their offspring, shaping their development and reproductive approaches. The strategies (in both behavioral domains and emotion regulation) learnt in infancy, constitute an adaptive advantage because they promote faster and more specific responses within the EEA. As a consequence, such strategies tend to remain relatively stable during the life-span, as confirmed by empirical research (Fraley, 2002; see also Raby et al., 2015, for the transmission of infant attachment). Numerous studies support the strong correspondence between mothers' states of the mind with respect to attachment and their children's attachment (van IJzendoorn, 1995a). This evidence seems stable and constant in different cultures (Grossmann et al., 1988; Sagi et al., 1997; Kazui et al., 2000; Hautamäki et al., 2010) and in different risk populations (Bus and van IJzendoorn, 1997; Tarabulsy et al., 2005; McMahon et al., 2006; Shlafer et al., 2015). In Bowlby's (1969/1982) and Ainsworth's (Ainsworth et al., 1974, 1978) view, the mechanism responsible for this transmission should be the so called "maternal sensitivity," defined as the ability of being aware of infants' signals and to correctly respond to them. The effect they hypothesized was that an insecure mother's attachment lead to a poor maternal sensitivity and in turn to the transmission of mother's attachment to the infant. Unexpectedly, research identified a "transmission gap" (van IJzendoorn, 1995a,b; van IJzendoorn and Bakermans-Kranenburg, 1997) because the mediating role of maternal sensitivity was significant but modest. Fonagy and Target (2005) proposed the mediating function of mothers' ability to mentalize as a necessary factor for creating a secure base environment for their children, as empirical research confirmed (Grienenberger et al., 2005; Slade et al., 2005). From a developmental perspective, Meins (Meins et al., 2001, 2012) proposed that is mothers' mind-mindedness, i.e., the capacity to understand children's mental states, what enables them to respond to the children's needs adequately. More recently, Bernier et al. (2014) proposed to add the notion of "maternal autonomy support" to describe mothers' ability to enhance children's confidence in exploring the environment. This approach seems to take into account the problem of the transmission gap, although further studies are needed to explore underlying social cognition processes. Scharf and Mayseless (2011) followed 60 men from adolescence to early adulthood and found a continuity between their state of mind with respect to attachment in adolescence and the quality of parenting 9 years later. Other studies used self-reported attachment measures (for reviews, see: Jones et al., 2014, 2015a,b) and found that insecurity is associated with more negative attitudes toward parenting, which is considered more stressful (Nathanson and Manohar, 2012). Secure individuals consider themselves more competent and effective in parenting, compared to less secure ones (Kilmann et al., 2009; Howard, 2010; Caldwell et al., 2011; Kohlhoff and Barnett, 2013). Anxiety was found to be associated to the perception of infants as interfering with parents' romantic relationship (Rholes et al., 2011) and jealousy toward the children (Wilson et al., 2007). Parental avoidance is correlated with less optimistic expectations for child outcomes (Lench et al., 2006).

From an evolutionary perspective, intergenerational transmission seems to foster the maintenance of strategies which are able to enhance the reproduction of the species (Belsky, 2005), but the emotional and cognitive mediators remain unclear. In particular, literature focused primarily on correlational studies, with a less intense focus on experimental manipulations.

The Present Study

Although there is a growing theoretical interest about the attachment transmission gap, few studies focused on the cognitive processes that may affect the individual's relational patterns. The aim of this study was to explore the link between adult attachment styles and attitudes toward different caregiving behavioral modalities. In particular, we investigated if current adult attachment styles make individuals discriminate different ways of caregiving, and if they are associated with a preference for a specific caregiving modality. We hypothesize that the preference for proximity, avoidance, or resistance in adult relationships could predict the attitude toward the perception of a new specific relationship (Brumbaugh and Fraley, 2007), like a caregiving one.

From an evolutionary perspective, the intergenerational transmission should foster the maintenance of strategies able to lead to reproduction of the species (Belsky, 2005). Therefore, if these strategies experienced by an individual led to reproduction, there is no need to change them and they can be transmitted to

next generations. Then we expect adult attachment styles to shape the adult perception of caregiving strategies.

In order to explore the association between attachment styles and the perception of different caregiving modalities, we designed a study to elicit a specific caregiving representation in the participants and, then, we assessed the attitude to the semantic category "mother." Our first hypothesis was that the activation of a caregiving representation in line with the participants' attachment style would entail a more positive attitude, implying a preference for a strategy that is coherent with one's own attachment style. For example, a participant who uses dismissing strategies in his/her adult relationships should show a more positive attitude when he/she is watching a dismissing caregiver than when he/she is watching a preoccupied mother and her baby.

Second, a fundamental question relates to whether the transmission of attachment styles is an automatic or implicit process of identification with an experienced caregiving modality. Do individuals have "script-like representations of secure base experiences" (Waters and Waters, 2006, p. 185) and do they use them as basis for comparison in forming attitudes of different situations? In order to face this issue we used two different measures of attitude, an implicit one and an explicit one. We expect a stronger effect of attachment style on the more implicit measure, because of the importance of automatic processes in IWMs.

Third, in the light of the strong connection between attachment styles and emotion regulation strategies, we are interested in linking the perception of different caregiving styles to a measure of emotion arousal. The process of forming attitudes has also an affective component (Petty et al., 2001; Clore and Schnall, 2005; Malhotra, 2005) so we propose at an explorative level an influence of attachment styles on the emotional processes that contribute to define a specific attitude toward a caregiving style. More specifically, disgust seems to be involved in the process of formation of attitudes, for instance in political orientations (Hibbing et al., 2014; Inbar and Pizarro, 2014). Disgust fosters avoidance not only of dangerous or unhealthy situations but also of unfair or not convenient conditions (Chapman et al., 2009; Chapman and Anderson, 2013; Tybur et al., 2013). The evolutionary purpose is to avoid unhealthy or unfamiliar behaviors, so it is possible that the same process takes place while an individual is selecting between different caregiving behaviors. Magai et al. (2000) found an effect of attachment "Preoccupation" on facial expression of disgust during an emotion elicitation task. For exploratory purposes, we want to test if this role of disgust can be extended during the perception of caregiving modalities. Then we tested whether the expression of disgust during the observation of a specific caregiving modality in adults depends on individual's attachment style. A caregiving modality less coherent with participant's attachment style should elicit more disgust. We are interested in this effect as a first step toward a better understanding of the mechanisms to form this kind of attitudes. This effect could be part of the process that increases the chances of intergenerational transmission of attachment style, influencing the formation of attitudes and driving behaviors. Attachment style would be confirmed as crucial in the psychophysiological process of discerning between different caregiving behaviors and the prominence of low-level information processes in forming these attitudes. The attitudes toward caregiving modalities would directly shape the emotions expression and regulation: this would suggest an explanation of transmission gap in a sort of communication at an implicit level between mother and child.

MATERIALS AND METHODS

Participants

Seventy-three Italian undergraduate students participated in exchange for course credits at the Psychology Department of the University of Milan-Bicocca. The only exclusion criteria was having children. Twenty-five participants (12 males) were assigned to a preliminary phase; 48 females were assigned to a second step of the present study.

Materials

Experiences in Close Relationship-Revised (ECR-R; Fraley et al., 2000; Busonera et al., 2014)

The ECR-R is a questionnaire used to assess adult romantic attachment style as resulting of two orthogonal dimensions: a subscale of anxiety and a subscale of avoidance. High scores on the first subscale indicate a tendency to preoccupation, jealousy and fear of abandonment, while high scores on the second scale suggest uneasiness with intimacy. The questionnaire is largely used to measure individual differences in romantic adult attachment styles and shows good psychometric properties both for validity and reliability (Sibley et al., 2005; Fairchild, 2006).

Single Target-Implicit Association Task (ST-IAT; Wigboldus et al., 2004)

The ST-IAT is a version of IAT (Greenwald et al., 1998) that measures the level of association between two categories characterized by opposite polarities (e.g., pleasant/unpleasant) and a single target category (in the present study the category was "mother"). It is a computer task developed with Inquisit 4 (Inquisit, 2013): participants are asked to categorize the words that appear in the center of the screen depending on the category they belong to. By pressing different response keys, they associate these words to the categories presented on the top part of the screen: the left key for the left categories or the right key for the right categories. The words can refer to the a polarity (e.g., "wonderful" vs. "awful") or to a target category (e.g., "care" or "comfort"). In different trials target category can be presented on the right or on the left, that is can be associated with each of the opposite polarities ("good," "bad"). The differences in reaction times between the conditions when the category is associated with each of the two polarities represent a measure of association between one side of the polarity and the target category. In our task the IAT algorithm (Greenwald et al., 2003) produced the score of the association between the category "good" and the category "mother." IAT has been shown to have good predictive validity (Greenwald et al., 2009) and validity of the scoring algorithm (Richetin et al., 2015). It is one of the most used task to study implicit attitudes (Teige-Mocigemba et al., 2010) and it has

been used also in attachment research (Zayas and Shoda, 2005). The words used in the present task are the following. Positive: Marvelous, Superb, Pleasure, Beautiful, Joyful, Glorious, Lovely, Wonderful. Negative: Tragic, Horrible, Agony, Painful, Terrible, Awful, Humiliate, Nasty. Mother: Care, Attention, Consolation, Support, Help, Bond, Comfort.

Semantic Differential (SD; Osgood et al., 1957)

Semantic differential is an explicit measure of attitude. The participant is asked to think to a category (in our study "mother") and to rate 10 bipolar adjective on 7-point Likert scales (e.g., "strong/weak," "good/bad"). It has been recently used to evaluate different kinds of parents (Weed and Nicholson, 2015), showing a good discriminant ability.

FaceReader Software

FaceReader software version 5.0 (FR, Noldus, 2013) automatically analyzed facial expressions to detect the six basic emotions described by Ekman (1992): happy, sad, angry, surprised, scared, disgusted and a neutral state. The software showed a good convergent validity (Den Uyl and Van Kuilenburg, 2005; Terzis et al., 2012) with the manually coded FACS ratings (Ekman and Rosenberg, 1997). FR reduces the time for behavioral coding without compromising accuracy and its use in psychological studies is increasing (Chentsova-Dutton and Tsai, 2010; He et al., 2014).

Stimulus Materials

Three different videos of mother–infant interactions were employed to activate three different representations of caregiving. The videos were chosen based on mothers' Adult Attachment Interview (AAI; George et al., 1985) classification, independently obtained. We selected the videos from a sample of mother infant free play (with standardized games) used in a previous study (Tagini et al., in preparation). The children in the selected videos were females of 23 months of age. Mothers' AAI classification was previously assessed and the mothers were selected to be one secure, one preoccupied and one dismissing. In addition, a further selection criteria was that all ECR-R (which was assessed as well) scores of mothers were consistent with their AAI classification. The secure mother had low anxiety (less than a standard deviation from the mean) and low avoidant scores, the preoccupied one was high in anxiety (more than a standard deviation from the mean) and the dismissing one was high on avoidance. After watching the three videos, 18 attachment experts (researchers and clinicians) answered the following questions for each video: "How much do you consider the caregiving behavior of this mother prototypic of a secure/preoccupied/dismissing mother? One is not prototypic at all and seven is very prototypic." Results confirm that our stimuli has been chosen to be actually able to represent different caregiving styles and this association seems to be empirically supported.

Procedure

This study was carried out in accordance with the recommendations of the Declaration oh Helsinki and the approval of the Ethical Committee of University of Milano—Bicocca. All subjects gave written informed consent in order to participate.

The first phase of the experiment consisted in evaluating the association between measures of attitude and participants' attachment style. The implicit and explicit measures were assessed for a first sample of 25 participants (females = 14) and subsequently their attachment style was evaluated with the ECR-R. Because no significant correlations were found, the presence of an effect of attachment style on attitudes during the second phase, could be interpreted a consequence of the experimental manipulation. The second phase consisted in a new, larger sample of female participants ($N = 48$), who watched the videos of mother-child interactions. In each session, after viewing the mother-child interaction video, the participants' attitude toward the category "mother" was measured, by means of both implicit (ST-IAT) and explicit (SD) measures. Thus, differences in attitudes could be attributed to having watched the different videos. The order of the videos was randomly generated to control learning effects on the ST-IAT. Three days was the minimum interval between one condition and the subsequent one. The choice to select only female participants was due to the characteristics of the videos, that represent mothers playing whit their daughters. This could make very difficult to interpret any possible gender difference in the data.

At the end of the first session, each participant was asked to fill out the ECR-R. The number of observations ($N = 138$) is slightly less than the maximum possible number ($N = 144$), because not all participants came three times to perform the task in the three different conditions. Participants who came just once were excluded from the analysis ($N = 4$).

While participants were watching the videos, their faces were video recorded in order to analyze their emotional expressions.

Data Analysis

We used R software (R Development Core Team, 2013) to analyze data. Correlations between the attachment measure and the ST-IAT and SD in the condition when no caregiving representation was activated (no video watched) were calculated, in order to control the possibility that the attitude toward the category "mother" depended on attachment style.

The effects of the experimental manipulation on ST-IAT and SD was tested with linear mixed models (LMMs). This allowed us to test within subjects experimental effects, considering attachment measures as covariates, and to perform repeated measure analyses, including those participants who were evaluated in only two conditions. The fixed effects were attachment style (anxiety and avoidance of attachment) and the type of condition (the vision of a video with a preoccupied/secure/dismissing mother). The outcome variable was the attitude toward the category "mother," in one model it was the explicit measure (SD), and in the other model the implicit one (ST-IAT). We report all significant main effects and interactions (up to three way interactions).

The same predictors were used in a different model, with the Disgust measure of FaceReader Software as the outcome variable. Because of the very skewed distribution (skewness =

3.27 and kurtosis = 11.97) the outcome measure was recoded as a binomial variable (median split), in which 0 indicated a low Disgust mean and 1 a high Disgust mean. In this way, we could test a logistic mixed regression model, as part of the generalized linear mixed models (GLMMs).

Linear mixed models and GLMM were performed in R by using the package "lme4" (Bates et al., 2015) and bootstrapping all the confidence intervals. Degrees of freedom and p-values for the LMMs were computed via Kenward–Roger's approximations (F-tests) and Satterthwaite's approximations (t-tests) through the "lmerTest" package (Kuznetsova et al., 2014). The GLMM p values and degrees of freedom for the Chi square tests were computed via the likelihood ratio tests through the package "afex" (Singmann et al., 2014). Plots were built using the package "ggplot2" (Wickham, 2009).

RESULTS

Correlation Between Attachment Style and Attitude Measures Without Manipulation

The first step was to test the correlation between the two dimensions of attachment style (avoidance, anxiety) and the two measures of attitude (ST-IAT, and SD), when no representation of caregiving was activated. This analysis was performed on the first sample ($N = 25$) that did not watch any video. The results indicate that there was no significant association, both for the ST-IAT (avoidance: $r = 0.09$; anxiety: $r = -0.06$) and for the SD (avoidance: $r = -0.13$; anxiety: $r = -0.16$). The non-significant correlations obtained allowed us to ignore the "baseline" condition (no experimental manipulation) in subsequent sample, in which it was therefore possible to consider the effect of attachment style as related to the experimental manipulation.

Effects of Attachment Style and Conditions on IAT

The first LMM model (within-subjects factor: type of conditions; covariates: anxiety and avoidance of attachment, centered on the means) showed no effect of the predictors (neither main effects nor interaction effects), on the attitude measured in an explicit way. The random terms were both intercept (var = 0.11) and condition (var = 0.26), because the model with both effects showed a significant improvement of fit [ΔBIC = −44.48, $\chi^2(5) = 54.48$, $p < 0.001$]. The same LMM model was performed with the ST-IAT scores as the outcome variable. The random term was just the intercept (var = 0.04), because the model with intercept and condition effects showed a not significant improvement of fit [ΔBIC = −17.89, $\chi^2(5) = 6.71$, $p = 0.24$]. IAT score was significantly affected by the type of Conditions [$F(2,83.20) = 5.83$, $p < 0.01$] but not by Avoidance [$F(1,42.90) = 0.06$, $p = 0.80$] and Anxiety [$F(1,43.41) = 0.45$, $p = 0.51$]. The three two-ways interaction terms were the following: Conditions × Avoidance, $F(2,82.32) = 8.53$, $p < 0.001$; Conditions × Anxiety, $F(2,82.82) = 7.86$, $p < 0.001$; Avoidance × Anxiety $F(1,42.80) = 0.26$, $p = 0.61$. The three-way interaction Condition × Anxiety × Avoidance was significant, $F(2,82.22) = 3.85$, $p < 0.05$, suggesting that the effect of type of conditions (one of the three videos) was different for different levels of the two attachment style scales. To interpret this interaction we calculated the simple slope analysis: on the left panel of **Figure 1** the effects of Avoidance are shown (Anxiety centered on the mean), while on the right panel of **Figure 1** the effects of Anxiety are shown (Avoidance centered on the mean).

When anxiety is centered on the mean, avoidance has a negative effect on implicit attitude after the Secure Video, $b = -0.11$, SE = 0.05, $t(89.83) = -2.26$, $p < 0.05$, 95% CI [−0.20, −0.004], a positive effect after the Dismissing Video, $b = 0.10$, SE = 0.05, $t(90.54) = 2.02$, $p < 0.05$, 95% CI [0.004, 0.189] and a negative not significant effect after the Preoccupied Video, $b = -0.02$, SE = 0.05, $t(90.48) = -0.37$, $p = 0.71$, 95% CI [−0.11, 0.81].

When avoidance is centered on the mean, anxiety has a negative effect on implicit attitude after the Secure Video, $b = -0.10$, SE = 0.05, $t(92.77) = -2.00$, $p = 0.05$, 95% CI [−0.21, −0.001], a negative not significant effect after the Dismissing Video, $b = -0.07$, SE = 0.05, $t(90.85) = -1.42$, $p = 0.15$, 95% CI [−0.17, 0.04] and a positive not significant effect after the Preoccupied Video, $b = 0.09$, SE = 0.05, $t(90.64) = 1.84$, $p = 0.06$, 95% CI [−0.0009, 0.01988].

To sum up, we found a positive effect of avoidance on IAT after the dismissing video and negative effects of both anxiety and avoidance after the secure video.

Effects of Attachment Style and Conditions on Emotion Expression

There was no significant association between Disgust variable and the explicit or implicit measures of attitude.

A third model with the same predictors and random effects was performed with the FaceReader measure of disgust as dichotomous outcome variable. The random term was just the intercept (var = 0.00) because the model with intercept and condition effects was not able to converge. The results showed a main effect of avoidance [$\chi^2(13) = 4.46$, $p = 0.03$] and no other significant main or interaction effect. The effect is positive, as it can be seen in **Figure 2** that represents the effect of the three different conditions even if no one of them is significant if taken singularly. Secure Video: $b = 0.43$, SE = 0.36, $z = 1.19$, $p = 0.23$, 95% CI [−0.25, 1.20]; Dismissing Video: $b = 0.33$, SE = 0.31, $z = 1.04$, $p = 0.30$, 95% CI [−0.27, 0.99]; Preoccupied Video: $b = 0.47$, SE = 0.33, $z = 1.42$, $p = 0.15$, 95% CI [−0.14, 1.16].

DISCUSSION

The results of this study confirmed the adequacy of the experimental paradigm in activating a specific caregiving representation, and measuring the process of forming an attitude. We found a role of adult attachment style in shaping the implicit attitude, but non the explicit one, toward the category "mother." The explicit attitude seems not to be influenced neither by the manipulation neither by participants' attachment style. This can be due to social desirability because the perception of the category "mother" is highly expected to be always good, or also to some kind of inability in being aware of a preference for a relational

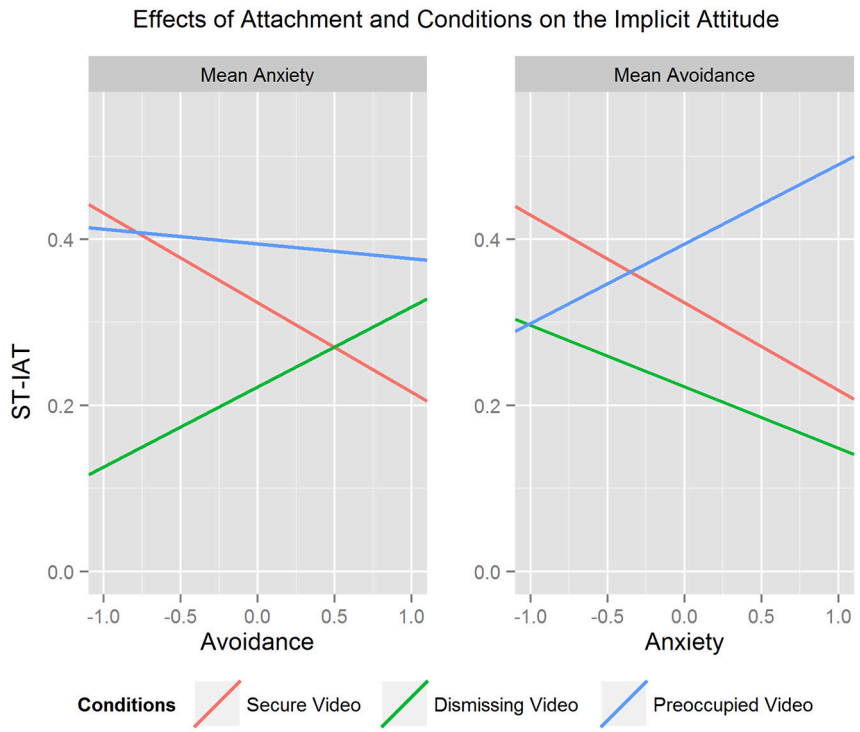

FIGURE 1 | Results of the simple slope analysis of the ST-IAT model: effects of attachment styles and conditions. The left panel shows the effects of avoidance when Anxiety is centered on the mean, while the right panel refers to anxiety effects when Avoidance is centered on the mean.

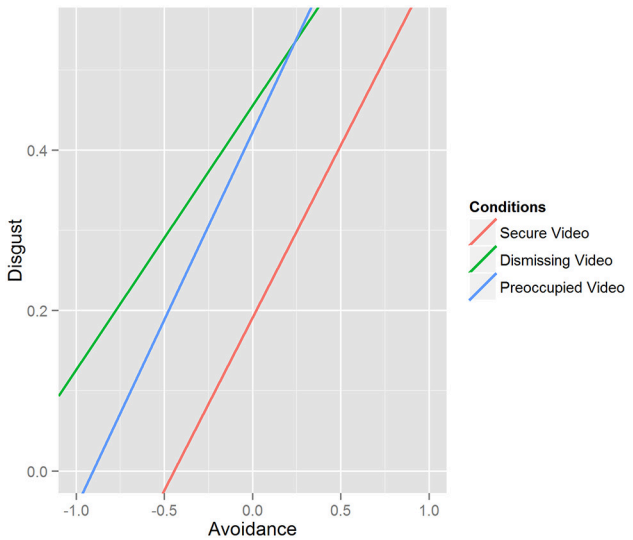

FIGURE 2 | Results of the simple slope analysis of the Disgust model: effects of attachment styles and conditions.

modality. On the contrary, the significance of the implicit attitude model could suggest the importance of the automatic processes of the IWMs. Participants are able to compare their relational expectations with the behavior they see in the videos, but they process this information in a not conscious way.

The results of the implicit attitude model are consistent with our expectations. In fact both Avoidance and Anxiety have a negative effects on IAT scores after the Secure Video (when the other variable is centered on the mean). This means that the more insecure a participant, the more negative her attitude toward the secure mother. On the contrary, avoidance has a positive effect on IAT scores after the Dismissing Video, but no effect after the Preoccupied one. This seems consistent with our hypotheses: very avoidant participants tend to prefer the Dismissing Video, while we had no predictions of a role of Avoidance on implicit attitude after the Preoccupied Video. Anxiety plays a similar role because it has a positive marginally significant effect on attitude after the Preoccupied Video and a negative not significant effect after the Dismissing Video.

The link between adult attachment style and the perception of different ways of caregiving can contribute to a better understanding of the mechanisms underlying the transmission of attachment. Avoidance or seeking of proximity in adult attachment seem to impact implicit processes of evaluation of caregiving modalities. The continuity between representations of partners and responses in new social encounters (Brumbaugh and Fraley, 2007) has a specific feature for what concerns caregiving relationships. From an evolutionary perspective, attachment schemata are influenced by the caregiving style of the parents. Thus, if an individual reaches the goal of reproduction, it is implied that the caregiving strategies have succeeded in that specific environment. In this sense it seems inexpensive to maintain a continuity between generations. It is consistent

with the definition of IWMs that they regulate the access to information relevant to attachment, and our findings underline that the information relevant for the caregiving system is also closely related to attachment styles.

The explorative hypothesis of the effect of the experimental manipulation and attachment style on the facial expression of disgust while participants were watching the different videos was not confirmed. The only significant effect was a positive one of avoidance that was also unexpected because Magai et al. (2000) found an association between facial expression of disgust and "Preoccupation" during an emotion elicitation task. Anyway it seems reasonable that a specific kind of human relationship like the mother infant one elicits more negative physiological reaction in participant with higher levels of avoidance, although this was not our hypothesis. Finally, we found no association between disgust and the two measures of attitude, so we can claim that the process of forming attitudes is not explained by the elicitation of this specific emotion.

CONCLUSION

Adult attachment styles seem to play a moderating role on high level implicit attitudes toward caregiving but not on explicit attitudes or on low level regulation and expression of emotion. These findings underline the fundamental role of adult attachment style in predicting attitudes related to the caregiving system. Our hypotheses are only partially confirmed because we found a correspondence only between attachment styles and the IAT. Anyway, this specific result is in line with Bowlby's statements on the complementarity of the caregiving and attachment motivational systems. Furthermore, our study confirms his belief in the complexity of the effects involved. In fact, Bowlby (1988) wrote: "Parenting behavior, as I see it, has strong biological roots, which accounts for the very strong emotions associated with it; but the detailed form that the behavior takes in each of us turns on our experiences – experiences during childhood especially, experiences during adolescence, experiences before and during marriage, and experiences with each individual child" (p. 5). From a clinical point of view, these issues are of great interest since they may contribute to the process of the intergenerational transmission of attachment, and the passing on of disorders, considering that an insecure attachment style can become a risk factor for psychopathology (Mikulincer and Shaver, 2012). It has in fact been associated to internalizing and externalizing problems in adolescence (Sarracino et al., 2011) clinical disorders such as depression (Roberts et al., 1996; Cantazaro and Wei, 2010; Santona et al., 2015), anxiety disorders (Warren et al., 1997), and personality disorders (Meyer and Pilkonis, 2005; Crawford et al., 2007).

The limitations of this study must be acknowledged. In fact, research on adult attachment reports a "trivial to small" correspondence between adult attachment style questionnaires and state of mind with respect to attachment (Roisman et al., 2007). Then a limitation of our study is the use of different models of measure between stimuli and participants' assessment. AAI is indeed considered the "gold standard" for adult attachment assessment (Hesse, 2008) and differs from adult attachment styles questionnaires because of its implicit nature. AAI relies on different processes and measures coherence of mind with respect to attachment, which, by definition, differs from the explicit thoughts about attachment style. Finally the correspondence between an individual's attachment style and his preference for the matching caregiving modality could however not be directly tested, because of the attachment model underlying the measurement used, which differed from the stimulus categorization. On one hand the continuous measure of attachment is more effective (Fraley et al., 2015), on the other hand led to a more difficult interpretation of the results because the videos had to be categorized.

A future perspective could explore the moderating role of gender in evaluating caregiving representations. Although differences in attachment style usually do not emerge from studies based on AAI (Bakermans-Kranenburg and van IJzendoorn, 2009), it seems reasonable that males and females could have different attitudes toward caregiving behaviors. In an evolutionary view, males tend to be more facultative investors (Del Giudice, 2009) than females, probably because a low parental investment can be more adaptive in order to save resources for additional mating. Thus, regardless of the effect of attachment style, we could expected higher levels of positive attitudes when representations were activated in females, due to evolutionary differences.

Approaching the transmission gap issue, the evidence of the non-linear effect of maternal sensitivity in shaping children attachment led to focusing on the role of other mediating constructs, such as Reflective Function (Fonagy and Target, 1997; Slade et al., 2005). This study attempted to investigate, at a more basic level, the link between attachment style and caregiving representations and we found an effect that may be a starting point for further research and for interventions on parenting skills in risk situations. Our results confirm that cognition and behavior linked to caregiving rely on automatic processes (Bowlby, 1969/1982; Soltis, 2004; Bos et al., 2010; Riem et al., 2011; Swain et al., 2014). In this regard, a key research area may be the study of the maternal representations, in order to understand how this caregiving attitude emerge and develop in pregnancy and early motherhood (Stern, 1995; Innamorati et al., 2010). It seems that every kind of intervention should face these implicit processes that do not reach a conscious level of elaboration. Finally, the results may be relevant to psychotherapy, considering that the interconnection between representations and the perception of relational contexts is a key concept in those contexts that focus on pointing out specific non-adaptive representations and reflecting on which specific environment allowed its development.

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A Prospective Longitudinal Study of Perceived Infant Outcomes at 18–24 Months: Neural and Psychological Correlates of Parental Thoughts and Actions Assessed during the First Month Postpartum

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The first postpartum months constitute a critical period for parents to establish an emotional bond with their infants. Neural responses to infant-related stimuli have been associated with parental sensitivity. However, the associations among these neural responses, parenting, and later infant outcomes for mothers and fathers are unknown. In the current longitudinal study, we investigated the relationships between parental thoughts/actions and neural activation in mothers and fathers in the neonatal period with infant outcomes at the toddler stage. At the first month postpartum, mothers ($n = 21$) and fathers ($n = 19$) underwent a neuroimaging session during which they listened to their own and unfamiliar baby's cry. Parenting-related thoughts/behaviors were assessed by interview twice at the first month and 3–4 months postpartum and infants' socioemotional outcomes were reported by mothers and fathers at 18–24 months postpartum. In mothers, higher levels of anxious thoughts/actions about parenting at the first month postpartum, but not at 3–4 months postpartum, were associated with infant's low socioemotional competencies at 18–24 months. Anxious thoughts/actions were also associated with heightened responses in the motor cortex and reduced responses in the substantia nigra to own infant cry sounds. On the other hand, in fathers, higher levels of positive perception of being a parent at the first month postpartum, but not at 3–4 months postpartum, were associated with higher infant socioemotional competencies at 18–24 months. Positive thoughts were associated with heightened responses in the auditory cortex and caudate to own infant cry sounds. The current study provides evidence that parental thoughts are related to concurrent neural responses to their infants at the first month postpartum as well as their infant's future socioemotional outcome at 18–24 months. Parent differences suggest that anxious thoughts in mothers and positive thoughts in fathers may be the targets for parenting-focused interventions very early postpartum.

Keywords: father, mother, parenting, postpartum, neuroimaging, infant, socioemotional development

INTRODUCTION

The first few months after a baby's birth are a critical period for parents and infants to establish a long-term emotional bond (Winnicott, 1956; Ainsworth, 1979; Porter and Hsu, 2003). Furthermore, the quality of parental care during these months has been established to have an enduring influence on the child's socioemotional development (Bornstein, 2002; Feldman, 2007a, 2015). Neuroimaging of new mothers and fathers during this critical period suggest that heightened neural sensitivity to infant-related stimuli are associated with parents' behavioral and emotional sensitivity toward their infants (Barrett and Fleming, 2011; Moses-Kolko et al., 2014; Rilling and Young, 2014; Swain et al., 2014b). These findings indicate the importance of specific aspects of psychological adjustment to parenthood and changes in the parental brain during the early postpartum period because they may contribute to predict later infant outcomes. The current longitudinal study addresses these issues by investigating the relations among postpartum parents' neural sensitivity to own infant's cry sounds, their concurrent thoughts and behaviors, and their perceptions of their infants' subsequent socioemotional outcomes. In addition, this study investigates similarities and differences among these associations in mothers and fathers – thus addressing the paucity of brain research on fathers (Swain et al., 2014a).

During the first few months after birth, infants are sensitive to the quality of parenting and caregiving has long-lasting effects on socioemotional competencies and stress regulation (Essex et al., 2002; Hostinar et al., 2014). Animal models indicate that caregiving quality during the first 10 days leads to epigenetic changes in offspring stress regulation. Offspring who receive low quality maternal care during this very early period of life exhibit increased stress reactivity and anxiety compared to offspring who received high quality maternal care all the way through to adulthood (Meaney, 2010). In humans, maternal sensitivity during the first few months after birth has been associated with infant physical and emotional stress reactivity and emotion regulation several years later (Feldman, 2007a; Lupien et al., 2009; Landers and Sullivan, 2012). Although current research on paternal care is more limited, the quality of father-infant interactions during the first year of the infant's life has also been associated with emotional and social development in infants, young children, and adolescents (Feldman and Masalha, 2010; Feldman and Bamberger, 2011; Lamb and Lewis, 2013; Ramchandani et al., 2013).

The early postpartum period is also noteworthy for its importance in the establishment of long-term emotional bonds between parents and infants as evident in parent brain physiology. During this period, human mothers and fathers exhibit dynamic neurobiological plasticity (Kim et al., 2010a, 2014, 2015; Pereira and Ferreira, 2015). Voxel-based morphometry analysis reveals that human mothers exhibit structural growth, indicated by increased gray matter volume, in several brain regions, including those involved in maternal motivation and reward processing such as the striatum, amygdala, hypothalamus, and the substantia nigra from the first month to 3–4 months postpartum (Kim et al., 2010a). Structural growth has also been noted in neural areas involved in processing sensory information and empathy, including the superior temporal gyrus, thalamus, insula, and pre- and post-central gyri. Finally, the inferior and medial frontal gyri, as well as the anterior cingulate cortex, regions associated with regulating emotions, also show structural increases. Functional magnetic resonance imaging (fMRI) studies provide converging evidence, with mothers showing increased activations in similar brain regions during the first few months postpartum in response to infant-related stimuli including cry sounds, pictures, and videos (Lorberbaum et al., 2002; Nitschke et al., 2004; Kim et al., 2010b, 2011; Landi et al., 2011; Barrett et al., 2012).

Like mothers, longitudinal changes from the first month to 3–4 months postpartum in human fathers' brains have been examined using voxel-based morphometry analysis (Kim et al., 2014). Fathers also exhibit anatomical growth in the amygdala and striatum (including putamen and caudate), regions associated with parental motivation, and the lateral prefrontal cortex and insula, regions involved in emotion regulation and social information processing. Recent fMRI studies also suggest that fathers increased brain responses to baby stimuli in these brain regions during the early postpartum period (Atzil et al., 2012; Kuo et al., 2012; Mascaro et al., 2013, 2014; Abraham et al., 2014). For example, during 2–4 months postpartum, fathers also show increased activation in prefrontal and striatal brain regions in response to their own infant images (Kuo et al., 2012).

Thus, the early postpartum period is a sensitive period for parents to undergo neural changes that support close emotional relationships with infants, which then support positive socioemotional development in infants. Moreover, in a published study (Kim et al., 2013), we demonstrated that parenting-related cognition and actions during the transition to parenthood also play a role in sensitive parenting behaviors among mothers and fathers. At the first, then again 3–4 months postpartum, mothers and fathers were asked about their parenting-related thoughts and actions using a semi-structured interview, the Yale Inventory of Parental Thoughts and Actions-Revised (YIPTA-R) (Kim et al., 2013). From the first month to 3–4 months postpartum, both mothers and fathers exhibited a decline in their anxious and intrusive thoughts about parenting and infants, but an increase in their positive thoughts about parenting and infants. Also, at 3–4 months postpartum, higher levels of maternal anxious and intrusive thoughts about parenting and infants were inversely related to sensitivity during interactions with infants. For fathers, higher levels of anxious and intrusive thoughts at 3–4 months postpartum were positively associated with paternal sensitivity, suggesting that their worries and concerns may motivate more involvement, at least in this low-risk sample. Thus, this study provides evidence of links between parenting cognition and parenting behaviors, but little is known about whether parenting-related thoughts can be related to parental neural responses to own infant stimuli during the early postpartum periods, and the implications for infants' later outcomes.

To address this gap in the literature, the current study recruited new mothers and fathers and interviewed them about their parental thoughts, twice during the early postpartum period - at the first month and three to 4 months postpartum. First, we identified specific parental thoughts that are associated with the infant's subsequent socioemotional outcomes at 18–24 months postpartum as perceived by their parents. Postpartum negative mood was included as a covariate to examine the unique effects of parenting-related thoughts on infant socioemotional outcome (as reported by the parents), independent of parental mood. Next, we investigated whether parental thoughts at the first vs. later (3–4 months postpartum) time points would better predict their perceptions of their infants' subsequent socioemotional functioning, as a step in identifying sensitive time windows of parental adjustment and caregiving behavior. These analyses permitted us to focus on specific cognitive aspects of parenting at particular postpartum time points and their associations with positive infant outcomes. In the next step we examined the associations among parental thoughts and parental neural sensitivity to infants. Mothers and fathers participated in an fMRI scanning visit, during which their neural responses to own and unfamiliar infant cry sounds were assessed at the first month postpartum. We examined whether neural responses to own infant cry vs. unfamiliar infant cry sounds were associated with parental thoughts in mothers and fathers. We hypothesized that positive and negative thoughts about parenting and infants would be associated with neural regions particularly involved in reward/motivation and emotion regulation in mothers and fathers. Finally, mediation analyses were conducted to examine the indirect effects of parental thoughts on later infant socioemotional outcomes via parental neural sensitivity to own infant stimuli.

MATERIALS AND METHODS

Participants

Families with infants who were born healthy and full-term were recruited at a Yale-New Haven Hospital postpartum ward. Families first participated in two waves - Time 1 (first month postpartum), and time2 (3–4 months postpartum). The families were re-contacted at Time 3 (18–24 months postpartum). Among families who participated in all three phases, two mothers and two fathers were excluded from the analysis due to excessive motion (>3 mm or degree) during the fMRI session at Time 1.

Thus, a total of 21 mothers (age $M = 35.56$, $SD = 7.81$ at Time 1) and 19 fathers (age $M = 37.68$, $SD = 4.67$ at Time 1) were included in the analyses. Among these parents, 17 mothers and fathers were married to each other. Both mothers ($M = 17.90$ years, $SD = 3.21$) and fathers ($M = 16.79$ years, $SD = 3.03$) were above college educated on average. In the sample, 61.9% of mothers and 47.4% of fathers were first-time parents. All infants of these parents were Caucasian background except one infant whose parents had Caucasian and Hispanic backgrounds and 52.2% of the infants were female. Nine of the 21 mothers and 8 of 19 fathers overlapped with the sample of a previous study (Kim et al., 2013).

Procedures

A trained researcher visited families' homes at all three time points, the first month (Time 1), 3–4 months postpartum (Time 2), and 18–24 months postpartum (Time 3). At times 1 and 2, mothers and fathers were interviewed separately by a trained researcher and completed self-report questionnaires. At Time 1, mothers and fathers also underwent a neuroimaging session at a university. At Time 3, mothers and fathers completed questionnaires at home. All procedures were approved by Yale University Human Investigation Committee and patients were fully informed and consented to all procedures.

Measures

Yale Inventory of Parental Thoughts and Actions – Revised (YIPTA-R)

Parenting-related thoughts/behaviors were assessed using YIPTA-R, a semi-structured interview (Leckman et al., 1999; Kim et al., 2013), at times 1 and 2 in mothers and fathers. The six domains of the YIPTA-R were the following: (1) caregiving thoughts and actions about the baby (CARE; e.g., Fed your baby [hrs/per day]); (2) thoughts and actions associated with relationship building (RELATIONSHIP; e.g., Thoughts about baby's future development); (3) the positive experiences of parenting (POSITIVE PARENTING; e.g., "fulfilling" for describing experience of being a parent); (4) positive thoughts about the baby (POSITIVE BABY; e.g., "perfect" for describing perception of baby); (5) preoccupation regarding the infant's needs and well-being (PREOCCUPATION; e.g., Mind occupied with thoughts about the baby [hrs/per day in past week]); (6) anxious intrusive thoughts and harm avoidant behaviors (AITHAB; e.g., Worries about something bad happening to the baby, Worries about being up to the task of parenting). More details on items and how the domains were scored are detailed in Leckman et al. (1999) and Kim et al. (2013).

The Beck Depression Inventory (BDI)

Beck Depression Inventory (Beck et al., 1988) was used to assess depressive symptoms at all three time points in mothers and fathers. The BDI consists of 21 items, with each item answered on a scale of 0 (symptom is absent) to 3 (symptom is severe).

The Spielberger State/TraitAnxiety Inventory (STAI)

State/Trait Anxiety Inventory questions were used to assessstate anxiety levels in mothers and fathers at all three time points (Spielberger and Vagg, 1984). The 20 state anxiety items are rated on a scale of 1 (almost never true) to 4 (almost always true).

The Brief Infant Toddler Social Emotional Assessment (BITSEA)

Infants' socioemotional functioning was assessed using the BITSEA (Briggs-Gowan and Carter, 2002; Briggs-Gowan et al., 2004). Mothers and fathers completed the questionnaires separately at Time 3. This parent report has 42 items, comprising two scales: 11 items assess socioemotional competence and 31 items assess problems. The competencies scale includes items on sustained attention, compliance, mastery motivation, prosocial peer relations, empathy, imitation/play skills, and

social relatedness. The problems scale focuses on externalizing, internalizing, and regulatory problems. Parents rate each item on a 3 point scale (0 = not true/rarely, 1 = somewhat true/sometimes, 2 = very true/always). Thus, the range of the scores was 0–33 for competence and 0–93 for problems. The BITSEA has demonstrated construct validity and clinical validity in discriminating children with clinically significant problems from matched control children (Briggs-Gowan et al., 2004; Briggs-Gowan and Carter, 2006; Karabekiroglu et al., 2010). Competence scores below 15th percentile (13 for boys and 15 for girls) or problem scores above 75th percentile (15 for both boys and girls) indicate a possible problem or deficit/delay (Briggs-Gowan et al., 2004). Using the cutoff, based on mother report, one girl in our sample had low competence and one boy had high problems. Based on father report, one girl had low competence, and two boys had high problems.

fMRI Paradigm

After consenting, parents were asked to record their own infant's cry samples at home during a diaper change using a portable digital recorder. The control cry samples were selected from cry samples of infants who did not participate in the study (see Kim et al., 2011 for more details). Any non-cry noise and background sounds were removed using sound editing software (Cool Edit Pro Version 2.0, Syntrillium Software, Phoenix, AZ, USA). Using the software, white noise sounds were matched to own baby cry and control cry samples.

Based on the role of baby cry in parental care evocation, especially in the early postpartum (discussed in Swain et al., 2004; Swain and Lorberbaum, 2008), during the fMRI session, mothers and fathers listened through headphones to two types of cry sounds: those of their own baby and of an unknown baby as well as two types of white noise sounds each matched to the infant cries (own noise and control noise). Parents were instructed to attend to and experience naturally the emotional state elicited by each set of sounds. The order of sounds was pseudo-randomized. Each sound was presented for 30 s with 10 s of rest between sounds. There were two runs for each participant and they heard each sound block a total of five times. During the scan, at the end of each sound block, participants rated levels of emotional responses to the sound stimuli by using a button press (1 = none, 2 = a little, 3 = moderate, 4 = maximum emotional response).

fMRI Data Collection and Processing

Anatomical T1-weighted echo-planar images (spin-echo; TR = 300 ms; TE = 4 ms; matrix size 64 × 64; 30 axial slices; 3.125 mm in-plane resolution, 5 mm thick) were acquired to be coplanar with the functional scans for spatial registration using a Siemens trio 3T full-body scanner (Erlangen, Germany). Then, functional data were acquired (echo planar T2*-weighted gradient-echo, TR = 2000 ms, TE = 30 ms, flip angle = 80°, matrix size 64 × 64, 30 axial slices, 3.125 mm in-plane resolution, 5 mm thick).

Functional imaging data were preprocessed and analyzed using SPM8 (Statistical Parametric Mapping 8; Wellcome Trust Center for Neuroimaging, University College, London, UK; http://www.fil.ion.ucl.ac.uk/spm) and Matlab 7 (The MathWorks, Natick, MA, USA). Two images at the beginning of each fMRI run were discarded to account for magnetic equilibrium. After slice time correction, images within each run were realigned to the third image of the run to correct for movement. After motion correction, the high resolution T1 anatomical images were co-registered to realigned functional images. The high resolution T1 anatomical images were spatially normalized to the SPM8 MNI template using the default setting. The normalized functional images were resampled 2 mm × 2 mm × 2 mm. Images were then spatially smoothed using a Gaussian filter with a full-width half-maximum value of 8 mm.

Analysis

Associations between YIPTA-R and BITSEA

First, a repeated-measure ANOVA was used with parent (mother, father) as a between-subject factor, and time (times 1 and 2) as a within-subject factor to compare YIPTA-R between mothers and fathers across time points. Parental moods (BDI, STAI-state) were compared using a repeated-measure ANOVA with parent (mother, father) as a between-subject factor, and time (times 1, 2, and 3) as a within-subject factor. BITSEA competencies and problems were compared using a one-way ANOVA with parent (mother, father) as a between-subject factor. Next, correlations analyses were performed to examine associations among YIPTA-R, BDI, and STAI-state with the BITSEA variables across time points. Last, stepwise regression analysis was used to identify specific domains of the YIPTA-R that were associated with the BITSEA scores. The stepwise regression accounted for maximal variance in the infant socioemotional outcomes measured by the BITSEA. Two stepwise regression analyses (one to test Time 1 variables, the other to test Time 2 variables) were conducted to predict competencies and problems in infants. The same analyses were repeated in mothers and fathers. The first stepwise regression included six domains of the YIPTA-R (Care, Relationship, Positive Parenting, Positive Baby, Preoccupation, AITHAB) at Time 1 as main predictors, and two parental mood variables (BDI, State Anxiety) at Times 1 and 3, as well as parity (primiparous vs. multiparous) as control variables. The second stepwise regression included six domains of the YIPTA-R at Time 2 as main predictors, and two parental mood variables at times 2 and 3 as well as parity as control variables.

fMRI Data Analysis

At the individual subject level, response amplitudes were estimated using the general linear model for each condition using a high pass filter (0.0078 Hz). Conditions included own baby cry, control baby cry, own noise, and control noise. For individual subjects, pair-wise comparison of response amplitudes created contrast images of the blood oxygen level-dependent (BOLD) signal change associated with the three main contrasts, own baby cry minus own noise, control baby cry minus control noise, and own baby cry minus control baby cry. The current analysis was focused on the own baby cry minus control baby cry contrast to identify the relations among parental thoughts/actions and neural responses specific to own baby cry sounds.

For the group-level analysis, contrast images for individual subjects were entered into a random-effects analysis. Multiple regression was performed with the specific YIPTA domain identified from stepwise regression (AITHAB at Time 1 for mothers; Positive Parenting at Time 2 for fathers; see Results) as an independent variable and parity as a covariate of no interest. An initial voxel-wise threshold of $p < 0.005$ and a minimum cluster size of 203 voxels in mothers and 213 voxels for the own baby cry vs. control baby cry contrast gave a corrected $p < 0.05$. This threshold was determined by Monte-Carlo simulations using the 3dClustSim program of the AFNI toolkit. The subcortical regions, including the limbic (hippocampus, parahippocampus, amygdala), striatum, and midbrain regions, are small in structure but are consistently activated in studies of parents (Kim et al., 2010a; Atzil et al., 2011; Barrett and Fleming, 2011; Rilling and Young, 2014; Swain et al., 2014b); thus, a less conservative statistical threshold of $p < 0.005$, uncorrected, with an extent threshold of 10 consecutive voxels was used. Lieberman and Cunningham (2009) have argued that this less conservative threshold still achieves a desirable balance between Types I and II error rates (Lieberman and Cunningham, 2009).

Mediation analyses were performed using PROCESS (Hayes, 2013). The indirect effect of parenting-related thoughts and actions through neural responses to infant cry was tested using 95% bias-corrected Confidence Intervals with bootstrapping procedures (10,000 bootstrap resamples) (Preacher and Hayes, 2008). The 95% bias-corrected Confidence Intervals without the inclusion of 0 indicates a statistically significant indirect relationship, $p < 0.05$ (Preacher and Hayes, 2008).

RESULTS

Means and Standard Deviations of Variables

Table 1 presents the means, standard deviations, and F statistics for parental thoughts/actions from the YIPTA-R domains at times 1 and 2, parental depressive and anxious moods at times 1, 2, and 3, as well as infant competencies and problems at Time 3 as reported by mothers and fathers.

Across times 1 and 2, mothers exhibited higher levels of all domains of YIPTA-R except the Relationship domain compared to fathers. At Time 1, mothers and fathers exhibited higher levels of Care, Preoccupation, and AITHAB compared to Time 2. There were no differences in depressive and anxious moods among mothers and fathers at any of the three time points. No difference was found in ratings of infant competencies and problems at Time 3 among mothers and fathers. No interaction between parent and time for the YIPTA-R domains and mood variables was found.

Parental Thoughts/Actions and Infant Outcomes

Correlation analyses were performed to examine associations among YIPTA-R domains, BDI and STAI-state scores with BITSEA variables at Time 3. In mothers, the AITHAB domains of the YIPTA-R at Time 1 was associated with both BITSEA socioemotional competencies inversely and problems at Time 3, $rs(21) = -0.53$ and 0.61, respectively, $ps < 0.05$. The Relationship domain of the YIPTA-R at Time 1 was also associated with BITSEA socioemotional competencies at Time 3, $r(21) = -0.49$, $p < 0.05$. Both BDI and STAI-state levels at times 1 and 3 were positively associated with BITSEA socioemotional problems at Time 3, $rs(21) > 0.50$, $ps < 0.05$. In fathers, only the Positive Parenting domain of the YIPTA-R at Time 1 was positively associated with the BITSEA socioemotional competencies at Time 3, $r(19) = 0.51$, $p < 0.05$. No other times 1 or 2 domains of the YIPTA-R or mood symptoms were associated with the BITSEA variables in mothers or fathers. The sex of infants was not associated with the YIPTA-R, BDI, STAI-state, and BITSEA scores reported either in mothers and fathers, with one exception. The Positive Baby domain of the YIPTA-R reported by fathers at Time 1 was also associated with the sex of the infants, $r(19) = 0.55$, $p < 0.05$, suggesting that fathers reported higher levels of Positive Baby (positive thoughts about baby) if their babies were females compared to males.

Stepwise regression was conducted to model relations between parental thoughts/actions and infant outcomes. For mothers the full model included six YIPTA-R Time 1 domains, depressive and anxious moods at times 1 and 3, and parity – thus controlling for multiple comparisons. There were two significant predictors of infant outcomes. First, only the AITHAB at Time 1 accounted for variance in infant socioemotional functioning at Time 3, $\beta = -0.53$, $p < 0.05$. Lower AITHAB score at Time 1 was associated with higher BITSEA socioemotional competencies at Time 3. Second, for infant problems, only maternal STAI-state levels at Time 3 was significant, $\beta = 0.73$, $p < 0.001$. No Time 2 parenting scores predicted either infant outcome.

The same model was run for fathers. The only significant predictor of infant outcomes was in the model predicting socioemotional competencies; higher Positive Parenting accounted better competencies in infants, $\beta = 0.51$, $p < 0.05$. No other Time 1 variables at predicted infant problems. Moreover, no Time 2 variables were associated with either infant competencies or problems. Based on these results, only Time 1 AITHAB at Time 1 for mothers and Time 1 Positive Parenting for fathers were used in analyses with neuroimaging data.

Neural Responses to Own Baby Cry and Parental Thoughts/Actions

For mothers and fathers whole brain analyses were conducted to examine associations with the parenting characteristic that had predicted infant outcomes. For mothers, whole brain analysis was used to examine the associations between the AITHAB and neural activation related to the contrast of own baby cry sounds vs. control baby cry sounds at Time 1, controlling for parity (**Table 2**, **Figure 1**). Several cortical regions were positively associated with the AITHAB at $p < 0.05$ corrected: the left superior temporal gyrus and bilateral precentral and postcentral gyri, which are both involved in sensorimotor and social information processing. In the subcortical regions, right hippocampus (**Figure 2A**) and putamen activity were positively

TABLE 1 | Yale Interview of Parental Thoughts and Actions-Revised (YIPTA-R), parental mood and anxiety at Time 1 (first month) and Time 2 (3–4 months), and infant outcome at Time 3 (18–24 months) with comparison between and time points and parental sex.

	Time 1				Time 2				Time 3					
	Mothers		Fathers		Mothers		Fathers		Mothers		Fathers		Time	Parent
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*	*F*	*F*
YIPTA-R														
Care	41.37	2.82	19.54	2.18	33.71	2.26	17.41	1.84	–	–	–	–	6.92*	48.75***
Relationship	7.05	0.46	6.58	0.68	7.29	0.43	6.58	0.43	–	–	–	–	0.10	0.96
Positive parenting	8.29	1.62	4.21	0.60	8.29	1.21	5.89	0.82	–	–	–	–	1.54	4.61*
Positive baby	5.86	0.60	4.21	0.32	6.71	0.65	4.89	0.49	–	–	–	–	3.84	6.93*
Preoccupation	23.95	2.01	17.08	2.27	20.50	1.65	13.39	1.95	–	–	–	–	7.90**	7.92**
AITHAB	1.03	0.07	0.85	0.06	0.92	0.05	0.77	0.06	–	–	–	–	6.66*	4.30*
BDI	5.60	0.79	5.22	1.88	5.17	1.02	3.50	1.57	4.95	1.20	4.84	1.46	1.43	0.29
STAI – State	31.48	1.71	32.26	2.04	30.20	1.78	31.06	2.16	31.33	2.36	32.05	2.41	0.65	0.10
BITSEA														
Competencies	–	–	–	–	–	–	–	–	18.71	0.38	17.84	0.47	–	2.11
Problems	–	–	–	–	–	–	–	–	8.57	1.32	9.26	1.19	–	0.15

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

associated with the AITHAB, $p < 0.005$, uncorrected. Thus, mothers with higher AITHAB levels exhibited greater responses to own baby cry sounds (vs. control baby cry sounds) in these brain regions. On the other hand, in the subcortical structures, the right substantia nigra (a key reward/motivation region; **Figure 2B**) and bilateral parahippocampi were negatively associated with the AITHAB. Thus, mothers with higher AITHAB scores exhibited reduced neural responses to own infant cry sounds (vs. control cry sounds) in these areas.

In fathers, the whole-brain analysis examined associations between Positive Parenting and neural responses to own baby cry sounds vs. control baby cry sounds at Time 1, controlling for parity (**Table 3**, **Figure 3**). The only cortical region that was positively associated with Positive Parenting was the right middle temporal gyrus (the auditory cortex), $p < 0.05$, corrected. In the subcortical structure, activations in a region including the thalamus and hypothalamus, and the left caudate (**Figure 4**) were also positively associated with Positive Parenting for the contrast of own baby cry sound (vs. control baby cry sound), $p < 0.005$, uncorrected. Thus, fathers with higher levels of positive thoughts about parenting exhibited greater neural responses to own infant cry sounds compared to control cry sounds in the auditory cortex, thalamus/hypothalamus, and caudate.

Additionally, we conducted the whole-brain analyses examining neural responses to own baby cry sounds between mothers and fathers. We also conducted the whole-brain analyses examining associations with the Positive Parenting in mothers and the AITHAB in fathers (Supplementary Tables S1 and S2). The results suggest that the Positive Parenting and AITHAB were

TABLE 2 | Maternal brain areas with the associations between anxious intrusive thoughts and harm avoidant behaviors (AITHAB) at Time 1 (first month postpartum) and neural activity for own infant cry vs. control infant cry at Time 1 (new mothers).

			MNI coordinates (peak within a cluster)				
Regions	**BA**	**Side**	***x***	***y***	***z***	**Cluster size**	***t*-value**
Cortical structures							
Superior temporal gyrus	41	L	−44	−38	−6	293	5.4*
Precentral, postcentral gyri	4/43	R	46	−8	24	514	4.96*
Precentral, postcentral gyri	4/43	L	−50	−10	40	607	4.89*
Subcortical structures							
Hippocampus, superior temporal gyrus	41	R	42	−30	−6	145	4.85†
Putamen		R	24	−2	−2	28	3.56†
Parahippocampus		R	26	−26	−16	35	−4.08†
Parahippocampus, brainstem		L	−12	−30	−12	38	−4.11†
Substantia nigra, midbrain		R	14	−18	−10	68	−5.29†

*$p < 0.05$ (corrected) >203 voxels, †$p < 0.005$ (uncorrected) >10 voxels.

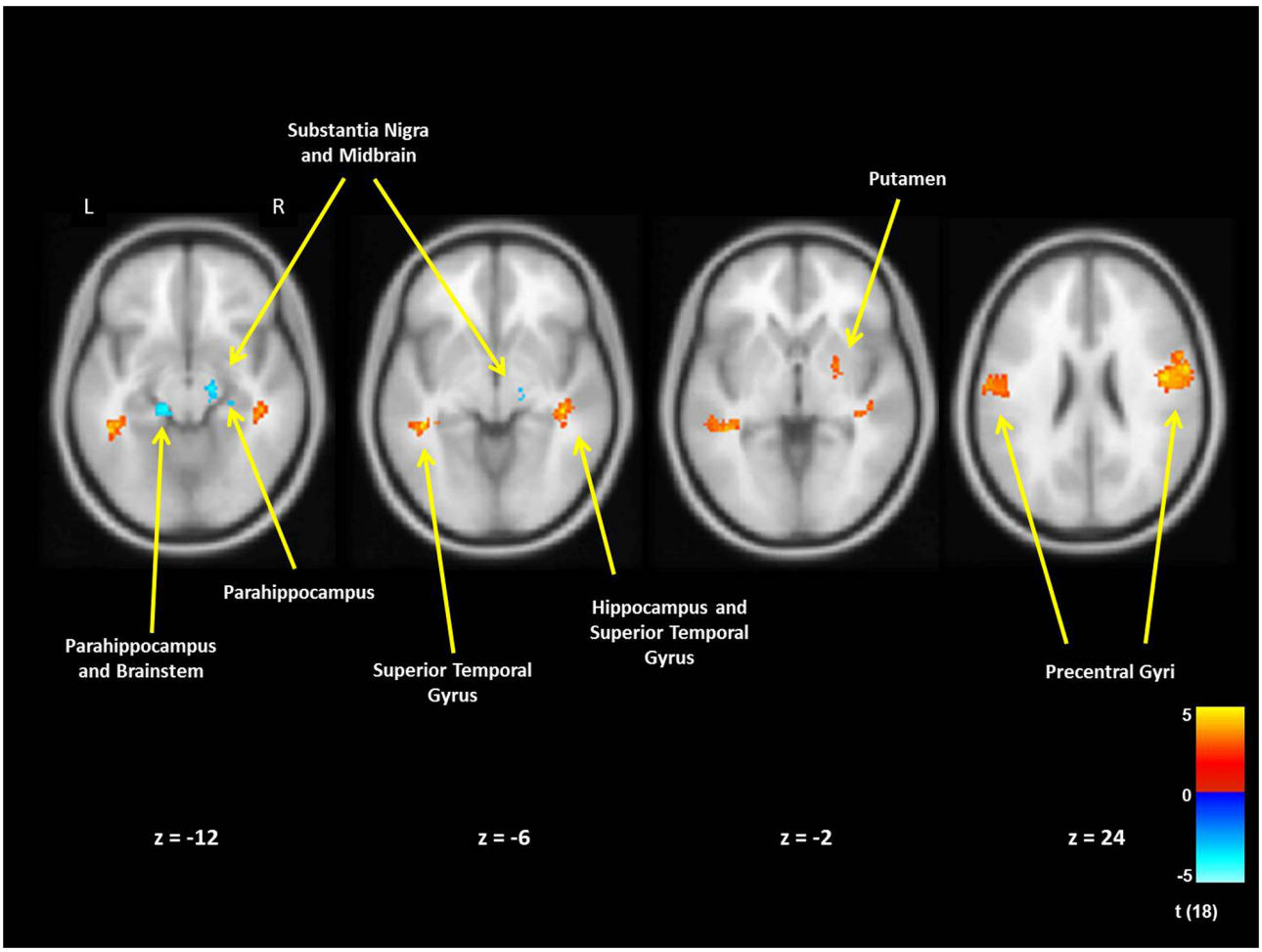

FIGURE 1 | New mother brain areas with the associations between the AITHAB at Time 1 (first month postpartum) and neural activity in the own infant cry vs. control infant cry contrast at Time 1. For cortex we set thresholds at $p < 0.05$ (corrected), >203 voxels and for subcortical regions at $p < 0.005$ (uncorrected), >10 voxels.

uniquely associated with different neural regions in mothers and fathers.

Mediating Role of Neural Responses to Infant Cry in the Links between Parental Thoughts/Actions and Parent's Subsequent Appraisal of Later Infant Socioemotional Outcome

In mothers, the indirect effect of the AITHAB on the BITSEA competence scores through activations of suprathreshold clusters (see **Table 2**) was tested. An indirect effect through the right substantia nigra/midbrain was significant: 2.15, 95% CIs [0.53–4.66]. The higher parenting-related anxious thoughts and actions were associated with reduced substantia nigra/midbrain responses to own infant cry (vs. unfamiliar infant cry) at Time 1. The reduced substantia nigra/midbrain responses were in turn associated with lower socioemotional competence in infants at Time 3. The direct association between the AITHAB and BITSEA score remained significant: −5.12, 95% CIs [−8.23 – −2.02]. Thus, substantia nigra/midbrain responses to own infant cry partially mediated the relation between parenting-related anxious thoughts and actions and infant outcomes in mothers. The indirect effect was not detected in other neural regions in mothers.

In fathers, the indirect effect of Positive Parenting on the BITSEA competence scores through activations of suprathreshold clusters (see **Table 3**) was tested. An indirect effect through the right thalamus/hypothalamus was significant: 0.27, 95% CIs [0.01–0.58]. The higher parenting-related positive thoughts and actions were associated with increased thalamus/hypothalamus to own infant cry (vs. unfamiliar infant cry) at Time 1. The increased thalamus/hypothalamus responses were in turn associated with higher socioemotional competence in infants at Time 3. The direct association between the Positive Parenting and BITSEA score was no longer significant: 0.14, 95% CIs [−0.29 – 0.57]. Thus, thalamus/hypothalamus responses in

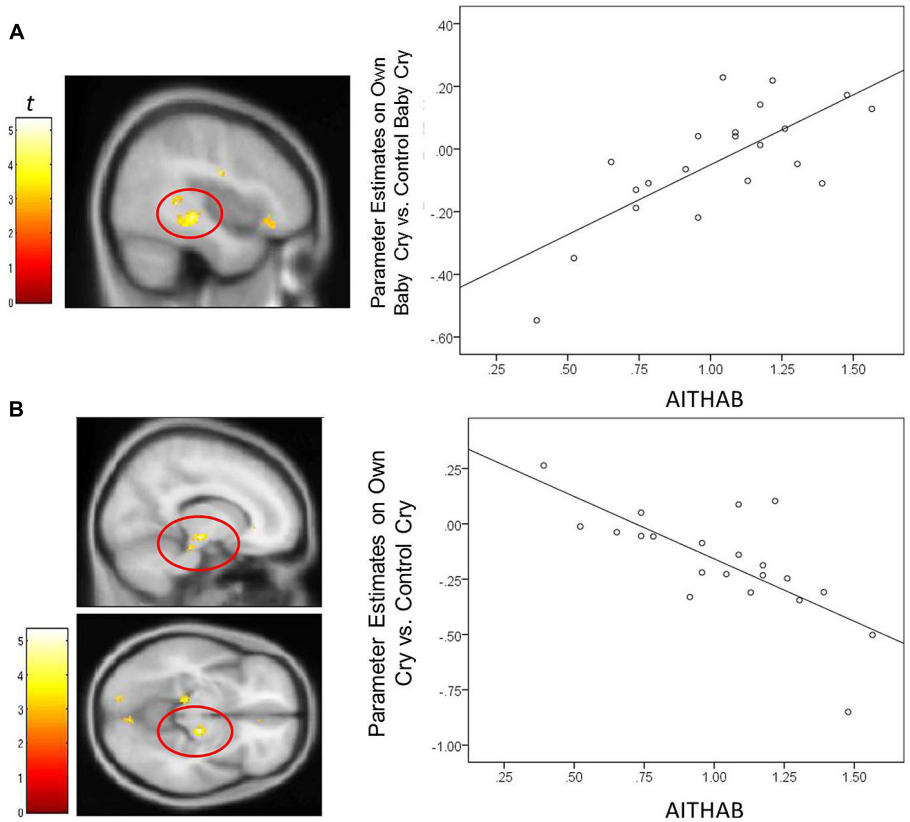

FIGURE 2 | For new mothers, scatter plots describing the associations between the AITHAB and parameter estimates of a region in the contrast of the own infant cry vs. control infant cry contrast at Time 1. (A) The right hippocampus ($x, y, z = 42, -30, -6$; 145 voxels; $p < 0.005$, uncorrected, >10 voxels); **(B)** the right substantia nigra ($x, y, z = 14, -18, -10$; 68 voxels; $p < 0.005$, uncorrected, >10 voxels).

fathers to own infant cry fully mediated the relation between parenting-related positive thoughts and actions and infant outcomes. The indirect effect was not detected in other neural regions.

TABLE 3 | Paternal brain areas with the associations between positive parenting at Time 1 (first month postpartum) and neural activity for own infant cry vs. control infant cry at Time 1 (new fathers).

Regions	BA	Side	MNI coordinates(peak within a cluster)			Cluster size	*t*-value
			x	*y*	*z*		
Cortical structures							
Middle temporal gyrus	21	R	52	−40	−2	224	4.5*
Subcortical structures							
Thalamus, hypothalamus		R	4	−2	−2	25	3.56†
Caudate		L	−12	12	10	12	3.56†

*$p < 0.05$ (corrected) >213 voxels, †$p < 0.005$ (uncorrected) >10 voxels.

DISCUSSION

Although it is an important developmental transition for a family, little is known about the neurobiological, cognitive and emotional reactions couples experience as they first encounter their infant's distress, and the implications of their reactions for infants' later outcomes. The findings from the current study provide evidence of (1) associations between new parents' parenting-related thoughts and actions and their neural activity when hearing their infant's cry sounds during the first month postpartum, and (2) associations between those thoughts and actions and the offspring's later socioemotional competence at 18–24 months. Notably, these associations were found immediately after the infant's birth and were no longer observed at 3–4 months postpartum. Furthermore, these relations differed for mothers and fathers. Specifically, mothers who reported fewer anxious thoughts about their parenting and baby, and the fathers who reported more positive thoughts about parenting, the better the child's perceived socioemotional functioning in toddlerhood.

In new mothers, anxious thoughts and actions about parenting and infants (anxious intrusive thoughts and harm avoidant behaviors; AITHAB) in the first month postpartum were associated with infants' socioemotional competencies at

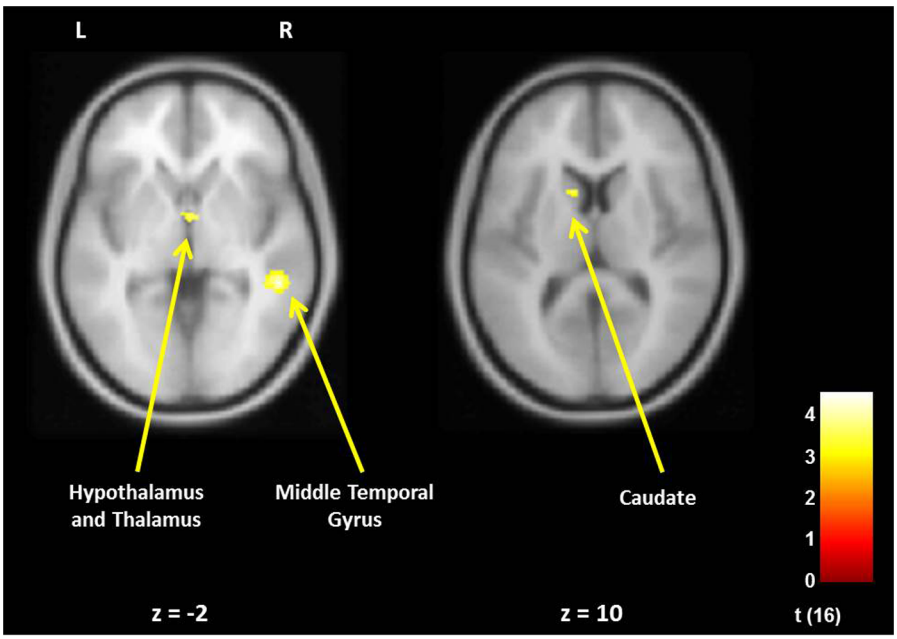

FIGURE 3 | For new fathers, brain areas with the associations between the Positive Parenting at Time 1 (first month postpartum) and neural activity in the own infant cry vs. control infant cry contrast at Time 1. Cortical Structure, $p < 0.05$ (corrected), >213 voxels; Subcortical Structure, $p < 0.005$ (uncorrected), >10 voxels.

18–24 months; caring and positive thoughts/actions were not. This finding adds to prior research from this same sample showing that greater parenting-related anxiety was associated with less maternal sensitivity (Kim et al., 2013). Together, these two sets of finding imply that more maternal anxiety at the first month postpartum may interfere with responding sensitively to infants at 3–4 months postpartum. Thus, increased levels of parental anxious thoughts behaviors at the first month postpartum – for mothers – may disrupt the expression of sensitive behavioral responses to infants at 3–4 months postpartum. It is interesting that global maternal mood and anxiety scales did not have similar associations. Perhaps during the early months postpartum, AITHAB, rather than mood and anxiety measures, was associated with infant socioemotional outcome precisely because it is specific to each mother–child dyad. Such anxious thoughts and actions about infant and parenting may diminish the sensitivity of maternal behaviors as a mechanism for later adverse toddler outcome (Haley and Stansbury, 2003; Feldman, 2007b; Feldman et al., 2009).

In mothers, parenting-related anxious thoughts and behaviors during the first month were inversely associated with neural responses in the substantia nigra, a key reward and motivation region. This is in accord with reports of substantia nigra activation specifically in response to own infant-related visual stimuli (Noriuchi et al., 2008; Strathearn et al., 2008). The negative associations we report between anxious thoughts/actions and substantia nigra activity may reveal one of the mechanisms through which new mothers with high infant related anxiety may have a diminished capacity to respond with sensitivity to their infants. The mediation results further support the importance of low substantia nigra activation for links between mothers' early parenting-related anxious and intrusive thoughts and behaviors, and infants' lower socioemotional competence reported by parents.

On the other hand, higher levels of parenting-related anxious thoughts and behaviors during the first months were associated with increased neural responses to own infants in several brain regions involved in stress regulation and motor responses, specifically the premotor cortex and fusiform gyrus, as well as the hippocampus. The hippocampus is rich in glucocorticoid receptors and shows increased activation when an individual is exposed to stress (Dedovic et al., 2009). Thus, the increased hippocampal activation among mothers who reported higher anxious thoughts/actions may reflect neural processes of anxious responses to infant cry sounds. Increased responses in the precentral and postcentral gyri and fusiform gyrus, regions for motor responses and face information processing, suggest action-oriented neural responses. The action-oriented neural responses associated with higher anxious thoughts and behaviors were associated with low maternal sychrony observed during interactions with infants (Atzil et al., 2011). The putamen is another interesting region to be associated with AITHAB because its association with the anxiety of obsessive-compulsive disorder (OCD; Huyser et al., 2009; Figee et al., 2013). AITHAB has also been discussed as a potentially adaptive form of subclinical anxiety akin to OCD for new mothers to manifest heightened vigilance for potential threats to the baby, coupled with near-compulsive behaviors that may ensure infant well-being (Leckman et al., 2004). However, high levels of maternal anxiety may diminish the mother's sensitivity to her infant.

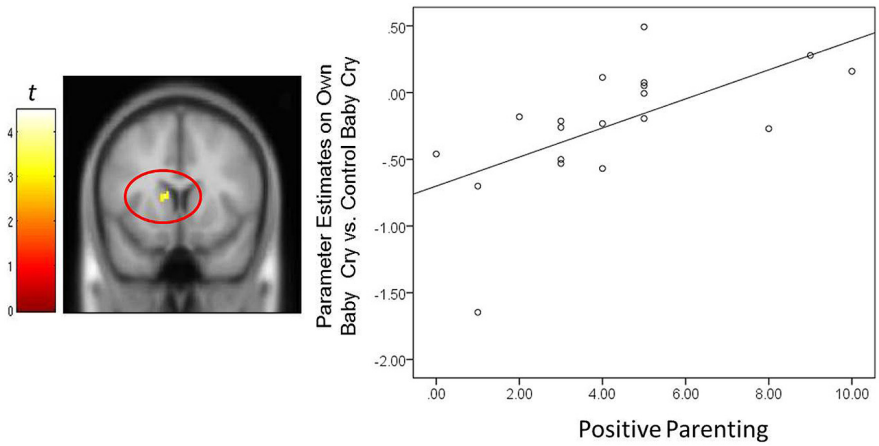

FIGURE 4 | For new fathers, scatter plots describing the associations between the Positive Parenting and parameter estimates of the left caudate (*x, y, z* = −12, 12, 10; 12 voxels; $p < 0.005$, uncorrected) in the contrast of the own infant cry vs. control infant cry contrast at Time 1.

In fathers, we also found that parental thoughts/actions in the first month, but not 3–4 months postpartum, were significantly associated with infant socioemotional competencies at 18–24 months. However, the only domain in fathers that was significantly associated with infant outcomes was different from the one identified in mothers. In fathers, it was the positive perception of being a parent, rather than lower anxious thoughts/actions that was associated with better infant socioemotional outcomes at 18–24 months. This interesting difference between mothers and fathers may be associated with the sex differences in parenting quality that contribute to interactions with infants (Volling et al., 2002). The father–infant interaction style that is associated with positive infant outcomes is characterized by high-intensity positive interactions (e.g., joy, stimulatory play), primarily through physical and sensory stimulations. Researchers suggest that parent–child interactions serve different roles in that while mothers provide emotional comfort and security in response to a child's distress, fathers provide challenges and encourage explorations during interactions with their infants (Grossmann et al., 2002, 2008). Thus, while anxious thoughts may importantly contribute to reduced ability to respond sensitively to infants in mothers, in fathers, positive thoughts related to parenting may play the most important role for predicting their positive interactions with infants.

Positive thoughts about parenting may be supported by increased own-baby-cry related neural activity, particularly in the auditory cortex, thalamus/hypothalamus, and the caudate. Increased responses to infant cry sounds in the auditory cortex and the thalamus suggest enhanced sensory information processing and integration, as in other studies where increased auditory cortex and thalamus structure and activations were observed in response to baby cry sounds in fathers (Atzil et al., 2012; Kuo et al., 2012; Mascaro et al., 2013, 2014; Kim et al., 2014). The caudate and hypothalamus is part of a parental motivation circuit in animal as well as human models (Numan and Insel, 2003; Montoya et al., 2012; Swain et al., 2012), thus, the increased caudate and hypothalamus activation may also support father's drive to respond appropriately to their infants, which fits with more positive infant socioemotional outcomes. Increased caudate and hypothalamus structure and activation in response to baby cry have been reported in fathers (Mascaro et al., 2013, 2014; Kim et al., 2014). Furthermore, increased thalamus/hypothalamus response to own baby cry mediated the links between positive thoughts about parenting and better subsequent infant socioemotional outcomes as reported by the parents. Thus, our study provides support that positive thoughts about parenting at the first month postpartum is associated with increased neural responses to infant cry in the thalamus and hypothalamus, possibly for enhanced sensory information processing and parental motivation. Neural responses are then associated with the parental perception of better infant socioemotional competence at 18–24 months.

The current study should be considered in light of limitations. First, because infant outcomes were assessed by parent report, there is a possibility that they were influenced by parents' mood or cognitive (positive or negative) bias toward their infants. However, studies using the BITSEA to assess infant outcomes have demonstrated that BITSEA scores at age 1–3 prospectively predict teacher-reported behavioral outcomes at age 6, after controlling for parental mood (Briggs-Gowan and Carter, 2008). The BISTEA shows moderate to high correlations with observation ratings of infant outcomes including the Mullen and Vineland Socialization (Karabekiroglu et al., 2010). We would also like to note that, in our study, mother-report and father-report of the BITSEA were similar (**Table 1**) and were correlated [$r(16) = 0.46$, $p < 0.05$] even though levels of thoughts and actions related to parenting were significantly different between mothers and fathers across almost all domains (**Table 1**). Therefore, although not completely independent from self-report bias, it is likely that the BITSEA captured infant outcomes that may be consistent with third-person report or observation ratings. However, it will be

important for future studies to include observation ratings or third-person report to examine associations between parental cognition and infant outcomes. Second, data on parental behaviors were available for only a small subset of the sample in this study, and understanding of the role of neural responses to infant cry in linking parenting-related thoughts and parenting behaviors is limited. Our previous work suggested that at 3 months postpartum, anxious and positive parenting-related thoughts were associated with maternal and paternal sensitivity observed during interactions with infants (Kim et al., 2013). Positive parenting behaviors among new mothers were associated with enhanced neural responses to infant stimuli in some regions overlapping with ones identified in the current study - the hippocampus and the parahippocampus (Musser et al., 2012) and the putamen (Wan et al., 2014). Longitudinal studies are needed to further examine how parenting-related thoughts and neural responses to infants at the first month postpartum may be associated with parenting behaviors in both mothers and fathers, which together may further predict infant outcomes at 18–24 months.

Third, for future research, it would be important to consider hormonal measures and their associations with neural and behavioral sensitivity to infants. During the early postpartum period, both mothers and fathers experience changes in levels of hormones, supporting their new roles as parents (Fleming et al., 2002; Gordon et al., 2010; Storey and Walsh, 2013; Swain et al., 2014a). Important hormone-brain systems for future studies may include oxytocin and vasopressin, for which levels have been associated with neural responses to infant stimuli among mothers and fathers (Atzil et al., 2012). Anxiolytic effects of oxytocin have been consistently observed among postpartum mothers (Riem et al., 2011), thus mothers with higher levels of oxytocin may exhibit lower levels of parenting-related anxious thoughts and actions, which may further be associated with neural and behavioral sensitivity to infants. Also, reduced testosterone levels were also associated with increased neural responses to own child's images in the reward circuits among fathers (Mascaro et al., 2013), thus fathers with lower levels of testosterone may be more likely to report higher levels of the positive thoughts about parenting, which further be associated with more optimal neural and behavioral sensitivity to infants. Furthermore, stress hormone reactivity has been associated with maternal brain connectivity between the hypothalamus and septal regions known to regulate parenting in animal models (Ho et al., 2014). Fourth, the current study's sample primarily includes participants from middle- to high-SES backgrounds, and the Caucasian population. The fact that the participants were largely from well-supported backgrounds may further be associated with a limited range of later problems reported among their infants. This may explain why our findings were significant only with competencies but not with problems among infants. Thus, future studies should include a larger and more diverse sample to examine the associations among parental brain functioning, psychological adaptations to parenthood, and later infant outcomes. The associations between parental thought/actions and neural responses to infants would also be important to study in parents who are at risk, such as those with psychopathology, substance use, or trauma exposure. Previously, mothers with a history of depression, trauma, or substance use exhibited altered neural responses to baby cry sounds (Landi et al., 2011; Laurent and Ablow, 2011; Schechter et al., 2012), which may be further associated with difficulties in sensitive parenting. Data on specific parenting-related thoughts associated with atypical neural responses to infants can enhance understanding of parents who are at greater risk for difficulties in adjustment to parenthood, as well as infant socioemotional problems.

Two important strengths of this study are the longitudinal design and the inclusion of both mothers and fathers. Studies using prospective and longitudinal designs provide implications for the timing of interventions. We found that the first month, rather than 3–4 months postpartum, was a sensitive period when psychological adjustment to parenthood and parenting-related thoughts/actions in both mothers and fathers had significant associations with infant outcomes a year and half later. Thus, to support optimal parent–infant relationships, it is likely important to support parents' adjustment to parenthood during or even possibly prior to the first month as future studies might explore. By including both mothers and fathers in one study, which has rarely been done in previous studies, we also identified sex differences in important aspects of parental thoughts and actions that are significant for long-term infant outcomes (Panter-Brick et al., 2014). There is also a potentially generalizable finding that it is the personally specific measures of parenting in addition to global mood and anxiety scales, that were associated with infant outcome underlining the importance of these measures for future studies that undertake to study transgenerational. Furthermore, we speculate that the combinations of personally tailored assessments and brain imaging stimuli may advance the neuroimaging field that has been hampered by inconsistencies using impersonal measures and stimuli to understand parental moods. The findings also have specific implications for the parental brain field given apparently differential targets for mothers and fathers when supporting their transitions to parenthood. Our findings suggest that efforts to reduce specifically anxious thoughts about parenting and baby in mothers, and efforts to increase positive thoughts about parenting in fathers, would be most effective in supporting adjustments to parenthood and improving parent–infant inactions. The neuroimaging evidence provides evidence for specific neural mechanisms underlying how parental thoughts and actions, distinct for mothers and fathers, are associated with positive infant outcomes.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: http://journal.frontiersin.org/article/10.3389/fpsyg.2015.01772

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Development and Validation of the Computerized Family Relations Test for Children

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The aim of the present study was to develop and investigate the psychometric properties of the Computerized Family Relations Test (CFRT) for children. This test assesses the quality of family relationships with the mother and father from a child's perspective. The CFRT consists of six scales relating to control (Restrictiveness and Justice), and support (Affection, Vulnerability, Acknowledgment, and Trust) within the family relationships. CFRT is an innovative approach to the Dutch Nijmegen Family Relations Test (NFRT) developed by Oud and Welzen (1989). The administration of the test has been computerized and graphical representations of female and male silhouettes were included to facilitate the child's parental identification. In total, 404 primary school children, aged 8 to 13 years ($M = 11.0$; $SD = 1.17$), took part in this study. The CFRT's reliability was assessed by McDonald's omega coefficients, and ranged from 0.71 to 0.86, except for Vulnerability which achieved the lowest reliability 0.57 for mothers' ratings and 0.56 for fathers' ratings. The test–retest procedure revealed higher stability for the ratings on father-child relationships of 0.71 compared to mother-child relationships of 0.67. Confirmatory factor analysis indicated that a six-factor model provided an adequate fit. Measurement invariance across the children's assessments of the quality of family relationships was achieved. The construct validity of CFRT was assessed by examining differences in the child's ratings of the relationships with the mother and father, the child's gender, and associations of CFRT scales with other variables such as depression, anxiety symptoms, and prosocial behavior.

Keywords: assessment, family relations, children, CFRT, computer

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INTRODUCTION

Prior studies in family psychology have indicated the need to highlight children's perspectives on family relationships in research and practice, as children are very careful observers who can provide distinctive views of overall family functioning, parenting and the quality of interpersonal relationships (e.g., Milkie et al., 1997). Researchers agree that special emphasis should be placed on the quality of measures that aim to obtain data on the quality of family relationships directly from children. These instruments must be adjusted to the child's current developmental stage, use age-appropriate, understandable language, and have an engaging design to hold the child's attention, to ensure the highest measurement accuracy (Strachan et al., 2010). Traditional pen and paper questionnaires might be difficult to complete, especially for young children, because they require good reading and attention skills. Research on testing technology has shown that children prefer

computer-based testing (Sim and Horton, 2005). Such testing impacts scores positively, for example, in the case when only one item is displayed at a time on the computer screen, and leads to greater focus and closure (Clariana and Wallace, 2002). Furthermore, valuable information can be obtained in a short period of time.

Despite the importance of this topic, there has been a measurement gap in analyzing family relations from the child's perspective in both research and practice. Very few instruments have been developed to elicit children's feelings and perceptions of family relationships (Strachan et al., 2010). The most widely used measure, The Family Relations Test (FRT), was developed by Anthony and Bene (1957) nearly 60 years ago and continues to encounter problems with standardized scoring, administration, question wording, and use with non-white ethnic groups (Parkin, 2001). The Structured Child Assessment of Relationships in Families (SCARF; Strachan et al., 2010) tackles important domains, such as emotional security, and positive and negative parenting; however, the child is restricted to selecting only one family member when answering a question (e.g., "Who gives you a treat or something special when you are good?"). The Child–Parent Relationship Test (ChiP–C; Titze et al., 2014) is clinically oriented and contains domains that relate to resources and risks; however, ChiP–C is sensitive to cultural differences and, therefore, requires further validation. The Network of Relationships Inventory (NRI; Furman and Buhrmester, 1985) has been used to assess a wide range of qualities of relationships with parents, siblings, grandparents, friends, and teachers, in which participants use the same set of items to describe their relationship with each of several members in their social network. Several attempts have been made to develop attachment styles measures in the form of narratives, such as the MacArthur Story Stem Battery (MSSB; Bretherton et al., 2003), the Attachment Story Completion Task (ASCT; Bretherton et al., 1990), and the Manchester Child Attachment Story Task (MCAST; Green et al., 2000), in which participants are asked to continue introduced attachment-relevant story stems. Although children find playing with the dolls engaging, these measures have been criticized because task administration requires good attention and control skills. Moreover, children need to focus on the technique, follow the researcher's or clinician's guidelines, and express their own views about the family simultaneously (Poehlmann et al., 2014). In addition, these instruments are time consuming and expensive to administer, as mostly they require prior user training and the purchase of appropriate equipment.

Computerized Family Relations Test and its Origins

The Computerized Family Relations Test (CFRT) for children is an innovative measure that aims to assess the quality of family relationships from the child's perspective. However, the CFRT has its origins in the Dutch Nijmegen Family Relations Test (NFRT; Oud and Welzen, 1989) that has been applied in several studies (e.g., Mathijssen et al., 1998; Delsing et al., 2003, 2005a,b).

During the development of the NFRT, Oud and Welzen (1989) attempted to operationalize family theories in psychological research, resulting in the development of a family relationships model based on the following six dimensions: Restrictiveness, Affection, Vulnerability, Justice, Acknowledgment, and Trust. The model is grounded in the theoretical framework of two systemic family therapists, Helm Stierlin's (1978) binding theory and Ivan Boszormenyi-Nagy's (Boszormenyi-Nagy and Spark, 1984) loyalty theory, various experiences of family and child psychotherapists, and information gathered directly from children. Two dimensions – Restrictiveness and Affection – originate from the psychoanalytically-oriented binding theory of Stierlin (1978), which refers to different types of transactions between the parent and the child on the id, ego and superego levels. The remaining four dimensions–Justice, Vulnerability, Acknowledgment and Trust–form key elements of the loyalty theory of Boszormenyi-Nagy (Boszormenyi-Nagy and Spark, 1984), which assumes that interpersonal perceptions of loyalty within the family are the product of the closely intertwined but distinctive dimensions of justice and trust. On one hand, children perceive their parents as just if they feel they are being treated fairly in the context of family obligations. On the other hand, children perceive their parents as trustworthy if they feel valuable and loved.

Based on this model, Fitriana (2011) developed an Indonesian version of the NFRT called the Bandung Family Relations Test (BFRT). The confirmatory factor analysis showed that the six dimensions of family relationships could be divided into two second-order factors, which describe *control* (Restrictiveness and Justice), and *support* (Affection, Vulnerability, Acknowledgment, and Trust). The division of control versus support is a common categorization in research on parent–child relationships (Tynkkynen et al., 2012; Hooghe et al., 2013).

The CFRT consists of 67 items, the same as the original NFRT, forming six scales: Restrictiveness (12 items e.g., "This person often bosses me around"), Affection (10 items e.g., "If I go away, this person will really miss me"), Vulnerability (7 items e.g., "I like to know what this person thinks or feels"), Justice (12 items e.g., "If I promise this person something, then I also do it"), Acknowledgment (13 items e.g., "This person often tells me that I do something well"), and Trust (13 items e.g., "This person protects me"). The main change is in the administration of the CFRT from a traditional pen-and paper questionnaire to a computerized version. While developing the CFRT, we translated the items in accordance with the International Test Commission (ITC) guidelines for translating and adapting tests in cross-cultural research (Brislin, 1986; Hambleton, 2005). The procedure included the following steps: (1) forward-translation of all items from the existing English version of the NFRT to Polish, (2) consultation over the results with two experts in child psychology and cross-cultural research regarding the linguistic, developmental and cultural suitability of the test, (3) back-translation of all items from Polish to English, (4) receiving authors' comments and suggestions, (5) preparation of the final version of CFRT prior to the introduction of all recommended modifications.

The CFRT has been programmed in Flash software and consists of an instruction, an animated guide on how to answer the questions, and a set of exemplar pictures of female and male

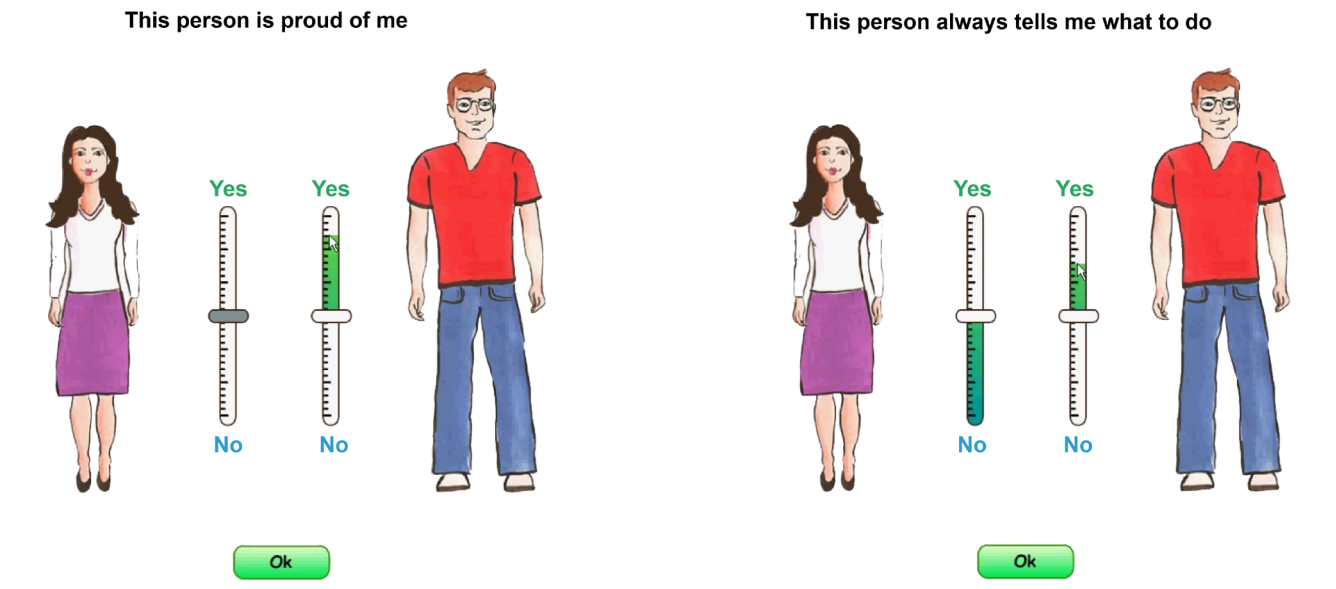

FIGURE 1 | Screen prints of the CFRT.

silhouettes, from which the test-taker chooses those most similar to his or her mother and father. The graphical representations of parents facilitate the child's parental identification, especially among younger children. Children assess relationships with their father and mother separately, with the possibility of selecting a single parent option. The questions appear in two synchronized ways, displaying at the top of the screen above the silhouettes and read aloud to the test-taker by a previously recorded voice. In contrast to the NFRT and BFRT, CFRT has a continuous response scale, which we believe is more accurate than traditional Likert-type scales and does not limit the test-taker to one particular category. With the use of a specially designed slider bar that is similar to a thermometer, the child is asked to indicate the extent to which he or she agrees that the item is applicable to each parent, ranking from totally agree (top scale—Yes) to totally disagree (bottom scale—No), or uncertain (middle point), as presented in **Figure 1**. Data collected by this approach meet the assumptions of many statistical analyses, including confirmatory factor analysis—CFA (Treiblmaier and Filzmoser, 2011).

We recorded and randomized the display of the items to minimize the impact of reading ability on participants' responses (Borelli et al., 2010) and to avoid order effect, decreases in children's motivation (e.g., when seeing that others perform faster), and increases in carry-over, fatigue, priming, and learning effects. It is worth noting that item order differentiation has become a common practice in psychological research (Khorramdel and Frebort, 2011).

THE CURRENT STUDY

The aim of this study is to report the development and psychometric properties of the CFRT. We intend to confirm the following seven assumptions: (1) the reliability of the CFRT will be acceptable and comparable to the original Dutch NFRT; (2) the construct stability will be satisfactory; (3) the six-factor CFA model will fit the data; (4) the measurement of family relationships across the mother and the father ratings will be supported; regarding the construct validity we expected (5) perceptions of the family relationships with the mother and the father to differ, such that the ratings of child-mother relationships will be higher on *support*, whereas the ratings of child-father relationships will be higher on the *control* dimension (as found in Oud and Welzen, 1989; Fitriana, 2011); (6) gender differences will occur in the ratings of family relationships with both parents. This assumption is in line with previous research that showed parents relate to their sons and daughters differently (e.g., Gurwitz and Dodge, 1975) and use different parenting techniques (Chao, 2011); (7) significant associations between the CFRT dimensions and other psychological variables will be observed. *Control* within family relationships is expected to correlate positively with the child's depression and anxiety symptoms, whereas *support* is assumed to correlate negatively, as found in previous studies (e.g., Cole and McPherson, 1993; Kim et al., 2008; Creveling et al., 2010). Justice in family relations is expected to correlate positively with the child's prosocial behavior, as found in Dunn et al. (2001).

MATERIALS AND METHODS

Participants

In total, 404 Polish children, ranging in age from 8 to 13 years ($M = 11.0$; $SD = 1.17$), participated in this study. Of the participating children, 54% were girls ($N = 219$) and 46% boys ($N = 185$). All participants were primary school pupils in grades three to six.

Additionally, a randomly selected group of the children $N = 60$ (55% girls and 45% boys), aged 8–13 years ($M = 11.0$; $SD = 1.16$), participated in the test–retest procedure after a 6-week interval.

Procedure and Measures

First, the institutional review board at the Psychology Institute, Cardinal Stefan Wyszyński University in Warsaw reviewed this project and gave us permission to implement it. An invitation letter to take part in a research project on the role of family relationships in childhood and adolescence was sent to 12 public primary schools across Poland, of which ten agreed to participate. After we gained consent from the school principals to carry out the project, the main researcher attended parent–teacher meetings that took place regularly at the schools to introduce the nature of the project and invite parents and their children to participate. Parents received a study description with a consent form for their children to participate in this study. Of all invited parents, 87% provided written consent for their children to participate. Only children with parental written consent participated. Participation in this study was voluntary and anonymous. The research was conducted at schools during Information Technology (IT) lessons and in groups of 10 to 12 children with the presence of one researcher and one trained graduate student to ensure the standardized setting of the data collection and participants' confidentiality. The results were analyzed at the group level and for scientific purposes exclusively.

The research equipment contained a computer, with a headset. Before the study began, all participating children were asked for oral permission to take part. The main researcher, with the help of a trained graduate student, explained the nature of the study and its procedure. Children were also informed about anonymity and their right to withdraw from the testing at any time without consequences. The researchers stressed that there were no good or bad answers and children were asked to provide honest answers, reflecting their perceptions about the quality of relationships in their families. The first item was neutral to enable the children to practice answering the questions. The researchers were available during the whole study to provide support in case of any questions or difficulties children might have had.

Depression and Anxiety Symptoms

Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a 47-item measure of depression and anxiety symptoms in children that consists of two general scales, Anxiety ($\alpha = 0.75$) and Depression ($\alpha = 0.77$). Items are rated on a four-point Likert scale (0 = *never* to 3 = *always*).

Prosocial Behavior

Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) is a 25-item screening instrument that measures children's strengths and difficulties in five domains: Emotional Symptoms, Conduct Problems, Hyperactivity/Inattention, Peer Relationships Problems, and Prosocial Behavior. For the purpose of the current study, only the Prosocial Behavior ($\alpha = 0.68$) scale was used. Answers were rated on a three-point Likert scale (0 = *not true at all* to 2 = *definitely true*).

ANALYSIS

All reliability and validity analyses were performed with SPSS version 21.0 (IBM Corp., 2012). We tested the reliability of CFRT through the assessment of internal consistency with the use McDonald's omega (McDonald, 1999) and test–retest coefficients. Confirmatory factor analysis and measurement invariance across the mother and father ratings were performed in statistical software for structural equation modeling—using AMOS version 21.0 (Arbuckle, 2011). Although previous research showed that analyses based on individual items or item parcels are equally appropriate (Hau and Marsh, 2004), parceling is recommended when a scale contains more than five items (Bagozzi and Heatherton, 1994) to increase the reliability of responses, obtain more stable parameter estimates, and simplify model interpretation (Bandalos and Finney, 2001). The CFRT scales consist of seven to thirteen items; therefore, the parceling approach was applied for the purpose of this study. Items from each scale were grouped randomly into three parcels and each parcel contained three to five items. We tested measurement invariance to assess whether the same construct was being measured across mother and father ratings. Furthermore, we tested construct validity by examining differences in the child's ratings of the relationships with the mother and the father, the child's gender, and the associations of CFRT scales with other variables such as depression, anxiety symptoms, and prosocial behavior.

RESULTS

Reliability

We examined the reliability of the CFRT scales by calculating McDonald's omega coefficients for each scale, separately for mother and father ratings, and the internal stability was assessed through a test–retest procedure after a 6-week interval. Reliability estimates are presented in **Table 1**.

With regard to mother and father ratings, CFRT showed good reliabilities for all scales, with Acknowledgment and Trust scoring highest, $\omega = 0.84$ for mothers and $\omega = 0.86$ for fathers, respectively. Parallel to the Dutch data, in the Polish results, Vulnerability achieved the lowest reliability, $\omega = 0.57$ for mothers and $\omega = 0.56$ for fathers. Test–retest coefficients showed higher stability for father ratings $r = 0.71$ than for mother ratings $r = 0.67$.

Factorial Structure of the CFRT

We tested two models, first-order CFA and second-order CFA, separately for mothers and fathers. The first-order CFA model

TABLE 1 | Model-based scale score reliabilities with Mcdonald's omega (Ω) with bootstrapped 95% confidence intervals of the CFRT and test–retest coefficients.

Scale	Mother $N = 401$		Father $N = 395$	
	ω (95% CI)	test–retest *r*	ω (95% CI)	test–retest *r*
Restrictiveness	0.82 (0.79–0.84)	0.71	0.82 (0.79–0.84)	0.72
Affection	0.76 (0.72–0.80)	0.68	0.81 (0.77–0.84)	0.74
Vulnerability	0.57 (0.49–0.64)	0.67	0.56 (0.47–0.63)	0.71
Justice	0.71 (0.65–0.77)	0.68	0.74 (0.67–0.78)	0.69
Acknowledgment	0.84 (0.80–0.87)	0.62	0.86 (0.83–0.89)	0.66
Trust	0.84 (0.81–0.88)	0.67	0.86 (0.83–0.89)	0.74

TABLE 2 | Model fit of the six scale CFRT in CFA.

Model	χ^2	df	CFI	RMSEA	SRMR
Mother First order CFA	442.2	120	0.910	0.082 (0.074–0.090)	0.079
Second order CFA	486.6	128	0.900	0.084 (0.076–0.092)	0.085
Father First order CFA	411.1	120	0.925	0.078 (0.070–0.086)	0.072
Second order CFA	449.1	128	0.918	0.079 (0.071–0.087)	0.078

CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

TABLE 3 | Fit indices for measurement invariance models.

Model	χ^2	df	CFI	RMSEA	SRMR
Configural	779.8	264	0.923	0.050 (0.046–0.054)	0.093
Metric at the first order part	794.7	276	0.922	0.049 (0.045–0.053)	0.093
Scalar at the first order part	824.8	288	0.920	0.048 (0.045–0.052)	0.094
Structural weights (equality of the loading at the second order part)	834.4	292	0.919	0.048 (0.045–0.052)	0.094

CFI, comparative fit index; RMSEA, root mean square error of approximation, SRMR, standardized root mean square residual.

consisted of six latent variables. Each latent variable was built upon three parcels as observed variables. The CFRT's factor structure was examined using chi-squared, the standardized root mean square residual (SRMR), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). A non-significant chi-squared, SRMR values below 0.08, CFI values above 0.95, and RMSEA values below 0.06 are recommended (Hu and Bentler, 1999). Model fit coefficients (as presented in **Table 2**) were acceptable; thus, it can be concluded that the measurement model of six separate dimensions fit the data well. However, some sets of dimensions were highly intercorrelated, which might indicate that children did not differentiate between them. In the CFA for mothers, three correlations were above 0.80 (the highest correlations were between Acknowledgment–Trust and Affection–Trust and equaled 0.88). In the CFA for fathers, four correlations were above 0.80 (the highest was between Acknowledgment–Trust and equaled 0.90). Thus, based on previous research assumptions (Fitriana, 2011; Hooghe et al., 2013), we included *control* and *support* in the second-order CFA model. Model fit coefficients for the two types of models tested are presented in **Table 2**. Second-order models are presented graphically in **Figure 2** for mothers and in **Figure 3** for fathers.

The analysis confirmed our expectations. The appropriate parcels loaded onto the six latent variables. Additionally, six scales loaded onto two second-order factors in the second-order CFA. Restrictiveness and Justice loaded onto the *control* factor, and Vulnerability, Affection, Acknowledgment, and Trust loaded onto the *support* factor.

Measurement Invariance

To test whether CFRT measures the same construct, i.e., family relationships, in the same manner across the child's parents, measurement invariance across the children's assessments of the quality of family relations with mother and father was tested (the results are presented in **Table 3**).

The following levels of measurement invariance were tested: the configural level (all conditions have the same pattern of factor loadings); the metric level (factor loadings are constrained to be equal across the compared conditions); and the scalar level (the indicator intercepts are constrained to be equal across various conditions; Vandenberg and Lance, 2000; Davidov et al., 2014). These three levels were examined in the first-order CFA model. In addition, we tested whether the second-order factors had the same meaning in the assessment of relations with mothers and fathers by constraining the loadings in the CFA to be equal. The results showed that changes in CFI were less than 0.01, changes in RMSEA were less than 0.015, and changes in SRMR were less than 0.03, which supports invariance of the measurement across mothers and fathers, according to Chen (2007).

Construct Validity

Repeated-measures MANOVA was conducted to test gender effect on the perception of family relations with mother versus father ratings within factor and child's gender between factor. The results showed significant multivariate effects for five out of the six CFRT dimensions: Affection $F_{(1,390)} = 54.37$, $p < 0.001$; Vulnerability $F_{(1,390)} = 46.86$, $p < 0.001$; Justice $F_{(1,392)} = 5.05$, $p < 0.05$; Acknowledgment $F_{(1,390)} = 23.73$, $p < 0.001$; and Trust $F_{(1,390)} = 7.94$, $p < 0.01$ with mother receiving higher ratings compared to father ratings. The multivariate effect for Restrictiveness was not significant $F_{(1,390)} = 1.60$, $p = 0.206$. No significant interaction effects between mother-father ratings and the child's gender were observed.

All scales of the CFRT were expected to be associated with measures of psychological adjustment. For all assumptions made, Pearson's bivariate correlations were used to determine the associations between the CFRT scales and target variables, including depression, anxiety symptoms, and prosocial behavior measured with the RCADS and SDQ. The findings revealed that higher ratings on Restrictiveness were associated with higher levels of child's depressive symptoms in relations with their mother ($r = 0.38$; $p < 0.01$) and father ($r = 0.31$; $p < 0.01$) and with higher levels of children's anxiety (mother $r = 0.34$; $p < 0.01$ and father $r = 0.35$; $p < 0.01$). Justice in relations with both parents was negatively correlated with depression (mother ratings $r = -0.45$; $p < 0.01$ and father ratings $r = -0.40$; $p < 0.01$) and anxiety (mother ratings $r = -0.34$; $p < 0.$ 01 and father ratings $r = -0.38$; $p < 0.01$). Three of the four *support* factors (Affection, Acknowledgment, Trust) negatively correlated with depression. Justice correlated positively with prosocial behavior (mother ratings $r = 0.31$; $p < 0.01$ and father ratings $r = 0.33$; $p < 0.01$).

DISCUSSION

The current study aimed to address an existing gap in the assessment of family functioning from the child's perspective by introducing a reliable and developmentally appropriate measure of family relationships for children, administered on computer. This paper focused on the development of a computerized measure of family relationships in middle childhood—the CFRT.

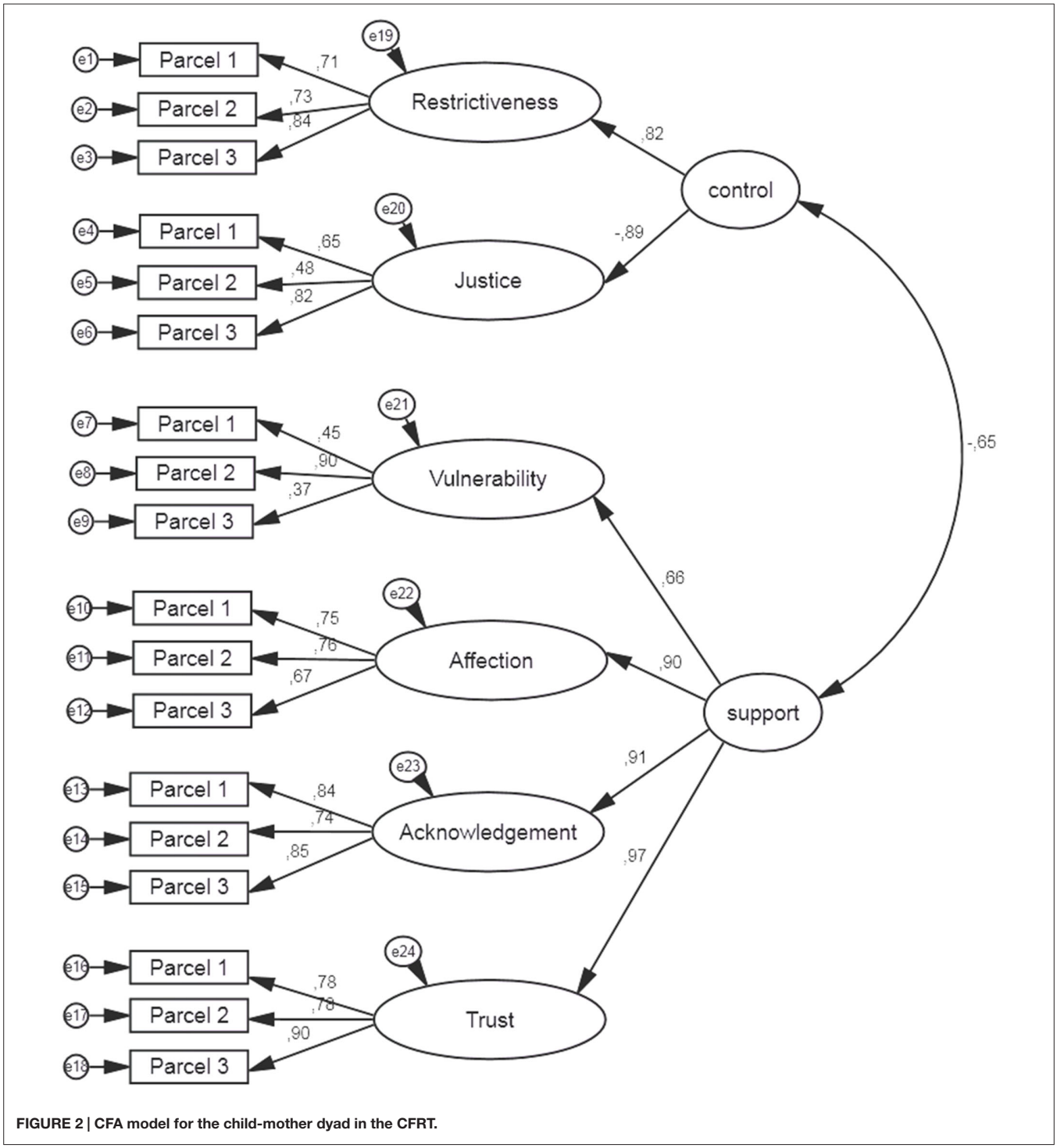

FIGURE 2 | CFA model for the child-mother dyad in the CFRT.

The current findings revealed the reliability and validity of the CFRT scales. Reliability was supported by internal consistency and test–retest reliability. However, Vulnerability achieved the lowest reliability coefficients, which might be caused by several factors. According to Oud and Welzen (1989), Vulnerability refers to the degree to which a child is able to sense the signs of pain and sorrow experienced by parents. It also creates the basis of sympathy and empathy in human relations. High scores on this dimension imply that the child and parent have much concern for each other. The low reliability coefficients might be due to the relatively high multidimensionality of items and the lowest number of items (seven) when compared to the remaining five CFRT scales.

Furthermore, we introduced the confirmatory factor analytic approach to test the factorial validity of the CFRT. The results obtained from the CFA indicated that the six-factor model

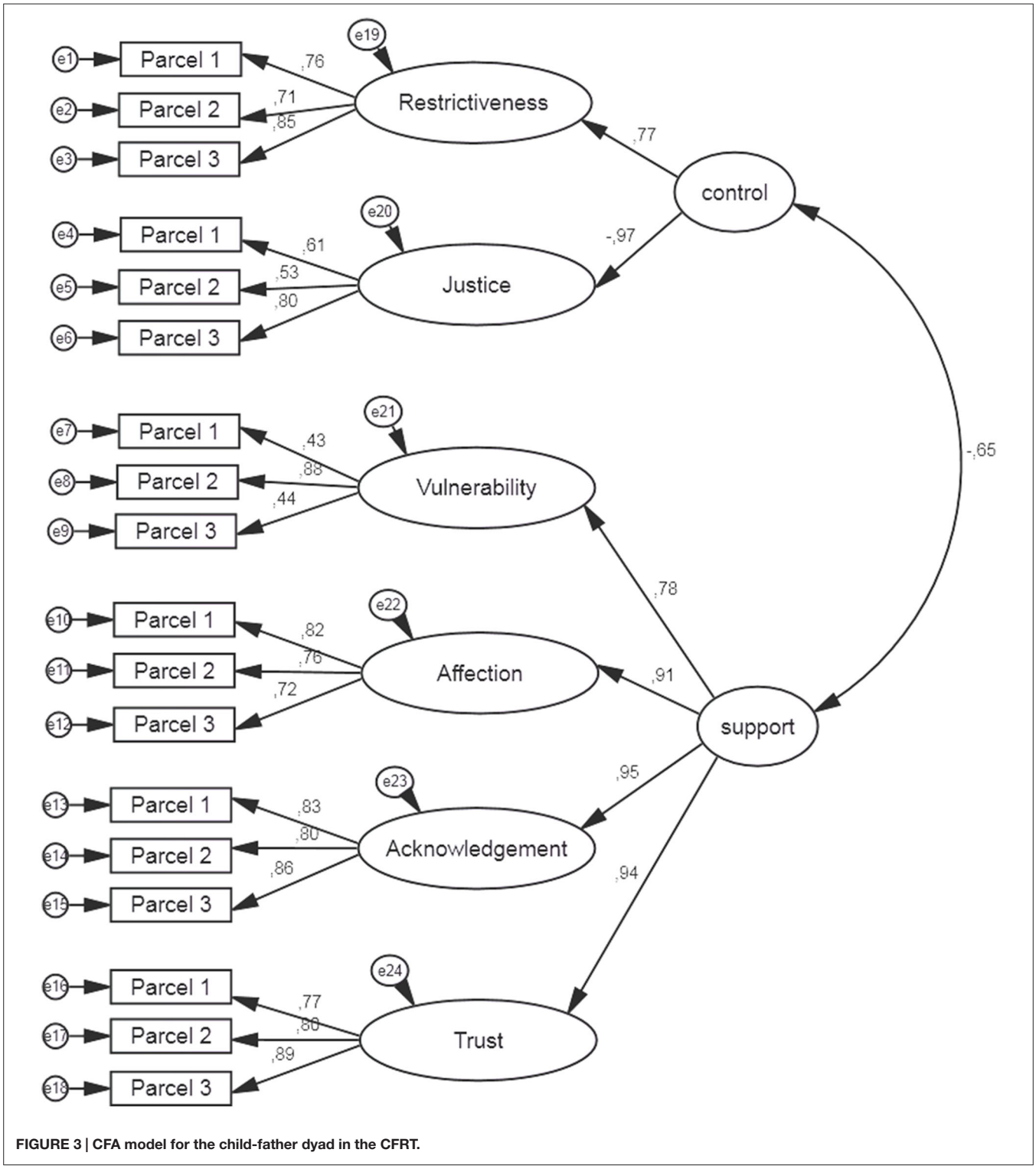

FIGURE 3 | CFA model for the child-father dyad in the CFRT.

appeared to provide an adequate fit. However, correlations between four scales reached a high value (above 0.9) which was not acceptable, therefore, the six CFRT dimensions are recommended to be divided into two groups: *control* and *support*, which we tested in the second-order CFA model, as suggested by Fitriana (2011). We achieved measurement variance, which means that the same construct was measured across mother and father ratings.

Overall, mothers achieved higher ratings on all four support dimensions and one control dimension (Justice) which partly supports our hypothesis. These results with mother ratings higher in support are in line with Oud and Welzen's (1989)

study and previous research that found mothers express more empathy in family interactions than fathers (e.g., Chao, 2011). In contrast to our hypothesis, we found mothers received higher ratings on Justice compared to father ratings. This finding might be due to parental role models having shifted over the past several decades with mothers taking on a more authoritarian role and fathers getting more involved in family life and forming more affection-based relationships with their children (Aldous, 1998; Delsing et al., 2003; Buswell et al., 2012) rather than being mainly responsible for maintaining discipline. Research on the importance of fathers' engagement in family life and their contributions to child development has increased recently (Dette-Hagenmeyer et al., 2014). We found no differences between mother and father ratings in the Restrictiveness dimension. In contrast to our hypothesis, we found no significant interaction effects between mother-father ratings and the child's gender.

Furthermore, we tested associations of CRFT with measures of psychological adjustment—depression, anxiety symptoms, and prosocial behavior. In accordance with our hypothesis, we found a strong association between high ratings on Restrictiveness in the relationships with both parents and child's depression and anxiety symptoms. The other scale from the control dimension—Justice—was positively related to prosocial behavior (e.g., helping others). Children who are treated in a fair way perceive the world as just and are more willing to help others. Higher levels of support—Affection, Acknowledgment and Trust—were related to lower levels of child depression, which also supported our hypothesis. In contrast to our expectations, Vulnerability ratings were positively related to the child's depression. This finding also contrasts with a previous study of Kim et al. (2008), who found that low levels of family support influence greater levels of depressive symptoms in children and adolescents. A possible explanation could lie in children's level of empathy, as those who more likely to observe signs of sorrow in their parents are, in general, more emotional and sensitive and, thus, more prone to develop depressive symptoms. According to Oud and Welzen (1989), Vulnerability is supposed to create the basis of sympathy and empathy in human relations; however, high ratings on this dimension imply that the child and parent have much concern for each other. Therefore, the levels of mutual worry might be so high that they lead to the emergence of depressive symptoms in the child as a result.

To summarize, our data provided evidence for the psychometric properties of the CFRT. We found the computer technique to be engaging and enabled children to express their feelings regarding the quality of family relationships accurately, in a non-verbal way. Children find the whole assessment process enjoyable and it is relatively short to administer, on average 20 min. To our knowledge, the current study is the first to adapt a computerized assessment tool to study family relationships from the child's perspective in this age group. Although the software was programmed in the Polish language and aimed at Caucasian participants, other linguistic and context-appropriate versions can be prepared. The CFRT requires minimal training for administration and can be performed on any standard PC or a laptop, making it a valuable assessment tool for both research and practice.

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REVIEW
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Parental brain: cerebral areas activated by infant cries and faces. A comparison between different populations of parents and not

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Literature about *parenting* traditionally focused on caring behaviors and parental representations. Nowadays, an innovative line of research, interested in evaluating the neural areas and hormones implicated in the nurturing and caregiving responses, has developed. The only way to permit a newborn to survive and grow up is to respond to his needs and in order to succeed it is necessary, first of all, that the adults around him understand what his needs are. That is why adults' capacity of taking care of infants cannot disregard from some biological mechanisms, which allow them to be more responsive to the progeny and to infants in general. Many researches have proved that exist specific neural basis activating in response to infant evolutionary stimuli, such as infant cries and infant emotional facial expression. There is a sort of innate predisposition in human adults to respond to infants' signals, in order to satisfy their need and allow them to survive and become young adults capable of taking care of themselves. This article focuses on research that has investigated, in the last decade, the neural circuits underlying parental behavioral responses. Moreover, the paper compares the results of those studies that investigated the neural responses to infant stimuli under different conditions: familiar versus unknown children, parents versus non-parents and normative versus clinical samples (depression, addiction, adolescence, and PTSD).

Keywords: parents, adults, parental brain, infant cries, infant faces

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INTRODUCTION

Parents play an essential role in the survival and development of the infant and the dyadic relation between parents-infants represent the first, and most important, interaction for the baby. It structures underlying neural mechanisms responsible of its typical or atypical development. Adult–infant relationships has a long evolutionary history, which suggests that specific brain circuits might mediate adult responsiveness to infants (Caria et al., 2012; Esposito et al., 2013). The efficacy of such relationship depends, among other things, on certain children's characteristics, such as facial expressions morphology and communicative signals (e.g., cry, laugh, gaze, gestures) that activates appropriate caregiving behaviors in the adults (Bornstein, 2002; Bornstein et al., 2008; Doi and Shinohara, 2012; Esposito et al., 2013). By the way, newborn infants communicate their needs and physiological states mainly through crying and facial expression. Therefore, crying is

the principal resource the immature newborn possesses to arouse parental care, especially from a distance or when infants are out of their sight (Soltis, 2004; Konner, 2010); at the same time infant facial expression represents an important resource of non-verbal communication between parents and their infants. There is a sort of mutual regulation between partners: at the infant signal, the adult is supposed to respond adequately. Such reciprocal adjustment suggests there might be a biological predisposition in establishing shared relations aimed at offspring protection and care, which has to be provided by an adult able to interpret and respond to the infant's needs.

Being a parent and adequately respond to the offspring necessities requires a huge amount of cognitive resources allowing parents to put into practice suitable caregiving behaviors and in case of parental psychopathology (e.g., depression, post-partum depression, drug addiction/dependence, etc.) these abilities may result substantially compromised, leading to inevitable consequences on the infants' development and wellbeing, as well as on the establishment of a healthy and functional parent–infant relationship.

Still little is known about neural substrates and functional mechanisms underlying influences of adult's ability to read infant's cues and to respond coherently with them. An innovative line of research has employed neuroimaging techniques to identify possible modifications to neural circuitries that accompany parenthood, providing a greater level of understanding of parental processes and how psychopathology may influence parenting at a neurobiological level (Squire and Stein, 2003). This research has employed different methods to study these processes, for example functional magnetic resonance imaging (fMRI), electroencephalography (EEG) and event-related potentials (ERPs), near infrared spectroscopy (NIRS) and magneto-encephalogram (MEG) techniques can be useful to identify the neuroanatomy of parental brain, the development of neural circuits that accompany parenthood and to explain parental processes and how all those factors may be influenced by psychopathology (Swain, 2011).

The most common technique used by these studies is fMRI, a non-invasive technique, which may be used to obtain data on the cerebral basis of human parental behavior and thoughts. Measuring physiological and blood-oxygen-dependent signals in response to infant salient cues/stimuli fMRI allows collecting functional and structural data. This technique has optimal spatial resolution and it allows to se "where" the stimuli activate the neural circuitry. On the other hand, EEG technique give precise temporal resolution, affording the opportunity to explore, with millisecond accuracy, the temporal dynamics of stimulus processing, so that it helps understanding "when" the neural responses to infant affective cues take place. EEG waveforms reflect voltages produced by 1000s of synchronized postsynaptic potentials of cortical pyramidal neurons, measured at the surface of the scalp via electrodes placed according to the international 10–20 system (Jasper, 1958; Luck, 2005).

In this article we present a systematic review of the literature of the last decade about the parental neural response to infant salient stimuli (faces, cries, videos, etc.). In accordance with general aims of systematic reviews, our purpose was to provide an up-dated state of the art, which synthesizes the work in this area of knowledge. Search engines, PsycINFO, PubMed, and Google Scholar, were systematically searched using specific key words, such as "parental brain," parenting, "brain basis," "areas activated," "infant cries," "infant faces" and so on. Seventy-six papers were initially selected. Only 50 studies that fulfilled certain criteria, such as the investigation of neural and hormonal activity in response to infant cues (cries, faces, behaviors), were used in the review process.

We divided the review in sections: the first section focuses on studies which have investigated the neural basis activated in women, who were mothers, in response to infant salient stimuli (infant faces and infant cries); the second section analyzed those studies which have investigated some hormonal factors (associated to the type of delivery, breastfeeding, assumption of hormones, etc.) which may influence, in some way, the neural response to the same stimuli in mothers; the third part focuses on the investigation about gender and parental status differences in response to infant stimuli; finally, the last section discusses those studies which have investigated the fact of being a parent under clinical condition (specifically depression and addiction).

NEURAL BASIS OF PARENTAL RESPONSES TO INFANT CRIES AND FACES

For infants, communicative signals include both facial and vocal components. Vocalizations, e.g., distress cries, allow the infant to capture the attention of a caregiver from a distance. The ability to respond to infant vocalizations is essential for parental responsivity (MacLean, 1990). At the same time, facial configuration of infants is thought to spontaneously attract attention and evoke caregiving in adults. Such features are viewed as pleasant and rewarding, they include large eyes and pupils, small noses and mouths, and a large forehead (Hall Sternglanz et al., 1977; Hildebrandt and Fitzgerald, 1979). There is an apparently universal and spontaneous preference for infant facial features, conserved across multiple species (Sato et al., 2012). In humans, the increased responsiveness and activity in cerebral areas implicated in communicative, infant-directed behavior is present in both parents and non-parents and specific to human infant faces, but not to faces of other infant mammals or adult faces (Caria et al., 2012). This reflects the specificity of infant-related responses, and indicates that specialized responses to infants can transcend the biological adult–infant relationship.

Neural Response to Infant Cries

As we said, cry is the primary "strategy" the newborns have to elicit parental care (Konner, 2010). It represents the first real communicative signal infants posses in the very first social interactions, to express their own needs, to communicate with the environment and to elicit a caregiving behavior in the adult (Newman, 2007; Venuti and Esposito, 2008). It is a universal communication signal; it exists both in humans and in animal, and it provokes a universal response of approach and caring

(Zeifman, 2001; Newman, 2007). The adult responsiveness to these signals is necessary to optimize the chances of survival for the individual, and for the species. The human adult brain seems to be programmed to select, elaborate and identify such type of signal and to prepare the individual for the protection and caring behavior. These mechanisms seem to supervise the individual survival and the species prosecution.

The first authors who tried to study the cerebral activity of human mothers while listening infant cries were Lorberbaum et al. (1999). Starting from Mac Lean's thalamocingulate theory of maternal behavior in animals, they accurately anticipated that infant crying would selectively activate thalamus, cingulate, medial and prefrontal circuits in mothers while listening an audio-taped 30-s standard baby cry, not from their own infant (Lorberbaum et al., 1999).

From that moment, many studies have developed, trying to understand and to explain this mechanism. Laurent and Ablow (2012a), investigated trough fMRI the neural response of 22 primiparous mothers (M age = 24.1 years, SD = 4.1), of 15–18-month old infants, to own and unfamiliar infant's cry and a control sound, related to infant attachment classification, evaluated trough a separate Strange Situation Procedure (SSP). Mothers were screened for psychopathology using the Structured Clinical Interview for the DSM-IV (SCID) and none of them met criteria for major depressive symptoms. Infants were classified as Avoidant, Resistant, Disorganized, or Secure based on their patterns of SSP behavior. Authors found that mothers of less secure infants maintained greater activation to their cry in left parahippocampal and amygdala regions and right posterior insula; mothers of infants showing more avoidant or contact maintaining behaviors during the SSP, displayed reduced response across left prefrontal, parietal and cerebellar areas involved in cognitive control and attentional processing; finally, mothers of infant exhibiting more disorganized behaviors showed reduced response in bilateral temporal and subcallosal areas relevant to social cognition and emotion regulation.

Some studies examined maternal sensitivity, intrusiveness and mother–infant dyadic harmony as correlates of mothers' neural responses to the cries of their own infants (Musser et al., 2012). Twenty-two primiparous mothers were observed during an interaction with their infants at 18 months postpartum and their behavior was coded on the dimensions of sensitivity, intrusive–coercive control, and overall dyadic harmony. In a separate functional neuroimaging session, mothers were exposed to own infant's cry sound, as well as unfamiliar infant's cry and control sounds. Positive correlations were found between sensitive behaviors of mothers and activation in the right frontal pole and Inferior Frontal Gyrus (IFG) to their infant's cry compared to unfamiliar cry, intrusiveness was positive correlated with activity in the left anterior insula and temporal pole while mothers who had more harmonious interactions displayed greater activation in left hippocampal regions.

These studies, which measured maternal behaviors and neural response at 15–18 months, also raises questions about temporal precedency. More studies should examine concurrent and prospective effects of maternal neural responses across early and later postnatal periods.

Neural Response to Infant Faces

There are several studies, mostly fMRI, investigating the neural response to infant faces in mothers, because of the importance which infants' facial expression performs in allowing the caregiver taking care of him. An infant's happy face represent one of the most salient and rewarding stimuli for a mother for its emotional valence and its evolutionary meaning.

Studies on mothers reported grater brain response for own compared to familiar infant faces in the amygdala, anterior insula (cerebral structures associated with the emotional response), superior temporal sulcus (associated with the Theory of Mind, ToM), anterior and posterior cingulate cortex (ACC and PCC) and prefrontal regions associated with memory processes (Leibenluft et al., 2004). Other studies shown that own child's face, compared to unknown children's faces, activates regions involved in cognitive processes (dorsolateral prefrontal cortex -dlPFC), emotional processes [insula, medial prefrontal cortex (mPFC), and anterior cingulate cortex (ACC)] and motor processes (Strathearn et al., 2008) thalamus, temporal cortex (Barrett et al., 2012), orbitofrontal cortex (OFC) (Nitschke et al., 2004; Minagawa-Kawai et al., 2009). Recently, Esposito et al. (2015) in an EEG investigation, found that when 21 primiparous mothers (M age = 32.06 years, SD = 4.66) were exposed to their own 3- to 6-month old infants faces they shown an immediate brain response, in contrast when they look at an unfamiliar but appearance-matched infant's face the cortical activation observed was similar but differed in magnitude in the opposite direction (Esposito et al., 2015).

Besides, Strathearn et al. (2008) in an event-related fMRI study investigated the activity of 28 primiparous women when shown face images of own 5- to 10-month old infant and a matched unknown infant. They were shown with sixty unique stimuli (own-happy, own-neutral, own-sad, unknown-happy, unknown-neutral, and unknown-sad) for 2 s each, with a variable 2- to 6-s interstimulus interval. Authors shown that only own-babies' different emotional expressions (sad, happy, and neutral), and not others', modulates the activation of dopaminergic circuits involved in the parental caregiving, especially the "happy" emotional expression. This finding support the idea that own-infant's smile represents a positive reinforcement to the mother's behavior; it represents a rewarding stimuli to the mother and reinforces her caregiving behavior. This mechanism may have a facilitating function in establishing a positive emotional circuit during the attachment relationship's development (Strathearn et al., 2008). Similarly, Lenzi et al. (2009) recruited 16 primiparous mothers (mean 33.7 years) of infants 6- to 12-month old, without any psychopathological symptoms. Regional brain activation was assessed by measuring changes in blood-oxygen-level–dependent (BOLD) fMRI signal. Authors found stronger activation during emotional expression in the amygdala and insula in mothers observing and imitating faces of their own and others' children, specifically they found that joy expression evoked a stronger response in right limbic and paralimbic circuits (Lenzi et al., 2009).

Thinking about the contribution of the infant's affect to maternal brain function other study tried to investigate the maternal neural response of mothers to videos. Ranote et al.

(2004) recruited ten healthy mothers with infants aged between 4 and 8 months old. Three of the mothers were primiparous; five had two children and two had three children. Ranote et al. (2004) showed to the mothers alternated blocks of videos of own and unfamiliar children and neutral videos. They found higher activity in bilateral cerebellum, visual processing regions and postcentral gyri in response to infant compared to neutral videos. Comparing own vs. unknown infants, higher activity was found in the left amygdala, right mPFC, right dlPFC, and bilateral OFC (Ranote et al., 2004).

On the other hand, Noriuchi et al. (2008) compared the response of thirteen healthy mothers (M age = 31.1 years, SD = 2.2) of children 12- to 20-month old, viewing silent videos of their own and other infants in play or separation circumstances. They found an increased activity, associated with the detection and recognition of own baby images, in cortical orbitofrontal areas (OFC), anterior insula, and precuneus, as well as subcortical regions, including the periaqueductal gray and putamen, regions operating in arousal and reward learning. Furthermore, they found strong and specific differential responses of mother's brain to own infant's distress in substantia nigra, caudate nucleus, thalamus, posterior and superior temporal sulcus, anterior cingulate, dorsal regions of OFC, right IFG, and dorsomedial prefrontal cortex (dmPFC; Noriuchi et al., 2008). They interpreted OFC and related activations as part of circuits required for the execution of well-learned movements. They also found correlations in OFC with own baby response and happiness as well as to their own distressed baby response in the superior temporal regions. Moreover Wan et al. (2014) included twenty healthy mothers (12 primiparous) of 4- to 10-month old healthy infants in their study and found that, viewing 30-s blocks of video of own 4–9 month infant compared to an unfamiliar matched infant, mothers shown higher activation in the precuneus, medial frontal gyri and right superior temporal gyrus (Wan et al., 2014). These results are consistent with the importance of these areas in social thoughts and behaviors.

Moses-Kolko et al. (2010), then, investigated how individual differences in mood anxiety in early post-partum are related to brain response to infant stimuli; anxiety has powerful impact on the motivation to the mother. Mothers experiencing higher levels of anxiety and parental distress and lower mood have demonstrated less amygdala responsiveness to own infant's facial expressions (Moses-Kolko et al., 2010; Barrett et al., 2012).

Only few researches have investigated maternal neural responses to infant facial expression trough EEG and ERPs techniques. Fraedrich et al. (2010) made a first attempt to relate attachment representation with brain activity during emotional perception. They assessed 17 psychologically and neurologically healthy women (M age = 40.5 years, SD = 4.2) and found that insecure mothers, compared to secure, showed a more pronounced negativity in the face-sensitive N170 component meaning a difference in basal cortical face-processing in mothers with different attachment representation. Secure mothers seem to be more capable in face perception and thus they may be better able to detect social stimuli, to perceive infant emotional expression and to use them for social interactions (Fraedrich et al., 2010).

The picture that appears from these researches is a set of programmed structures and even circuits connected with the parental task and behaviors. This circuits incudes thalamus, insula, PFC, OFC, and ACC. These areas associated with parental response seems to overlap with circuits involved in reward and empathic processes (e.g., PFC), highlighting an intuitive close association between those tree human functions. Besides that, it has been shown that, equal circuits, mothers show different pattern of activity in terms of intensity and reactivity, when exposed to own child vs. other children (familiar and unknown); meaning non just a specie-specific response to the infant stimuli, but a more enhanced response when the infant are their own.

All the studies presented show similar limitations. The most important one is the modest size of the samples: each research included a small number of participants – from 10 to 22 (except for Strathearn et al., 2008). Larger samples of participants should be recruited to increase power and allow examination of different and more specific aspects of each research.

HORMONAL FACTOR WHICH MAY INFLUENCE THE RESPONSE OF MOTHERS

Literature has identified brain regions related to maternal behaviors, and little research has investigated the neurobiological mechanisms underlying the relationship between maternal behavior and the hormonal changes that occur during and after pregnancy or related to that. A range of early situations surrounding the birth of a child affects postpartum hormones, parental behavior and infant wellbeing. Many studies highlights how, the internal hormonal equilibrium of the mother, can be part of the environmental maternal factors, which can positively influence the caregiving or not.

Many researches have sustained the importance of breastfeeding for supporting closer mother-infant interaction and infant socio-emotional development. Kim et al. (2011) recruited 17 mothers of healthy infants, from 2 to 4 weeks post partum, and divides them according to their feeding method (breastfeeding exclusively vs. formula-feeding exclusively) to investigate their neural activation in response to infant auditory stimuli. Breastfeeding mothers demonstrated greater activation in the superior frontal gyrus, insula, precuneus, stratum and amygdala, when listening to their own baby-cry as compared to formula-feeding mothers. This result suggests links between breastfeeding and greater response to infant cues in brain regions implicated in maternal-infant bonding and empathy during early post-partum (Kim et al., 2011). One possible mechanism underlying the relationships between breastfeeding and greater activations in the maternal circuits could be due to the effects of the oxytocin, a neurohormones involved in nurturing. Oxytocin, is synthesized in the hypothalamus and released from the posterior pituitary; it stimulates milk release at the mammary glands. It has been shown that oxytocin also facilitates other maternal behaviors in animal studies (Febo et al., 2005). Higher levels of peripheral oxytocin are associated with sensitive and synchronous parental behaviors in human mothers

and fathers (Feldman et al., 2007). Such cerebral activation may facilitate greater maternal sensitivity as infants enter their social word.

A range of other circumstances around the dyad may affect the maternal capacity of perceiving and elaborate the infant stimuli. An example of such variability may be the type of delivery; Swain et al. (2008) tried to investigated whether there were any differences in the neural circuits activated in mothers responding to infant cues due to the type of delivery they had. They recruited a sample of 12 mothers (six who delivered vaginally and six who had an elective cesarean section delivery) and conducted a fMRI, 2–4 weeks after delivery. Authors found that mothers with natural childbirth showed higher neural activation in subcortical areas (hypothalamus and pons' regions) in listening their own baby's cry, compared to Cesarean section delivery mothers. Those regions are involved in the oxytocin neural regulation. Oxytocin is released from the uterine contractions during the delivery and during breastfeeding. Swain et al. (2008) reached to the conclusion that the higher activation in cerebral areas linked with oxytocin, in mothers with natural delivery, may be associated to events happened during the delivery itself. It can be related with a better ability to recover in the mothers with natural delivery and a higher empathic sensibility through their baby's signals (Swain et al., 2008). One of the most important limits of this study regards the sample size, it includes only six mothers per group and the samples should be enlarged. Moreover, futures studies should examine whether the same effects are maintained several months after delivery.

Then, Laurent et al. (2011) investigated the maternal neural activity in response to infant cry, related to hypothalamic-pituitary-adrenal (HPA) axis regulation with their infants. They recruited primiparous mothers of 15–18-month-olds infants and scanned them with fMRI while listening to the cry sounds of their own, an unfamiliar infant and a control sound. Salivary cortisol was collected at four timepoints in a separated SSP session. Mothers who showed less HPA reactivity showed increased activation to the cry of their infants relative to control sound across right insula, bilateral OFC and anterior cingulate-medial prefrontal cortex (Laurent et al., 2011). On the other hand, Bos et al. (2014) showed that in non-parents males cortisol administration, compared to placebo administration, significantly increases posterior hippocampal activation selectively toward infant crying and not toward a control sound (Bos et al., 2014).

An other hormone, which has been investigated as a responsible for some differences in parental responses, is testosterone. Bos et al. (2010) measured the neural responses of sixteen young women while listening to crying infants in a double blind, placebo-controlled, counterbalanced, testosterone administration experiment. They fund heightened activation in the testosterone condition compared to placebo in the thalamocingulate region, insula and the cerebellum in response to crying, confirming him role of the thalamocingulate circuit in infant cry perception and suggesting exogenous testosterone act on the thalamocingulate circuit to upregulate parental care.

GENDER DIFFERENCES IN NEW, EXPECTANT OR NON-PARENTS

Becoming a parent involves a wide neuro-hormonal restructuring that prepares for the expression of adequate caregiving. Across mammalian, pregnancy and childbirth are associated with evident changes in maternal brain areas involved in motivation, nurturance and attention and, studies in bi-parental species, reveal analogous alterations in fathers' brains, depending on the exposure to infant signals. Nowadays, only little is known about the psychological and physiological changes that expectant fathers experience before the birth of their first child or right after that, and it remains still unclear whether fathering, as mothering, involves integration of limbic and cortical circuits and is mediated by processes related to pair bonding as in other bi-parental mammals. Storey et al. (2000) measures hormone concentrations and responses to infant stimuli in expectant and new fathers, living with their couples, to determine whether men can experience variations analogous to the dramatic shift seen in pregnant women. They recruited 34 couples and took blood samples at one of four times either before or after the birth of their babies. Authors concluded that men and women had similar stage-specific differences in hormone-levels, including higher concentrations of prolactin and cortisol in the period just before the childbirth and lower postpartum concentrations of sex steroids (testosterone and estradiol). Hypothesizing that gender and experience would affect the neural responses to baby cry and laughter Seifritz et al. (2003) examined 10 women (M age = 31.6 years, SD = 4.5) and 10 men (M age = 36.2 years, SD = 4.7) with children younger than 3 years (M age = 1.3 years, SD = 0.8), and 10 women (M age = 27.6 years, SD = 3.7) and 10 men (M age = 28.4 years, SD = 4.8) without children. Using an event-related design, measuring localized brain responses to brief 6-s events, they found that over the entire sample, crying and laughing baby stimuli produced more activity in a small portion of the auditory cortex (AC), the Heshyl's gyrus. Further, they reported that women have a decrease in activity to both baby cry and laughter in the anterior to these brief signals, which was not present in men (Seifritz et al., 2003). This is contrary to other studies (Lorberbaum et al., 1999; Lorberbaum et al., 2002; Swain et al., 2003) probably due to the different stimuli presented to the new parents in those studies. Finally, the response pattern changed fundamentally with parental experience: in the amygdala and limbic regions, parents despite of sex, showed stronger activation from crying, while non-parents showed stronger activation from laughing. These data represent the first steps into the study of gender and experience-dependent aspects of parental brain circuitry. From that point the research have developed; to investigate individual differences in tendencies to engage or withdrawal from motivationally relevant stimuli, Montoya et al. (2012) used fMRI to scan seventeen nulliparous women (M age = 22.7 years, SD = 2.9) exposing them to novel infant cries of two distress level (low and high) and unknown infants faces of varying affects (happy vs. neutral vs. sad). They found that infant cries activated bilateral superior and middle temporal gyri (STG and MTG) and precentral and postcentral gyri and the activation was grater for low- relative to

high-distress cries. Happy relative to neutral faces activated the ventral striatum, caudate, ventromedial prefrontal (vmPFC) and OFC, while sand vs. neutral faces activated the precuneus, cuneus and PCC (Montoya et al., 2012).

In mixed sample of both women and men, parent and not, was shown that face processing of both adult and infant faces elicits similar waves of activity in the visual areas, from the striate cortices along dorsal and ventral pathways (Kringelbach et al., 2008); furthermore, participants of both gender showed more significant activity in the medial OFC when viewing infant faces compared to adult faces. The same pattern of activity was found when the sample was restricted to participants who were not parents (Kringelbach et al., 2008).

Similarly, Caria et al. (2012) hypothesized that non-parents' processing of unfamiliar infant faces compared to adult faces would activate brain circuits involved in preparation for communicative and interactive responses as well as reward circuits shown to mediate attachment and caregiving behaviors in parents toward their own children. They recruited sixteen healthy adults non-parents (nine females and seven males M age = 28.06, SD = 5.66) and they scanned them with fMRI while viewing pictures of infant and adult faces. Authors fund that human infant faces activated several brain systems including lateral premotor cortex, other motor areas, cingulate cortex, anterior insula and thalamus. The same regions preferentially responded to human infant faces than to animal infant faces, suggesting species-specific adult brain responses (Caria et al., 2012). From an evolutionary perspective, adults' grater responsiveness to human infant cues has a clear adaptive value as it supports progeny survival.

Investigating, tough, the neural activity of nine women (M age = 24.3 years, SD = 3.2) and nine men (M age = 27.8 years, SD = 6.4), without own children, in response to crying and laughing, compared to vocalization-derived control stimuli, Sander et al. (2007) found stronger activation in amygdala and ACC of women in response to natural laughing and crying, whereas the control stimuli elicited stronger activation in men. Independent of listeners' gender, AC and PCC were more strongly activated by the control stimuli than by infant laughing or crying. The stronger activation in amygdala and ACC in women may be explained as a gender-predisposition for responding to preverbal vocalizations, while the gender-independent similarity of activation pattern in PCC and AC may reflect a more deep level of cognitive processing (Sander et al., 2007). More studies have found a coordination between mothers' and fathers' brain responses to their own 4- to 6-month-olds infants stimuli in social-cortical networks associated with mentalizing and empathy, including the insula, inferior-parietal lobule (IPL), dmPFC and IFG, suggesting that parents may share in real time their intuitive understanding of the infant's state and signals (Atzil et al., 2012). This result may suggest that co-parenting evolved on the basis of the higher mammals' capacity for a neural coordination with social partners and the ability to represent the other's state in one's physiology.

Studies assessing ERPs demonstrated some differences in the cortical response to infant stimuli between parents and non-parents (Proverbio et al., 2006, 2007; Grasso et al., 2009). In particular fathers and mothers showed larger amplitude 300 ms after the stimulus onset in parietal sites compared to non-parents when viewing unfamiliar infant faces (Proverbio et al., 2006, 2007). In a similar way, Grasso et al. (2009) enrolled 28 mothers (M = 36.61, SD = 8.26; 14 birth mothers and 14 foster/adoptive mothers) of children between the ages of 1.6 and 4.7 years (M = 2.7, SD = 0.9), and found in adoptive mothers larger P300 component when they were exposed to own compared to other infants faces, indicating a potential role of attachment at this level of processing (Weisman et al., 2012).

From these research emerges that adults, despite of their parental status or gender, are genetically and evolutionary programed to respond to human infants signals even considering some differences due to the experience.

PARENTHOOD UNDER CLINICAL CONDITIONS

There are many psychopathological conditions that may affect the ability of parents to take care of their infants. There's a wide range of literature investigating how psychopathological conditions can affect parental abilities from a behavioral perspective (Kowalenko et al., 2013) but in the last decade few studies has explored the neural basis of such impairing conditions (e.g., maternal depression and maternal drug addiction).

One of the most common and alarming diseases a mother could experiment in the perinatal period is the postpartum depression (PPD). It can have devastating and sometimes deadly consequences for mothers and babies when unidentified and untreated. PPD affects 13% of women worldwide within the first 12 weeks after giving birth, and 20% (which means one in five women) within the first postpartum year (Cole, 2015).

Many authors tried to investigate, in the last decade, which are the neural circuits interested by such condition in mothers responding to infants' cues. For example, Moses-Kolko et al. (2010) examined 16 postpartum healthy mothers and fourteen unmedicated depressed mothers with fMRI blood-oxygen-level-dependent acquisition during a block-designed face versus shape matching task. A two-way analysis of variance was performed examining main effects of condition and group and group-by-condition interaction on activity in bilateral dorsomedial prefrontal cortical and amygdala regions of interest. All participants were medication-free, multiparous and breast- or bottle-feeding. Authors found that faces were associated with increased amygdala activity and shapes were associated with increased dorsomedial prefrontal activity in all women. But at the same time, they found that negative emotional faces activated the left dmPFC over a large region in Brodmann's area 32, significantly less in depressed mothers than in healthy mothers (Moses-Kolko et al., 2010). They interpret this deficit in dmPFC activity as an index depressed mother's present diminished awareness of empathic responses to other's emotions (Donges et al., 2005). Again Laurent and Ablow (2013) studies these same sample's responses to infant happy compared to distress facial expression; depressed mothers showed diminished responses to their own infants distress

faces in the dorsal ACC compared to non-depressed mothers. Moreover, mothers with more severe symptomatology showed reduced responses to their own infant's joy faces in the OFC and insula, circuits associated with motivation and self-regulation processes.

These authors conduced multiple studies comparing depressed and non-depressed mothers (Laurent and Ablow, 2012b, 2013); to examine the response to infant auditory stimuli, they compared 11 mothers with major depressive disorder to 11 mothers with no diagnosis recruited from the Women Infant Children (WIC) program, exposing them to their own 18-months-old infant's cry, an unfamiliar infant's cry and a control sound, during fMRI. Non-depressed mothers responded to their own infant's cry grater than control sound in paralimbic areas (anterior insula and OFC), striatum, thalamus, midbrain [ventral tegmental area (VTA)], bilateral dmPFC, PCC and cerebellum. Compared to unfamiliar infant's cry, these mothers showed greater responses to own infant's cry in a more limited set of areas: ACC, right insula, right occipital fusiform and lingual gyrus and left posterior supramarginal gyrus. Depressed mothers failed, as a group, to show a significant response to own infant cry grater than both control sound and other infant's cry. These results can be interpreted as whereas non-depressed mothers respond across multiple emotional responses and regulation circuits to infants crying while depressed mothers failed to respond to their infants. Depressed mothers' failure to engage striatal and thalamic circuits in response to infants crying may underline motivational ad social bonding difficulties in mother–infant relationship (Laurent and Ablow, 2012b).

At the best of our knowledge, few studies have investigated the neural response of depressed mothers through the ERPs technique; Noll et al. (2012) investigated the role of parental status and depressive symptoms on early visual processing of infant faces in a sample of adult woman. They recruited from the New Haven community thirty adult women (17 mothers, 13 non-mothers, M age = 31.53 years, SD = 6.84). Participants underwent an EEG session and randomly selected infant face was presented for 1500 ms followed by another blank screen, which varied in duration between 500 and 700 ms. There were 75 trials in total each expressing one of three emotions: pleasure, comfort, or distress (25 exemplars for each expression). Authors observed a positive correlation between depressive symptoms severity and the N170 amplitude (Noll et al., 2012).

There's also one other clinical issue affecting mother–infant relationship, with high rates of abuse, neglect, foster care placement and disturbed attachment toward the child; we're talking about maternal drug addiction. Surprisingly, there is almost no literature about the neuroanatomical circuits affected by addiction in mothers. It is well know, though, that infant visual and auditory cues activate similar brain reward regions to drugs (e.g., cocaine), including the VTA, nucleus accumbens, cingulate and prefrontal cortices. Thus, in non-addicted mothers, exposure to infant cues appears to be reinforcing and important in activating healthy maternal reward and motivation circuits. In drug-addicted mothers healthy parent–infant interactions are disrupted by artificial stimulants of the dopaminergic system, such as cocaine, which may act as a highly reinforcing infant substitute (Swain et al., 2007).

Landi et al. (2011) investigated the degree to which neural circuits associated with parenting are disrupted in substance-using mothers. They included 26 substance-using (M age = 25.58 years, SD = 5.64) and twenty-eight non-using mothers (M age = 29 years, SD = 5.89) of children 1- to 3-months old. Substance use status was determined by a combination of self-report data and urine toxicology; women were considered substance-using if they used any teratogenic substance during pregnancy and/or into the post-partum period. Ten participants used only tobacco; four marijuana only; two alcohol only; one heroine, tobacco and cocaine; two heroine and tobacco; one tobacco and heroine; one amphetamine and tobacco; and five non-disclosed drugs. Using fMRI to examine the neural response to emotional infant cues (faces and cries), authors found that, in response to faces (of varying emotional valence) substance-using mothers, compared to non-using, showed reduced neural activation in prefrontal regions (dlPFC and vmPFC), visual processing (occipital lobes) and limbic regions (parahippocampus and amygdala). Similarly, in response to infant cries (of varying distress levels), the clinical group showed reduced activation in prefrontal regions auditory sensory processing regions, insula and limbic regions (parahippocampus and amygdala) (Landi et al., 2011). Such general reduced neural responsiveness may lead to difficulty in subsequent behavioral maternal response to the infant, and in the development of a healthy mother–infant attachment bonding.

Finally, Moser et al. (2013) examined, through fMRI, the influence of dissociation on neural activation of twenty mothers with post-traumatic stress disorder (PTSD) while viewing vide-stimuli of their children (aged 12–42 months) during stressful (separation) and non-stressful (play) mother–infant interactions. They found a positive association of limbic activation and PTSD symptom severity as well as negative association of limbic activation and dissociative symptom severity. Moreover, higher PTSD symptoms predicted activation in additional limbic areas, the enthorinal cortex, areas associated with emotional regulation and OFC. Activation in the enthorinal cortex originated from a positive correlation of neural activation with PTSD symptom severity during separation, while activation in the OFC originated from a negative correlation between PTSD symptom severity and play. Activation in the dlPFC originated from both a negative correlation of PTSD symptom severity with paly, and positive correlation of PTSD symptom severity with separation. While his diminished activation may be adaptive for the mother's downregulation of physiological arousal due to her PTSD symptoms, it becomes maladaptive in the context of mother-child interaction (Moser et al., 2013).

It is not surprising there's no literature investigating the diverse effects different types of drug abuse may have on the maternal abilities, it is maybe due to the wide variety of cerebral areas involved in this disease, the frequency of polydrug use which makes difficult to isolate the effect of one single substance and the peculiarity and fragility of such sample, all factors that make this research still to deepen.

CONCLUSION

The main aim of this review was to present what is known about the neurobiology of mothering to neuroimaging techniques; we have delineated the complexity and abundance of the mechanisms underlying and influencing parental behavior and its connected physiological, psychological and behavioral adaptations.

From literature we reported, a set of brain circuits of parental response to baby stimuli, whether cries or faces, emerges: starting from the cingulate circuits involving midbrain and thalamus involved motivation and reward processes; frontal, insular, fusiform and occipital circuits engaged in social emotional/empathy responses and planning; memory processing regions including hippocampus, parahippocampus and amygdala implicated.

One of the first evidence which emerges from our exploration of the literature is that infant cues do not just orient the adult trough the infant, but also provides a wide range of information, including affective expression. Moreover, the overlapping neural circuitry for reward and affective processing provide an important link to understanding motivational factors underlying parental behavior. In addition to "liking" being a useful characterization of parental responsivity to infant cues, "wanting" also represents a hedonic dimension characterized by motivation to act. Infant visual and auditory stimuli can be used to selectively activate brain circuits related to arousal, mood, and social and habitual behaviors. Though, different groups we reported have used a mixture of stimuli including baby cries (of different distress level), laughter and images of different ages and different facial affect (happy vs. neutral vs. sad) and experience (own vs. familiar vs. unknown).

The nature of the adult–infant relation is complicated and relies on the integrity and function of physiological and behavioral systems in the domains of sensation, perception, affect, reward, executive function, motor output and learning. To engage in parenting behaviors, adults have to be sensitive to infant cues and emotionally prepared and motivated to engage socially with the infant; adults must selectively attend to the infant in the context of competing stimuli, and finally, they must be restrained and consistent in their responsiveness. Consequently, when a mother is at risk to engage in dysfunctional parenting, such as when she is depressed or has a history of drug addiction, the function of many or all of maternal and related systems may be compromised. In fact, the studies we reported showed noticeable differences in the neural responses to infant stimuli in mothers who presented a history of psychopathology in those areas mentioned above, involved in parental understanding and reaction.

Further research is needed to deeply explain the complex "panorama" underlying the neural mechanisms regulating the biological response of parents to their infants' signals, needs and requests. One of the possible future perspectives we are approaching is the possibility to investigate neural activity of mothers in ecological situations. For example, by using an innovative and specific EEG cap endorsed in the "MOVE" system, it will be possible to monitor neural parent–infant dyadic activity during interactive, face-to-face and every-day sessions and this would be essential to more deeply understand which mechanisms take place during real dyadic exchanges.

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CASE REPORT
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Skin to skin interactions. Does the infant massage improve the couple functioning?

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Transition to parenthood is a critical stage of life due to several changes the couple has to handle. A large body of studies described how transition to parenthood can be linked to the onset of depressive symptoms, as well as the perception of a low social support, and an increased stress, representing a risk for the early mother–baby relationship. Infant massage (IM) emerged as a helpful tool to improve maternal skills in interacting with the baby, and leading toward a decreasing of post-partum symptoms. However, a growing body of literature highlights that men also may experience post-partum diseases, representing an additional risk for the development of the baby. To date, no study observed the impact of the IM on both partners. The aim of the current qualitative research is to observe the impact of the IM on a single couple of parents at childbirth. Pre (Time 1) and post-intervention (Time 3) procedure has been established to observe the changes occurring over the time in the couple. In particular, each member of the couple filled out the EPDS, the BDI-II, the MSPSS, and the PSI-SF both at Time 1 and at Time 3. The treatment (Time 2) was represented by the IM training, and lasted 4 weeks. Findings revealed a decrease in depressive symptoms in both partners, as well as an improvement of their perception of stress related to parental role. No changes has been detected with respect to the perception of social support. The IM seems to be a helpful approach to prevent the establishment of pathological conditions in new parents. Although no direct measures on the child were used, the current qualitative data seem to suggest that the IM may represent a valuable tool to prevent the onset of early negative outcomes of the baby. Further investigations and empirical data are needed to improve the knowledge in this field.

Keywords: infant massage, couple adjustment, childbirth, parental stress, depressive symptoms

Introduction

Infant massage (IM) is a traditional care practice particularly widespread in Africa and South Asia (Field, 2000), and over the past decades also in Western countries (Underdown et al., 2013). IM can be defined as "a systematic touch by human hands, which stimulates the tactile sense of the infant" (Abdallah et al., 2013, p. 663). IM consists of traditional Swedish and Indian massage techniques, yoga and reflexology, and it can be applied by both mother and father on the child's arms, legs, back, chest, belly, and face, using a vegetable odorless oil, and according to a standard

sequence designed by McClure (2000). As mentioned by Underdown et al. (2013), IM may help to establish eye contact, as well as a sensitive tone of voice and touch which in turn may help both the development of baby's ability in regulating emotions (Belsky, 2001; Fonagy et al., 2004) and the dyadic attachment relationship (Beebe and Lachmann, 2002; Slade, 2005; Tronick, 2007).

Several studies highlighted the benefits of IM performed by mothers or medical staff. Indeed, premature infants gained weight (Field et al., 2004, 2010; Diego et al., 2005; Ang et al., 2012) with an increase of 21–48% compared to control groups. Preterm babies – randomly assigned to a control or massage therapy group – also reached a significant increase in body temperature when receiving the massage (Diego et al., 2008). Other studies documented a lower pain responses following sensorial stimulation (Bellieni et al., 2002; Ludington-Hoe and Hosseini, 2005; Jain et al., 2006; Bellieni et al., 2007; Diego et al., 2009; Moyer-Mileur et al., 2012), weight gain (Ferber et al., 2002; Mainous, 2002; Liu, 2005; McGrath et al., 2007; Vaivre-Douret et al., 2009; Diego et al., 2014; Ahmed et al., 2015), less amount of energy expenditure compared to when they had not received the massage (Lahat et al., 2007), and shorter hospital stay (Vickers et al., 2004; Mendes and Procianoy, 2008; Vaivre-Douret et al., 2009; Field et al., 2010). Furthermore, from a neurological point of view, the effects of IM on the baby results positively influencing the Heart Rate Variability (Field et al., 2010; Smith et al., 2013), reducing the stress response, leading to a more rapid maturation of both visual function and brain electrical activity (Guzzetta et al., 2009, 2011) and to a better neurodevelopment outcome in psychomotor and mental development, compared to the long term effects on the babies of the control group (Procianoy et al., 2010).

Infant massage encourages early mother–child interactions through the promotion of maternal ability to understand the baby's cues, leading toward a decrease in depressive symptoms (Onozawa et al., 2001; Glover et al., 2002; O'Higgins et al., 2008). Thus, the IM affects the mother, and in turn may support her relationship with the child, offering a unique opportunity to learn how to adjust each other's emotional states and to improve the physical and emotional dyadic contact (Shai and Belsky, 2011).

The Couple Functioning during the Transition to Parenthood

Transition to parenthood is an important and critical stage of life. Several changes occur with the need to find a new couple adjustment. Studies highlighted the presence of a strong decrease in couple satisfaction (Lawrence et al., 2008; Doss et al., 2009; Mitnick et al., 2009) and high level of parental stress (Meijer and van den Wittenboer, 2007; Lawrence et al., 2008; Bartolo et al., 2013). Other studies showed how becoming a parent may lead to a strong decrease in the level of partners' adjustment concerning the relationship (e.g., Shapiro et al., 2000; Feeney et al., 2001), even among couples who show high level of adjustment in pre-pregnancy (Lawrence et al., 2008).

An increased body of literature stressed the importance of maternal post-partum mental health in affecting the quality of couple relationship. In particular, post-partum depression (PPD) – the higher maternal mental health risk at childbirth – it is a clinical condition affecting 10–15% of women, and is able to compromise both the dyadic and the family functioning. PPD is represented by the loss of interest in normal activities, by a greater tendency toward crying, feelings of guilt, anxiety, excessive sense of fatigue, lack of self-esteem, loss of concentration, excessive concern for the child or a lack of worry, panic attacks, suicidal impulses (Wisner et al., 2002).

Recent studies suggested that men also may experience PPD. A recent meta-analysis (Paulson and Bazemore, 2010) reported that PPD affects 23.8% of women and 10.4% of men. Although the clinical relevance of this phenomenon, just a few studies investigated the co-occurrence of depressive symptoms in the couple after the childbirth and throughout the first year of the baby's life (Matthey et al., 2000; Dudley et al., 2001; Zelkowitz and Milet, 2001). Soliday et al. (1999) showed that the percentage of couples with at least one parent experienced PPD is between 32.6–47%. Zelkowitz and Milet (2001) highlighted that the 24% of couples with a woman suffering of PPD had also a man with PPD, as measured at 6 months of the baby's life. Matthey et al. (2000) found the 53% of mothers who scored high on the Beck Depression Inventory (BDI; Beck et al., 1961) at 12 months of the baby had partners who also reached high scores. Soliday et al. (1999) reported that 19.6% of both parents reported the presence of depressive symptoms 1 month after the delivery, and about 4.7% of them also at 8 weeks after the delivery (Raskin et al., 1990). Escribà-Aguir et al. (2008), considering a sample of 687 women and 669 men, found a prevalence of depression in the 10.3% of women, and a 6.5% of prevalence in men, as assessed by the Spanish version of EPDS (Cox et al., 1987). The authors reported that among men whose partners were experiencing PPD, a prevalence of depressive symptoms occurred in 14.5% of them, while in women whose husband were experiencing PPD the prevalence was about 23.3%. In the study leaded by Bielawska-Batorowicz and Kossakowska-Petrycka (2006), and considering a sample of 80 men and their partners, with babies of 3 to 4 months old, the authors found that 27.5% of men received scores above the cut-off score of 13 in the EPDS, as well as for 31.2% of women. These results showed that depressive mood, after the birth of the child, is often experienced by men also, and sometimes by both partners. Similar results were reported in the study of Goodman (2008), where the EPDS was used along with other measures aimed to investigate parenting stress and mother/father–infant interactions. The study was conducted on 128 couples and their babies, and findings showed that 28% of mothers was depressed at 2 to 3 months post-partum, and about the 22% of their partners was experiencing the same condition. The authors found that the existence of maternal depression significantly increased the risk for fathers to experience a higher stress, depression, and a greater dysfunctional father–infant interaction. However, PPD can be recognized since the 4th month after birth. The first 3 months, even called *baby blues*, implicate several biological and hormonal changes which can be underlined to rapid mood variations. Thus, other factors should be considered before and

after the baby blues. Research findings showed that the perception of a low social support during and after the baby blues phase, represent a substantial predicting factor for the emerging of PPD (Gao et al., 2009; Negron et al., 2013; Verreault et al., 2014).

Post-partum depression has been extensively investigated in women (Di Folco and Zavattini, 2015; Yim et al., 2015) and – as described above – little research on men highlighted the existence of this condition within the couple. Given this assumption, it could be argued that the presence of depression in both parents represent a higher risk for the developmental outcome of the baby. To date, just a few studies (Goudreau and Duhamel, 2003; Tandon et al., 2011; Petch et al., 2012) paid their attention to helpful interventions for both partners after childbirth. To the best of our knowledge, no study at all observed the impact of the IM taught to both partners. Given that, our clinical study aimed to observe whether the IM training could shape the adjustment of parents after childbirth. Our hypothesis is that the IM taught to both partners may reduce the depressive symptoms, the perceived parental stress, and increase the perceived social support.

Clinical Case Description

A couple of parents with their first child, a baby boy of 5 months, were involved in our study. Barbara was 38 years old while Luca was 41 years old. Both parents belong to a high socioeconomic status and they are both graduates. The couple has been married for 5 years and after several attempts to have a baby, Barbara got pregnant during their fourth year of marriage. They first contacted us when their son Marco was 3 months old. The couple told us about their difficulties during the pregnancy, in particular they described their past failures in trying to have a baby and the fear they felt when they realized the risk of a premature birth during the 6th month of gestation. This event forced Barbara to stay in bed until the delivery.

The baby was born at term, through a vaginal birth and with the use of the epidural anesthesia. Marco weighed 2840 g at birth, he was 49 cm long and he did not show any physical problem. Although they described the delivery as "*good enough*", they then reported a feeling of strong concern with respect to the care of their child. This emotional status probably represented the reason why they agreed to participate in a pre–post assessment on an IM class, indirectly expressing a request of help.

Procedure and Instruments

Before the beginning of the study, each parents has been informed that the study was not reviewed by the Ethics Committee, and that the maximum risk involved in their participation was related to experience distress. They all signed a written informed consent form before the study begins, and they were informed about the chance to withdraw from the study in any moment. Parents signed a written informed consent form for their baby, and they were also informed that literature does not highlight any risk in participating in IM classes for the time being.

Once they agreed to participate, the couple was involved from the 4th month of the child's life in four weekly meetings with a duration of 1 hour and half each, as required by the IM training. During these meetings, they were instructed by a certified massage instructor. Meetings were attended by both parents practicing on their child, following the massage sequences shown by the teacher on a doll and by using a odorless oil that facilitates the massage and allow the child to continue to feel the smell of the parent. In each meeting, it has been displayed a specific sequence for each part of the body that will be massaged (foots, legs, hands, arms, abdomen, chest, back, and face). Before the beginning, the instructor encourages parents to take time to relax, and invite parents to ask the child for permission to begin the massage, to interpret signals of availability/unavailability of their child. If the child's behavior indicates an unavailability to start, the massage does not begin. During the practical part, parents are informed about some issues concerning the care of the child, such as recognizing different types of baby's crying and different types of agitation of the newborn, in order to understanding the best time to begin the massage. During the massage the baby may cry and/or fidget. Thus, the parents are helped in exploring the meaning of these signals in order to feel more comfortable during the massage and to better help their baby.

Before and after the IM training, we administered a set of self-reports with the aim to assess changes occurring over the time. This assessment consisted of two phases. The first phase was at 4th months of the baby (T1; Pre-Test), while the second was at 5 months of the baby (T2; Post-test).

Measures

The following measures were administered to both mother and father during the pre- (T1) and post-intervention (T2):

Edinburg Postnatal Depression Scale (EPDS; Cox et al., 1987)

The Edinburg Postnatal Depression Scale (EPDS) is a *self-report* questionnaire used to assess depression, and consisting of 10 items (on a 0–3 Likert scale), which investigate the presence and intensity of depressive symptoms, specifically: anhedonia, guilt, anxiety, fear or panic, sadness and crying, sense of failure, difficulty sleeping, thoughts getting hurt. The questionnaire does not investigate signs of depression such as tiredness and fatigue, as they are considered general effects of childbirth and the post-partum. The minimum and maximum score of the test were, respectively, 0 and 30. The authors suggested a cut-off of 12/13 for the detection of depressive symptoms in a clinical assessment, while a cut-off of 9/10 if the questionnaire is used for social surveys or for screening. The questionnaire was also validated in Italian (Benvenuti et al., 1999), using the cut-off of 8/9 and in current study we used this version. The instrument showed a good internal consistency tested using Chronbach's alpha coefficient (0.79), and Guttman split-half coefficient (0.82) (Benvenuti et al., 1999).

Beck Depression Inventory-II (BDI-II; Beck et al., 1996)

The BDI-II is a self-report questionnaire for the assessment of symptoms and attitudes typical of depression. The questionnaire consists of 21 items (Likert scale 0–3). It provides a Total score and two dimensions of self-reported depression. The first dimension is the Somatic-Affective area, which concerns the manifestations of depression such as loss of interest, loss of energy, changes in sleep and in appetite, agitation and crying. The second one is the Cognitive area, which concerns the psychological symptoms of depression and the episodes of pessimism, guilt, self-criticism, and worthlessness. The scoring is done as following: 0–13 scores indicate no depressive content; scores between 14–19 a mild depression; scores between 27–29 a moderate degree of depression; and scores between 30–63 a severe depression. Adequate internal consistency (Cronbach's alpha = 0.92) and evidence for convergent and discriminant validity were reported (Beck et al., 1996).

Parenting Stress Index-short Form (PSI-SF; Abidin, 1995)

The Parenting Stress Index-Short Form (PSI-SF) is a self-report used to assess the parenting distress related to parental role and it consists of 36 items about parents' perceptions of the child's behavior and attitudes about parenting. Responses are rated on a 5-point Likert scale, ranging from strongly agree to strongly disagree and they are clustered into three subscales [parental distress (PD), parent–child dysfunctional interaction (P-CDI), and difficult child (DC)] composed of 12 questions each, plus one scale to control the defensive answers. The subscale Defensive Responding (DR) permits to evaluate the parent's attempt to answer, trying to minimize any problems, or stress related to the relationship with their child. The parents answer in a defensive manner to deny the fact that being a parent is difficult. On this scale scores of 10 or less could mean that the parent is trying to represent him/herself as very competent, or that the parent does not invest in the parental role. Specifically, the subscales of PD refers to distress related to parental role, such as impaired sense of parental competence, stress due to the restrictions on his/her life imposed by the parental role, marital conflicts, lack of social support, and depression symptoms. Regarding the subscale of P-CDI, this refers to parental perception of his child as a negative factor in his life, something that does not allow the onset of an appropriate parent–child relationship. Concerning the subscale of DC, this refers to some characteristics of the child's behavior, related to the temperament that makes him as an easy or DC to manage. Finally, the Total score in PSI-SF concerns the stress experienced when the mother or the father are parenting. Construct validity was appropriate and reliability scores (Cronbach's alpha) ranged from 0.88 to 0.93 on the fourth scales (Guarino et al., 2008).

Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988)

The Multidimensional Scale of Perceived Social Support (MSPSS) is a brief questionnaire that assess the perceived social support by 12 items on a 7-point Likert scale, rating the level of agreement/disagreement with respect to each statement. The items are designed to assess three dimensions of perceived social support and they refer to the figures of significant support. In particular, the three scales relate to family, friends, and to a significant other. The instrument showed good psychometric properties: the coefficient Cronbach's alpha for the total scale is between 0.87 and 0.93, while for the subscales ranges between 0.81 and 0.98; with regard to the stability over the time, test–re-test correlation for the total scale is 0.85 and for the subscales ranges from 0.72 to 0.85 (Zimet et al., 1988).

Results

Edinburg Postnatal Depression Scale

Before the beginning of the training, Barbara told us her past fears related to the failed attempts to get pregnant and the difficulties experienced in carrying on the gestation. Then, Barbara filled out the EPDS and she reported a score of 10 during the pre-intervention phase (**Table 1**). The cut-off of 8/9 suggests the presence of depressive symptoms risk (Benvenuti et al., 1999). She reached high scores on those items related to anxiety, fear, panic, and worries for no good reason. In detail, she reported to feel "*so unhappy to cry a few times*". A core feature of Barbara's answers was represented by the high score to the item indicating "*thoughts about harming herself*", which lead us to assume she was not just reporting baby blues symptoms or a low risk for PPD. In addition, her mood seemed to be closely related to the onset of a clinically relevant depressive syndrome. At the end of her participation at the IM classes, her EPDS' score was 0. The post-intervention indicated the absence of depressive risk, accompanied by an absence of panic or anxiety without good reason, as well as an absence of unhappiness and thoughts of self-harming. From a clinical perspective, she seemed to be more responsive and involved with her child. She seemed warmer and more focused on child's needs.

During our first meeting Luca appeared disinterested and "*a man of few words*". However, and similarly to his wife, Luca

TABLE 1 | Barbara's self report scores in the pre- and post-intervention.

Measures	Pre-intervention	Post-intervention
	Barbara	
EPDS	10	0
BDI-II	5	2
PSI-SF Total Stress	49	36
PSI-SF Parental Distress (PD)	22	12
PSI-SF Parent–Child Dysfunctional Interaction (P–CDI)	13	12
PSI-SF Difficult Child (DC)	14	12
PSI-SF Defensive Responding (DR)	12	7
MSPSS Total	5.08	4.75
MSPSS Family	5.5	4.25
MSPSS Friends	3.75	4.25
MSPSS Significant Other	7	6

TABLE 2 | Luca's self report score in the pre- and post-intervention.

Measures	Pre-intervention	Post-intervention
	Luca	
EPDS	10	2
BDI-II	1	2
PSI-SF Total Stress	44	42
PSI-SF PD	20	18
PSI-SF P-CDI	12	12
PSI-SF DC	12	12
PSI-SF DR	10	12
MSPSS Total	6.17	6.17
MSPSS Family	7	7
MSPSS Friends	5.5	5.75
MSPSS Significant Other	6.5	6

reported a score of 10 at T1 (**Table 2**), indicating the presence of depressive symptoms. He reported feelings of anxiety and panic, difficulties to sleep because of his mood, and a tendency to self-blame when things went wrong. After the training, his score dropped to 2, indicating an improvement of his mood, with a substantial decrease on the items described above, except for his tendency to self-blame.

Beck Depression Inventory-II

Barbara reached a score of 5 on the BDI at T1 (**Table 1**), while Luca reported a score of 1 (**Table 2**). Both scores fall in a range (0–13) indicating a lack of depressive contents which is contradictory compared to the EPDS findings. However, a few details should be taken into account with respect to their answers. Barbara answered 1 on question about "Pessimism", indicating a low but still present negative feeling about her own future, and also a score of 1 on "Loss of Energy". Same score on "Concentration difficulty", and a score of 2 on "Fatigue". Luca reported a score of 1 on "Changes in appetite", indicating more attention on his physical state, and an increased appetite with respect to the past. At T2, Barbara's overall score was 2, with her reporting less pessimism and tiredness, and more concentration; while Luca's overall score went from 1 to 2, associated to a greater sense of fatigue.

Parenting Stress Index-short Form

Barbara reported a PSI Total score of 49 (10° percentile) at the pre-intervention stage (**Table 1**), while Luca reported a score of 44 (10° percentile; **Table 2**). These scores highlighted how both parents described themselves as featured by a low perception of stress compared to those given by first time parents and represented by scores between the 15 and 80° percentile (Guarino et al., 2008). In details, Barbara's individual subscales showed a score of 22 on the PD, a score of 13 on the P-CDI, a score of 14 on the DC sub-scale, and a score of 12 on the DR sub-scale. These scores revealed how she seemed to be comfortable in her parental role, and able to handle parenting tasks. She seemed to experience a positive relationship with Marco, featured by the perception of an "easy baby", and by her tendency to avoid defensive responses.

At T1, Luca reported a score of 20 on the PD, a score of 12 on the P-CDI sub-scale, a score of 12 on the DC sub-scale, and a score of 10 on the DR sub-scale. These scores represent a feeling of comfort expressed by Luca, showing a sense of security in responding to the parenting tasks. However, he showed a greater tendency to respond in a defensive way compared to Barbara.

After the IM training, the scores of both parents showed a lower level of stress related to the parenting role, with Barbara reporting a total score of 36 and Luca a total score of 42. Considering the sub-scales, Barbara reported lower scores on each dimension, highlighting a lower attitude toward a defensive style, a lower PD, and a greater perception of her interaction with Marco. Given the self-report features, this result may be associated to the improvement in their parental skills, which in turn affect their perceived stress. Luca, instead, reported scores indicating his sense of comfort in the parental role and within the relationship with their child. His answers showed the lack of a defensive style and of the need to show the relationship with his child as positive.

Multidimensional Scale of Perceived Social Support

Barbara reported a score of 5,5 in the MSPSS's Family sub-scale, which refers to the perceived social support from family. She also reached a score of 3,75 on the Friends sub-scale, and a score of 7 on the Significant Other sub-scale. Her MSPSS' overall score is 5,08, (**Table 1**). These scores represent the perception of a greater social support received from both the family and the significant other compared to friends. Surprisingly, after the IM training, her scores decreased in each scale except for the Friends subscale, highlighting an overall lower perception of the perceived social support, while an increase on the social support experienced from friends.

Luca reported a scores of 7 on the Family sub-scale, a score of 5,5 on the Friends sub-scale, a score of 6,5 on the Significant Other sub-scale, with a Total score of 6,17 (**Table 2**). Luca described the family as the higher source of social support compared to other sources, and he also showed a greater perception of support provided by the environment.

Discussion

The current single case study aimed to explore the possible effects of the IM training on a couple at childbirth. The main purpose of the training is to improve parental skills in touching the baby, which in turn may help their overall interaction with the child. According to the existing literature (Guzzetta et al., 2009, 2011; Procianoy et al., 2010), the IM taught to the mother improves the baby's development promoting long-term benefits. Beyond this aim, our main goal was using IM as a way to promote the adjustment of parents after childbirth. In particular, our specific aim was to observe wheatear the IM training could promote positive changes with respect to the presence of depressive symptoms, to the perception of parenting stress, and to the perceived social support in both parents.

Regarding our first aim both partners showed a risk of depressive symptoms in the pre-intervention phase, as seen

through the EPDS' scores. These scores should be explained according to different perspectives. They can be the result of the hormonal changes occurring in the post-partum period, also known as the "maternity blues phase", and represented by rapid mood changes, and by the tendency toward depressive feelings. Barbara and Luca described their fear during pregnancy in losing the baby, and their concern for a preterm delivery, which probably affected their subsequent adjustment to the perinatal period. Their previous failed attempts of having a baby, and their difficulties in handling a healthy pregnancy should be indeed considered as risk factors for the post-partum phase (Blom et al., 2010). Interestingly, these difficulties have emerged in both partners, suggesting how events related to expecting a baby and the maternal state during pregnancy affect the emotional functioning of the father as well, beyond the hormonal changes of the woman. Several studies (Goodman, 2004, 2008; Paulson and Bazemore, 2010) corroborate the idea that the couple works as a unit, and this is especially true in this phase, during which they seem to share – among other aspects – depressive symptoms. Although these difficulties may represent an obstacle in seeking for help, they decided to begin the IM training. On one hand, this choice showed how the feelings they experienced were disturbing, but on the other hand it also showed their desire in taking care of the baby, which represents a protective factor during this life stage. Their reciprocal adjustment to the perinatal stage also showed some differences with respect to the depressive symptoms. Barbara's depressive symptoms emerged as a difficulty in regulating her emotional states, expressed by the tendency toward anxiety and depression. However, this features were associated to the ability to openly express her mood. Similarly, Luca showed a presence of depressive symptoms but with a greater tendency toward a defensive style (Figueiredo et al., 2007; Beebe et al., 2008). In addition to these results, BDI's scores partially confirmed the presence of a depressive risk. However, some considerations should be reported. BDI showed how this couple was experiencing an overall sense of loss of energy, especially for Barbara, while a lack of depressive symptoms was found for Luca, partially disconfirming the EPDS results. One hypothesis might be that the BDI is a strong and reliable measure to detect depression in adults, but not enough adequate to explore the emerging depressive symptoms during the post-partum period (Affonso et al., 2000; Eberhard-Gran et al., 2002; Teng et al., 2005; Yonkers et al., 2009). A sense of fatigue and loss of energies are common and *normal* aspects after childbirth, whereas they can be seen as risk factors in other life's stages. The interpretation of the BDI scores as specifically correlated to the couple's mental health can represent a potential bias for our conclusion, and they worth to be considered with caution. However, at the end of the training – and according to those studies reporting the outcomes of the IM classes on mothers (Onozawa et al., 2001; Glover et al., 2002; O'Higgins et al., 2008) – the couple EPDS' scores highlighted a drastic decrease, indicating the absence of depressive symptoms. These findings highlight how the IM training had an impact on the couple adjustment. However, given the length of the intervention and the lack of long term follow-up, the total absence of depressive symptoms should be seen as an index of positive change and not as a stable result.

Our second aim was related to the IM's impact on parental stress. PSI's results at T1 showed an overall sense of comfort for Barbara in being parent, accompanied by the pleasure to accomplish the parental tasks and by a general positive attitude within the relationship with the baby. After the IM training, Barbara showed an improvement in all these areas, reaching exceptionally positive scores related to a deep competence in her parental role. However, it should also pointed out that her score on the DR subscale might indicate the tendency toward the desire to show a positive attitude, instead of giving a reliable answer, as suggested by several authors (Paulhus, 2002; van de Mortel, 2008). Vice-versa, Luca showed a decreasing in the overall perception of his stress, as shown by the Total score, and the same was true for the stress related to the parental role. Differently, those areas concerning the baby – such as the stress related to the parent–child interaction and the perception of the child as difficult – did not changed. These findings seem to highlight how the IM may shape the personal sense of efficacy, which in turn affects the perception of stress. From this perspective, IM emerges as a tool, which may help the father in exploring the right way to be close and in touch with the baby. Thus, it is reasonable to observe an improvement on the perception of parental role and to a feeling of being competent. On the other side, the perception of the child as difficult vs. easy, or the distress in interacting with the baby, seemed to be related to the baby's temperament, and to the interactions with him, which is something more concrete and objective compared to the parental role (de Campora et al., 2014; Cavanna and de Campora, 2015).

Lastly, our third aim referred to the perceived social support and to its change due to the IM training. Findings related to the MSPSS scores showed a decrease in Barbara's perception and no changes in Luca's view, which is somewhat peculiar. Indeed, previous literature (Gao et al., 2009; Negron et al., 2013; Verreault et al., 2014) stressed how the low perception of social support is at the same time a risk factor for PPD by itself, and the strongest predictor for the risk of PPD. Given that, we expected to observe an improvement in both these variables, as a result of the IM training. Our data did not confirmed this hypothesis. However, it should be pointed out that MSPSS does not distinguish between emotional and instrumental support. This characteristic limits the assessment of the social support as related to the depressive symptoms, and it should taken into account for further studies.

Conclusion

The present study confirmed previous findings suggesting that the IM can be considered as a helpful intervention to decrease the symptoms of maternal PPD and to promote maternal ability to understand the baby's signals (Onozawa et al., 2001; Glover et al., 2002; O'Higgins et al., 2008). The interesting outcome is the possibility to observe this improvement not only in the mother, as expected, but also in the father. Both participants showed improvements, which can be due to a direct effect of the massage

on each parent in decreasing symptoms of depression, but also to an indirect effect of the maternal state on the emotional state of the father. Indeed, the decreasing risk of depressive symptoms in the mother may in turn affect the psychological state of the father. From this point of view, the IM training seems to work as a protective factor for the couple adjustment after childbirth. The improvement in parents' mental health positively affects their ability in reading and responding to the baby's signals, which in turn promote the child's ability to regulate his own internal states (Fonagy et al., 2004).

Lastly, we observed the impact of the IM on the stress related to the parental role and on the perceived social support, variables often associated with PPD (Horwitz et al., 2007; Gao et al., 2009; Manuel et al., 2012; Negron et al., 2013; Verreault et al., 2014). In this study, the parents seemed to benefits from the use of IM training in terms of a decrease of the stress related to the new parental role, such as the perception of their parental responsibility or the feeling of being parents in a less restrictive way. Otherwise, the perception of social support does not seem to take advantage from the IM training, showing the importance to further investigate this area through different kind of measures.

In the present study, there are several limitations. First, the use of a single case approach limits the generalizability of our results and conclusions; in addition, the exploratory nature of this study does not allow comparisons of our findings against previous data. Despite these limitations, the case study still occupies a central position within the psychology research field, as it appears well-suited for the observation of a phenomenon within its real-life context. Indeed, many researchers do believe that single case studies are appropriate for the exploratory stage of an investigation (Yin, 2009), and that in any case they can be confirmed or disconfirmed by following replication studies. Secondly, the procedure does not provide the opportunity to control wheatear the observed changes were due to the IM or to the process of the time. However, previous research (Field et al., 2004, 2010; O'Higgins et al., 2008) findings suggest the positive impact of the IM during the post-partum phase. Deepen empirical researches and control groups should be used for this purpose. Thirdly, the use of self-report is a limitation by itself. Indeed, the parental availability to participate in our study, and their desire to provide a positive image of themselves, also through the replies to the self-reports, may represent a significant *bias* to the reliability of these data, and it should be considered for further investigations on this topic. Lastly, we did not assess the impact of the IM on the baby's development. Additional measures and outcomes related to the baby should be taken into account and further considered.

With these limitations in mind, an important strength point should be highlighted. To date, no research observed the impact of the IM on both partners or on father only. According to a recent literature, and to significant social changes occurred in the caregiver roles, the investigation of the father role emerges as a central issue for the child's development (Cowan et al., 2009; Fletcher, 2009; Di Folco and Zavattini, 2014; Di Folco et al., 2015). Literature (Diego et al., 2008; Field et al., 2010; Ang et al., 2012; Moyer-Mileur et al., 2012; Ahmed et al., 2015) showed how the infant can take advantage from the massage provided by the mother, but more investigations are needed on the effects of the massage performed by the father, and to its impact on his relationship with the baby.

In sum, the results discussed in our study describe the importance to provide early interventions for those cases at risk to experience PPD. The IM training seems to be a valuable way to protect the couple by the establishment of post-partum difficulties, and to improve their parental skills. The IM training provides an opportunity for parents to communicate with their child not just verbally but also through the quality of touch, the movement, the rhythm, and the bodily sensations (Underdown et al., 2013).

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Influence of adult attachment insecurities on parenting self-esteem: the mediating role of dyadic adjustment

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Background: Parenting self-esteem includes two global components, parents' self-efficacy and satisfaction with their parental role, and has a crucial role in parent–child interactions. The purpose of this study was to develop an integrative model linking adult attachment insecurities, dyadic adjustment, and parenting self-esteem.

Methods: The study involved 118 pairs (236 subjects) of heterosexual parents of a firstborn child aged 0–6 years. They were administered the Experiences in Close Relationships-Revised (ECR-R) questionnaire, the Dyadic Adjustment Scale, and the Parenting Sense of Competence Scale.

Results: Path analysis was used to design and test a theoretical integrative model, achieving a good fit with the data. Findings showed that dyadic adjustment mediates the negative influence on parenting self-efficacy of both attachment anxiety and attachment avoidance. Parenting satisfaction is positively influenced by parenting self-efficacy and negatively affected by child's age. Attachment anxiety negatively influences parenting satisfaction.

Conclusion: Our findings are in line with the theoretical expectations and have promising implications for future research and intervention programs designed to improve parenting self-esteem.

Keywords: adult attachment, dyadic adjustment, parenting self-esteem, parenting self-efficacy, parenting satisfaction

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Introduction

It has been recognized in both developmental and clinical research that parents' cognitions and beliefs about parenting have a crucial role in parent–child interactions (Dix and Grusec, 1985; Johnston, 1996; Bugental and Johnston, 2000; Rubin and Chung, 2006), and relate to virtually every aspect of children's developmental accomplishments (Sigel and McGillicuddy-Delisi, 2002). Parents' cognitions and beliefs (i.e., their knowledge, values, attitudes, and goals) can have numerous functions (Bornstein, 2002), among which they may generate and shape parental behavior, and help to organize parenting activities (Murphey, 1992; Darling and Steinberg, 1993; Teti and Candelaria, 2002).

One form of parental cognition that has received increasing attention is parenting self-esteem, also known as parenting sense of competence. By definition, this concept encompasses two global,

closely related components (Johnston and Mash, 1989): parents' perceived self-efficacy in their parental role, and the satisfaction they derive from parenting (Sabatelli and Waldron, 1995; Coleman and Karraker, 1997; Bugental et al., 1998; Ohan et al., 2000; Jones and Prinz, 2005; Carpenter and Donohue, 2006; Nunes et al., 2014).

Self-efficacy is about people's belief in their ability to achieve their goals (Bandura, 1997), and in the context of parenting this means how confident people feel about their capacity to deal competently with difficult childrearing situations. It stems from parents' cognitions and self-perceptions about how skillfully they accomplish tasks related to parenting (de Montigny and Lacharité, 2005; Jones and Prinz, 2005; Farkas and Valdés, 2010), and positively influence their children, fostering the latter's adjustment and development (Ardelt and Eccles, 2001). In other words, parenting self-efficacy refers to an instrumental dimension of parenting, notably the degree to which parents feel competent, capable of solving problems, and familiar with the demands of parenting (Johnston and Mash, 1989). Parenting satisfaction indicates a more affective dimension, reflecting the degree to which parents feel frustrated, anxious, gratified and motivated in their parenting role (Johnston and Mash, 1989).

Efficacious parenting beliefs are often associated with greater competence in performing parenting tasks: parents who feel more competent exhibit a greater confidence in acquiring and exercising effective parenting skills, strategies, and types of behavior than parents who feel less competent (Jones and Prinz, 2005). Feeling competent as a parent influences the quality of maternal adaptation during the transition to parenthood (Ngai et al., 2007), the care that parents give to their newborn (Teti and Gelfand, 1991; Tucker et al., 1998; de Haan et al., 2009; Dumka et al., 2010). When parents feel competent, they are likely to use more effective parenting practices, developing more secure, warm, and involving interactions with their child (Coleman and Karraker, 1997; Shumow and Lomax, 2002; Jones and Prinz, 2005). Parents who feel effective have also proved better able to provide an adaptive, motivating and nurturing childrearing environment (Locke and Prinz, 2002). To be more specific, mothers who feel efficacious and competent in their role as parents are more responsive (Parks and Smeriglio, 1986; Schellenbach et al., 1992) and less punitive, and their developmental expectations are more appropriate (East and Felice, 1996). They are also more strongly motivated to engage in further interactions that, in turn, provide them with additional opportunities to interact positively with their infants (Teti et al., 1996). Research has demonstrated that parenting self-esteem is a protective factor in the mother-child relationship, mediating the negative effects of maternal depression and temperamental offspring (Teti and Gelfand, 1991; MacPhee et al., 1996; Gondoli and Silverberg, 1997). On the other hand, a scarce confidence in one's parenting skills is associated with frustration and irritation, and a less supportive behavior (Bugental et al., 1984; Sanders and Woolley, 2005; de Haan et al., 2009), which increases the risk of the offspring developing externalizing problems (Hill and Bush, 2001; Sanders and Woolley, 2005; Dishion and Patterson, 2006; Grusec and Hastings, 2007; Prinzie et al., 2010), and delinquent behavior in adolescent age (Bogenschneider et al., 1997).

In the light of the apparent importance of parenting self-esteem in parent–child relationships and children's well-being (Teti and Gelfand, 1991; Tucker et al., 1998; de Haan et al., 2009; Dumka et al., 2010), it is crucial to investigate and clarify which factors influence the development of its cognitive and emotional components, such as parenting self-efficacy and parenting satisfaction (Sevigny and Loutzenhiser, 2010).

A growing body of empirical research shows that adult attachment profoundly influences parents' behavior, emotions, and cognitions (Jones et al., 2015). From the standpoint of attachment theory, parenting behavior, cognitions, and emotions are conceptualized as serving the caregiving bio-behavioral system, and thought to be influenced and shaped by previous experiences with caregivers in earlier phases of development (Cassidy and Shaver, 1999; Mikulincer and Shaver, 2007). Caregiving is seen as a primary component of parenting behavior, but also as a key constituent of romantic and marital relationships, and of all forms of prosocial behavior (Mikulincer and Shaver, 2007). Secure working models of attachment are thought to promote and sustain effective caregiving and parenting self-esteem (Mikulincer and Shaver, 2007).

In the tradition of attachment theory, numerous studies have investigated the connections between parenting characteristics and adult attachment, using both interview-based attachment measures, such as the Adult Attachment Interview (AAI; George et al., 1984, 1985, 1996), and also – more recently and with growing interest – self-report questionnaires designed to assess attachment styles, dimensions, and orientations (Jones et al., 2015).

Only relatively few studies have addressed the influence of adult attachment styles on such components of parenting self-esteem as parenting self-efficacy and parenting satisfaction, yielding a complex and variable picture. Some early studies provided preliminary support for the association between adult attachment orientations and parenting self-efficacy (Coleman and Karraker, 1997). Caldwell et al. (2011) studied the relationships between forms of maltreatment, adult attachment dimensions (anxiety and avoidance), maternal depression, and parenting self-efficacy in a group of at-risk mothers: they found that attachment anxiety has an indirect effect on parenting self-efficacy, mediated by maternal depressive symptoms, whilst the direct link between attachment anxiety and parenting self-efficacy was not significant. Similarly, Kohlhoff and Barnett (2013) examined the role of adult attachment and depression as predictors of parenting self-efficacy in a sample of primiparous mothers during the first year after childbirth: their results showed that both attachment anxiety and attachment avoidance have a significant indirect effect on parenting self-efficacy and this link is mediated by the presence of maternal major depression. Only attachment anxiety had a significant but moderate, direct relationship with parenting self-efficacy, after taking the mediating effect of depression into account. Another study explored the connections between fathers' romantic attachment style, as coded by means of the Hazan and Shaver (1987) three-category measure of attachment, parenting beliefs and the offspring's attachment security (Howard, 2010): consistently with expectations, fathers who rated themselves as secure scored

higher for parenting efficacy and had a better knowledge of their child's development.

As for the other dimension of parenting self-esteem – parenting satisfaction – a recent review (Jones et al., 2015) examined the literature concerning the links between attachment styles and parenting satisfaction, generating a rather inconsistent picture. As expected, La Valley and Guerrero (2012) found that security was associated with more parenting satisfaction. Along the same lines, attachment avoidance correlated with less parenting satisfaction in four studies (Cohen and Finzi-Dottan, 2005; Rholes, 2006; Cohen et al., 2011; Vieira et al., 2012). One of these four studies only found this link for mothers (Cohen and Finzi-Dottan, 2005), however, and Vieira et al. (2012) only identified an indirect effect of attachment on parenting satisfaction, mediated by work-family conflict. Findings concerning attachment anxiety are less convincing: only Cohen et al. (2011) reported a negative relationship between anxiety and satisfaction (as expected); Rholes (2006) found no significant relationship between the two; Vieira et al. (2012) found both a positive direct effect of attachment anxiety on satisfaction and an indirect path linking anxiety with less parenting satisfaction via more severe work-family conflict; and (contrary to expectations) Lau and Peterson (2011) found no significant associations between attachment style and parenting satisfaction.

Taken together, these results provide some support for links between adult attachment styles and parenting self-efficacy, but these links are likely to be indirect and mediated by other relevant variables; and the picture concerning parenting satisfaction is unclear. More research is needed on these topics to further investigate the association between attachment styles and parenting self-esteem in the general normative (non-clinical) population. The issue is important, given that sociological theory on family stress and role strain point to stress levels as a moderating variable that significantly affects the links between marriage quality, parent–child relationship, and parenting (Erel and Burman, 1995). Indeed, six out of the eight above-mentioned studies examined parents dealing with stressful life circumstances, such as mothers on residential programs for early parenting difficulties (Kohlhoff and Barnett, 2013), at-risk mothers (Caldwell et al., 2011), war veteran fathers (some of them suffering from acute combat-induced stress reaction and post-traumatic stress disorder; Cohen et al., 2011), couples in the first year after divorce (Cohen and Finzi-Dottan, 2005), parents of children with Asperger syndrome (Lau and Peterson, 2011), or parents in the early months of their transition to parenthood (Rholes, 2006).

The extant literature has yet to investigate the mediating role of couple quality and dyadic adjustment in influencing parenting self-esteem, in families where both parents are present. A considerable amount of theoretical and experimental data suggests that the quality of the couple's relationship might be a salient mediator between adult attachment and parenting self-esteem. Empirical research has shown that adult attachment has a direct impact on couple quality and dyadic adjustment (Collins and Read, 1990; Carnelley et al., 1994, 1996; Collins, 1996; Frazier et al., 1996; Jones and Cunningham, 1996; Whisman and Allan, 1996; Cozzarelli et al., 2000; Frei and Shaver, 2002; Schmitt, 2002; Steiner-Pappalardo and Gurung, 2002; Shi, 2003; Kachadourian et al., 2004; Sumer and Cozzarelli, 2004; Williams and Riskind, 2004; Shaver et al., 2005), and that parental beliefs are strongly influenced by the quality of the relationship with the other parent (Belsky, 1984; Goldberg and Easterbrooks, 1984; Cox et al., 1989; Howes and Markman, 1989; Simons et al., 1992, 1993; Kerig et al., 1993; Erel and Burman, 1995; Cowan et al., 1996; Holloway et al., 2005; Schoppe-Sullivan et al., 2007; Suzuki, 2010). Moreover, Millings et al. (2012) found that attachment orientations have a significant indirect effect on parenting styles, mediated by responsive caregiving to partner.

In short, the literature highlights significant theoretical, conceptual and empirical links between adult attachment orientations, couple quality and parenting self-esteem. In particular, it is apparent that dyadic adjustment can mediate the influence of adult attachment on parenting self-efficacy. At the same time, there is contrasting evidence on the possible direct effect of attachment anxiety on parenting satisfaction, and this issue warrants further investigation.

The aim of the present cross-sectional research was therefore to extend our understanding of the effects of attachment on parenting self-esteem by developing an integrative model linking attachment insecurities (i.e., attachment anxiety and attachment avoidance) to parenting self-efficacy and parenting satisfaction, taking into account the possible role of dyadic adjustment with the partner as a mediator variable. Drawing from attachment theory and past empirical work, we consequently hypothesized a path analytical model of influences, postulating: (a) a direct effect of attachment orientations (attachment anxiety and attachment avoidance) on parenting self-efficacy and/or parenting satisfaction; and (b) a mediated influence of attachment orientations on parenting self-efficacy and parenting satisfaction, via dyadic adjustment. In particular, our hypotheses were that: (a) higher levels of attachment insecurity are directly associated with lower levels of parenting self-esteem; and (b) attachment insecurity negatively influences dyadic adjustment, which in turn reflects on parenting self-esteem. Finally, in accordance with Johnston and Mash (1989), we included in our model a path for the influence that links parenting self-efficacy with parenting satisfaction, hypothesizing that lower levels of parenting self-efficacy may result in less parenting satisfaction. The literature on parental cognitions has shown that beliefs concerning self-efficacy (specifically in the parenting domain) are a powerful variable explaining a significant portion of the variance observed in parenting skills and satisfaction (Coleman and Karraker, 1997). According to Bandura (1982), beliefs concerning their self-efficacy influence people's way of thinking and determine individuals' motivations and behavior. Parents with a strong sense of self-efficacy can be more at ease and effective in dealing with the everyday difficulties of being a parent, and this positively influences their satisfaction with their role. Vice versa, a weak sense of self-efficacy may negatively influence parenting practices, causing anxiety, depression, and stress, and reducing parenting satisfaction (Coleman and Karraker, 1997).

Our theoretical integrative model is outlined in **Figure 1**.

Some studies found significant gender-related differences in parenting self-esteem, suggesting that fathers tend to have higher levels of parenting satisfaction than mothers (Johnston and Mash, 1989; Rogers and Matthews, 2004; Gilmore and Cuskelly, 2009). Since mothers and fathers experience at least some parenting processes differently (Bretherton et al., 2005; Gamble et al., 2007; Gilmore and Cuskelly, 2009), we used a multiple group analysis without any specific *a priori* hypothesis to test the extent to which the proposed theoretical model is consistent across genders.

Materials and Methods

Participants and Procedure

The study group included 118 pairs (236 subjects) of heterosexual parents with a firstborn child aged 0–6 years. In most cases, the couples had only one child (87 couples, 73.7%), while 30 couples had two (25.4%), and one couple had three (0.8%). The firstborn children were a mean 2.58 years of age (SD = 22.27 months; range: 1–72 months); 52 (44.1%) of them were females, and 66 (55.9%) males.

All parents were Caucasian. The mean age of the mothers was 33.51 years (SD = 5.54; range: 19.10–47.16 years) and for the fathers it was 36.19 years (SD = 5.67; range: 24.54–51.15). The mean duration of the couples' relationships was 9.20 years (SD = 4.29; range: 2–22), and they had been living under the same roof for a mean 5.25 years (SD = 3.15; range: 0.5–22). The parents' formal education had lasted a mean 14.90 years (SD = 3.08) for the mothers, and 13.94 years (SD = 3.41) for the fathers.

The couples included in the study were enrolled using a chain sampling method. They were invited to participate in a study on the relationships between adult attachment, couple adjustment, and parenting self-esteem. The inclusion criteria were: (1) having a firstborn child aged 0 to 6; (2) being married to or living with the child's other parent. A psychologist administered all the questionnaires to both parents after informing participants about the aims of the study and asking them to give their written informed consent. The whole procedure took approximately 30 min. The study was approved by the Ethical Committee for the Psychological Research of the University of Padova.

Instruments and Measures

All participants independently completed the following self-report questionnaires to measure adult attachment, dyadic adjustment, and parenting self-esteem.

Adult Attachment

The Experiences in Close Relationships-Revised (ECR-R; Fraley et al., 2000b) questionnaire is a self-report measure of adult attachment. It consists of 36 items, scored on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The ECR-R assesses two dimensions of attachment (18 items for each scale): (a) attachment anxiety, which reflects variability in fear of abandonment and sensitivity to issues relating to rejection and loss (Fraley et al., 2000a); and (b) attachment avoidance, which reflects the degree of the individual's discomfort with intimacy, closeness, and dependence. Higher mean scores indicate greater degrees of anxiety and/or avoidance, and consequently lower levels of attachment security, which is therefore conceptualized as a low degree of attachment anxiety and/or avoidance. Individuals with low scores for both dimensions are willing and able to use their attachment figures as a safe haven during times of distress and danger, and as a secure base from which to explore their worlds. The scores for the two ECR-R dimensions were not used to assign participants to specific attachment categories (i.e., secure, fearful, dismissing, preoccupied) because it has been suggested that individual variation in attachment is modeled better using dimensions rather than categories (Fraley and Waller, 1998; Fraley and Spieker, 2003a,b; Roisman et al., 2007). The Italian version of the ECR-R has demonstrated good psychometric properties in terms of internal consistency, factorial and concurrent validity (Calvo, 2008; Busonera et al., 2014). In the present study, Cronbach's alpha reliability value was 0.82 for the attachment anxiety score, and 0.86 for the attachment avoidance score.

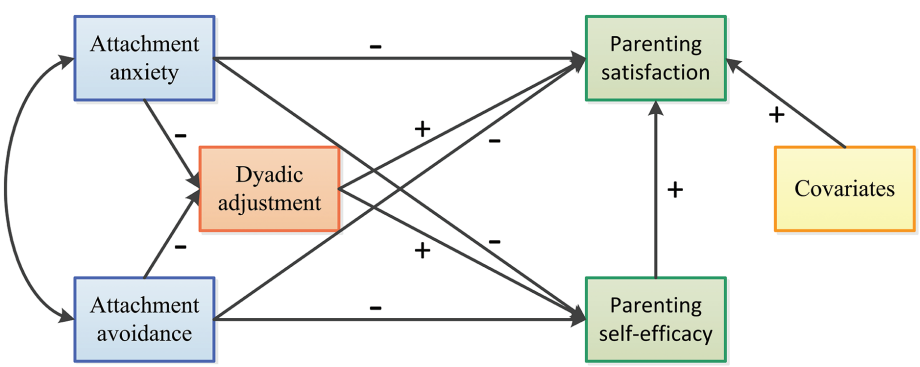

FIGURE 1 | Theoretical model linking adult attachment, dyadic adjustment, parenting self-esteem. Plus and minus signs indicate the hypothesized direction of the proposed paths.

Dyadic Adjustment

The Dyadic Adjustment Scale (DAS; Spanier, 1976) is a 32-item self-report questionnaire assessing marital dyadic adjustment, under four headings: dyadic consensus (13 items), dyadic satisfaction (10 items), dyadic cohesion (five items), and affective expression (four items). Dyadic consensus is the degree to which the couple agrees on matters of importance to the relationship, such as handling family finances or making major decisions. Dyadic cohesion is the degree of closeness and shared activities experienced by the couple. Dyadic satisfaction refers to the degree to which the partners are satisfied with their relationship. Affective expression concerns the demonstrations of affection and sexual relationships. For the purposes of the present study, we only used the DAS total score, computed as the sum of the four subscales, as a measure of overall dyadic adjustment. The Italian version of the DAS has demonstrated an adequate internal consistency and factorial structure (Gentili et al., 2002). In this study, Cronbach's alpha coefficients for the DAS total score, dyadic consensus, dyadic satisfaction, dyadic cohesion, and affective expression subscales were 0.89, 0.81, 0.81, 0.69, and 0.63, respectively.

Parenting Self-Esteem

The Parenting Sense of Competence Scale (PSOC; Gibaud-Wallston and Wandersman, 1978, cited in Johnston and Mash, 1989) includes 17 items rated on a six-point Likert scale ranging from 1 (strongly agree) to 6 (strongly disagree), and designed to measure two related but distinct dimensions of parenting self-esteem, i.e., satisfaction with parenting and self-efficacy in the parenting role. Parenting satisfaction is an affective dimension reflecting parenting motivation, frustration, and anxiety (Johnston and Mash, 1989); parenting self-efficacy is as an instrumental dimension involving competence, problem-solving ability, and capability in the parenting role (Ohan et al., 2000). The PSOC has shown an adequate reliability, factor structure, and validity (Ohan et al., 2000). In the present study, in accordance with the Johnston and Mash (1989) method, parents were asked to complete the PSOC while thinking only about one target child in the family (their firstborn). The internal consistency of this measure for our sample was 0.75 for parenting satisfaction and 0.70 for parenting self-efficacy.

Data Analysis

First, we examined descriptive statistics, gender-related differences in parenting self-efficacy and parenting satisfaction, and bivariate relationships between the measures. We had only two participants with one missing item in the DAS scale (in the DC subscale). In that case, we computed the mean for the non-missing responses. We had no missing data in the ECR-R and PSOC scales. Then we considered the pattern of relationships in our theoretical model using path analysis with the SPSS Amos software (Arbuckle, 2011). Path analysis enables direct and indirect dependence to be tested in a set of variables, providing estimates of the magnitude and significance of the causal connections hypothesized between variables. Path coefficients were estimated using the maximum likelihood method. Each parameter estimate was considered statistically significant if the t-test result was $p < 0.05$. At the beginning, we included in the model all direct paths from attachment anxiety and attachment avoidance to parenting self-efficacy and parenting satisfaction, as well as all paths from attachment to dyadic adjustment and from dyadic adjustment to parenting self-esteem. Then, as in the method used by Millings et al. (2012), the model was refined in a series of steps, in which a portion of the model was constrained and the reduction of the model fit verified. If a constraint did not decrease the model fit, then we accepted the simplified model and performed the next step. The following four indices were used to assess the goodness of fit of each model: (a) a chi-square statistic with $p > 0.05$ (i.e., statistically non-significant); (b) a goodness-of-fit index (GFI) above 0.95; (b) a comparative fit index (CFI) above 0.95; a root-mean-square error of approximation (RMSEA) smaller than 0.06. We then performed a bootstrap analysis (based on 2,000 replications) to calculate CIs for path coefficients for the model. Finally, we used a multiple group analysis with no *a priori* hypotheses to check whether the final model was consistent between genders.

Results

Effects of Parent's Gender and Demographic Data on Parenting Self-esteem

First, we used paired t-test comparisons on the PSOC scores of mothers and fathers belonging to the same family. Mothers rated their own parenting satisfaction significantly lower than fathers ($t[117] = 3.37$, $p = 0.001$), whereas there were no differences between the two on the parenting self-efficacy scale ($t[117] = 0.79$, *n.s.*).

To check the effects on PSOC scores of the child's gender and its interaction with the parent's gender, we conducted two analyses of variance, with parenting satisfaction and self-efficacy as dependent variables, and the child's and parent's gender as between-subjects factors. As expected, we found a significant effect of the parent's gender on parenting satisfaction ($F[1,232] = 8.11$, $p = 0.005$), while the child's gender ($F[1,232] = 0.001$, *n.s.*) and the interactions between factors were not significant. No significant effects or interactions were found for parenting self-efficacy.

Then, we separately analyzed the mothers' and fathers' ratings, calculating Pearson's bivariate correlations between the PSOC measures and the demographic data (the parent's age and years of formal education, duration of the couple's relationship, the child's age, and the number of children). Parenting satisfaction showed a significant negative correlation with the child's age, for both mothers ($r = -0.21$, $p = 0.028$) and fathers ($r = -0.19$, $p = 0.037$). Satisfaction also correlated negatively with the number of children in the family, but only for fathers ($r = -0.18$, $p = 0.047$). Satisfaction was not related with either parent's age or formal education, or the duration of their relationship.

Fathers' parenting self-efficacy correlated negatively with the parent's age ($r = -0.26$, $p = 0.005$), the child's age ($r = -0.24$, $p = 0.008$), and the number of children ($r = -0.23$, $p = 0.010$), but was unrelated with formal education or duration

of the couple's relationship. Mothers' parenting self-efficacy was independent of all these variables.

Correlations computed between mothers' and fathers' PSOC scores showed significant relations for parenting satisfaction ($r = 0.23$, $p = 0.011$), and parenting self-efficacy ($r = 0.20$, $p = 0.027$). The satisfaction and self-efficacy scores correlated significantly for both mothers ($r = 0.39$, $p < 0.001$), and fathers ($r = 0.54$, $p < 0.001$).

Before conducting the path analysis, we computed Pearson's bivariate correlations for adult attachment, dyadic adjustment, and parenting self-esteem (**Table 1**). As expected, this correlation analysis showed that the two dimensions of parenting self-esteem (satisfaction and self-efficacy) correlated negatively with the attachment measures in both parents, and positively with dyadic adjustment. Attachment anxiety was the predictor variable showing the strongest correlation with parenting satisfaction, and total score on the DAS with parenting self-efficacy. Lastly, we compared mothers' and fathers' scores of attachment dimensions and dyadic adjustment using independent samples *t*-test. Mothers scored significantly higher on attachment anxiety ($M = 2.69$, $SD = 0.93$) than fathers ($M = 2.45$, $SD = 0.73$); $t(234) = -2.19$, $p = 0.029$. There were no significant differences in the attachment avoidance ($t[234] = 1.42$, *n.s.*) and dyadic adjustment scores ($t[234] = -0.13$, *n.s.*) between mothers and fathers.

Path analysis

Initially, the overall model of parenting self-esteem shown in **Figure 1** (Model 1) was tested. Child's age was included in the model as covariate, because in the preliminary analyses it resulted significantly associated with parenting self-esteem in both mothers and fathers (parent's age and number of children were not included because they were both significantly correlated with child's age). Model 1 showed only a partial fit with the data: $\chi^2(4) = 9.97$, $p = 0.041$; GFI = 0.986; CFI = 0.984; RMSEA = 0.080 (90% CI [0.015, 0.143]). The path from child's age to parenting satisfaction was significant ($\beta = -0.17$, $p < 0.001$) and thus it was included in all the subsequent steps of the model refinement. Inspecting the direct paths from attachment to parenting self-esteem, the only significant direct effect was the negative path from attachment anxiety to parenting satisfaction ($\beta = -0.48$, $p < 0.001$).

Next, we verified the direct associations between attachment and parenting self-esteem by constraining all attachment paths to parenting self-esteem to zero (Model 2). This model fitted significantly worse than Model 1, $\Delta\chi^2(4) = 56.48$, $p < 0.001$, and did not meet good-fit criteria: $\chi^2(8) = 66.45$, $p < 0.001$, GFI = 0.922; CFI = 0.840; RMSEA = 0.176 (90% CI [0.139, 0.217]).

Therefore, we next fixed to zero all attachment paths to parenting self-esteem except that from attachment anxiety to parenting satisfaction (Model 3). This step did not decrease model fit compared with Model 1, $\Delta\chi^2(3) = 3.85$, $p > 0.05$, and Model 3 met satisfactory fit criteria: $\chi^2(7) = 13.83$, $p = 0.054$; GFI = 0.982; CFI = 0.981; RMSEA = 0.064 (90% CI [0.000, 0.114]). Examining the coefficients from dyadic adjustment and parenting self-esteem, it resulted that dyadic adjustment significantly predicted parenting self-efficacy ($\beta = 0.30$, $p < 0.001$) but not parenting satisfaction ($\beta = -0.03$, $p > 0.05$).

Consequently, in Model 4 we examined whether there were direct paths from dyadic adjustment to parenting self-efficacy and parenting satisfaction, by constraining both paths to zero. This model fitted significantly worse, $\Delta\chi^2(2) = 21.79$, $p < 0.001$, indicating that a meaningful effect of dyadic adjustment was present in the data.

Finally, we included in the model the direct path from dyadic adjustment to parenting self-efficacy, fixing to zero the path from dyadic adjustment and parenting satisfaction (Model 5). This model did not fit significantly worse than Model 3, $\Delta\chi^2(1) = 0.26$, $p > 0.05$, and model fit was good: $\chi^2(8) = 14.09$, $p = 0.079$; GFI = 0.982; CFI = 0.983; RMSEA = 0.057 (90% CI [0.000, 0.105]). Therefore, we considered Model 5 as our final model for interpretation (see **Figure 2**).

In the final model, higher levels of attachment anxiety were associated with lower levels of parenting satisfaction ($\beta = -0.46$, $p < 0.001$). Higher levels of attachment anxiety ($\beta = -0.33$, $p < 0.001$) and attachment avoidance ($\beta = -0.42$, $p < 0.001$) had a negative impact on dyadic adjustment. Dyadic adjustment positively influenced parenting self-efficacy ($\beta = 0.30$, $p < 0.001$) which, in turn, increased parenting satisfaction ($\beta = 0.31$, $p < 0.001$). Child's age was negatively correlated with parenting satisfaction ($\beta = -0.17$, $p < 0.001$).

The squared multiple correlations indicated that our model could account for 44% of the variance in dyadic adjustment, 9% in parenting self-efficacy, and 39% in parenting satisfaction.

The significance of the (indirect) mediating effects of dyadic adjustment and parenting self-efficacy in the final

TABLE 1 | Pearson's correlation, mean scores, and standard deviation for measures of adult attachment, dyadic adjustment, and parenting self-esteem.

Measure	1	2	3	4	5	*M* (fathers)	*SD* (fathers)
(1) Attachment anxiety (ECR-R)	–	0.48**	−0.50**	−0.63**	−0.26**	2.45	0.74
(2) Attachment avoidance (ECR-R)	0.65**	–	−0.54**	−0.40**	−0.26**	2.02	0.71
(3) Dyadic adjustment (DAS total score)	−0.62**	−0.66**	–	0.40**	0.26**	119.41	12.64
(4) Parenting satisfaction (PSOC)	−0.43**	−0.27**	0.29**	–	0.39**	44.48	5.17
(5) Parenting self-efficacy (PSOC)	−0.27**	−0.23*	0.32**	0.54**	–	30.71	4.34
M (mothers)	2.69	1.88	119.64	42.22	31.50		
SD (mothers)	0.93	0.72	14.27	6.48	4.81		

*Results for mothers (n = 118) are shown below the diagonal; results for fathers (n = 118) above the diagonal. *p < 0.05; **p < 0.01.*

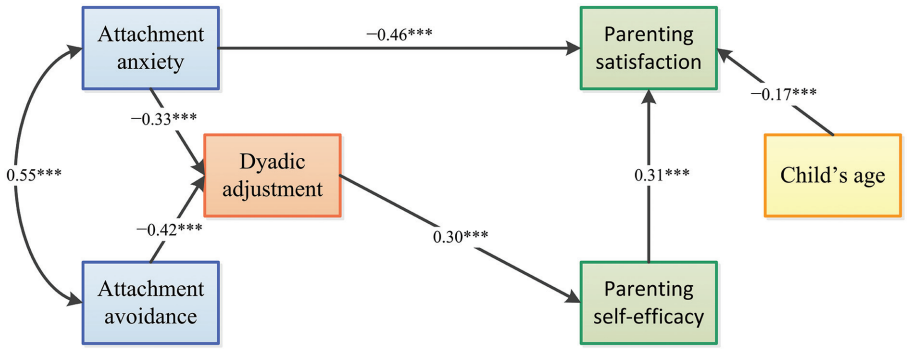

FIGURE 2 | Final path model of the effects of adult attachment and dyadic adjustment on parenting self-efficacy and parenting satisfaction. Path coefficients are standardized structural coefficients; ***$p < 0.001$.

model were tested using the bootstrap estimation procedure in AMOS (specifying a bootstrap sample of 2000). **Table 2** shows the indirect effects and their associated 95% confidence intervals. None of the estimated values of the indirect paths overlapped with zero, indicating that both attachment anxiety and attachment avoidance have a significant indirect effect on both measures of self-esteem, mediated by the effect of dyadic adjustment.

Finally, we ran a multi-group analysis to see whether the path coefficients differed significantly between mothers and fathers. We compared the first model (which allowed for the structural paths to vary across genders) with the second (which constrained the regression paths to remain the same for mothers and fathers) in order to identify any gender-related differences. The non-significant chi-square differences between the two models, $\Delta\chi^2(6) = 12.18$, $p > 0.05$, suggest that the final model did not differ by gender. In other words, multi-group analysis indicated that gender did not moderate the association between the variables in the combined final model.

Discussion

The purpose of this study was to examine the links between adult attachment insecurities, dyadic adjustment, and parenting self-esteem (i.e., parenting self-efficacy and parenting satisfaction) in a sample of non-clinical parents, and to develop and validate an integrative theoretical model of these connections.

Parenting self-efficacy and parenting satisfaction are crucial psychological components of parenting self-esteem that affect both the parent's personal well-being and the parent's relationship with his/her child. Adults who feel effective and satisfied as parents are more likely to be behave appropriately with their children, and to provide an adequate quality of care (Dix and Grusec, 1985; Johnston, 1996; Bugental and Johnston, 2000; Sigel and McGillicuddy-Delisi, 2002; Rubin and Chung, 2006). The importance of parents' beliefs concerning their parenting role has been seen in several phases of a family's life cycle, from the prenatal phase of the transition to parenthood (Palkovitz, 1992) to the offspring's adulthood (Schofield et al., 2014).

There is now convincing empirical evidence of parents' adult attachment influencing many facets of parenting and directly and indirectly affecting parents' behavior, emotions, and cognitions (Jones et al., 2015). So far, however, the relatively small number of studies on the influence of adult attachment styles – assessed by means of self-report measures focusing on aspects of parents' self-esteem such as parenting self-efficacy and parenting satisfaction – have yielded a complex and unclear picture. There is some evidence of adult attachment styles affecting parents' self-esteem, and their self-efficacy in particular, while findings concerning parenting satisfaction are less consistent and more difficult to interpret. Such preliminary findings are also difficult to extend to the general (non-clinical) population of families because they have often concerned parents at risk or facing challenging conditions or difficulties. It is also noteworthy that the extant literature fails to consider the plausible mediating role of dyadic adjustment in families where both parents are present.

TABLE 2 | Final model: standardized indirect effects and 95% confidence intervals based on 2000 bootstrap replications.

Model pathways	Estimated	95% CI
Attachment anxiety → Dyadic adjustment → Parenting self-efficacy	−0.10[a]	[−0.16, −0.05]
Attachment anxiety → Dyadic adjustment → Parenting self-efficacy → Parenting satisfaction	−0.03[a]	[−0.06, −0.01]
Attachment avoidance → Dyadic adjustment → Parenting self-efficacy	−0.12[a]	[−0.18, −0.08]
Attachment avoidance → Dyadic adjustment → Parenting self-efficacy → Parenting satisfaction	−0.04[a]	[−0.07, −0.02]
Dyadic adjustment → Parenting self-efficacy → Parenting satisfaction	0.09[a]	[0.05, 0.15]

[a]*Empirical 95% confidence intervals do not overlap with zero.*

Based on these premises, we analyzed the determinants of parenting self-efficacy and parenting satisfaction in a sample of non-clinical families belonging to the general normative population, with a firstborn child aged from 0 to 6 years. We developed an integrative model linking attachment insecurities to parenting self-efficacy and parenting satisfaction, taking the mediating influence of the couple's dyadic adjustment into account. To obtain a complete picture of the couples involved, we only considered families in which both parents – married or living together – participated in the study.

In the current study, fathers reported higher levels of parenting satisfaction than mothers, whereas there was no difference between the parents' self-efficacy scores. These results replicate the findings reported by several researchers who found that fathers were more satisfied with their parenting role than mothers (Johnston and Mash, 1989; Rogers and Matthews, 2004; Gilmore and Cuskelly, 2009). According to Johnston and Mash (1989), an explanation for this may lie in the greater emphasis that fathers put on playing activities in their parenting role (Lamb, 1976), in contrast with the more instrumental and demanding nature of the mother's parenting role.

Additionally, parenting satisfaction was negatively influenced by child's age, for both mothers and fathers, i.e., both parents were more satisfied as parents when their children were younger, and they became less satisfied as their child grew older. This effect had already been found in some previous studies (Mash and Johnston, 1983; Rogers and Matthews, 2004), but not in others (Johnston and Mash, 1989; Ohan et al., 2000; Gilmore and Cuskelly, 2009), so this issue needs to be further investigated.

We also found that fathers' parenting satisfaction correlated negatively with the number of children in the family, whereas – consistently with previous research (Johnston and Mash, 1989; Ohan et al., 2000; Rogers and Matthews, 2004; Gilmore and Cuskelly, 2009) – parenting satisfaction was found unaffected by any of the other variables considered, such as age, years of formal education, and duration of the couple's relationship, for mothers or fathers.

Lastly, when considering the influence of such potential covariate or moderator variables on parenting self-efficacy, our findings showed that fathers who were younger, or had fewer children, or their children were younger, tended to perceive themselves as more effective in managing parenting tasks than older fathers, with older children, or in families with a larger number of children. These outcomes are consistent with previous reports of the father's role being less well-articulated and defined by social convention than the mother's (Belsky et al., 1991), and less stable in the father's involvement over time (Coley and Chase-Lansdale, 1999). It has been reported that, as their children grow up, fathers significantly reduce their level of involvement in absolute terms (Yeung et al., 2001; Parke, 2002), and this lesser involvement may result in a diminished sense of parenting self-efficacy.

In the preliminary correlation analyses, we found that attachment anxiety and attachment avoidance correlated negatively with dyadic adjustment and parenting self-esteem in both mothers and fathers. On the other hand, dyadic adjustment correlated positively with parenting self-efficacy and parenting satisfaction in both genders. In other words, consistently with theoretical expectations, attachment insecurities were significant *negative* predictors of couple quality and parenting self-esteem, and dyadic adjustment was a significant *positive* predictor of parenting self-esteem.

Path analysis revealed a theoretical integrative model in which dyadic adjustment mediates the influence of attachment insecurities on parenting self-efficacy and, at the same time, attachment orientations directly affect parenting satisfaction, which in turn is negatively influenced by child's age. The multiple group comparison also showed that the pattern of relationships between the variables was the same for mothers and fathers, which goes to show that adult attachment and dyadic adjustment may be equally important for women and men in terms of their parenting self-esteem.

Based on our results, we can draw some conclusions consistent with previous studies on the influence of attachment orientations on couple quality and parenting.

First, as hypothesized in our model, higher levels of attachment insecurity (attachment anxiety and attachment avoidance) are associated with lower levels of dyadic adjustment in the couple's relationship. This association is consistent with reports of attachment insecurities negatively affecting dyadic adjustment and dyadic satisfaction: insecure attached people report lower levels of couple adjustment and satisfaction in almost every phase of the family life cycle, and in various parenting conditions (Collins and Read, 1990; Carnelley et al., 1994, 1996; Collins, 1996; Frazier et al., 1996; Jones and Cunningham, 1996; Whisman and Allan, 1996; Cozzarelli et al., 2000; Frei and Shaver, 2002; Schmitt, 2002; Steiner-Pappalardo and Gurung, 2002; Shi, 2003; Kachadourian et al., 2004; Sumer and Cozzarelli, 2004; Williams and Riskind, 2004; Shaver et al., 2005; Calvo et al., 2015).

The above finding may indicate that attachment security (i.e., low anxiety and low avoidance) is associated with a greater dyadic adjustment. In fact, the literature indicates that individuals more secure in their attachment generally show higher levels of satisfaction with their relationship and are better able to handle relationship stress without experiencing a loss of relationship quality (Amir et al., 1999; Rholes et al., 2001). More in general, this path confirms the important influence of adult attachment on many aspects of a couple's relationship (Mikulincer and Shaver, 2007). It has been well-established that secure individuals can facilitate the consolidation of a lasting positive relationship with their partners (Morgan and Shaver, 1999), whereas attachment insecurities are associated with less constructive attitudes and beliefs, and a dyadic behavior that may interfere with the construction of a couple's relationship as a secure base. As Mikulincer and Shaver (2007) showed in their review, people with insecure attachment styles report less intimacy (Knobloch et al., 2001; Treboux et al., 2004; Whiffen, 2005), lower levels of commitment (Tucker and Anders, 1999; Steiner-Pappalardo and Gurung, 2002; Treboux et al., 2004), and more difficulties with communication (Fitzpatrick et al., 1993; Feeney et al., 1994; Feeney, 1995, 1999), and with managing interpersonal conflict in their relationships (Feeney, 1994; Feeney et al., 1994; Roberts and Noller, 1998; Shi,

2003; Marchand, 2004; Marchand et al., 2004) than secure individuals.

Second, our model confirmed the hypothesis that parenting self-efficacy is affected directly by dyadic adjustment on the one hand, and indirectly by attachment dimensions on the other. As expected, parents' attachment insecurities impaired the quality of the couple's relationship, which in turn was associated with lower levels of parenting self-efficacy.

We postulated a causal connection between dyadic adjustment and parenting self-efficacy in accordance with the spillover hypothesis (Erel and Burman, 1995), because parenting self-efficacy is considered an instrumental dimension of parenting. The spillover hypothesis suggests that parents who have satisfying and supportive relationships as a couple will be more sensitive to the needs of their child (Easterbrooks and Emde, 1988), and experience less discord concerning discipline and fewer inconsistencies in their parenting (Erel and Burman, 1995). These aspects augment their personal instrumental feeling of being competent, capable of solving problems, and familiar with their parenting role (Johnston and Mash, 1989). On the other hand, according to the same spillover hypothesis, a couple's negative relationship may lead the parents to engage in stressful and dysfunctional interactions that leave them irritable and emotionally drained. They consequently become less efficacious as parents, less attentive and sensitive to their child's needs (Easterbrooks and Emde, 1988; Erel and Burman, 1995). Numerous studies have shown that a good relationship between the two parents – in terms of agreement, intimacy, warm interaction, and effective communication – can enhance parenting practices and have a significant positive impact on parenting self-efficacy (Belsky, 1984; Goldberg and Easterbrooks, 1984; Cox et al., 1989; Howes and Markman, 1989; Simons et al., 1992, 1993; Kerig et al., 1993; Erel and Burman, 1995; Cowan et al., 1996; Holloway et al., 2005; Schoppe-Sullivan et al., 2007; Suzuki, 2010), whereas parents' conflictual relationships with one another and hostile communication are negatively associated with optimal parenting behavior (Kerig et al., 1993).

As expected, parenting self-efficacy was positively associated with parenting satisfaction. Parents who have more positive perceptions of their efficacy as parents tend to experience higher levels of satisfaction with their parenting role. It has been shown that efficacious parents are likely to be more at ease and effective in dealing with parenting problems, and this reflects positively on the satisfaction they derive from being parents, whereas anxiety, stress and depression coincide with lower levels of self-efficacy and consequently less parenting satisfaction (Coleman and Karraker, 1997).

Taking these findings together, our model identified a significant indirect negative effect of attachment insecurities on parenting satisfaction, considering the mediating effect of both dyadic adjustment and parenting self-efficacy. Security of attachment is associated with higher levels of dyadic adjustment, which reinforces parenting self-efficacy, increasing parenting satisfaction as a result. It is noteworthy that this indirect path linking attachment, dyadic adjustment, parenting self-efficacy and parenting satisfaction applied to both parents. This finding is particularly relevant if we consider the repercussions that satisfaction with fatherhood and caregiving have on the father's involvement. Several studies have reported significant links between fathers' satisfaction with their relationship with their partners and their participation in childcare (Levy-Shiff and Israelashvili, 1988; Volling and Belsky, 1991; Coley and Chase-Lansdale, 1999), and there is evidence of the couple's support for each other being more crucial to fathers' than to mothers' adequate parenting (Parke, 2002). Our model suggests that adult attachment is indirectly involved in this pathway of influences and may therefore play a relevant part in fathers' involvement too. Further research is warranted to confirm this implication of our findings.

Lastly, the results emerging from our model suggest that attachment anxiety has a direct negative association with parenting satisfaction. These results are consistent with previous reports of attachment anxiety being more associated with poor affect regulation and emotional control, and distress, than in the case of secure and avoidant attachment (Cooper et al., 1998; Feeney, 1999).

According to adult attachment theory, internal working models are thought to influence not only how individuals organize their behavior but also how they perceive, attend to, and process information of emotional significance (Niedenthal et al., 2002; Feeney and Cassidy, 2003; Fraley et al., 2006). Individuals with anxious attachment have been described as characterized by a chronic activation of the attachment system and by a major use of hyperactivating strategies in attachment-related situations (Cassidy and Kobak, 1988; Main, 1990; Shaver and Mikulincer, 2002; Mikulincer et al., 2003; Collins et al., 2006; Mikulincer and Shaver, 2007). These strategies may have a negative impact on emotional information processing, amplifying the individual's distress, and ultimately affecting their self-image and satisfaction with themselves (Mikulincer and Shaver, 2007). Consistently with theoretical expectations, attachment anxiety levels have been found to correlate inversely with satisfaction, not only with relationships in a couple, but also with life generally (Kirchmann et al., 2013), and even with the outcome of nasal plastic surgery (Saragusty et al., 2011). This link may also reflect anxious individuals' persistent feeling that they are not getting enough out of their relationships and want more, even in relationships with their children. They may feel they are not as close as they would like to be to their children and this may reduce satisfaction.

Contrary to our hypothesis, we found no significant direct negative path from attachment avoidance to parenting self-esteem. However, our model revealed a significant indirect effect linking attachment avoidance to parenting satisfaction, mediated by dyadic adjustment and parenting self-efficacy. From a theoretical standpoint, avoidant attachment is characterized by different emotional regulation strategies from anxious attachment. In the former, such strategies are termed deactivating (Cassidy and Kobak, 1988; Shaver and Mikulincer, 2002), and include creating an emotional distance from others in response to discomfort with interpersonal dependence (Mikulincer et al., 2003), the use of compulsive self-reliance, the suppression of distressing cognitions and memories (Shaver and Mikulincer, 2002; Gross and John, 2003; Mikulincer and Shaver, 2007; Velotti et al., 2015), and the minimization of negative feedback from the

outside environment in order to maintain a positive self-image (Bartholomew, 1990; Bartholomew and Horowitz, 1991). As a result, the parenting self-esteem of avoidant individuals is less likely to suffer from negative self-perceptions deriving from a maladaptive emotional regulation.

To conclude, our findings are consistent with attachment theory and the related literature. They confirm the importance of using implicit dimensions of attachment, as well as global attachment classifications, to better understand an adult's psychological functioning (Salcuni, 2015), and better define their parenting profile (De Palo et al., 2014), particularly when considering such complex psychological traits as parenting self-esteem.

The present study has some limitations that need to be considered. First, our data was of a cross-sectional nature, and this hampered any effort to interpret the direct and mediating effects in a causal sense. Longitudinal investigations are needed to assess the processes underlying the associations in our model. Second, we only considered self-report questionnaires, which are vulnerable to same-source bias. Future directions of research should address this limit using different measures of parental self-esteem and integrating self-report assessments with qualitative analysis of in-depth interviews about parental cognitions and beliefs. Third, in this study we did not include any measure of parents' depression. In future work, it will be important to consider also this dimension, given the links between depression and parenting self-efficacy and satisfaction (Caldwell et al., 2011; Kohlhoff and Barnett, 2013). Finally, the current study included only parents of 0–6 years-old children. Further research should also examine parents of older children to investigate how parental self-esteem is influenced by attachment orientations and dyadic adjustment, in other child developmental stages, such as middle and late childhood or adolescence.

Despite these limitations, to the best of our knowledge, this is the first study to examine the connections among adult attachment insecurities, dyadic adjustment, and parenting self-esteem in a normative sample of parents, and to develop an integrative model of these links taking the mediating role of dyadic adjustment with the partner into account. Our sample was relatively large and our findings may be relevant to preventive, empowering, and clinical interventions. In fact, we identified dyadic adjustment as a potential "malleable mediator" (Fraser and Galinsky, 2010), a factor on which action may be taken in an effort to mitigate the negative influence of attachment insecurities on parenting self-esteem. This finding could have crucial practical implications because professionals could enhance parenting self-efficacy more effectively by intervening on couple quality. According to Jones and Prinz (2005), parenting self-efficacy should be considered one of the targets for prevention programs to improve the well-being of parents and children.

Author Contributions

Design and conceptualization of the study: VC. Statistical analysis and interpretation of the data: VC. Drafting and revising the manuscript: VC, FB. Final approval of the version to be published: VC, FB. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: VC, FB.

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Antecedents of maternal parenting stress: the role of attachment style, prenatal attachment, and dyadic adjustment in first-time mothers

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The transition to parenthood is widely considered a period of increased vulnerability often accompanied by stress. Abidin conceived parenting stress as referring to specific difficulties in adjusting to the parenting role. Most studies of psychological distress arising from the demands of parenting have investigated the impact of stress on the development of dysfunctional parent–child relationships and on adult and child psychopathology. Studies have largely focused on mothers' postnatal experience; less attention has been devoted to maternal prenatal characteristics associated with subsequent parental stress and studies of maternal prenatal predictors are few. Furthermore, no studies have examined that association exclusively with samples of first-time mothers. With an observational prospective study design with two time periods, the aim of this study was to investigate the role of mothers' attachment style, maternal prenatal attachment to the fetus and dyadic adjustment during pregnancy (7th months of gestation) and their potential unique contribution to parenting stress 3 months after childbirth in a sample of nulliparous women. Results showed significant correlations between antenatal measures. Maternal attachment style (especially relationship anxiety) was negatively correlated with prenatal attachment and with dyadic adjustment; positive correlations resulted between prenatal attachment and dyadic adjustment. Each of the investigated variables was also good predictor of parenting stress 3 months after childbirth. Findings suggested how these dimensions could be considered as risk factors in the transition to motherhood and in the very beginning of the emergence of the caregiving system, especially with first-time mothers.

Keywords: parenting stress, prenatal attachment, first-time mothers, risk factors, dyadic adjustment

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Introduction

Pregnancy, childbirth and the transition to motherhood involve complex cognitive, affective, and behavioral changes that require restructuring goals, behaviors, and responsibilities to achieve a new conception of self (Mercer, 2004). In addition to experiencing body changes, new mothers undergo the process of attaining their maternal identity (Hung et al., 2011a). The transition to parenthood is widely considered a period of increased vulnerability that is often accompanied by stress (Morse et al., 2000). A mismatch between parents' perception of the available resources for meeting the demands of parenthood and the perceived demands of the parenting role can cause parental stress (Deater-Deckard et al., 1998).

In particular, Abidin (1995) conceived parenting stress as referring to specific difficulties in adjusting to the parenting role, reflecting parents' conscious perceptions of their child, their relationship with their child and themselves as parents. Parenting stress, as assessed by the Parenting Stress Index (PSI; Abidin, 1986), one of the most widely used instruments, is considered a factor that influences parenting behavior and a determinant of dysfunctional parenting (Belsky, 1984; Abidin, 1992; Rodgers, 1993).

Most studies of psychological distress arising from the demands of parenting have investigated the impact of stress on the development of dysfunctional parent–child relationships and on adult and child psychopathology (Deater-Deckard et al., 1998). Studies have largely focused on mothers' postnatal experience (i.e., Ostberg and Hagekull, 2000; Gray et al., 2012); less attention has been devoted to maternal prenatal characteristics associated with the subsequent onset of parental stress.

Studies of maternal prenatal predictors of postpartum parenting stress levels are few. The majority of studies investigate ante-partum depression and anxiety and postnatal parenting stress. Leigh and Milgrom (2008) in a study aiming to identify risk factors predictive of prenatal depression, postnatal depression, and parenting stress, found that prenatal anxiety, prenatal low self esteem and prenatal depression were related to postnatal parenting stress, although the strongest predictor of parenting stress was postnatal depression. Misri et al. (2010), in a study with pregnant women prospectively monitored for depression and anxiety during the third trimester and 3 and 6 months postpartum, found that prenatal depression and anxiety directly impact postnatal maternal parenting stress. In a recent longitudinal birth cohort study following sub-Saharan African women from the third trimester in pregnancy to 2 years postnatal and adjusting for confounders, Guo et al. (2014) found that prenatal depression was associated with parenting stress, while prenatal anxiety was not. Another study focused on the role of a woman's own parenting history in postnatal parenting stress. Specifically, Grant et al. (2012) examined the associations between perceived parental care and control in childhood assessed during the third trimester of pregnancy and maternal parenting stress at 7 months postpartum. A significant association was found between the maternal perception of parenting as characterized by low care or/and high control and postnatal parenting stress.

Researchers have emphasized the need to examine the relationships among the predictors of parenting stress to develop more comprehensive theoretical models (Abidin, 1992; Ostberg and Hagekull, 2000). Furthermore, no studies have examined the association between postnatal PSI and maternal prenatal characteristics exclusively with samples of first-time mothers. The relevance of studies conducted with nulliparous women arises from research showing that first-time mothers have more difficulties coping with life changes than pluriparous women do (Pridham and Chang, 1989; Cronin and McCarthy, 2003). The transition from the known reality to a new reality that characterizes the experience of the transition to motherhood in nulliparous mothers brings profound changes affecting the reorganization of the self and of the infant's representations together with transformations in the relationship with one's partner (Mac Beth-Williams et al., 1987; Lis et al., 2004; Mercer, 2004; Deave et al., 2008).

The mother's own attachment pattern is considered a powerful predictor of future parenting. The attachment pattern reflects early experiences of handling distress. A secure attachment pattern has been associated with the ability to cope with distress and to adjust to the tasks of parenthood (Alexander et al., 2001; Feeney, 2003; Jones et al., 2015; Pazzagli et al., 2015). Lionetti et al. (2015) found that in the postnatal period attachment state of mind, along with the current experience between partners, contributed to their adjustment to the task of parenting in terms of parenting stress.

Having a baby is a powerful experience that, according to attachment theory, should activate the attachment system and the related behavioral systems, such as caregiving behavior (Bowlby, 1988). The transition to motherhood requires a new organization of mental life that is adapted to the reality of caring for an infant (Stern, 1998). The development of a tie between the mother and her fetus has been conceptualized and assessed as antenatal attachment. Specifically, Condon (1993) conceived the term "parent-to-infant attachment", to refer to the emotional bond or tie of affection experienced by the parent toward the infant (Condon and Corkindale, 1998). So, a key component of the construct seems to be the protection for the fetus, expressed by maternal disposition toward the fetus of knowing, being with, protecting, gratifying needs, and avoiding loss (Condon, 1993; Walsh et al., 2014). Recent contributions have proposed that this bond, which involves attending to needs and providing protection, is indicative not of the attachment system but of the caregiving system (George and Solomon, 1999; Brandon et al., 2009; Walsh et al., 2014). During pregnancy, antenatal attachment to the fetus is associated with several maternal characteristics, such as attachment style and the quality of the relationship with one's partner (Condon and Corkindale, 1997; Bloom, 1998; Mikulincer and Florian, 1999; White et al., 1999; Barone et al., 2014; Walsh et al., 2014). In the postpartum period, studies have found associations between antenatal attachment and familial and parental functioning, such as the quality of mother–infant interaction and child attachment (Siddiqui and Hagglof, 2000; Cannella, 2005; Alhusen, 2008; Crawford and Benoit, 2009).

The transition to parenthood also requires adaptive changes in the couple's relationship (Hazan and Shaver, 1994). As observed by Durkin et al. (2001), if prospective parents feel emotionally distant from and unsupported by their partners, then their adjustment to parenthood is likely to be negatively affected. Studies show that family functioning contributes to parenting satisfaction and perceptions of negative marital quality is associated with higher degrees of parenting stress (Horowitz and Damato, 1999; Ostberg and Hagekull, 2000; Salonen et al., 2010). In particular, in a longitudinal study with a sample of first-time parents, Morse et al. (2000) found that poor relationship functioning at mid-pregnancy predicted vulnerability to postnatal distress. The quality of dyadic

adjustment during the transition to parenthood has also been associated with attachment patterns (Paley et al., 2005; Velotti et al., 2011; Parker et al., 2013).

On the basis of the paucity of studies on maternal prenatal predictors of postnatal parenting stress and the lack of research conducted exclusively with first-time mothers, the aims of the present study were:

(1) to investigate the role of certain psychological aspects of maternal functioning during the transition to motherhood in a sample of first-time mothers;
(2) to assess their unique role in maternal postnatal adjustment at the very beginning of the relationship with the newborn.

Specifically, using an observational prospective study with two time periods (pre – and postnatal), this paper explored the following in a group of nulliparous women:

(1) the associations between maternal attachment style, maternal antenatal attachment to the fetus (MAAS) and dyadic adjustment in the prenatal period;
(2) how maternal parenting stress, as assessed 3 months after delivery, can be predicted by each of the prenatal variables investigated.

On the basis of the reported studies, a relationship among the mother's attachment pattern, the emotional bond with the fetus and the quality of the relationship with the partner was expected. Furthermore, a prediction of each of these prenatal variables of the onset of postnatal maternal parenting stress was hypothesized.

Materials and Methods

Procedure and Participants

An observational prospective study focused on the investigation of certain psychological factors contributing to the construction of the caregiving system in nulliparous women and their power in predicting parenting stress with two time periods, before the child's birth, – at the 7th months of gestation (32nd weeks) – and 3 months after the child's birth was used.

The study was approved by the University of Perugia Ethics Committee and was conducted in accordance with the Helsinki Declaration.

Participants were enrolled at the Operative Unit of Obstetrics and Gynecology (OUOG) of a hospital in central Italy. The choice of the hospital resulted from the availability of the unit staff to participate in the study. Pregnant women in this unit received antenatal care from obstetricians. During childbirth classes, obstetricians invited pregnant women to participate in the study, providing a preliminary information session on the aims and two-step methodology of the research. The obstetricians received preliminary training by a study researcher to make them feel confident in responding to any women's questions about the study and its procedures.

For the enrollment, because of the use of questionnaires, the inclusion criteria required the women to be able to read and understand Italian; furthermore, because of the specificity of the questionnaire regarding the couple relationship, the women needed to have a romantic partner and to be in the 32nd weeks of gestation (plus or minus 1 week). This point of pregnancy was chosen because of the evidence of increased expectations regarding the unborn child during this phase of pregnancy as well as because of the increase of fetal movements (Lis et al., 2004).

After this presentation, the women were given a packet that included the consent form to participate to the first phase of the study and a consent form to be contacted for the second phase. At approximately the 32nd weeks of gestation, the women who had given written informed consent completed the prenatal measures (including a questionnaire on socio-demographic information) at the hospital before the beginning of a childbirth class. The time needed to complete the questionnaires in the first phase was approximately 50 min. Approximately 3 months after their children's birth, the women who had given consent to participate in the second phase of the study, were invited by phone to return to the hospital to complete the postnatal questionnaire. The time needed for this second phase was approximately 20 min.

A total of 130 packets were distributed; 95 (73%) women agreed to participate in both phases of the study; 5 (5%) questionnaires were not fully complete at the first step and were then excluded; and of the 90 (95%) women who agreed to participate, 20 (22%) refused to participate in the second phase when contacted because they could not reach the hospital. Only women who had completed both the first and second phase measures were included in the data analysis.

Sample

The total sample consisted of 70 women recruited at the OUOG of a hospital in central Italy. All the women were nulliparous and were in the 32nd weeks of gestation (plus or minus 1 week). The mean age of the women was 32.75 ($SD = 4.84$); they belonged to a medium socio-economic status (SES) level (Mean = 36.67; $SD = 12.26$). Other socio-demographic information are reported in **Table 1**.

Measures

Prenatal Measures

Socio-Demographic Questionnaire

This series of questions included the participants' age, level of education, employment status, family structure and the duration of the marital/conjugal relationship. Familial SES was calculated using the Hollingshead Index of Social Position (Hollingshead, unpublished manuscript).

Attachment Style Questionnaire (ASQ; Feeney et al., 1994)

The ASQ is a 40-item Likert-type self-report questionnaire designed to measure five dimensions of adult attachment that are central to Hazan and Shaver's (1987) and Bartholomew's (1990) conceptualizations of attachment: Confidence in Self and Others (eight items), Discomfort with Closeness (10 items), the Need

for Approval (seven items), Preoccupation with Relationships (eight items), and Relationships as Secondary (sevan items). Each item is rated on a 6-point scale ranging from 1 ("totally disagree") to 6 ("totally agree"). The ASQ has shown adequate reliability (Feeney et al., 1994; Fossati et al., 2003), with Cronbach's alpha coefficients for the five scales ranging from 0.81 to 0.87. According to previous studies (Alexander et al., 2001; Feeney, 2003), two major factors were computed for these scales.

Discomfort with Closeness and Relationship Anxiety

The former (16 items) measures the tendency to be uneasy with intimacy and dependency in relationships; the latter (15 items) measures concerns about the attachment other's feelings of love and fears of being rejected. In the present study, the Italian version of this measure was used (Fossati et al., 2007), with internal consistency in terms of Cronbach's alpha coefficients of 0.80 and 0.85 for the two major factors.

Maternal Antenatal Attachment Scale (MAAS; Condon, 1993)

Developed to measure the emotional bond between a pregnant woman and her unborn child, the MAAS consists of 19 items focused on the past 2 weeks rated on a 5-point scale. Two scales Attachment Quality (AQ) and Attachment Intensity (AI) are combined to obtain a total score. The two scales, respectively, measure the quality of the emotional bond AQ and the time spent in attachment mode (the intensity of preoccupation). The internal consistency of the instrument is acceptable (Condon, 1993). In the present study, the Italian version of the MAAS was used (Righetti et al., 2005), with an internal consistency in terms of Cronbach's alpha of 0.81 for the total score, of 0.80 for AQ scale, and of 0.82 for AI scale.

Dyadic Adjustment Scale (DAS; Spanier, 1976)

Developed to measure conjugal adjustment, the DAS can be used with married or unmarried couples engaged in a dyadic romantic relationship. Consisting of 32 items, the scale has a range of scores from 0 to 151. Lower scores indicate distress and divergence in the dyadic relationship. The DAS has shown adequate psychometric properties and good internal consistency ($\alpha = 0.95$; Carey et al., 1993). In the present study, the Italian validated version of the DAS was used (Gentili et al., 2002). The internal consistency coefficient in terms of Cronbach's alpha for the total score was 0.85.

Postnatal Measure

Parenting Stress Index: (PSI-SF; Abidin, 1986)

This self-report scale was developed to measure stress associated with the parenting role and is used as a screening instrument for dysfunctional parenting. It consists of 36 items rated on a 5-point scale indicating the degree to which each item has been a problem for the parent during the past week. The composite total score range is between 36 and 158, where lower scores indicate lower overall levels of parenting stress. The PSI-SF has shown good overall psychometric properties (Abidin, 1986). The internal consistency reliability for the composite total score was reported by the author to be 0.91. The Italian validated version of the PSI-SF (Guarino et al., 2008) was used in this study. The internal consistency coefficient for the present sample was 0.89 for the total score.

Data Analysis

Standard descriptive statistics in the form of means and standard deviations or frequencies and percentages were used to summarize the sample's socio-demographic characteristics and used in the measures assessed. A series of one-sample Kolmogorov–Smirnov tests (Z), were conducted and showed that the measures were distributed normally. Pearson's correlation analyses were conducted on the prenatal measures to examine the associations between maternal attachment style, MAAS and dyadic adjustment. *p*-values of 0.05 or less were first identified as statistically significant; Bonferroni's correction was applied, with critical alpha value set to 0.001 (0.005/25 correlations). The effect size of the correlation was classified according to Cohen (1992): low effect size $\leq$0.30; medium effect size = 0.31–0.50; and large effect size $\geq$0.50. To measure the single contribution of each of the prenatal measures to the prediction of postnatal parenting stress, a regression analysis was conducted. Because of the paucity of the studies on maternal prenatal characteristics associated with the subsequent parental stress, the regression analysis was conducted separately for each of the variable investigated, in order to test the existence of each variable's unique effect, as a first investigation of their specific contribution. In the first and the second model two Multivariable Linear Regressions were performed separately in order to test the effect of the two factors of maternal attachment (Discomfort with Closeness and Relationship Anxiety) and of the maternal antenatal attachment AQ and AI. A Univariate Regression was also performed for testing the effect of conjugal adjustment. The data were analyzed using SPSS version 21.0.

Results

Descriptive statistics for the sample socio-demographic characteristics are reported in **Table 1**.

Means (*M*) and standard deviations of the pre-natal and post-natal measures are reported in **Table 2**.

TABLE 1 | Descriptive statistics for the socio-demographic characteristics.

	M	*SD*
Socio-demographic variables		
Age	32.75	4.84
SES	36.67	12.26
Time length of the couple relationship (years)	3.15	1.48
Family situation	***N***	**%**
Married and cohabiting	45	64.3
Unmarried and cohabiting	25	35.7

TABLE 2 | Descriptive statistics for the antenatal and postnatal measures.

Pre-natal measures	*M*	*SD*	Range	Z	*p*
ASQ – DC	48.89	8.41	28–68	0.134	0.200
ASQ – RA	41.67	9.03	17–61	0.147	0.200
MAAS – TOT	78.74	4.62	66–88	0.198	0.117
MAAS – AQ	46.78	2.28	39–50	0.305	0.112
MAAS – AI	30.28	3.46	23–37	0.305	0.200
DAS TOT	121.84	11.59	75–146	0.186	0.321
Post-natal measure					
PSI-SF, TOT	60.48	14.54	36–101	0.169	0.212

ASQ – DC, Attachment Style Questionnaire, Discomfort with Closeness; ASQ – RA, Attachment Style Questionnaire, Relationship Anxiety; MAAS – TOT, Maternal Antenatal Attachment, Total Score; MAAS – AQ, Maternal Antenatal Attachment, Attachment Quality; MAAS – AI, Maternal Antenatal Attachment, Attachment Intensity; DAS TOT, Dyadic Adjustment Scale Total Score; PSI – SF, TOT, Parenting Stress Index – Short Form, Total Score.

Regarding MAAS, data were compared with a previous study conducted with women at 19–23 weeks of gestation in terms of confidence interval. Previous data revealed a slightly lower mean total score ($M = 75.7$, $SD = 8.15$), 95% CI (73.29, 78.11) than that obtained for this sample (Righetti et al., 2005). This was perhaps due to the specific time of measure in the present study: the last trimester of pregnancy is a time that is particularly rich in emotions and fantasies because of the increase in fetal movements (Ammaniti et al., 1992; Lis et al., 2004). The dyadic adjustment score for this group had a mean value of 121.84 ($SD = 11.59$). The data were consistent with previous Italian data on nulliparous women (Pazzagli et al., 2015). With regard to postnatal parenting stress, the mothers in the sample showed a mean value of 60.48 ($SD = 14.54$). Compared with the normative data for the age subgroup (1 month/2 years and 11 months) extracted from the total sample of the Italian validated version of the scale, the mean score for the present sample showed a lower value than the normative Italian sample ($M = 69.27$, $SD = 16.91$); 95% CI (68.13, 70.42; Guarino et al., 2008).

Prenatal Measures

The correlation analysis revealed the existence of significant associations between the antenatal measures after Bonferroni's correction was applied (**Table 3**). According with Cohen's criteria (Cohen, 1992), the effect sizes for the significantly correlated measures were generally moderate to large. The correlations between mothers' attachment style (ASQ) and MAAS revealed the existence of a significant small negative association of Relationship Anxiety with the MAAS – AQ score ($r = -0.361$, $p = 0.001$). Relationship Anxiety was also negatively correlated with dyadic adjustment (DAS TOT; $r = -0.485$, $p < 0.001$). The total score for dyadic adjustment (DAS TOT) was strongly and positively correlated with MAAS – TOT ($r = 0.447$, $p < 0.001$) and with AQ ($r = 0.528$, $p < 0.001$). The smaller low correlation for the AI subscale ($r = 0.256$, $p = 0.033$) was not significant after Bonferroni's correction.

TABLE 3 | Correlations between antenatal measures.

	MAAS – TOT	MAAS – AQ	MAAS – AI	DAS TOT
ASQ – DC	−0.189	−0.197	−0.127	−0.350*
ASQ – RA	−0.256	−0.361*	−0.104	−0.485*
MAAS – TOT	–	0.760*	0.900*	0.447*
MAAS – AQ		–	0.425*	0.528*
MAAS – AI			–	0.256

*ASQ – DC, Attachment Style Questionnaire, Discomfort with Closeness; ASQ – RA, Attachment Style Questionnaire, Relationship Anxiety; MAAS – TOT, Maternal Antenatal Attachment, Total Score; MAAS – AQ, Maternal Antenatal Attachment, AQ; MAAS – AI, Maternal Antenatal Attachment, Attachment Intensity; DAS TOT, Dyadic Adjustment Scale Total Score. *$p < 0.001$ [Bonferroni correction (0.05/25 correlations; N = 70].*

Prediction of Postnatal Stress

Results of the regression analysis showed that mother's attachment style explained 38.1% of the variance ($R^2 = 0.381$, $F(2, 68) = 3.699$, $p = 0.047$). In detail, Relationship Anxiety ($\beta = 0.516$, $SE = 0.496$, $t = 2.271$, $p = 0.041$) significantly predicted postnatal parenting stress, whereas Discomfort with Closeness ($\beta = 0.345$, $SE = 0.351$, $t = 1.519$, $p = 0.155$) did not.

Maternal antenatal attachment accounted for 44.5% of the variance in parenting stress ($R^2 = 0.445$), which was significant [$F(2, 68) = 4.807$, $p = 0.029$]. AQ ($\beta = -0.737$, SE = 1.898, $t = -3.094$, $p = 0.009$) emerged as a significant predictor for postnatal parenting stress, while AI ($\beta = 0.274$, $SE = 1.142$, $t = 1.149$, $p = 0.879$) was not.

Total dyadic adjustment was a significant negative predictor of postnatal maternal parenting stress ($\beta = -0.435$, SE = 0.123, $t = -4.402$, $p < 0.001$) accounting for 18.9% of variance in maternal parenting distress [$F(1,69) = 19.380$, $p < 0.001$]. Results are reported in **Table 4**.

Discussion

This study contributes to the research on parenting in first-time mothers by investigating the relationships between some psychological aspects of maternal functioning in late pregnancy and their potential contribution to predict parenting stress during the early period of the mother–child relationship, after childbirth. Because, as noted previously, few empirical papers have addressed this issue, the present paper provides a contribution to the field of research devoted to identifying the contribution of prenatal variables to the onset of postnatal maternal parenting stress. Furthermore, this paper, which focuses on a sample of nulliparous women, contributes new data to a field of research that currently lacks information on this population.

Specifically pertaining to the first aim, this study examined the maternal attachment style, the maternal antenatal bond to the fetus and dyadic adjustment as prenatal factors, and the data showed interesting connections. The literature on parenting states that differences in attachment have implications for the transition to parenthood, with a positive link between attachment security and parenting (Rholes et al., 1995; Mikulincer and Florian, 1999). Conversely, attachment insecurity has been conceived as a risk factor in the development of parenting.

TABLE 4 | Results of regression analyses for antenatal measures on the Parenting Stress Index, Total Score, at 3 months after childbirth.

		R	R^2	β	*SE*	*T*	*p*
Model 1		0.618	0.381	−0.14.69		−0.528	0.042*
	ASQ – Discomfort			0.534	0.351	1.519	0.155
	ASQ – Anxiety			1.127	0.496	2.271	0.041*
Model 2		0.667	0.445			3.684	0.023*
	MAAS – AQ			−0.737	1.898	−3.094	0.009**
	MAAS – AI			0.274	1.142	−0.155	0.879
Model 3	DAS TOT	0.435	0.189	−0.435	0.123	−4.402	0.001***

ASQ – DC, Attachment Style Questionnaire, Discomfort with Closeness; ASQ – RA, Attachment Style Questionnaire, Relationship Anxiety; MAAS – TOT, Maternal Antenatal Attachment, Total Score; MAAS – AQ, Maternal Antenatal Attachment, AQ; MAAS – AI, Maternal Antenatal Attachment, Attachment Intensity; DAS TOT, Dyadic Adjustment Scale Total Score; PSI – SF, Parenting Stress Index – Short Form, Total Score ($p < 0.05$, **$p < 0.01$, ***$p < 0.001$).*

Consistent with previous studies, particularly that of Grant (Grant et al., 2012), the findings of this paper showed the importance of attachment to others in adulthood during childhood in the transition to parenthood.

According to Feeney (2003), this study focused on two dimensions of attachment insecurity: discomfort with closeness and relationship anxiety, which, respectively, measure the tendency to be uneasy with intimacy and concerns about the attachment other's feelings of love, alongside fears of being rejected. Attachment anxiety was negatively correlated with maternal antenatal attachment, especially to the quality of the emotional bond, and to the adjustment in the couple relationship. Mothers-to-be who were found to be more anxious and preoccupied in their personal attachment have also less positive feelings about the fetus and were less confident in their relationship with their partner. The results of the present study appear to be consistent with previous studies showing such associations (Condon and Corkindale, 1997; Bloom, 1998; White et al., 1999; Barone et al., 2014; Walsh et al., 2014), especially studies devoted to exploring the link between adult attachment patterns and antenatal attachment. Moreover, this research contributes data on the relationship between antenatal attachment to the fetus and couple relationships, a field that has been little investigated by the previous literature (Alhusen, 2008). Antenatal attachment, previously explored as aspect connected to attachment system (Cannella, 2005), has recently been viewed as a bond that involves attending to the child's needs and providing protection. Recent studies have suggested considering antenatal attachment to be indicative of the caregiving system instead of (only) the attachment system (Brandon et al., 2009; Walsh et al., 2014) and thus to be particularly informative of the parental challenges connected to the transition to parenthood (George and Solomon, 1999). The couple relationship also faces challenge in the transition to parenthood because of the many re-organizations that this moment brings for the couple: in the partners' relationship quality, in their responsibilities and in their reciprocal routines (Antonucci and Mikus, 1988; Hazan and Shaver, 1994). Particularly, the birth of the first child has been found to have detrimental effects on partnerships (Cowan et al., 1985; Belsky and Rovine, 1990), and relationship quality can decrease as a result of the decline in marital satisfaction and feelings of love that can result from the challenging new task of caring for a newborn.

Based on the need to develop more comprehensive theoretical models to explore the relationships among the predictors of parenting stress (Abidin, 1992), the second aim of this study used a measure at 3 months after the child birth to show that each of the investigated variables was a good predictor of parenting stress 3 months after childbirth. In particular, the mother's adult attachment, specifically the anxiety dimension, contributed to this predictive power. These results are consistent with findings indicating the implications of differences in attachment for parenting (Jones et al., 2015). Secure mothers have less difficulty coping with parenthood tasks and are more capable in engaging in supportive parenting behavior. Conversely, in a paper studying the effect of child care on infant development, the authors found that parenting stress was significantly associated with insecure (child) attachment to mothers and fathers (Jarvis and Creasey, 1992). While attachment security can be considered a protective factor against parenting stress, attachment insecurity can be considered a risk factor in predicting parenting stress.

Moreover, maternal antenatal attachment to the fetus significantly predicted parenting stress 3 months postpartum, with the specific contribution of AQ. Previous findings that were largely focused on the association between these dimensions were not consistent, with some studies indicating an inverse correlation between stress and antenatal attachment and others unable to replicate such results (Cranley, 1981; Curry, 1987; Grace, 1989). Moreover, findings from the literature suggest that the correlation is also linked to the specificity of the postnatal period investigated. Our data are consistent with the few studies that have investigated this association from a longitudinal perspective (Alhusen, 2008). The findings of this study are consistent with those of Mikulincer, who found such a relationship during the first trimester (Mikulincer and Florian, 1999). According to our data, negative AQ during pregnancy seems to be a risk factor in predicting parenting stress during the first 3 months after childbirth. These findings contribute to filling the gap in evidence in the literature (Alhusen, 2008).

Regarding dyadic adjustment, findings showed its predictive role. According to the present data, a low level of dyadic adjustment during pregnancy was a risk factor for the onset of parenting stress during the initial period after childbirth. Previous data showed that if a woman lacks adequate social support during pregnancy, the result would be negative

outcomes, such as postpartum depression and insensitive parenting behavior (Crockenberg, 1981; Cutrona, 1984). Conversely, women who receive support during pregnancy have more positive physical and mental health outcomes during the postnatal period (Collins et al., 1993). Moreover, Hung et al. (2011b) found that women with longer marriages had a significantly lower level of postpartum stress. According to Krieg (2007), being in a marital relationship buffers stress during the postpartum transition. Mothers with a longer length of marriage generally experience more positive qualities in their marriages, with decreased role differentiation and increased role satisfaction in the transition to motherhood (Knauth, 2001).

As noted previously in this paper, parenting stress is a construct that can be affected by different types of stressor. Parenting stress can be considered a function of many different variables (Crnic and Low, 2002). In this paper, the role of some of these variables was considered, but the results need to be interpreted with caution because the relative influence of the different sets of variables were not considered together in the same model. Moreover, the proposed models are not exhaustive. This is a another limitation of the study because other dimensions could affect and mediate the connections observed; for example, everyday tasks specifically associated with parenting as well as the role of children's characteristics (e.g., temperament) should be added to the model to increase understanding of the phenomenon. Notably, this sample of first-time mothers showed lower levels of parenting stress with respect to normative data (thus, low level of parenting stress) and it should be important to further investigate such connection with a larger first-time mothers sample. Moreover, this paper did not consider the specific role played by the women's partner. Another limitation of the study is the exclusive use of a self-report procedure to investigate both prenatal variables and postnatal parenting stress. Further studies should incorporate other psychological aspects, including also observational procedure, to obtain a richer picture of the dimensions that affect the initial emergence of the caregiving system and its first challenges, especially with first-time mothers. In spite of these limitations, findings from this study suggest how important is the role of prenatal characteristics in first-time mothers and underline the need to be considered in order to develop effective prevention plans.

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Adoptive parenting and attachment: association of the internal working models between adoptive mothers and their late-adopted children during adolescence

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Introduction: Recent literature has shown that the good outcome of adoption would mostly depend on the quality of adoptive parenting, which is strongly associated with the security of parental internal working models (IWMs) of attachment. Specifically, attachment states-of-mind of adoptive mothers classified as free and autonomous and without lack of resolution of loss or trauma could represent a good protective factor for adopted children, previously maltreated and neglected. While most research on adoptive families focused on pre-school and school-aged children, the aim of this study was to assess the concordance of IWMs of attachment in adoptive dyads during adolescence.

Method: Our pilot-study involved 76 participants: 30 adoptive mothers (mean age = 51.5 ± 4.3), and their 46 late-adopted adolescents (mean age = 13.9 ± 1.6), who were all aged 4–9 years old at time of adoption (mean age = 6.3 ± 1.5). Attachment representations of adopted adolescents were assessed by the Friend and Family Interview (FFI), while adoptive mothers' state-of-mind with respect to attachment was classified by the Adult Attachment Interview (AAI). Adolescents' verbal intelligence was controlled for.

Results: Late-adopted adolescents were classified as follows: 67% secure, 26% dismissing, and 7% preoccupied in the FFI, while their adoptive mothers' AAI classifications were 70% free-autonomous, 7% dismissing, and 23% unresolved. We found a significant concordance of 70% (32 dyads) between the secure–insecure FFI and AAI classifications. Specifically adoptive mothers with high coherence of transcript and low unresolved loss tend to have late-adopted children with high secure attachment, even if the adolescents' verbal intelligence made a significant contribution to this prediction.

Discussion: Our results provides an empirical contribution to the literature concerning the concordance of attachment in adoptive dyads, highlighting the beneficial impact of highly coherent states-of-mind of adoptive mothers on the attachment representations of their late-adopted adolescent children.

Keywords: attachment, adoption, adolescence, internal working models (IWMs), Friend and Family Interview

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Introduction

Attachment theory stressed the importance of early parent–child relationships for normative development of socio-emotional functioning across the life span (Thompson, 1999). These relationships play a significant role on the development of a child's internal working models (IWMs) of the self, others, and relationships influencing the child's attachment security (Bowlby, 1969), and they guide the construction and the expectations of future social interactions. IWMs of caregivers are expected to affect parenting and caregiving transactions that mothers enact both consciously and unconsciously in their interactions with the child (Bretherton and Munholland, 2008; Dazzi and Zavattini, 2011; Velotti et al., 2011). Literature also established that parents' IWMs, manifested in discussions about childhood experiences during the Adult Attachment Interview (AAI; George et al., unpublished), predicted the quality of the infant-parent attachment relationship as observed in Ainsworth's Strange Situation procedure (SSP; Ainsworth et al., 1978; van IJzendoorn, 1995; Steele et al., 1996; Tini et al., 2003; Verhage et al., 2015).

Overall, literature suggested parents' IWMs that form the basis of parenting behaviors (sensitivity, attunement, monitoring, etc.) may influence the child's IWMs from early childhood to adolescence (Karavasilis et al., 2003; Gamble and Roberts, 2005; Bosmans et al., 2006; Gallarin and Alonso-Arbiol, 2012). However, only a few studies assessed the concordance of attachment representations between parent–children dyads (mostly "mother–son") in this stage of life (Rosenstein and Horowitz, 1996; Zimmerman et al., 1997; Allen et al., 2003; Scharf et al., 2012), providing evidence of a weak to moderate intergenerational effect. Further, the measurement of attachment in adolescence presents some weaknesses. Literature showed that, when assessing IWMs, the AAI (Bakermans-Kranenburg and van IJzendoorn, 2009) and the Attachment Interview for Childhood and Adolescence (AICA; Ammaniti et al., unpublished) were used, but without taking into account the specificity of this stage. Moreover, conscious attachment styles may be captured by questionnaires, such as the Inventory of Parent and Peer Attachment (IPPA; Armsden and Greenberg, 1987; Pace et al., 2011), which measures attachment security and its factors (trust, communication, and alienation) in adolescence, but presents obvious limitations characterizing self-reports. Finally, in recent years, the Friends and Family Interview (FFI; Steele and Steele, 2005) were developed to assess attachment representations in late childhood and adolescence, including important relationships beyond the child–parent relationships and provided encouraging results (Kriss et al., 2012; Pace, 2014; Steele et al., unpublished).

Growing literature has recently examined attachment among adoptive families in the years following adoption. Adoption in Italy is a very common phenomenon. In the period between 2000 and 2013, 42,048 children were legally authorized to enter the country for adoption. Children were adopted by 33,820 couples with an average of 1.24 children per couple (Italian Commission for International Adoptions, 2013). Internationally adopted children's mean age at arrival was 5.5 years with four children out of 10 (42.1%) between 1 and 4 years old and 43.8% of adopted children between 5 and 9 years old; 8.8% were 10 years or older, while only 5.4% of adopted children were younger than 1 year old.

As reported in a 2009 meta-analysis (van den Dries et al., 2009), children who were adopted before 12 months of age were as securely attached as their non-adopted peers, whereas children adopted after their first birthday were less securely attached than non-adopted children ($d = 0.80$, CI = 0.49–1.12). Moreover, adopted children showed more disorganized attachment compared to their non-adopted peers ($d = 0.36$, CI = 0.04–0.68), but they were less often disorganized compared to institutionalized children. Thus, early adoption is a considerable and effective intervention in the domain of attachment relationships (Lionetti, 2014).

However, as mentioned above, in the Italian adoption practice, almost 95% of internationally adopted children were placed after 1 year of life, and, thus, they should be considered as late-adopted children (Howe, 1998). Late adoption represents an exceptional intervention aimed at influencing and reprocessing representations of children who often suffered traumas, abuse, and neglect in their early infancy or childhood (Rutter and O'Connor, 2004; Juffer and van IJzendoorn, 2005; van IJzendoorn and Juffer, 2006; Dozier and Rutter, 2008). Furthermore, no differences were found in the attachment patterns between international and domestic adopted children probably because similar early negative experiences were suffered by the adopted children, independently from the type of adoption (van den Dries et al., 2009). On the one hand, late-adoption represents a window for the investigation of the impact of children's negative pre-adoption experiences on the development of insecure-disorganized IWMs of attachment (Steele et al., 2007; Pace et al., 2015b). On the other hand, late adoption embodies the opportunity for children's schemas to be revised and reprocessed based on the "new" relationships with adoptive caregivers (Steele et al., 2003, 2008; Juffer and van IJzendoorn, 2005). Some studies highlighted that previously maltreated and neglected children placed after 4 years of age and assessed both through a behavioral procedure and narrative tasks (Pace and Zavattini, 2011; Pace et al., 2012) showed increasing attachment security over 2 years after adoption. Additional findings showed that late adopted children improve markedly in the positive representations of the self, the caregiver, and in the relationship with others and also in the narrative's coherence (Hodges et al., 2003; Kaniuk et al., 2004). As suggested from these empirical findings, further positive revision may be possible, even in older adopted children, and, therefore, exploring which parental characteristics could foster their "earned" security deserves attention (Pace et al., 2012). In the Attachment Representations and Adoption Outcome study (Steele et al., 2003, 2007) mothers' insecurity of attachment (either dismissing or preoccupied) as assessed by the AAI 3 months after adoption was correlated with children's (4–8 years old) negative narratives and disorganized or bizarre themes proposed in an attachment story completion. In addition, children with unresolved adoptive mothers failed to establish secure attachment and positive representations of self and

others (Steele et al., 2003). Both parents' attachment insecurity was strongly associated with high levels of disorganization or insecurity in the adoptees and confirmed even 2 years later. When neither parents' AAI was secure at the time of placement, 2 years later 86% of adopted children scored high for disorganization (Steele et al., 2008). Veríssimo and Salvaterra (2006), assessing a sample of Portuguese children adopted between 3 weeks and 47 months of age, found that the scores reflecting the presence and quality of maternal secure representations predicted the level of attachment security of adopted children, as measured by Secure Base Scripts (SBS; Waters and Waters, 2006) and assessed by the Attachment Behavior Q-Set (AQS; Waters, 1995) (Spearman rho $= 0.38$, $p < 0.01$) with no correlations either with child's age at time of adoption or the child's age at time of assessment. Barone and Lionetti (2012), assessing parents' attachment state-of-mind using the AAI and children's (3–5 years old) attachment patterns, administered a doll story completion task 12–18 months after placement and found 80% concordance with respect to two attachment classifications in mother–child dyads and 60% concordance with respect to three-way attachment classification. Concerning father–child dyads, no significant associations were found. Pace and Zavattini (2011) and Pace et al. (2012) found that late-adopted children (4–7 years old) who presented significant enhancing attachment security were predominantly placed with secure adoptive mothers ($p < 0.05$). However, the concordance between the adoptive mothers' attachment representations and their adopted children's narratives on the two-way system (secure vs. insecure) was not significant (56%).

All these studies focus on the few years after late-adopted children's placement, usually during middle childhood, while only a few studies examine what happens during later stages, such as late-childhood and adolescence. These studies show a percentage of secure attachment of adolescent adoptees that range between 32% (Beijersbergen et al., 2012) and 63% (Riva Crugnola et al., 2009), using the AAI or AICA and from 32% (Escobar and Santelices, 2013) to 51% (Groza et al., 2012) and 60% (Barcons et al., 2012), using the FFI. Most of these studies found no unresolved or disorganized (U/D) classifications either by the AAI or the FFI (only 2% in Barcons et al., 2012), meaning that adoptees were able to develop an organized attachment strategy, despite their early negative experiences. This data is worthwhile given that the disorganized attachment could be considered a strong predictor of short- and long-term psychopathological problems (van IJzendoorn et al., 1999; West et al., 2001). Except for Escobar and Santelices (2013), no study found a significant association between the age of adoption and attachment patterns, meaning that older age at adoption did not automatically imply high attachment insecurity.

Given that parenting seems to continue to influence children's attachment representations, even during adolescence (Hoeve et al., 2011), attachment researchers have recently questioned the role of adoptive parents in influencing attachment in adopted adolescents. A longitudinal adoption study (Beijersbergen et al., 2012), assessed through the AAI, revealed that mothers of secure adolescents showed significantly more sensitive support during conflicts than did mothers of insecure adolescents. The authors concluded that both early and later maternal sensitive support were important for continuity of secure attachment for the first 14 years of life of early adopted adolescents. Another study (Riva Crugnola et al., 2009) assessing attachment in adopted adolescents and their adoptive parents, using the AAI and the AICA (Ammaniti et al., unpublished), did not find any significant concordance between mother–child and father–child two-way attachment systems. However, they suggested that the majority of parents who were secure with respect to attachment had children who were also secure, while those who were insecure had adopted children who were equally distributed in the two-way attachment classifications (secure vs. insecure). Limitations of this study, however, should be addressed due to both the wide variability of the sample characteristics and the lack of control for background variables.

Given the growing importance of assessing attachment bonds between adoptive parents and their children, especially in adolescence where there is a shortage of literature, in the current correlational study we investigated attachment concordance between late-adopted adolescents and their adoptive mothers. We expected correspondence between mothers' AAI attachment representations and children's FFI attachment representations (AAI and FFI categories and state-of-mind scales), mostly at the level of secure vs. insecure partition, as we controlled for demographic variables, adolescents' verbal cognitive status, that can foster secure attachment patterns (West et al., 2013), and maternal psychopathological symptoms.

Materials and Methods

Participants

The adoptive families were recruited through two authorized international adoption agencies [e.g., Centro Italiano di Aiuti all'Infanzia-CIAI (Italian Center for Supporting Childhood) and Associazione Teresa Scalfati (Teresa Scalfati's Association)], an association supporting adoptive families [Genitori si Diventa (Becoming Parents)] and the social-health service specialized on adoption working in Rome. All the participants lived in the following cities of the Center of Italy: Rome, L'Aquila, and Teramo.

The eligible criteria for this study were the following: age range of late-adopted adolescents between 11 and 16 years old, age of adoption after 4 years of age, length of placement equal to 4 years at least (considered a sufficient length of time for stabilizing adoptive child–parent relationships, van den Dries et al., 2009), absence of children's special needs, absence of maternal clinical diseases, parents with medium-to-high education level, married couples still living together, and families living in urban contexts.

This study included 76 participants: 46 late-adopted adolescents (23 female) and their 30 adoptive mothers. Of the adolescents, 14 were "only" children, while 32 were siblings both involved in the study. 21 mother–child dyads had already participated in a longitudinal study (Pace and Zavattini, 2011; Pace et al., 2012). The pre-adoption histories of the adoptees were characterized by severe adversities, such as serious neglect,

physical maltreatment, sexual abuse, and widely variable periods of institutionalization.

Variables and Measures

Late-adopted Adolescents

Adolescents' attachment representations

Attachment representations of adolescents were assessed using the Italian version of the FFI (Steele and Steele, 2005), authorized by the author Howard Steele. The FFI is a semi-structured interview informed by, yet distinct from, the AAI (Main et al., 2008). Interviews are video-recorded and transcribed verbatim.

The FFI's coding system comprises eight scales, each including subscales as follows: (1) *Coherence*, based on Grice's well-known maxims of good conversation—truth, economy, relation, and manner, and overall coherence; (2) *Reflective Functioning*—developmental perspective, theory of mind, diversity of feelings; (3) *Evidence of Secure Base*—father, mother, and other significant figure; (4) *Evidence of Self–Esteem*—social competence, school competence, and self-regard; (5) *Peer Relations*—frequency of contact and quality of best friendship; (6) *Sibling Relations*—warmth, hostility and rivalry; (7) *Anxieties and Defense*—idealization, role reversal, anger, derogation, adaptive response; and (8) *Differentiation of Parental Representations*.

The interview also includes the following global *attachment classifications* (Steele et al., unpublished): (1) *secure* classification indicates that the person's narrative reflects flexibility, ease, and ability to turn to others for support when in distress; (2) *insecure-dismissing* classification describes people who use derogation or idealization as a defense and show restriction when they have to acknowledge or express distressing feelings; (3) *insecure-preoccupied* classification describes adolescents rated highly in anger or passivity; and finally, (4) *insecure-disorganized* classification describes people showing some lapses in monitoring or reasoning as well as contradictory or incompatible strategies in the attachment narratives.

The scales are scored on a 7-point scale from 1 to 4 (1 = no evidence; 2 = mild evidence; 3 = moderate evidence; 4 = marked evidence), including mid-points.

In the FFI coding system, the interviews have both a final classification (the above-mentioned secure, dismissing, preoccupied, and disorganized categories) like in the AAI and a scoring (1–4) for each classification, which is unlike the AAI. This double coding system captures attachment representations both at categorical and dimensional levels.

For this study, two blinded raters (both trained by Howard Steele and reliable coders for the FFI) coded 14 of the 46 interviews (30.4%). Inter-rater agreement was 100% ($k = 1$, $p < 0.001$) on the four-way classification system (secure, dismissing, preoccupied, and disorganized). Spearman's rho correlations for the five coherence scales ranged from 0.66 for the relation scale ($p < 0.05$) to 0.86 for the manner one ($p < 0.01$). The other FFIs were coded only by one trained coder. To our knowledge, this is the first study assessing attachment representations of late-adopted adolescents with the FFI in Italy.

Adolescents' Cognitive Status

Given the contrasting findings on the links between attachment representations and cognitive level of participants at developmental stages (Steele and Steele, 2005; Stievenart et al., 2011; Beijersbergen et al., 2012; West et al., 2013), we assessed the verbal intelligence of late-adopted adolescents.

Participants' verbal IQ was measured by the vocabulary subtest from the Wechsler Intelligence Scale for Children (verbal WISC-III, Wechsler, 1991; Italian validation, Orsini and Picone, 2006) for participants aged between 6 and 16 years and 11 months. The verbal WISC III consists of the following subtests: information, similarities, arithmetic reasoning, vocabulary, comprehension (CV), memory figures. The child's verbal IQ is obtained from the sum of the weighted points of the first five verbal subtests, while the factor score of verbal CV is obtained based on the weighted score received in the last subtest.

Adoptive Mothers

Maternal attachment states of mind

The states of mind with respect to attachment of adoptive mothers were assessed through the AAI (George et al., unpublished; Main et al., unpublished), a well-known and semi-structured interview with 20 questions lasting approximately 1 h. The AAIs are audio-recorded and transcribed verbatim.

The transcripts were used to assess possible past experiences with attachment figures in infancy (Loving, Rejection, Neglecting, Role Reversal, and Pressure to Achieve) and current states of mind (Idealization, Lack of Memory, Anger, Derogation, Passivity, Transcript Coherence, Mental Coherence, Metacognitive Monitoring, Fear of Loss, Unresolved Loss, Unresolved Trauma) on 25 1-to-9 scales.

The coding system classifies attachment states of mind into one of three principal categories: (1) *free-autonomous and secure* (F/A), where individuals freely describe their attachment experiences with balance and coherence; (2) *insecure-dismissing* (Ds), where they are unable to give evidence for the positive evaluations of their parents showing idealization or normalization strategies; (3) *insecure-preoccupied* (P), where they use angry or vague language when talking about their attachment relationships. One of two transversal categories can also be added: *insecure-unresolved/disorganized loss or trauma* (U), where transcripts presented lapses in monitoring of reasoning or discourse or reports of extreme behavioral reactions during discussion of these specific topics, or *cannot classify* (CC), where completely contradictory attachment patterns (e.g., dismissing/entangled) emerged.

Psychometric studies in many countries have shown that attachment classifications provided by the AAI are steady across periods of up to 15 months and are independent of the interviewer. The AAI categories were not correlated with the interviewees' cognitive level, social desirability, memory, or general discourse style (Bakermans-Kranenburg and van IJzendoorn, 1993; Crowell et al., 1996).

For our study, all the AAIs were coded by a reliable coder. For inter-rater reliability, 10 interviews (30%) were also classified by another expert evaluator. Both coders were trained by Deborah Jacobvitz and Nino Dazzi and they were provided

with AAI's reliability and unaware of the other data collected. Inter-rater agreement was 88% ($k = 0.77$, $p < 0.01$) for four-way classifications (free-autonomous, dismissing, entangled, or unresolved). Spearman's rho correlation of 0.72 was found for the coherence of transcript's scale ($p < 0.05$), 0.74 for coherence of mind ($p < 0.05$), and 0.97 for unresolved loss ($p < 0.01$).

Socio-demographic and Adoption Data

Ad-hoc questions were developed for this research and they were answered by adoptive mothers to collect personal data (age of birth, education level, year of marriage, etc.) and information concerning the details of adoption (children's age at arrival, country of origin, length of adoption, pre-adoption information, etc.). A part of this sheet was designed to investigate the children pre-adoption histories, especially the motivations for which they were placed for adoption (e.g., parental abandonment, death, drug abuse, etc.) and the events leading to change of guardianship, such as neglect, physical and sexual abuse, institutionalization, and multiple placements. In the last part we asked about physical condition, mental retardation, and psychiatric diagnoses of the children.

Maternal psychopathology

Before adoption, parents seeking to adopt were assessed to examine their psychopathological risk, but at the time of this study's assessment, some years had passed since this pre-adoption selection. Therefore we checked the psychopathology level of adoptive mothers to ensure they were free from mental disorder symptoms and no psychological problems had emerged after adoption.

Mental health problems of mothers were measured using the Symptom Checklist 90 (SCL-90-R; Derogatis, 1994), a 90-item standardized instrument designed to measure current symptom severity grouped in 10 main symptom dimensions (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and other symptoms, such as problems with sleep) and an index of psychopathology (Global Severity Index, GSI). This measure provides a reliable estimate of the likelihood of being diagnosed with a mental health disorder (T score above 63 on the GSI for any two symptom dimensions).

Procedure

The data were collected during a session lasting approximately 2 h at the university's laboratory. Mothers and children were assessed separately: the FFI and the WISC-III were administered to the adolescents, while the AAI, the socio-demographic questionnaire, adoption sheet, and the SCL-90 were used with their adoptive mothers. Participation in this research was voluntary. Before the session, written informed consent was obtained from all families. The research protocol had been previously approved by the University Ethical Committee.

Data Analysis

Results were analyzed using the Statistical Package for Social Science (SPSS, Version 21.0). We decided to use primarily non-parametric tests, which are appropriate for variables of this type because they do not require that the sample is drawn from a normally distributed population (Siegel and Castellan, 1988). The significance level for all analyses was set at $p < 0.05$.

First, we presented descriptive statistics of all of the study variables and then we investigated whether FFI and AAI classifications were associated with background and control variables. Next, we tested the study's hypotheses with respect to the association of attachment between mothers and late-adopted adolescents. Specifically:

(1) We examined the concordance between adoptive mothers' AAI categories and late-adopted adolescents' FFI categories on the two-way system (secure–insecure) and, when possible, three-way (secure, dismissing, and preoccupied) and four-way systems (secure, dismissing, preoccupied, and disorganized). Using multinomial logistic regression analyses, we then tested whether FFI attachment category of late-adopted adolescents could be predicted by taking into account mothers' AAI categories.
(2) We examined the correlation between late-adopted adolescents' FFI scales and adoptive mothers' AAI state-of-mind scales (especially coherence scales considered to be the best predictors of free-autonomous classifications). Using linear regression analyses, we then tested whether FFI scales of late-adopted adolescents could be predicted by taking into account mothers' AAI state-of-mind scales.

Results

Descriptive Variables

Table 1 presents descriptive results concerning background variables and attachment classification for both adolescents and mothers.

Late Adopted Adolescents

The statistical analyses with adolescents' FFI categories were conducted using a secure vs. insecure partition with preoccupied adolescents included in the insecure group together with dismissing ones. Adolescents' FFI classifications were not associated with gender ($p = 0.35$), continent of origin ($p = 0.10$), age at arrival ($p = 0.50$), length of adoption ($p = 0.60$), age at assessment ($p = 0.27$), educational level ($p = 0.26$), or presence or absence of siblings ($p = 0.69$). However, secure adolescents ($M = 104.39$, $SD = 23.62$) showed a significantly higher level of verbal IQ ($T = 3.49$, df $= 44$, $p < 0.01$) than insecure ones ($M = 79.67$, $SD = 20.05$). Hence, we decided to include verbal IQ as a covariate in the regression model.

Adoptive Mothers

The statistical analyses using maternal AAI categories were conducted using a free-autonomous vs. non-free-autonomous partition with dismissing mothers included in the non-free-autonomous group together with unresolved ones. Mothers' AAI classifications were not associated with age ($p = 0.87$), years of education ($p = 0.28$), length of marriage ($p = 0.16$), or level of psychopathological symptoms ($p = 0.13$).

TABLE 1 | Child and mothers demographic and adoption characteristics.

	Range	Mean	*SD*
Late-adopted adolescents (*n* = 46)			
Children's age at adoption (years)	4–9	6.30	1.52
Children's age at assessment (years)	11.11–16.11	13.9	1.58
Length of adoptive placement (years)	4–11	7.6	1.46
Lenght of istituzionalization (months)	6–72	31.56	19.67
Verbal IQ	77–154	96.33	25.18
		N	***%***
Children's sex	Boys	23	50
	Girls	23	50
Type of adoption	Domestic	4	8.7
	International	42	91.3
Children's continent of origin	South America	21	50
	Eastern Europe	10	28.8
	Africa	6	14.3
	Asia	5	11.9
Level of schooling	Middle school	39	84.8
	High school	7	15.2
Friend and Family Interview (FFI) classifications	*S*	31	67.4
	Ds	12	26.1
	P	3	6.5
	D	0	0
Adoptive mothers (*n* = 30)			
Mothers' age	44–59	51.47	4.26
Length of marriage	12–31	20.46	5.43
Years of education	13–21	15.87	2.82
SCL-90 (GSI)	4–62	50.47	5.17
Level of education		***N***	***%***
	High school	14	46.7
	College/Post-graduate	16	53.3
Adult Attachment Interview (AAI) classifications	*F/A*	21	70
	Ds	2	6.7
	P	0	0
	U/D	7	23.3

Attachment IWMs in Adolescent-Mothers Dyads

Classifications

Table 2 presents the distributions of the attachment classifications of adoptive mothers' AAI and late-adopted adolescents' FFI.

We found a significant of 70% (32 dyads) on the two-way AAI and FFI systems (rphi = 0.31, $p = 0.04$) and a concordance of 61% (28 dyads) on the four-way system approaching significance ($\chi^2 = 8.29$; df = 4, $p = 0.08$). To further examine the possibility of interaction, we conducted multinomial logistic regression analyses predicting adolescents' secure–insecure FFI categories from mothers' AAI free-autonomous vs. not-free-autonomous, adding verbal IQ as a covariate. The multinomial logistic regression model indicated that free-autonomous adoptive mothers showed a tendency to have secure late-adopted children ($\beta = 1.42$, $p = 0.08$), although adolescents' high verbal IQ appeared to be a better predictor of their secure classification ($\beta = 0.05, p = 0.01$).

TABLE 2 | The concordance between adolescents' FFI and maternal AAI classifications[1].

		Adoptive mothers' AAI				
		F/A	***Ds***	***P***	***U/D***	**Total**
Late-adopted adolescents' FFI	*S*	26	2	0	3	31
	Ds	8	2	0	2	12
	P	1	0	0	2	3
	D	0	0	0	0	0
	Total	35	4	0	7	46

[1]*The number of adoptive mothers was counted on the base of the number of their children (N = 46; e.g., if a mother had two children, she was counted twice).*

Scales

Table 3 shows the correlations between the FFI and the AAI state-of-mind scales.

The FFI scales were highly correlated with verbal IQ scorings (r between 0.35 and 0.63, $p < 0.01$), while no correlations were found between maternal AAI scale of states of mind and adolescents' verbal IQ scorings (r between −0.17 and 0.29, p = ns). Based on these correlations, we ran two linear regression analyses (**Table 4**). The first entered the secure pattern as the dependent measure and the second entered the disorganized pattern as the dependent variable. For both regressions, we inserted coherence of transcript, coherence of mind, and idealizing father as independent variables; for the first two, we added unresolved loss in the independent blocks. Verbal IQ was added as a covariate.

The regression summary indicated that high coherence of transcript and low unresolved loss of adoptive mothers could predict high secure attachment of their late-adopted children, even if the adolescents' verbal intelligence made a significant contribution to their prediction. Moreover, high cognitive status of adoptees made a significant contribution to the prediction of low scores on their disorganized patterns of attachment.

Discussion

Our sample of late-adopted adolescents was classified through the FFI with 67.4% as secure, 26.1% as dismissing, 6.5% as preoccupied, and none disorganized, showing attachment representation distribution overlap with those both from the Italian AAI meta-analysis of non-clinical adolescent samples (Cassibba et al., 2013, 62% free-autonomous, 24% dismissing, 10% preoccupied, and 4% unresolved), and adoption studies using the AICA (Riva Crugnola et al., 2009) and the FFI (Barcons et al., 2012; Stievenart et al.,

TABLE 3 | Spearman's correlations between the AAI and the FFI scales.

		Adoptive mothers						
		AAI scales of states of mind						
	Late-adopted adolescents	Coherence transcript	Coherence of mind	Idealizing mt	Idealizing ft	Lack of memory	Passivity	Unresolved loss
FFI scales	Coherence-truth	0.10	0.05	−0.20	−0.37**	0.03	0.17	−0.16
	Coherence-econ.	0.39**	0.33*	−0.13	−0.20	0.15	0.01	−0.24
	Coherence-relation	0.32*	0.27*	−0.16	−0.29*	−0.03	0.08	−0.25*
	Coherence-Manner	0.33*	0.21	−0.20	−0.39**	−0.08	−0.14	−0.03
	Overall Coherence	0.30*	0.22	−0.20	−0.37**	0.05	0.03	−0.20
	Safe haven Mt	0.23	0.12	−0.14	−0.28*	−0.30*	0.10	−0.00
	Safe haven Ft	0.27*	0.28*	−0.17	−0.37**	0.01	0.01	−0.04
	Secure	0.30*	0.29*	−0.17	−0.31*	0.05	0.03	−0.35**
	Dismissing	−0.12	−0.12	0.22	0.31*	−0.07	−0.24	0.04
	Preoccupied	−0.11	−0.10	−0.31*	−0.13	0.07	0.23	0.11
	Disorganized	−0.37**	−0.32*	0.14	0.28*	0.12	0.11	0.05

*$p < 0.05$, **$p < 0.01$.

TABLE 4 | Regression model predicting adolescents' secure and disorganized FFI scales from maternal AAI states-of-mind scales.

Factor	Standardized β	*t*	*p*
Secure pattern			
AAI: coherence of transcript	1.352	2.084	0.044
AAI: coherence of mind	1.286	2.003	0.052
AAI: idealizing ft	−0.145	−1.007	0.320
AAI: unresolved loss	−0.408	−3.271	0.002
Verbal IQ	0.601	5.788	0.000
Disorganized pattern			
AAI: coherence of transcript	−0.875	−1.119	0.270
AAI: coherence of mind	−0.611	−0.819	0.418
AAI: idealizing ft	0.011	0.056	0.955
Verbal IQ	−0.307	−2.128	0.039

2012). These data confirms that adoption can be seen as a positive intervention also for late-adopted children who were considered a high risk group due to their adverse pre-adoption experiences.

Concerning the distribution of AAI classifications of adoptive mothers, we found a high percentage of free-autonomous classifications (70%), similar to those in the Italian AAI meta-analysis of non-clinical mothers (Cassibba et al., 2013, 62% free-autonomous, 24% dismissing, 10% preoccupied, and 4% unresolved-disorganized), post-adoption studies including parents assessment (Steele et al., 2008, 2010; Barone and Lionetti, 2012; Pace et al., 2012), and studies on couples seeking to adopt (Cavanna et al., 2011; Calvo et al., 2015; Pace et al., 2015a).

We found a significant concordance between the attachment states of mind of adoptive mothers using the AAI and the attachment representations of late-adopted adolescents using the FFI (70% for two-way and 61% for four-way attachment classification). This result confirmed findings from most of the studies on adoptions, although some research did not find significant associations (**Table 5**).

We would suggest that maternal attachment states of mind, characterized by highly coherent narratives of their own attachment relationships, could be very beneficial for their children via several pathways. First, attachment security of mothers in the AAI is usually associated with both physical and emotional availability, responsiveness, acceptance, and cooperativeness (Allen et al., 2003; Riva Crugnola et al., 2009; Scherf et al., 2013). We would suggest that these maternal behaviors may teach children to feel confident in considering their own and others' feelings, and to build their own security and self–esteem. Second, free-autonomous adoptive mothers may be more capable of managing and tolerating their children's separation process during adolescence without experiencing adolescents' autonomy and exploration behaviors as an attack on the mother–child relationship. Third, free and autonomous adoptive mothers, who are able to coherently integrate their own past attachment history, may be especially good at helping their children to process their early negative and traumatizing experiences and integrate them coherently into their personal biography (Pace et al., 2012). Palacios and Brodzinsky (2010) pointed out that the construction of personal identity becomes even more significant for adopted teenagers, since, during adolescence, connecting the past, the present, and the future in a single and

TABLE 5 | Studies assessing attachment concordance between adopted children and their mothers.

Adoption studies	*N* dyads	Children's age at assessment	Mothers' attachment measure	Child's attachment measure	Concordance/correlations
Dozier et al., 2001	50	12–24 months	AAI	Strange situation procedure (SSP)	72% (two ways), $k = 0.43$, $p < 0.01$
Veríssimo and Salvaterra, 2006	106	1–4 years	Secure base scripts	AQS	$r = 38$, $p < 0.01$
Steele et al., 2008	58	4–8 years	AAI	Story stem	$r = -0.29$ (child insec.), $p < 0.05$; $r = -0.36$ (child disorgan.), $p < 0.01$
Riva Crugnola et al., 2009	35	10–15 years	AAI	AICA	63%, (two ways), n.s.
Barone and Lionetti, 2012	20	3–5 years	AAI	MCAST	80%, $p < 0.01$ (two ways)
Pace and Zavattini, 2011	20	4–7 years	AAI	Separation-reunion	60% (two ways), n.s.
Pace et al., 2012	28	4–8 years	AAI	MCAST	56% (two ways), n.s.
Lionetti, 2014	30	1–13 months	AAI	SSP	60% (three ways), $p = 0.08$; 53% (four-way), $p = 0.01$

coherent story becomes central and requires the processing and integration of their own story both in adopted children and their parents. On the other hand, adoptive mothers with insecure attachment states of mind, in our study classified as dismissing or unresolved, mostly had insecure children. These data indicated that mothers with low coherence and high unresolved loss would fail to transmit to their late-adopted children the emotional security required for self-confidence and relationally competence (Scharf et al., 2012), and they could be less capable of reducing the impact of their negative past experiences. However, surprisingly three secure adopted adolescents, despite their free-autonomous secondary classification, had unresolved adoptive mothers. From a clinical perspective, it is interesting to mention two points to explain this counter-intuitive data: on one hand, these adoptive mothers were among the few involved in psychotherapeutic treatment in their young adulthood; on the other hand, the three secure adolescents were among the few in our sample who were placed in foster care after the abandonment from biological parents, without experiencing any institutionalization. We would suggest that these protective factors could reduce the impact of the unresolved states of mind of the adoptive mothers on the attachment representation of their adopted children.

Finally, attachment security is overrepresented in late-adopted adolescents with high verbal cognitive scores. This result, in line with findings on early adopted children (van Londen et al., 2007), seems intriguing at different levels. First, our data may indicate a problem with the discriminant validity of the FFI: the more advanced the child's verbal abilities are, the better she or he is able to describe and talk about attachment relationships, leading to an overrepresentation of attachment security (Atkinson et al., 1999). However, this interpretation does not seem to be confirmed by a study with non-clinical samples (Steele and Steele, 2005). Moreover, controlling for verbal IQ, the relationship between AAI and FFI remained significant and this favored the content and the discriminant validity of the FFI. A second hypothesis could be that, unlike the adult sample, where attachment representations and verbal intelligence were completely distinct domains (Crowell et al., 1996), among adopted adolescents, attachment may be related to cognitive development, as revealed among non-clinical children (O'Connor and McCartney, 2007; Kerns, 2008; West et al., 2013). Lastly, we would suggest that late-adopted adolescent showing high verbal IQ may represent another factor that can help them build their secure attachment representation together with maternal attachment security (adopted children with high verbal IQ may be able to easily learn new habits in adoptive families, etc.). Further studies are needed to investigate whether the correlation between attachment classifications by the FFI and verbal intelligence also holds in normative samples.

Limitations and Future Developments

This study had several limitations. First, the restrictive eligibility criteria (absence of children with special needs in the sample, low maternal psychopathology, medium-to-high maternal education level, married couples living together) to take part in the study are a limitation for the generalizability of results and they could explain the low rate of insecure attachment in our sample, which was comparable to the rate of the non-adoptive adolescent population. Second, our sample size was quite small and it was not homogeneous (adolescents' age, age at adoption, children' country of origin, etc.). Third, fathers' assessments were lacking in our study. Fourth, the correlational nature of the research design did not allow causal inferences. Lastly, the voluntary participation of adoptive families might have self-selected more sensitive families. Further research is needed to replicate our findings with larger and more uniform samples, using longitudinal research design, and including fathers' assessment.

Conclusion

First our results highlighted a concordance of attachment representations among adoptive mother–child dyads during adolescence, endorsing results of some previous studies (e.g., Barone and Lionetti, 2012) on late-adopted children during childhood, and indicating that a relationship with a secure mother may represent a very beneficial experience for the late-adopted adolescents, despite their hard past-experiences. Second, we found a correlation between adolescents' attachment security and verbal IQ that deserves to be investigated in further studies to assess whether it also holds in normative samples.

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Dyadic adjustment and parenting stress in internationally adoptive mothers and fathers: the mediating role of adult attachment dimensions

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Previous research has shown that a positive marital functioning represents a resource in adoptive families, leading to a decrease in parenting stress, but little is known about the factors mediating such a relationship. This study aimed to explore whether adult attachment avoidance and anxiety mediate the effect of dyadic functioning on parenting stress in 90 internationally adoptive couples (mothers and fathers) who had adopted a child (aged 3–10 years) in the last 36 months. Participants completed self-report measures of dyadic adjustment, adult attachment, and parenting stress. A series of path analyses supported the mediation hypothesis, but differentially for mothers and fathers. Among mothers, there was a direct and negative relationship between dyadic adjustment and parenting stress. In addition, a better dyadic adjustment was related to lower levels of attachment anxiety, which in turn were associated with less parenting stress. Among fathers, increased dyadic adjustment was related to lower levels of attachment avoidance, which in turn were associated with reduced parenting stress. These findings suggest the importance of including both mothers and fathers in adoption research. Adoptive parents could benefit from specific interventions aimed at reducing attachment avoidance and anxiety by supporting parental sense of competence and involvement for mothers and fathers, respectively.

Keywords: adoptive parents, adult attachment, parenting stress, dyadic adjustment, international adoption

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Introduction

Parenting stress is a complex construct determined by multiple sources, including parent, child and situational factors related to parent–child interaction (Abidin, 1995) and interferes with many aspects of family functioning, such as positive parenting practices and child psychosocial adjustment (Cummings et al., 2000; Greenley et al., 2006). Parenting stress, especially during the delicate phase of transition to parenthood, has been extensively studied in its association with marital quality (Cowan and Cowan, 1995). However, most studies so far have focused on biological parents, whereas less is known about the associations between dyadic functioning and parenting stress in the context of adoptive parenthood, especially in the post-adoption period (McKay et al., 2010).

Adoption may be a detrimental factor for parenting stress and marital satisfaction, as adoptive parents face unique challenges linked to both life events (e.g., infertility, suddenly becoming parents, adoption stigma) and child characteristics (e.g., children adopted at an older age, history of

adversity, behavioral and emotional problems; Glidden, 2000; Nickman et al., 2005; Goldberg, 2010). Moreover, in the context of inter-country adoptions parents have to deal with the additional stressor of adopting children who might come from a different ethnic group (Lazarus et al., 2002). Such risk factors could account for findings that report higher parenting stress in adoptive parents compared to biological parents (McGlone et al., 2002; Rijk et al., 2006). At the same time, adoptive parents present some advantages over their biological counterparts, such as being older, financially secure, with a stable career and married longer, which could help them face the additional stressors linked to the adoption process mentioned above (Brodzinsky and Huffman, 1988; Levy-Shiff et al., 1991; Salcuni et al., 2003, 2006). Another important protective factor is the quality of dyadic functioning Lionetti et al., 2015). Recent findings highlight how the presence of a solid and positive marital relationship represents a resource in adoptive families, leading to a decrease in parenting stress and to better family and child adjustment post-adoption (Ceballo et al., 2004; Goldberg et al., 2010; Goldberg and Smith, 2014). Lionetti et al. (2015) showed how unresolved attachment in parents predicted their level of perceived stress to a greater extent than insecure attachment, together with low parenting alliance. Differences between mothers and fathers were also found. These findings are in line with the most recent trends in adoption research, which highlight the importance of family and parenting processes as predictors of child and parent outcomes (Palacios and Brodzinsky, 2010; Grotevant and McDermott, 2014), viewed as important points of entry for prevention and intervention efforts (Goldberg and Smith, 2014; Lionetti et al., 2015).

Parents' adult attachment dimensions have been extensively linked to both marital satisfaction and parent–child adjustment in adoptive and biological families (Erel and Burman, 1995; Roberson, 2006; Mikulincer and Shaver, 2007). Attachment dimensions refer to aspects of avoidance and anxiety in establishing interpersonal relationships. Avoidance is characterized by discomfort with intimacy and dependency in relationships, whereas anxiety reflects fears of abandonment and rejection together with a strong desire for closeness in relationships (Shaver and Mikulincer, 2002). Increasingly in the literature, adult attachment is considered to be responsive to environmental circumstances, especially to the quality of ongoing relationships (Bowlby, 1973; Cozzarelli et al., 2003; Moreira et al., 2003; Simpson et al., 2003), and the transition to adoptive parenthood can clearly be considered as a major life event able to activate and change parents' attachment systems (Bowlby, 1973; Jones et al., 2015). Moreover, recent findings show that dimensional measures, rather than categorical ones, provide a better conceptualization of adult attachment (Roisman et al., 2007; Jones et al., 2015), as they can help to explain how anxiety and avoidance independently relate to parenting. In line with these results, Green et al. (2007) found that attachment anxiety was a mediator in the relationship between social support and parenting outcomes in a sample of low SES, at risk mothers. Specifically, increased social support was linked to lower levels of attachment anxiety which, in turn, were related to better parent–child activities. However, the extent to which these results may apply to adoptive parents remains unclear.

Most studies so far have found that avoidance and anxiety are related to greater parenting stress in both mothers and fathers (Jones et al., 2015). Overall, the literature on gender issues in the attachment field shows that men report higher avoidance and lower anxiety compared to women (Del Giudice, 2011). However, findings are still inconsistent as regards the role of attachment dimensions and parent gender in the experience of parenting stress. In some cases, avoidance has been found to negatively influence parenting stress, especially for mothers (Rholes et al., 2006), whereas other research reports that anxiety is the best predictor of parenting stress both for mothers and fathers (Nygren et al., 2012). These contrasting results may be due to the heterogeneity of samples and measures used in prior studies, and highlight the need to include both parents and the use of dimensional measures to study the role of parent gender and adult attachment dimensions in parenting research (Jones et al., 2015).

The current study aims to investigate the relationships between dyadic adjustment, attachment dimensions and parenting stress among mothers and fathers of children internationally adopted in the past 36 months. Although both attachment dimensions and the quality of dyadic functioning have been shown to impact on parenting stress, little research has examined how these variables are associated with parenting outcomes (Green et al., 2007; Jones et al., 2015) and these relationships remain virtually unexplored among adoptive families. Based on the extant literature, it was hypothesized that (1) better dyadic functioning would be related to lower levels of attachment avoidance, attachment anxiety, and parenting stress; (2) attachment avoidance and anxiety would be positively associated with parenting stress, and (3) adult attachment dimensions would mediate the relationship between dyadic adjustment and parenting stress. Specifically, we expected a better dyadic adjustment to be linked to lower levels of both attachment avoidance and anxiety, which, in turn, would be related to lower levels of parenting stress (Moreira et al., 2003; Green et al., 2007; Goldberg and Smith, 2014; Jones et al., 2015). Due to existing evidence of gender differences in adult attachment (Del Giudice, 2011), it was expected that fathers would be more likely to report higher avoidance in attachment compared to mothers. Hence, we also examined whether the mediational model would differ between mothers and fathers. Given the lack of research investigating the links between dyadic adjustment, adult attachment, and parenting stress in adoptive fathers, no *a priori* hypothesis was formulated in this regard. In our study, we also included parent age, child age at assessment, child gender, number of adopted children, length of time the child spent in the adoptive family and child behavioral and emotional problems as control variables, because these factors have been previously linked to parenting stress. Specifically, a younger parental age (Mainemer et al., 1998), school-aged children (Palacios and Sánchez-Sandoval, 2005), a shorter time spent by the child in the adoptive family (Goldberg and Smith, 2014), more child emotional and behavioral problems reported by parents (Smith et al., 2001; Farr et al., 2010), as well as adopting a boy (Palacios and Sánchez-Sandoval, 2006) or more than one child (Bird et al.,

2002), all represent potential risk factors for elevated levels of parenting stress.

Materials and Methods

Participants

Participants included $n = 90$ mother-father pairs who adopted $n = 90$ children (n boys = 51; 57%) through international adoption. Participants all lived in Northern Italy. Inclusion criteria were: (a) married couples; (b) children were from intact families (i.e., both the mother and father lived at home and both participated in the study); (c) no reported parents' psychiatric illness; (d) parents did not have any biological children; (e) participants adopted a child via international adoption in the last 3 years. The average length of marriage was 12.60 years (SD = 4.84). Mothers were on average 43.44 years old (SD = 4.44), while fathers were 45.28 years old (SD = 4.58). According to Hollingshead's index (1975), the vast majority of adoptive parents (74%) were well educated and middle to upper-middle class. Most families adopted one single child (81%), while 19% adopted two or more children. To achieve independence, we randomly selected one child from families with more than one adopted child in the last 36 months. The majority of children included in the current sample came from Eastern Europe (40%), followed by Latin American countries (33%), and by Asian countries (19%). Only 8% of children came from Africa. At the time of adoption, children ranged in age from 9 months to 10 years, with a mean of 4.98 years (SD = 2.41). At the time of the study, children were 3 to 10 years old ($M = 6.52$, SD = 2.36) and had been residing in their adoptive homes on average for 18.47 months (SD = 12.05, ranging from 1 to 36 months). The demographic characteristics reported in our sample are in line with Italian adoptive couples' socio-demographic characteristics (Official data provided by the Government Central Authority, www.commissioneadozioni.it).

Procedure

This study was conducted in compliance with the ethical standards for research outlined in the Ethical Principles of Psychologists and Code of Conduct (American Psychological Association, 2010). Approval from the Ethical Committee for Psychological Research of the University of Padua was obtained (Protein Number 1213/2012). Adoptive families were recruited through agencies working in the field of international adoption in Northern Italy and asked to take part in a research project on family adaptation in the post-adoption period. All parents who agreed to participate signed their informed consent and completed a set of self-report questionnaires. Confidentiality was assured by replacing parents' personal information with a numeric code. No incentives were awarded and voluntary participation was emphasized. A total of 153 adoptive couples were contacted, of whom 104 participated in this study, with a response rate of approximately 68%. Among the participants, 14 couples (13.46%) were excluded from data analysis either due to missing values ($n = 5$, see paragraph 2.4 on data analysis for details about procedural aspects) or because they did not meet our inclusion criteria ($n = 9$), resulting in a final sample of 90 couples.

Measures

Demographic and Control Variables

Parents' and children's demographic variables were collected using a questionnaire developed specifically for the current study. Information about adoptive families' Socio-Economic Status (SES; Hollingshead, 1975) was obtained. Variables unique to adoption were surveyed, such as age of the child at adoption, length of time spent by the child in the adoptive family and number of adopted children. Parental perception of children's emotional and behavioral problems were used as control variables and measured by the Strengths and Difficulties Questionnaire-Parent Version (SDQ-Parent Version; Goodman, 1997). SDQ is a brief behavioral screening questionnaire asking parents of children aged 2 to 16 years about 25 attributes. The 25 items are divided between five scales of five items each, generating scores for Conduct Problems, Inattention-Hyperactivity, Emotional Symptoms, Peer Problems and Prosocial Behavior; all scales but the last are summed to generate a Total Difficulties score, which were considered in the present research. Parents are asked to rate their children's behaviors on a Likert Scale ranging from 0 (not true) to 2 (absolutely true). The Italian version of the instrument is available and has shown good psychometric properties (Marzocchi et al., 2002). Further information about reliability and convergent validity can be found on www.sdqinfo.com. In the present study, the Total Difficulties score was taken into account as a control variable in our mediation model. Cronbach's α for this scale was $\alpha = 0.76$ for mothers and $\alpha = 0.74$ for fathers (for mothers $M = 9.46$, SD = 4.94, range 1–25; for fathers $M = 9.41$, SD = 4.87, range 0–21).

Dyadic Adjustment

The Dyadic Adjustment Scale (DAS; Spanier, 1976) is currently the most widely used self-report measure of relationship adjustment in the social and behavioral sciences. Four factors (Consensus, Satisfaction, Cohesion, Affectional Expression) load on one, higher order factor (Adjustment). The scale contains 32 Likert scale items that provide information on four different subscales: Relationship satisfaction, Positive relationship behaviors, Similarity in goals and beliefs and Affectional expression. The total score ranges from 0 to 151, where higher values indicate a general better level of marital adjustment. The Italian version of the questionnaire was validated by Gentili et al. (2002). A confirmatory factor analysis confirmed the factors of the original version and good internal reliability was found. In the present study, Cronbach's alpha for the Total adjustment score was $\alpha = 0.86$ for mothers, and $\alpha = 0.82$ for fathers.

Parents' Attachment Dimensions

The Experiences in Close Relationships Scale (ECR; Brennan et al., 1998) is a 36-item self-report measure of adult attachment providing a measure of both attachment-related avoidance (18 items; e.g., "I prefer not to show others how I feel deep down") and anxiety (18 items; e.g., "I want to get very close to others, and this sometimes scares them away") in close relationships. Participants had to indicate the extent to which they agreed with each statement on a 7-point Likert scale ranging from 1 (disagree

strongly) to 7 (agree strongly). The ECR has demonstrated excellent psychometric properties including internal consistency, test–retest reliability, and construct validity (Brennan et al., 1998; Mikulincer and Shaver, 2007). The ECR Italian validation confirmed these excellent psychometric properties ($\alpha = 0.89$ for both avoidance and anxiety; Picardi et al., 2002). In the present study, both attachment dimensions demonstrated high internal consistency (for avoidance, $\alpha = 0.83$ for mothers and $\alpha = 0.87$ for fathers; for anxiety, $\alpha = 0.84$ for both mothers and fathers).

Parenting Stress

The Parenting Stress Index-Short Form (PSI-SF; Abidin, 1995) is a 36-item self-report questionnaire that asks parents of children on a Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") the degree to which they are experiencing stress in relation to their parenting role. The PSI-SF yields a Total Stress score and three subscales labeled according to the source of stress: Parental distress (PD), Parent–child dysfunctional interaction (P-CDI), and Difficult child (DC). The PSI-SF Total Stress score is obtained by adding all items, with possible scores ranging from 36 to 180. The Italian version of the questionnaire has shown good psychometric properties (Guarino et al., 2008). In the present study, Cronbach's α for the Total Stress score was $\alpha = 0.92$ for mothers and $\alpha = 0.91$ for fathers.

Data Analysis

Prior to conducting the analyses, exploratory statistics and graphs (i.e., boxplots) were used to assess normality and check for the presence of outliers on study variables. No relevant departure from normality assumptions and no extreme outliers were identified. Imputation of missing values for all variables was performed using the PASW Statistics, Release Version 18.0 (SPSS Inc, 2009). Cases were eliminated when 10% or more of the items of one measure did not receive an answer (Muris et al., 2006), resulting in a final sample of 90 adoptive couples. The missing values were imputed based upon values observed in other cases that had a similar response pattern over a set of matching variables. Descriptive information for the sample was summarized using means and standard deviations for continuous variables and counts and proportions for categorical variables. Differences between mothers and fathers were assessed using paired *t*-tests, interpreted on the basis of their significance at the 0.05 level and of Cohen's *d* measure of effect-size (Cohen, 1988). Bivariate associations among study variables were assessed using Pearson's correlations. At the multivariate level, the pattern of relationships specified by our theoretical model was examined through a series of path analyses (i.e., structural equation modeling for observed variables), using the package Lavaan (Rosseel, 2012) of the software R (R Development Core Team, 2013) and using a single observed score for each construct included in the model, separately for mothers and fathers. Data were analyzed using the maximum likelihood method with robust standard errors estimator. The mediating role of attachment anxiety and avoidance was evaluated using the Sobel test for mediation (Baron and Kenny, 1986; MacKinnon et al., 1995) with robust standard error estimate.

To evaluate the goodness of fit of the models, the R^2 of each endogenous variable and several other indices were considered (Schermelleh-Engel et al., 2003). Since the χ^2 statistic is extremely sensitive to sample size, two relative fit indices have been considered: the non-normed fit index (NNFI) and the comparative fit index (CFI), as they both perform well with small and large samples. For these indices, values that are > 0.95 and > 0.97 are associated with acceptable and good fit, respectively (Schermelleh-Engel et al., 2003). The root mean square error of approximation (RMSEA) was also used. This is an absolute fit index that assesses the approximation of parameter estimates to true parameters in the population. RMSEA values that are < 0.05 can be considered as a good fit, whereas values between 0.05 and 0.08 are thought to be an adequate fit (Schermelleh-Engel et al., 2003).

Results

Preliminary Analyses

Means and Group Differences

Means and standard deviations for study variables appear in **Table 1** separately for mothers and fathers. Fathers reported higher attachment avoidance than mothers. The remaining scales showed no gender differences.

Correlations

Intercorrelations among study variables are reported in **Table 2** separately for mothers and fathers, together with correlations between partner reports. As the matrix shows, correlations showed the expected pattern of association for both mothers and fathers. A better marital relationship was negatively related to parenting stress and to attachment avoidance and anxiety, whereas both attachment dimensions were positively related to parenting stress. Moderate correlations between partner reports on all relevant study variables were found, highlighting a moderate agreement in the perception of mothers and fathers as regards individual functioning and the perception of child difficulties.

Model Assessment

Path analysis was used to evaluate the contributions of dyadic adjustment and attachment dimensions to parenting stress at a multivariate level. A direct relationship between dyadic adjustment and parenting stress was hypothesized, and an indirect relationship between these two variables via the mediating role of attachment avoidance and anxiety. Bivariate correlations were allowed between the two mediators. Control variables were inserted in the model as covariates on parenting stress. A graphical representation of the baseline theoretical model is presented in **Figure 1**. Specifically, in order to select the most plausible model that explains data (i.e., the model that represents the best compromise between fit and parsimony), we started from the baseline model and removed path coefficients based on their significance at the 5% level, their size, and in accordance with theoretical reasons. At each step, the goodness of fit of the new model (i.e., the one with less parameters) was assessed and compared with the goodness of fit of the previous model in terms

TABLE 1 | Descriptive statistics of study variables for mothers ($n = 90$) and fathers ($n = 90$).

Scale		*M*	SD	Range	Paired *t*-test ($df = 89$)	Cohen's *d*
Dyadic Adjustment	Mothers	122.93	11.64	89–146	$t = -0.38$; $p = 0.708$	0.04
	Fathers	123.29	10.14	84–146		
Attachment avoidance	Mothers	32.03	12.20	18–74	$t = -2.10$; $p = 0.038$	0.22
	Fathers	34.88	13.41	18–80		
Attachment anxiety	Mothers	54.81	17.68	22–94	$t = 1.50$; $p = 0.138$	0.16
	Fathers	51.58	16.28	24–97		
Parenting stress	Mothers	69.76	17.26	37–111	$t = -0.88$; $p = 0.381$	0.09
	Fathers	71.10	16.55	40–120		

TABLE 2 | Intercorrelations among study variables for mothers ($n = 90$) and fathers ($n = 90$) and correlations between mother and father reports.

Variable	1	2	3	4
1 Dyadic adjustment	0.67***	−0.62***	−0.41***	−0.31**
2 Attachment avoidance	−0.66***	0.50***	0.54***	0.32**
3 Attachment anxiety	−0.42***	0.67***	0.28**	0.32**
4 Parenting stress	−0.33**	0.30**	0.26*	0.63***

*Values above the diagonal are for mothers, values below are for fathers. Correlations between mother and father reports are shown in the diagonal. *p < 0.05; **p < 0.01; ***p < 0.001.*

of explained variance and several fit indices for structural equation models (i.e., chi-square, CFI, NNFI and RMSEA).

Mothers

The baseline model showed a direct and negative link between dyadic adjustment and parenting stress ($\beta = -0.30$, SE = 0.13, $z = -2.36$, $p = 0.018$; $\beta_{\text{STANDARDIZED}} = -0.21$). Results of the Sobel test supported a mediating role of attachment anxiety in links between dyadic adjustment and parenting stress ($\beta = -0.12$, SE = 0.05, $z = -2.31$, $p = 0.021$; $\beta_{\text{STANDARDIZED}} = -0.08$), but did not support the mediating role of attachment avoidance ($\beta = -0.02$, SE = 0.09, $z = -0.19$, $p = 0.852$; $\beta_{\text{STANDARDIZED}} = -0.01$). The whole model accounted for 57% of the variance for parenting stress, 38% of the variance for attachment avoidance and 16% of the variance for attachment anxiety. The fit indices of the model were good (NNFI = 1.113; CFI = 1.00; RMSEA < 0.001) and the chi square was not significant [$\chi^2 = 4.664$ (12, $n = 90$), $p = 0.968$], providing a good fit to the data. Despite the good R^2 and fit indices, we removed attachment avoidance from the model since the link between dyadic adjustment and parenting stress via attachment avoidance was not significant at the 5% level with a small effect size. The fit indices of the model remained excellent (NNFI = 1.108; CFI = 1.00; RMSEA < 0.001), the chi square remained non-significant [$\chi^2 = 2.56$ (6, $n = 90$), $p = 0.862$], and the R^2 did not change, showing that the whole model accounted for 57% of the variance for parenting stress, confirming this final model as the most plausible for the observed data. **Figure 2A** shows the final path analytic model for mothers. In this model, dyadic adjustment was directly and negatively associated with parenting stress ($\beta = -0.32$, SE = 0.11, $z = -2.94$, $p = 0.003$; $\beta_{\text{STANDARDIZED}} = -0.22$). In addition, the Sobel test confirmed that dyadic adjustment predicted parenting stress via attachment anxiety ($\beta = -0.123$, SE = 0.05, $z = -2.49$, $p = 0.013$; $\beta_{\text{STANDARDIZED}} = -0.08$). More specifically, dyadic adjustment was negatively associated with attachment anxiety ($\beta = -0.62$, SE = 0.13, $z = -4.66$, $p < 0.001$; $\beta_{\text{STANDARDIZED}} = -0.41$), which in turn was positively associated with parenting stress ($\beta = 0.20$, SE = 0.07, $z = -2.83$, $p = 0.005$; $\beta_{\text{STANDARDIZED}} = -0.20$). Thus, among mothers the relationship of dyadic adjustment to parenting stress was partially mediated via attachment anxiety.

Fathers

As regards fathers, the baseline model did not show a direct link between dyadic adjustment and parenting stress ($\beta = -0.24$, SE = 0.24, $z = -0.97$, $p = 0.331$; $\beta_{\text{STANDARDIZED}} = -0.15$). Despite the good R^2 (44% of the variance for parenting stress, 43% of the variance for attachment avoidance and 17% of the variance for attachment anxiety), this model did not provide a good fit to the data. The fit indices of the model were not acceptable (NNFI = 0.787; CFI = 0.894, RMSEA = 0.120) and the chi-square was significant [$\chi^2 = 27.423$(12, $n = 90$), $p = 0.007$]. As a next step, since the direct link between dyadic adjustment and parenting stress was not significant at the 5% level with a small effect size, we decided to remove this link from the model. The fit indices of the model improved, but still did not provide a good fit to the data (NNFI = 0.819, CFI = 0.902, RMSEA = 0.110) and the chi-square remained significant [$\chi^2 = 27.178$ (13, $n = 90$), $p = 0.012$]. The Sobel test supported a mediating role of attachment avoidance ($\beta = -0.30$, SE = 0.13, $z = -2.35$, $p = 0.019$; $\beta_{\text{STANDARDIZED}} = -0.18$), but not of attachment anxiety ($\beta = 0.041$, SE = 0.07, $z = 0.55$, $p = 0.580$; $\beta_{\text{STANDARDIZED}} = 0.03$) in the relation between dyadic adjustment and parenting stress. Therefore, attachment anxiety was removed from the model. **Figure 2B** shows the final path analytic model for fathers. In this model, dyadic adjustment was negatively associated with attachment avoidance ($\beta = -0.870$, SE = 0.10, $z = -8.35$, $p < 0.001$; $\beta_{\text{STANDARDIZED}} = -0.66$), which in turn was positively associated with parenting stress ($\beta = 0.29$, SE = 0.09, $z = 3.15$, $p = 0.002$; $\beta_{\text{STANDARDIZED}} = 0.23$). Thus, among fathers the relationship of dyadic adjustment to parenting stress was fully mediated through attachment avoidance and this indirect link was confirmed by the Sobel test ($\beta = -0.25$, SE = 0.09, $z = -2.83$, $p = 0.005$; $\beta_{\text{STANDARDIZED}} = -0.15$). The fit indices improved in this final model, providing a good fit to the data (NNFI = 0.932; CFI = 0.968; RMSEA = 0.067) and the chi-square became non-significant [$\chi^2 = 9.845$ (7, $n = 90$), $p = 0.198$]. In addition, the R^2 remained almost unchanged compared to the baseline model,

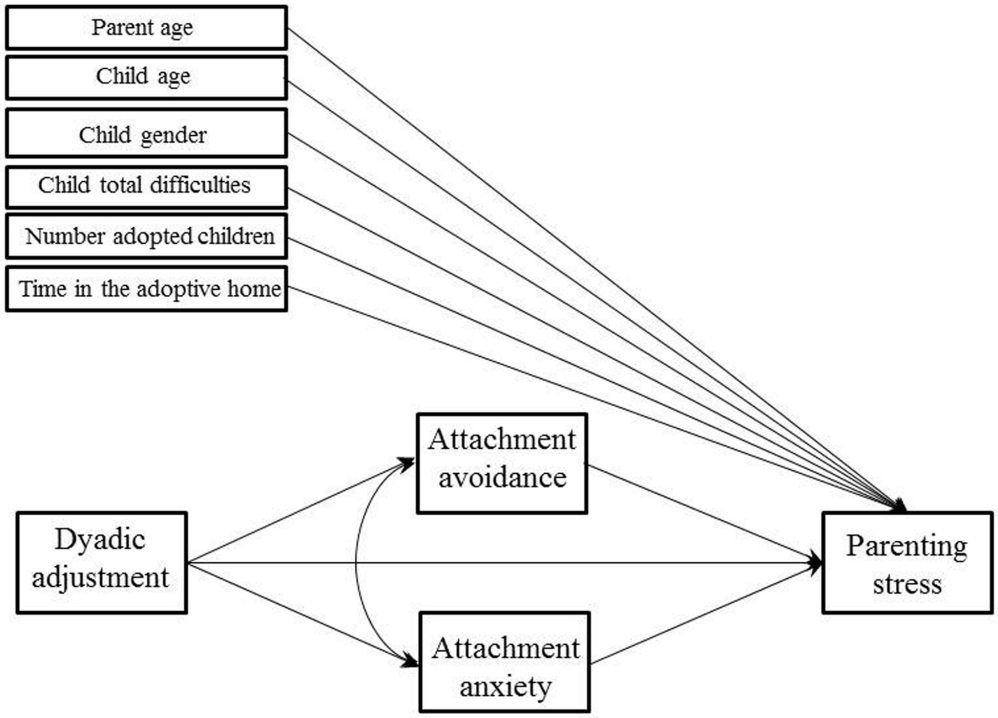

FIGURE 1 | Baseline theoretical model.

showing that the whole model accounted for 42% of the variance for parenting stress, confirming this final model as the most plausible for the observed data[1].

Discussion

Dyadic functioning has been shown to have a positive influence on parenting quality in both adoptive and non-adoptive families, but less is known about the factors mediating this relationship. The current study set out to investigate the role of dyadic adjustment, attachment anxiety and attachment avoidance in predicting parenting stress among mothers and fathers who had adopted a child via international adoption in the last 3 years. Path analytic models were used separately for mothers and fathers to examine whether dyadic adjustment would be related to parenting stress, and whether this link would be mediated by adult attachment dimensions (i.e., anxiety and avoidance). In addition, the focus of interest was on whether the mediational model would differ across parental gender. Results supported the mediational role of adult attachment dimensions, but differentially for mothers and fathers.

Consistent with previous findings (Leve et al., 2001; Viana and Welsh, 2010; Goldberg and Smith, 2014), this study documented the overall protective role of positive dyadic adjustment and low adult attachment anxiety and avoidance on parenting stress in adoptive families. On average, mothers and fathers had a positive perception of their relationship and reported a non-clinical level of parenting stress (Rosnati et al., 2013). In line with our hypotheses, a better dyadic adjustment was negatively related to attachment anxiety and avoidance and to parenting stress, both for mothers and fathers. In addition, both attachment dimensions (i.e., avoidance and anxiety) were positively related to parenting stress for both parents, confirming our expectations. Mothers and fathers did not differ in their overall perceived level of dyadic functioning and parenting stress; however, the inter-correlations between mother and father variables showed a moderate agreement, suggesting that, despite these similar perceptions, they nonetheless provide a somewhat different perspective on their individual, dyadic, and parental functioning (Rosnati et al., 2008). Specifically, one difference emerged as a function of parental gender. As expected, adoptive fathers reported higher attachment avoidance than mothers, in line with previous findings from attachment research (Rholes et al., 2006) showing that men are more avoidant and less anxious than women. While gender differences in anxiety peak during early adulthood and decrease over time, differences in avoidance between men and women increase later in life, supporting our findings (Del Giudice, 2011).

As anticipated, our path analytic models also differed as a function of parental gender. The hypothesized mediational role of attachment dimensions in the relationship between dyadic adjustment and parenting stress was confirmed for both mothers and fathers, but with some relevant differences. Among mothers, a better dyadic adjustment was related to lower levels of attachment anxiety, which in turn were associated with decreased parenting

[1]We re-tested the presence of a direct link between dyadic adjustment and parenting stress in the final model but it remained non-significant, confirming our final model as the most plausible for the observed data.

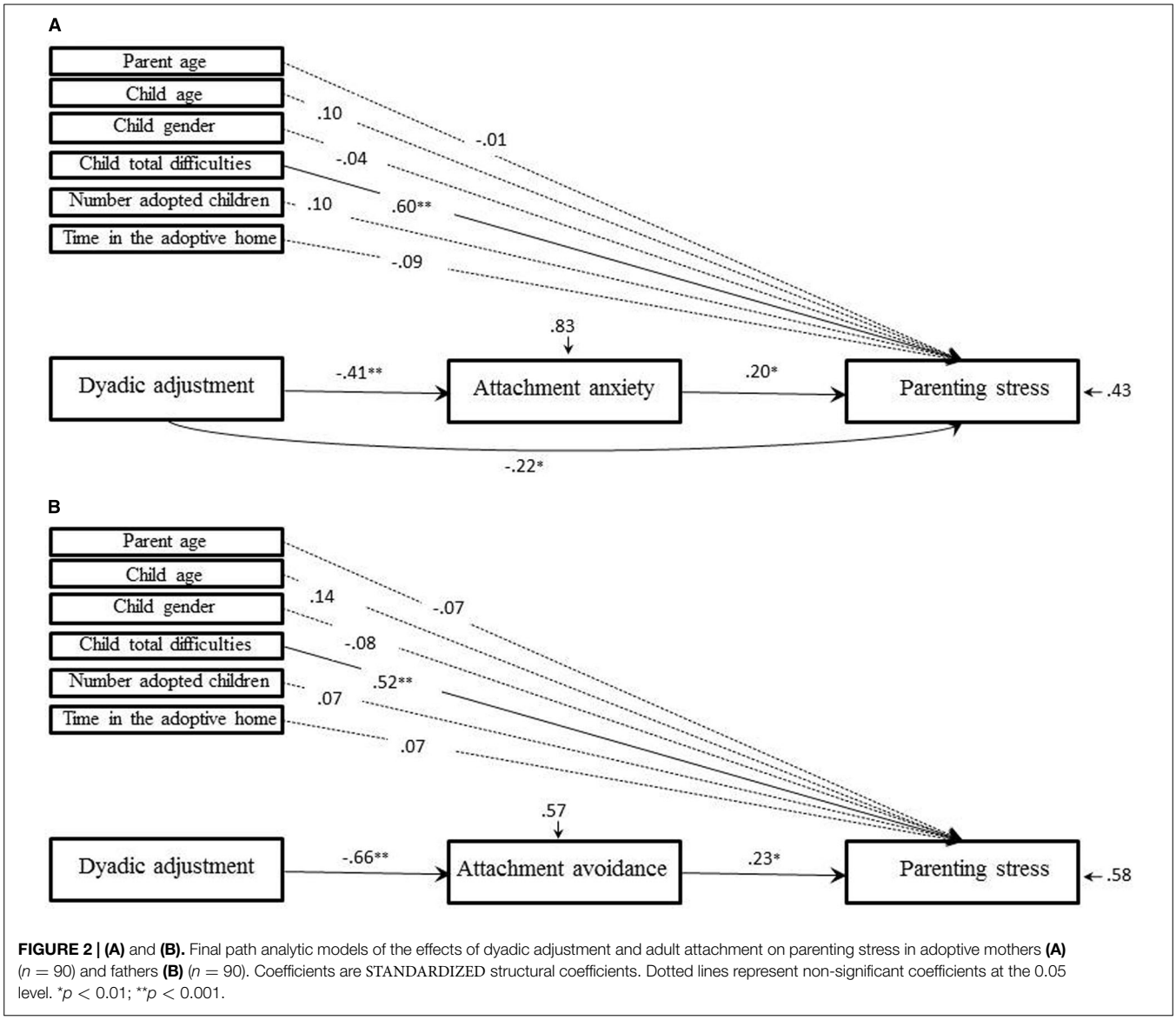

FIGURE 2 | (A) and **(B).** Final path analytic models of the effects of dyadic adjustment and adult attachment on parenting stress in adoptive mothers **(A)** ($n = 90$) and fathers **(B)** ($n = 90$). Coefficients are STANDARDIZED structural coefficients. Dotted lines represent non-significant coefficients at the 0.05 level. $^{*}p < 0.01$; $^{**}p < 0.001$.

stress. On the contrary, increased dyadic adjustment among fathers was linked to lower levels of attachment avoidance, but not to anxiety, which in turn were associated with lower levels of parenting stress. In addition, a direct and negative relationship between dyadic adjustment and parenting stress emerged, but only among mothers. These results only partially confirm our expectations of a link between attachment avoidance and anxiety and parenting stress in both mothers and fathers (Jones et al., 2015). However, Rholes et al. (2006), in their study on a sample of married couples after the birth of their first child, found that avoidant mothers and fathers showed more parenting stress, even if this relation was stronger among women. On the other hand, Nygren et al. (2012) found attachment anxiety to be associated with more parenting stress in parents of toddlers and did not find any gender differences, although their sample consisted mostly of mothers. In line with Nygren's results, Green et al. (2007) found anxiety, rather than avoidance, to be a predictor of parenting stress among a sample of at-risk low SES mothers. Such contrasting findings may be due to the variety of samples and measures used (Jones et al., 2015). We can consider adoptive mothers and fathers an at-risk population, due to the many challenges that adoptive parents have to face when adopting a child (Viana and Welsh, 2010). In this perspective, our findings confirm the central role of anxiety in predicting parenting stress in a sample of adoptive mothers (Green et al., 2007). Previous studies show how attachment anxiety is linked to greater feelings of incompetence in parenting and to more social isolation, since anxiously-attached individuals seek, but cannot benefit from, intimate social support (Collins and Feeney, 2000; Moreira et al., 2003).

As regards fathers, their role has been less extensively studied in the literature (Jones et al., 2015). Our results support the idea that avoidance, but not anxiety, predicts parenting stress among adoptive fathers. Past research found that avoidant parents feel more distant and less involved and supportive of their children, express less desire to become a parent and lack experience with children (Rholes et al., 2006). Overall, as previously stated, in

our sample adoptive fathers were more avoidant than mothers, and therefore sought and provided less support, being less involved in their relationships. Moreover, women's motivation to adopt is generally greater than men's, and, especially for fathers, partnership in the adoptive process plays a fundamental role for their emotional and functional involvement with the child, and this aspect is further enhanced in international adoption (Levy-Shiff et al., 1997). This can also explain why dyadic functioning did not directly predict parenting stress among fathers, but only indirectly through the influence on personal aspects such as feelings of avoidance, leading to a stronger involvement with the child and to a decrease in parenting stress (Rholes et al., 2006). On the other hand, among mothers a better dyadic relationship reduced parenting stress not only indirectly by decreasing levels of anxiety linked to personal feelings of incompetence and social isolation, but also directly, showing that perceived quality of the marital relationship is paramount for adoptive mothers, both to contain their personal feelings of anxiety and incompetence, and to support them in their parental role as mothers (Viana and Welsh, 2010).

To sum up our results as a "clinical vignette," adoptive couples in our sample appear to be overall well-adjusted and satisfied. Husbands and wives show a positive perception of their marital and reciprocal caring relationship, reporting on average a quite similar and non-clinical level of parenting stress. The characteristics of the adoption process couples have to face in Italy may explain—at least in part—these similar perceptions. In fact, the process is very long (almost two and a half years) and comprises many reiterated psychological and economical assessments. However, mothers and fathers in our sample also provide a rather different perspective on their individual, dyadic, and parental functioning. Specifically, more women report feelings of anxiety in their marital attachment relationship, higher feeling of parental incompetence emerges. From a clinical perspective, increased feelings of anxiety could lead mothers to seek greater reassurance and approval from their partners but at the same time, due to such feelings, they may continue to question their relationship and their personal value both as wives and as mothers. Hence, their personal abilities in parenting and marital functioning are impaired, resulting in a direct increase in their levels of parenting stress. On the other hand, more men report avoidant feelings in the marital attachment relationship, higher sense of exclusion and distance emerges, leading to higher parenting stress. Feelings of avoidance lead individuals to disregard relationships, undermining the universal need to belong, which is crucial in adoptive families, especially at the initial stages. We could hypothesize that feelings of avoidance among fathers lead to a decrease in the sense of involvement in the family, which in turn leads to a stronger sense of exclusion that can be responsible for the increase in parenting stress experienced with their adoptive child.

Limitations

Despite the unique contribution of our findings to extending knowledge about the factors involved in adoptive parents' adaptation processes, especially as regards fathers, this study presents some limitations. First, the reduced sample size limits the generalizability of our findings to the whole population of Italian adoptive parents, and did not allow to test mothers and fathers simultaneously in the same statistical model. Replicating this study in larger and more homogenous samples (e.g., adoptive families with children from a specific age range, ethnicity and country of origin) may be useful for obtaining more reliable results. Second, there could have been some overlap between our measure of behavioral problems and our measure of parenting stress, since both refer to some extent to parents' perceptions of child difficulties. Third, the lack of a comparison group of biological parents prevents us from drawing conclusions about specific and unique processes characterizing adoptive mothers and fathers. Fourth, this study relied exclusively on parental self-report measures, and a negative or positive reporting bias might result due to methodological variance and respondents' personal characteristics. Despite the choice of well-established and STANDARDIZED measures, future research could benefit from a multi-method approach to increase the validity of results. Finally yet importantly, the cross-sectional nature of our study prevents us from drawing conclusions about causality. Longitudinal studies are needed to sketch the developmental trajectories of dyadic adjustment, adult and parenting stress in adoptive parents. Future research should address these issues, which need to be held in consideration when interpreting our results.

Final Considerations and Implications for Practice

The present findings, together with prior research, document the overall protective role of dyadic adjustment and adult attachment dimensions on parenting stress in adoptive families (Lionetti et al., 2015). To the best of our knowledge, this is the first study to examine relationship among dyadic adjustment, attachment dimensions and parenting stress in a sample of adoptive mothers and fathers, highlighting the differential role of attachment avoidance and anxiety in mediating the relationship between dyadic adjustment and parenting stress as a function of parental gender. Understanding the processes through which dyadic functioning influences parenting stress holds significant implications for professionals who work with adoptive parents; interventions such as analyzing the family's adjustment, the changes in marital relationship to adoption emphasizing the role of individual and dyadic variables involved in childrearing, could help parents -in particular in post adoption phase- to better cope reciprocally and with the child, increasing positively the newborn parental relationship, decreasing parenting stress. Moreover, intervention such as collaborative assessment (Finn, 2007) based on sharing diagnosis and assessment data and making sense of a problem together (Finn, 2007), or video feedback intervention (Alink et al., 2006) will be indicated to improve the effectiveness of positive parenting and family cooperation.

Our findings, such as ones from Lionetti et al. (2015), suggest differential protective effects of dyadic adjustment and attachment dimensions on mothers' and fathers' parenting stress, highlighting the importance of including both parents in adoption research. Results show that dyadic adjustment is important to directly reduce parenting stress, especially among adoptive

mothers, whereas marital satisfaction has a more indirect effect on parenting stress among fathers. These findings confirm the importance of assessing and supporting marital adjustment pre- and post-adoption as an important variable for identifying couples who are suitable as prospective adoptive parents and as a resource in the post-adoption phase. More specifically, attachment dimensions represent an important pathway by which dyadic functioning has its effects on parenting stress, although differentially for mothers and fathers. It may be important for adoption professionals to recognize the importance of specific interventions aimed at reducing feelings of relationship anxiety and avoidance by building on parents' successful marital functioning and supporting parental sense of competence and involvement for mothers and fathers, respectively. Preventive and support interventions with adoptive families, in pre- and post-adoption phases, may enable parents to increase their levels of security and involvement in the marital relationship and to strengthen individual and family resources. Hence, this would provide adoptive parents with some protective factors able to contain and modulate parenting stress, thereby enabling them to cope with the challenges stemming from adoption.

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Mother-preterm infant interactions at 3 months of corrected age: influence of maternal depression, anxiety and neonatal birth weight

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Maternal depression and anxiety represent risk factors for the quality of early mother-preterm infant interactions, especially in the case of preterm birth. Despite the presence of many studies on this topic, the comorbidity of depressive and anxious symptoms has not been sufficiently investigated, as well as their relationship with the severity of prematurity and the quality of early interactions. The Aim of this study was to evaluate the quality of early mother-infant interactions and the prevalence of maternal depression and anxiety comparing dyads of extremely low birth weight (ELBW) and very low birth weight (VLBW) preterm infants with full-term ones. Seventy seven preterm infants (32 ELBW; 45 VLBW) and 120 full term (FT) infants and their mothers were recruited. At 3 months of corrected age, 5 min of mother-infant interactions were recorded and later coded through the Global Ratings Scales. Mothers completed the Edinburgh Postnatal Depression Scale and Penn State Worry Questionnaire. Infant levels of development were assessed through the Griffiths Mental Development Scales. A relation emerged among the severity of prematurity, depression, anxiety, and the quality of interactions. When compared with the FT group, the ELBW interactions were characterized by high maternal intrusiveness and low remoteness, while the VLBW dyads showed high levels of maternal sensitivity and infant communication. Depression was related to maternal remoteness and negative affective state, anxiety to low sensitivity, while infant interactive behaviors were impaired only in case of comorbidity. ELBW's mothers showed the highest prevalence of depressive and anxious symptoms; moreover, only in FT dyads, low maternal sensitivity, negative affective state and minor infant communication were associated to the presence of anxious symptoms. The results confirmed the impact of prematurity on mother–infant interactions and on maternal affective state. Early diagnosis can help to plan supportive interventions.

Keywords: maternal depression, maternal anxiety, birth weight, mother–infant interaction, preterm birth

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Introduction

Maternal Depression and Anxiety in the Postnatal Period

Postnatal depression has been widely recognized as a significant risk factor for woman's health, baby's development and the quality of mother–infant interactions (O'Hara and Swain, 1996; Martins and Gaffan, 2000; Guedeney and Jeammet, 2001; Righetti-Veltema et al., 2002; Beebe et al., 2012; Piteo et al., 2012). Recent studies have underlined that postnatal depression is associated to

infants' level of oxytocin, imparing their response to stress (Apter-Levy et al., 2013; Feldman, 2015; Pratt et al., 2015). Over the last decade, literature has highlighted that anxiety is also common and often comorbid with depression during the perinatal period (Josefsson et al., 2001; Austin et al., 2010; Field et al., 2010; Beebe et al., 2011; Figueiredo and Conde, 2011).

The prevalence of maternal depression and anxiety in the postpartum period is about 15–20% (O'Hara and Swain, 1996; Guedeney and Jeammet, 2001; Reck et al., 2008; Seymour et al., 2015) and can increase in women that experienced miscarriage, still birth or preterm birth (Davis et al., 2003; Voegtline et al., 2010; Padovani et al., 2011).

When undiagnosed, postnatal depression and anxiety might have long-term effects both on the mother and on the infant (Kersting et al., 2004; Murray et al., 2011) and literature shows how both depression and anxiety impact on the quality of mother–infant interactions, which appear as less synchronous and coordinated than those of non-depressed or non-anxious mother-infant dyads (Mertesacker et al., 2004; Nicol-Harper et al., 2007; Zelkowitz et al., 2009). Depressed mothers appear to be less sensitive and responsive than non-depressed ones; indeed, they are more remote or intrusive during the interaction with their babies, who, in return, tend to react to maternal behavior with passivity or distress (Field, 1984, 1995; Diego et al., 2006; Feldman and Eidelman, 2007). Anxiety has a similar effect on the quality of mother–child interactions, even though the interactive behavior of these dyads has been less explored so far. In particular, recent literature focused on the cognitive components of anxiety and on the specific worries linked to the perinatal period (Murray et al., 2007; Stein et al., 2012).

Maternal Depression and Anxiety after Preterm Birth

Prematurity is defined as the condition of all babies born alive before the 37th week of pregnancy has been completed (World Health Organization [WHO], 2012). It has been estimated that more than 1 out of 10 babies around the world are born preterm and prematurity is one of the leading causes of infant mortality, pediatric morbidity and long-term disability (Aarnoudse-Moens et al., 2009; McCormick et al., 2011). Along with the objective risk for the baby's health, preterm birth is an unexpected and stressful event for the parents, which may leave them disoriented and frightened (Lasiuk et al., 2013). Parents might experience feelings of guilt, grief and recurrent concerns about their baby's survival and health (Mendelsohn, 2005; Korja et al., 2009, 2010; Shah et al., 2011; Lasiuk et al., 2013). The persistent worries and the stress experienced can be so intense as to satisfy the criteria of post-traumatic stress disorder (DeMier et al., 2000; Pierrehumbert et al., 2003; Kersting et al., 2004).

The risk of developing anxiety and depression increases when the baby's prematurity is more severe (Vigod et al., 2010). The prevalence of depression in mothers of very low birth weight (VLBW) infants ranges from 12 to 30% in the first 4 months post-partum (Padovani et al., 2004; Miles et al., 2007; Mehler et al., 2011; Gray et al., 2012). As for anxiety, literature showed that the rate of maternal anxiety ranges from 35 to 43% during the baby's hospitalization in the NICU (Singer et al., 1999; Padovani et al., 2004, 2011) and from 12 to 26% after its discharge (Padovani et al., 2004; Rogers et al., 2013). However, to our knowledge, there is a lack of studies exploring the cognitive components of maternal anxiety in case of preterm birth. Similarly, the comorbidity between anxiety and depression has been poorly investigated in the maternal context.

Mother–Infant Interactions and Preterm Birth

Recently, an increasing number of studies have focused on the impact of prematurity on early- interactions between mother and baby, finding that preterm dyads experience poorer and less synchronous interactions than full-term ones (Poehlmann and Fiese, 2001; Holditch-Davis et al., 2007; Korja et al., 2012). On the one hand, preterm babies appear as less active and responsive during the interaction with their mothers than full-term infants; this is due to their biological immaturity (Bozzette, 2007; Feldman and Eidelman, 2007). On the other hand, preterm infants' mothers are generally reported as less sensitive and more intrusive than full term (FT) infants' ones (Feldman, 2007a; Forcada-Guex et al., 2011).

However, literature on mother–child interactions in preterm dyads shows some inconsistencies (Bozzette, 2007; Korja et al., 2012). There is a lack of data exploring the relationship among the quality of early interactions, maternal depression, anxiety, and the severity of prematurity. To our knowledge, only Agostini et al. (2014) have partially investigated this relationship, finding that the quality of mother-preterm infant interactions could be impaired in specific ways both by the presence of maternal depression and by the severity of premature birth.

Aim of the Study

The objective of the following study was to fulfill the gap existing in previous literature.

The general aim was to explore how the severity of prematurity, depression, and anxiety might impact on the quality of early interactions, therefore to conduct an explorative study. Specifically, we aimed at evaluating if the severity of birth weight was significantly associated to the quality of mother–infant interactions. Secondly, we investigated the influence of maternal depression/anxiety, considered both separately as well as their interaction, on interactive patterns (maternal and infant ones). With reference to anxiety, we specifically focused on detecting maternal worries, which are the cognitive components of anxiety and the key symptoms of generalized anxiety disorder (GAD; American Psychiatric Association [APA], 2000).

To this end, mother–infant interactions in preterm dyads were observed and compared to mother–infant interactions in FT dyads at 3 months post-partum. This time of the assessment was chosen, based on the evidence that the third month postpartum is a significant step for the co- construction of dyadic interactive patterns (Feldman, 2007b; Tronick, 2007) and for the detection of postnatal depression (Cox et al., 1987a; Cramer, 2000).

Materials and Methods

Participants

During the period March 2010-February 2013, all the mothers of preterm infants with birth weight under 1500 g and a gestational age <32 weeks, who had been hospitalized at the NICU of the Bufalini Hospital (Cesena, Italy), were asked to take part in the study. Only five mothers refused to participate. A total of 77 mother–infant dyads were recruited. The severity of their prematurity was evaluated according to their birth weight: 32 infants were extremely low birth weight (ELBW; under 1000 g) and 45 were VLBW (birth weight between 1000 and 1500 g).

During the period March 2011–August 2012, a psychologist met potential subjects for the control group in 36 antenatal classes held in Cesena. Each antenatal class was attended by 10–12 pregnant women, at the third trimester of pregnancy; ∼30% in each group accepted to participate in the study voluntarily. All women were included in the sample as none of them had severe complications at delivery and gave birth to a healthy full-term baby. A total of 120 women were recruited (FT group).

Exclusion criteria for both groups were: infant chromosomal abnormalities, cerebral palsy, malformations and fetopathy, previous or present parents' psychiatric illness and lack of fluency in Italian.

Procedure

This study is part of a longitudinal research that followed mother-preterm infant dyads from 3 to 18 months of corrected age. The study protocol was approved by the Ethic Committee of the Department of Psychology (University of Bologna).

Mother–infant dyads were assessed at infant's 3 months of age (corrected age for preterm infants). Mothers and their infants were met by a psychologist at the Laboratory of Psychodynamic of Development, Department of Psychology, University of Bologna, Italy.

All mothers completed a written consent form and a socio-demographic questionnaire. Perinatal data were collected for all dyads.

Measures

A general quotient (GQ) of the infants' development was assessed by means of the Griffiths Mental Development Scales-Revised version (GMDS-R for 0–2 years), a well-recognized measure for infant mental and psychomotor development (Griffiths, 1996). The GQ represents the mean score of 5 areas of development (Locomotor, Personal-Social, Hearing and Language, Eye and Hand Co-ordination, Performance). The GMDS-R has been largely used in Italian samples of preterm infants (Giannì et al., 2007; Monti et al., 2013; Agostini et al., 2014; Biasini et al., 2015b).

The presence of depressive symptoms in the postnatal period was investigated through the Edinburgh Postnatal Depression Scale (EPDS; Cox et al., 1987b), a self-report questionnaire. Mothers were asked to describe their mood during the previous 7 days by means of 10 items, each scoring between 0 to 3, with higher total scores indicating increasing distress. The Italian version (Benvenuti et al., 1999) showed good internal consistency (0.78). In the present study, EPDS was used both as a continuous and a categorical variable (depressed vs. non-depressed), with a cut-off value of 12/13 to screen for major depressive symptomatology, according to a previous Italian study (Agostini et al., 2015).

As to maternal anxiety, all mothers completed the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990), a self-report questionnaire designed to assess generalized pathological worries, considering the degree of excessiveness and of uncontrollability. It was developed to evaluate an individual's disposition to worry, as well as the frequency of the condition, its excess or intensity, as well as the tendency for the person to worry generally and not in one or a small number of situations. PSWQ is composed of 16 items, rated on a Likert scale between 1 (Not at all typical of me) to 5 (Very typical of me). Eleven items are positively worded (e.g., "Once I start to worry, I can't stop") and five items are negatively worded (e.g., "I never worry about anything"). All negatively worded items are reverse scored and the sum of all the item scores gives a total that ranges from 16 to 80, where the higher the value, the higher the levels of pathological worry. PSWQ was previously used to detect the presence of anxious symptomatology in the perinatal period (Murray et al., 2007; Swanson et al., 2011; O'Connor et al., 2013). The Italian version of PSWQ suggests a cut-off score of 57 to discriminate anxious and non-anxious subjects and showed good internal consistency (0.85) (Morani et al., 1999). As for EPDS, in the present study we used both continuous and categorical scores (anxious vs. non-anxious mothers).

Infant and maternal interactive behaviors were coded by means of the Global Rating Scales (GRS) for Mother–Infant interaction (Murray et al., 1996a,b). Similarly to other rating systems (e.g., Cohn et al., 1986; Field et al., 1990), GRS are video-based assessments of the quality of mother-infant engagement in the 2–4 month postnatal period and have originally been developed to distinguish depressed and non-depressed mother–infant interactions for research purposes. Previous Authors often used GRS to discriminate a wide range of infant and maternal populations (e.g., clinical groups with schizophrenia, social adversity), showing good reliability (Riordan et al., 1999; Gunning et al., 2004; Grant et al., 2010; Costa and Figueiredo, 2011; Montirosso et al., 2012; Agostini and Murray, 2014) and validity in predicting the subsequent child's performance (Murray et al., 1996a,b). As to the procedure, the mother was asked to sit opposite her baby, and to freely interact for 5 min without toys, as she usually would do at home. Video recordings of the episode were rated by a trained and expert rater (blind to maternal mood) on four maternal behavioral dimensions (Sensitivity, Intrusiveness, Remoteness, Signs of depression) and on three infant's ones (Communicative, Inert, Distressed). All the dimensions are scored on a 5-point Likert scale, where 1 always corresponds to "poor" interactive maternal or infant behavior and 5 to most "optimal" behavior. A second rater coded ten videos randomly selected: the intra-class correlations showed acceptable reliability (mean = 0.75, range 0.68–0.88).

Results

The infant and maternal socio-demographic characteristics are shown in **Table 1**.

The three groups showed significant differences regarding the following infant characteristics: gestational age, birth weight, birth length, length of hospitalization, and type of delivery (**Table 1**); since these variables are strictly linked to preterm birth, these results were expected. No differences emerged regarding the infants' gender.

As to maternal variables, the three groups were homogeneous with relation to most of the variables, except for parity and level of education (**Table 1**): FT infants' mothers, compared to ELBW and VLBW ones, were primiparous in a higher percentage [$\chi^2(2) = 11.495$; $p = 0.003$] and had a higher level of education [$F(1,196) = 12.023$; $p < 0.0005$; Bonferroni *post hoc*: $p < 0.0005$ and $p = 0.003$, respectively].

Moreover, the level of infant development, as measured by the GQ (GMDS-R) was significantly different among the three groups [$F(2,196) = 9.69$, $p < 0.0005$; **Table 1**]: Bonferroni's *post hoc* analyses showed that ELBW infants had significantly lower scores than both VLBW and FT groups ($p = 0.004$ and $p < 0.0005$, respectively).

Specific analyses were run to control the effect of maternal parity, years of education and GQ on EPDS, PSWQ and GRS scores: parity did not show any significant influence, while education and level of development were significantly associated with dependent variables. Therefore, the years of education and GQ were always included as covariates in consecutive analyses in order to control their influence.

Mother–Infant Interactions

The Univariate ANOVA was run for each GRS scale in order to analyze the main effects of birth weight, maternal depression and anxiety variables on interactive behaviors, also considering their possible interaction; GQ score and maternal education were always included as covariates (**Table 2**).

Birth Weight

The three groups showed significant differences on all the scales about maternal behaviors: Sensitivity [$F(2,196) = 3.147$; $p = 0.045$], Intrusiveness [$F(2,196) = 4.993$; $p = 0.008$], Remoteness [$F(2,196) = 2.985$; $p = 0.050$] and Signs of Depression [$F(2,196) = 5.720$; $p = 0.004$; **Table 2**].

In the case of Sensitivity dimension, VLBW mothers obtained higher scores than those of FT infants (Bonferroni *post hoc*, $p = 0.031$). When maternal Intrusiveness and Remoteness dimensions were considered, ELBW mothers showed more intrusive and less remote behaviors than the mothers of FT ones (Bonferroni *post hoc*, $p = 0.006$; $p = 0.012$). Finally, Bonferroni *post hoc* showed higher scores on Signs of Depression dimension in the mothers of ELBW and VLBW infants than those of FT infants ($p = 0.028$; $p = 0.022$, respectively; **Figure 1**).

When infant's scales were considered, a significant effect of birth weight emerged on Communicative dimension [$F(2,196) = 6.436$; $p = 0.002$]: VLBW infants showed higher scores than those of FT infants (Bonferroni *post hoc*, $p = 0.016$).

TABLE 1 | Infant and maternal characteristics.

	ELBW (*n* = 32)	VLBW (*n* = 45)	FT (*n* = 120)	*p* value
Infant characteristics				
Gestational age, weeks (mean ± *SD*, range)	27.52 ± 2.06, 24–31	29.70 ± 1.33, 26.86–32	39.93 ± 1.08, 37–41	<0.0005
Birth weight, grams, (mean ± *SD*, range)	823.00 ± 96.6, 599–985	1260.39 ± 162.7, 1005–1500	3476.57 ± 428.4, 2700–4780	<0.0005
Birth Length, cm (mean ± *SD*, range)	34.28 ± 2.47, 30.0–38.8	39.24 ± 2.99, 28.50–43.50	51.41 ± 2.08, 46.0–57.0	<0.0005
Length of hospitalization	60.93 ± 16.74, 36–92	37.23 ± 15.94, 10–89	2.09 ± 0.34, 2–4	<0.0005
Type of delivery,				<0.0005
Spontaneous (%)	25.0	22.5	78.4	
Cesarian section (%)	75.0	77.5	21.6	
Gender				0.153
Male (%)	51.6	66.7	50.0	
Female (%)	48.4	33.3	50.0	
GMDS general quotients (GQ), (mean ± *SD*, range)	104.09 ± 12.44	111.02 ± 8.48	111.98 ± 8.15	<0.0005
Maternal characteristics				
Maternal age, years (mean ± *SD*, range)	33.54 ± 5.46, 21–42	33.82 ± 5.91, 23–47	32.89 ± 5.02, 18–45	0.588
Education, years, (mean ± *SD*, range)	11.90 ± 3.75, 8–18	12.78 ± 3.19, 8–18	14.67 ± 3.20, 8–18	<0.0005
Parity				0.004
Nulliparous (%)	75.0	66.7	88.3	
Multiparous (%)	25.0	33.3	11.7	
Marital status				0.319
Married/cohabiting	96.9	97.8	92.3	
Other	3.1	2.2	7.7	

ELBW, extremely low birth weight infants; VLBW, very low birth weight infants; FT, full term infants.

TABLE 2 | Mother–infant interactive behaviors (GRS): differences among groups.

	Birth Weight			Maternal Depression		Maternal Anxiety		F					
	ELBW (n = 32)	VLBW (n = 45)	FT (n = 120)	Depressed (n = 20)	No-depressed (n = 177)	Anxious (n = 15)	No anxious (n = 182)	Birth weight	Maternal depression	Maternal anxiety y	Maternal depression × anxiety	Birth weight × maternal depression	Birth weight t × maternal anxiety y
Maternal interactive dimensions													
Sensitivity	3.37 ± 0.12	3.60 ± 0.13[b]	3.12 ± 0.14[b]	3.31 ± 0.12	3.38 ± 0.08	3.13 ± 0.13	3.51 ± 0.08	3.147*	0.633	4.355*	0.280	0.280	5.153*
Intrusiveness	4.50 ± 0.20[a]	4.25 ± 0.22	3.83 ± 0.22[a]	3.90 ± 0.17	3.76 ± 0.12	3.86 ± 0.19	3.82 ± 0.11	4.993*	0.382	0.028	0.244	0.244	0.138
Remoteness	3.42 ± 0.17[a]	3.86 ± 0.19	4.24 ± 0.19[a]	3.91 ± 0.20	4.52 ± 0.14	4.18 ± 0.22	4.20 ± 0.13	2.985*	7.389*	0.046	2.408	1.716	0.544
Signs of depression	3.98 ± 0.11[a]	4.02 ± 0.12[b]	3.56 ± 0.12[ab]	3.72 ± 0.11	3.98 ± 0.74	3.72 ± 0.12	3.94 ± 0.07	5.720**	5.373*	1.327	3.726*	0.625	3.445*
Infant Interactive Dimensions													
Communicative	2.85 ± 0.18	3.08 ± 0.20[b]	2.30 ± 0.20[b]	2.64 ± 0.17	2.81 ± 0.12	2.55 ± 0.20	2.85 ± 0.12	6.436*	3.641	0.205	6.041*	0.252	5.768*
Inert	3.11 ± 0.17	3.21 ± 0.18	2.93 ± 0.19	2.96 ± 0.16	3.21 ± 0.11	2.94 ± 0.18	3.19 ± 0.11	1.328	2.913	0.413	3.777*	0.324	1.347
Distressed	3.76 ± 0.13	3.82 ± 0.14	3.53 ± 0.15	3.67 ± 0.13	3.73 ± 0.09	3.68 ± 0.14	3.71 ± 0.09	1.577	0.504	0.009	1.073	0.027	1.636

Scores are rated on 5-point scale (1 = poor, 5 = optimal). Values are mean ± SD

[a]$p < 0.05$ *for post hoc test (ELBW preterm dyads vs FT dyads).*

[b]$p < 0.05$ *for post hoc test (VLBW preterm dyads vs FT dyads).*

*$p < 0.05$.

**$p < 0.005$.

No significant effect on any other infant dimensions emerged (**Figure 1**).

Maternal Symptomatology: Depression and Anxiety

When we considered the categorical score of EPDS (depressed vs. non-depressed), 10.2% women ($n = 20$) of the total sample resulted in the "depressed group."

As to mother–infant interactions, maternal depression showed a significant effect on the mean scores of Remoteness dimension [$F(1,196) = 7.389$; $p = 0.007$]: depressed mothers were more remote than non-depressed ones. Besides, depressed mothers showed a lower mean score on the Signs of depression dimension [$F(1,149) = 5.373$; $p = 0.022$; **Table 2**], meaning that their interactive behavior was significantly affected by their negative affective state in terms of low energy, sad facial expressions and tendency to self-absorption. No differences emerged between depressed and non-depressed groups on mothers' Sensitivity and Intrusiveness dimensions and on any of the infants' dimensions considered (**Table 2**).

Considering the categorical score of PSWQ (anxious vs. non-anxious), the "anxious group" was composed of 7.6% of the women ($n = 15\%$) of the total sample.

With regard to mother–infant interaction, the analyses showed no differences between the two groups on the dimensions of Intrusiveness, Remoteness, and Sign of Depression (**Table 2**). Indeed, anxious mothers obtained lower mean scores than non-anxious ones as to Sensitive dimension [$F(1,196) = 4.355$; $p = 0.038$]: this means that they showed less ability to detect and understand the infant's signals and to respond with adequate levels of acceptance, affection and warmth. No differences emerged between anxious and non-anxious groups on any dimensions of the infants' interactive behavior (**Table 2**).

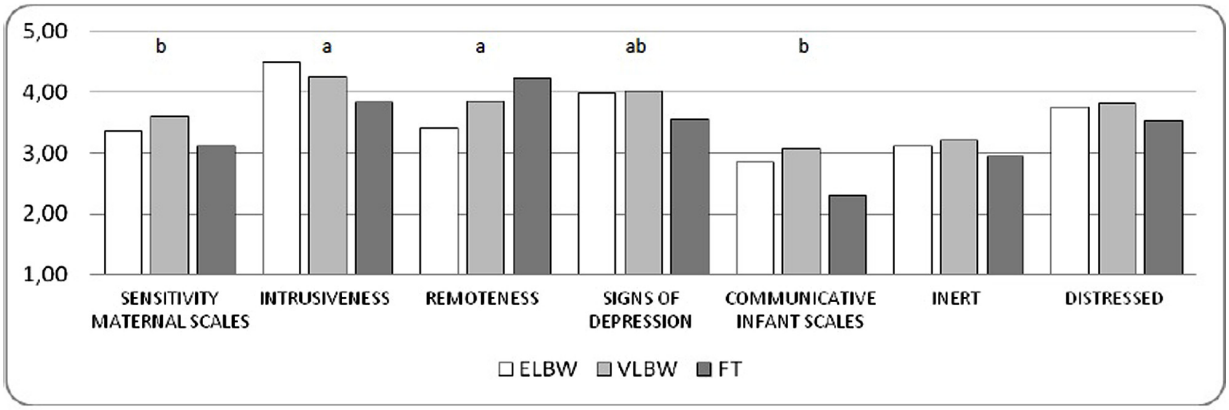
A significant interaction effect emerged between maternal depressive and anxiety symptomatology on the mean scores of Signs of Depression [$F(1,196) = 3.726$; $p = 0.050$], Communicative [$F(1,196) = 6.041$; $p = 0.015$], and Inert dimension [$F(1,196) = 3.777$; $p = 0.050$]. In all cases, the comorbidity of depression and anxiety was associated to lower levels of affective maternal behaviors and less attention, communication and engagement in the infant (**Figure 2**).

Birth Weight and Maternal Symptomatology

The three birth weight groups showed significant differences on EPDS mean scores [$F(2,196) = 11.345$; $p = 0.001$]: the mothers of ELBW infants showed higher scores compared to those of VLBW and FT ones (10.06, 6.62, 5.39, respectively; Bonferroni *post hoc* test $p = 0.015$ and $p < 0.0005$, respectively). The Pearson chi square test showed a significantly higher frequency of depressed women in the ELBW group compared to those of the FT group (25.0, 4.2%, respectively; $\chi^2(2) = 13.888$, $p = 0.001$); even if 15.6% of VLBW infants' mothers were depressed, their prevalence did not significantly differ from the other two groups.

The interaction between birth weight and maternal depression showed no significant effect on any interactive dimensions mean scores.

When maternal anxiety was considered, the mean scores of PSWQ resulted significantly different among the three categories



a $p < 0.05$ for post hoc test (ELBW preterm dyads vs FT dyads).
b $p < 0.05$ for post hoc test (VLBW preterm dyads vs FT dyads).

FIGURE 1 | Mother–infant interactive behaviors mean scores according to Birth Weight.

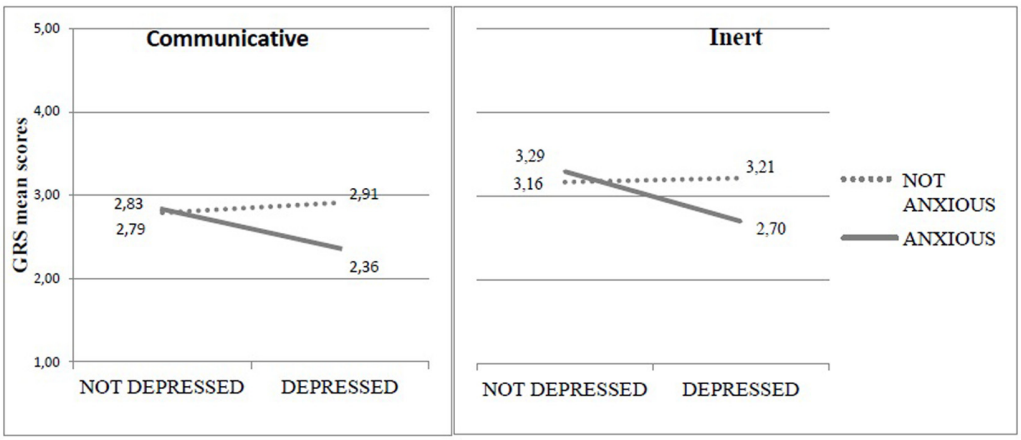


FIGURE 2 | Communicative and Inert mean scores in relation to depressive × anxious symptomatology.

of birth weight [$F(2,196) = 4.31$; $p = 0.026$]: Bonferroni *post hoc* analysis showed that ELBW infants' mothers got higher scores compared to FT infants' ones (44.22, 37.85, respectively; $p = 0.026$). The Pearson chi square test showed a significantly higher prevalence of anxious women in the ELBW group compared to those in the VLBW and FT ones [21.9, 6.7, 4.2%, respectively; $\chi^2(2) = 11.336$, $p = 0.003$].

Differently from maternal depression, a significant interaction between birth weight and anxiety emerged on the means scores of Sensitivity, Signs of Depression and Communicative dimensions [$F(2,196) = 5.513$; $p = 0.007$; $F(2,196) = 3.445$; $p = 0.034$; $F(2,196) = 5.768$; $p = 0.004$, respectively; **Table 2**]. Simple effect analyses showed that, only in FT mothers, lower scores were strongly associated to the presence of anxious symptoms, while for ELBW and VLBW mothers the quality of interaction was similar, independently from the exhibition of anxiety symptoms (**Figure 3**).

Discussion

Many studies have investigated the effect of maternal affective state on the quality of mother–infant interactions in the first 3 months of life, especially in the context of preterm birth. However, to our knowledge, there is a lack of studies exploring both the direct and the combined effect of maternal affective state (depressive and anxious symptoms) and the severity of preterm birth on early interactions. Therefore, we aimed at investigating how mother–infant interactions were influenced by maternal depression, anxiety and the severity of preterm birth.

A first interesting result is related to the effect of preterm birth on early interactions. Even if the development of mother–infant relationship in case of preterm birth has been deeply analyzed in literature, the effect of birth weight as a risk factor is still understudied. Our study has the strength of considering two groups of preterm infants characterized by a different level of

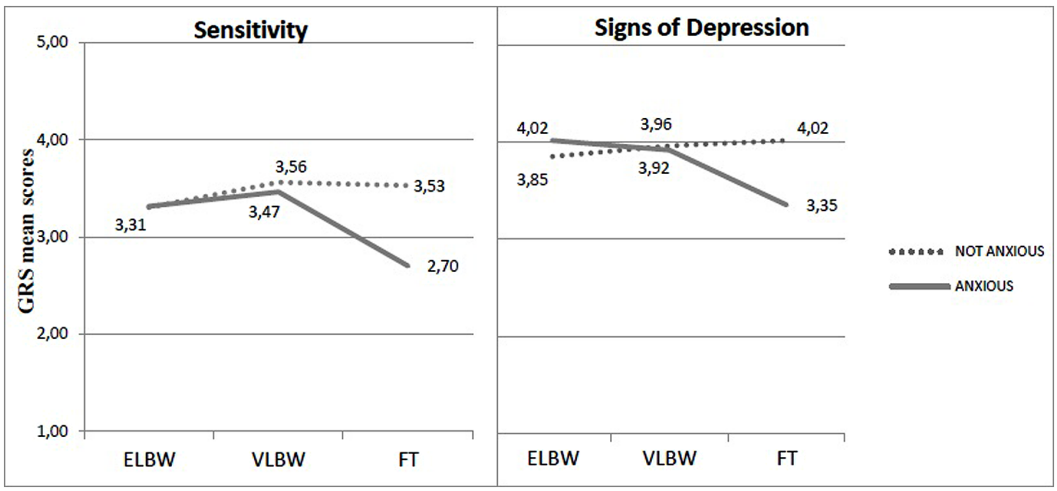


FIGURE 3 | Sensitivity and Signs of Depressions mean scores in relation to birth weight × anxious symptomatology.

severity of prematurity (very/extremely low birth weight) and a control group of full-term dyads.

In the present study, birth weight did not seem to compromise the quality of infant interactive patterns: preterm babies showed similar interactive scores compared to full-term infants; indeed, differently from what emerged from previous studies (Crawford, 1982; Singer et al., 2003; Korja et al., 2012; De Schuymer et al., 2012), they did not show high levels of passivity, fretful and disengaged behaviors. Moreover, VLBW infants appeared very communicative, with higher mean scores when compared to full-term ones.

When maternal interactive patterns are considered, many differences emerged as to birth weight. However, the results seem to indicate that birth weight has a different and specific effect on the single dimensions of maternal interactive behavior. Globally, all mothers showed good scores on Sensitivity dimensions, with higher mean scores in VLBW mothers compared to FT mothers. This result was somehow unexpected, because many authors previously described preterm babies' mothers as non-sensitive (Zarling et al., 1988; Muller-Nix et al., 2004; Forcada-Guex et al., 2006, 2011). Nevertheless, other studies failed to find significant differences between maternal interactive behaviors when comparing preterm to FT mothers (Greenberg and Crnic, 1988; Schermann-Eizirik et al., 1997; Korja et al., 2008a; Montirosso et al., 2010), showing how prematurity was associated to high levels of caretaking (Crawford, 1982; Jean and Stack, 2012). The attention paid to different categories of prematurity may show specific interactive patterns, which did not emerge in previous studies where prematurity was considered as a global and homogenous category. The same explanation may be useful to understand the differences between VLBW and FT infants that emerged on infant communication dimensions. It is also important to consider the characteristics of the instrument chosen to evaluate interactive behaviors; GRS scales describe Sensitivity as the mother's ability to detect and understand her infant's signals and to appropriately respond, with adequate levels of acceptance, affection and warmth (Murray et al., 1996a). Therefore, our study may stress the differences related to the warmth and affection showed by VLBW mothers.

When the maternal intrusive and remote behaviors were considered, the results were consistent with previous studies (Crawford, 1982; Muller-Nix et al., 2004; Forcada-Guex et al., 2006; Korja et al., 2012) that described preterm mothers as very active and overstimulated. However, this pattern was detected only in the ELBW infants' mothers. In the case of VLBW, the higher level of infant communication may possibly endorse maternal behaviors, reducing their intrusiveness. This result may add some information to the previous literature (Schmücker et al., 2005; Forcada-Guex et al., 2011) about the role of birth weight as a possible moderator between preterm birth and maternal intrusiveness, thus widening the areas for future investigation.

Another interesting result is related to the mean scores obtained by both groups of preterm infants' mothers on the Signs of Depression dimension. This data may appear inconsistent with the prevalence of depression found by means of EPDS, which was significantly higher in ELBW mothers than in FT ones. As to the Sensitivity dimension, some considerations must be taken into account. The prevalence of depression detected with the EPDS concerns the subjective perception of maternal affective state as to sense of guilt, lack of pleasure, and dissatisfaction. To this end, the levels of depression found in ELBW infants' mothers confirm and enrich the existing literature (Padovani et al., 2004; Miles et al., 2007; Vigod et al., 2010; Brandon et al., 2011; Gray et al., 2012), showing how the higher is the severity of prematurity the higher is the risk of maternal depression. On the contrary, the GRS Signs of Depression dimension focuses on detecting depressive symptoms emerged during the interaction with their baby in terms of low energy, self-absorption and poor engagement with the infant (Murray et al., 1996a). It should be noted that literature on prematurity shows preterm infants' mothers to be engaged with their babies also in case of depression

(Agostini et al., 2014): this pattern was observed in both groups of preterm dyads (ELBW and VLBW) and it might represent a specific interactive behavior of their mothers, while depression detected by EPDS was high only in the case of ELBW infants' mothers. As a result, the difference found between the scores of the EPDS and the GRS Sign of Depression dimension might be explained as the different aspects of depression investigated by the two instruments. Moreover, it should be considered that while the EPDS is a self-report questionnaire, the GRS is a measure of the quality of interaction evaluated by a blinded rater: therefore he can observe also adequate interactive behaviors independently by the level of maternal sense of guilt, lack of pleasure, and dissatisfaction. This aspect has clinical implications: when interventions are planned to support parenting skills, the GRS may enrich maternal self-representation, showing positive aspects that could be missed by the mother due to her depressive mood/state.

Another objective of the study was to evaluate the effect of maternal symptomatology (depression and anxiety) on the quality of mother–infant interactions. The results seem to show that, when their interaction is considered, maternal depression was associated with Remoteness and Sign of Depression dimensions, while maternal anxiety significantly affected the level of Sensitivity.

The results seem to underline that both kind of symptoms impaired the relationship between mothers and their infants, but with a specific effect on maternal behaviors: depression has a negative influence on the maternal ability to stay close to her infant, on her level of energy and engagement during the interaction; conversely, anxiety has a major effect on the skills of perceiving and responding to infant cues. This result is very relevant and widens the literature on the topic, since previously depression and anxiety have been investigated separately.

Another peculiarity of the present study was the use of PSWQ to detect the symptoms of maternal anxiety. While in previous studies about perinatality, anxiety was often evaluated through generic instruments as STAI (Padovani et al., 2004, 2008; Correia and Linhares, 2007; Zelkowitz et al., 2007, 2009), we chose to focus on worries, a specific component of anxiety. It could be hypothesized that the tendency to worry or ruminate might alter the mother's attentional focus, reducing her ability to adequately respond to her infant's cues (Stein et al., 2012).

Interestingly, the study did not detect a direct effect of anxiety on any infant dimensions. However, when the interaction between maternal depression and anxiety was considered, we found a significant effect on infant Communicative and Inert dimensions: in both cases, the infant interactive behaviors were negatively influenced by the presence of maternal depression and anxiety. Besides, a significant interaction effect emerged on the Signs of Depression dimension, underlining how the level of maternal affective state, as measured by GRS scales, was affected by the presence of depression and worsened in case of comorbidity with anxiety – a cumulative effect.

Globally, the results seem to indicate a direct effect of maternal symptomatology (depression or anxiety) on maternal behaviors, whereas infant interactive patters seem to be more influenced by the co-occurrence of maternal depression and anxiety. Considering that the comorbidity of depression and anxiety is high in the first postpartum period (18–34%; Reck et al., 2008), it is very important that future studies pay particular attention to the effects of co-occurrence of both maternal depression and anxiety.

The study confirmed how the first postpartum months can be a very sensitive period with an elevate risk of onset of maternal depression and anxiety, especially in case of preterm birth. However, it is important to note that, when preterm birth was considered, a high prevalence of both depressive and anxious symptoms only in ELBW mothers were found, while in case of VLBW group the frequency was similar to those of full-term mothers.

As to depressive symptomatology, the review by Vigod et al. (2010) showed how a severe preterm birth may be associated, during the first postnatal year, with higher levels of depressive symptoms in LBW and VLBW infants' mothers. This study deepened Vigod's results adding the evaluation on ELBW infants' mothers.

To our knowledge, there are no specific studies that investigate the prevalence of maternal anxiety according to preterm birth weight. In this research, the use of PSWQ showed a high tendency of worries or rumination only in ELBW infants' mothers. The extreme severity of prematurity may possibly represent a very frightful event for mothers with concerns and worries which last for many months after the discharge of the baby (Singer et al., 1999; Wijnroks, 1999; Kersting et al., 2004; Feeley et al., 2007).

Considering both depression and anxiety, the results give a contribution to literature and it emphasizes the need for future research to distinguish among different preterm conditions. This element could deepen existing literature and identify those parents who, after a preterm birth, are forced to face stress with less adaptive coping skills.

However, it should be noted that, in full-term mothers, the rate of maternal depressive and anxiety symptoms was slightly lower compared to the prevalence reported in other studies (depression: 4.2 vs. 10%; Murray et al., 1996a; Gavin et al., 2005; anxiety: 4.2 vs. 27.9%, Ross et al., 2003; Britton, 2005). This result could be partially influenced by the method of recruitment and explained by the sample characteristics; therefore, it is suggested to confirm these data on wider samples in the future.

According to the objectives of this study, an interactive significant effect emerged between the birth weight and maternal symptomatology only in case of maternal anxiety. As previously reported, the use of PSWQ could be particularly adequate to detect how the tendency to worry may impair the maternal ability to capture and reply to their infant's needs (Stein et al., 2012). Interestingly, this effect is particularly evident in the mothers of the control group. In absence of birth risk factor, this group of mothers tends to interact with the infant in a sensitive way. The presence of anxious symptomatology can worsen the maternal ability to interact with the infants, while maternal anxiety may represent a very common condition when premature birth occurs. The influences of anxiety on mother–infant interactions could be then screened by the preterm birth, while anxiety may function as an adaptive response in this traumatic condition

to help mothers to maintain the focus on the infant and their relationship.

Differently, depression have the same negative effects on preterm and FT dyads, confirming existing literature (Murray et al., 1996a; Korja et al., 2008b; Poehlmann et al., 2011).

Some considerations must be done regarding the NICU where preterm infants were recruited. According to NIDCAP guidelines (Als and Gibes, 1986; Ohlsson and Jacobs, 2013), all the staff is careful to protect and enhance the infant's and parents' quality of life. Since the first moments of life, the relationship between preterm infant and their parents is guaranteed by 24-h free access to the unit. In fact, after preterm birth mothers could feel inadequate to care to such a fragile infant, a number of specialized professional figures (e.g., physiotherapists, clinical psychologists) are present to help them feel useful and involved in their infant's care. To this end, many methods are used, such as kangaroo care, infant massage, both useful to teach to touch the infant in a comfortable way, and reading a little fairy-tale, which allow the baby to listen to maternal voice as it used to do during pregnancy (Biasini et al., 2015a). Literature states that these interventions are very important to reduce the level of psychological distress in the NICU and after discharge (Melnyk et al., 2006; Trombini et al., 2008), with positive effects on the quality of the dyadic interaction. These elements could explain the high levels of maternal sensitivity and infant communicative interactive patterns found in this study. These protective factors could be particularly relevant for the VLBW group, which being less at-risk may better benefit from the interventions. Globally, when a NICU functions as a supportive environment, it can promote positive mother–infant interactions during hospitalization, inducing mechanistic changes in the brain structure and function, maximizing positive neurodevelopmental outcomes and reducing neurologic deficits (Weber et al., 2012).

Some limits of the study might be acknowledged. Firstly, all results need replication, based on studies with wider samples. Secondly, in the present study the role of the infant's father was not considered. Because the father plays a relevant role in moderating the effects of maternal depression on dyadic interactions and can represent a strong source of support for his partner (Robertson et al., 2004; Fletcher, 2009), it is advisable that future studies should deepen this. Moreover, further investigation could better understand the possible influences of maternal characteristics, i.e., parity or level of education. Finally, it will be clinically relevant to understand how these mother–infant interactions will evolve in a longitudinal way.

Conclusion

Globally, the results suggested that mothers of both preterm groups' appear involved and close to their babies. Nevertheless, the ELBW preterm group was characterized by a higher risk of maternal symptomatology and by a more "intrusive and controlling" mothering. These results, therefore, seem to suggest that, within preterm populations, the ELBW dyads could represent a sample with peculiar characteristics, specific needs and difficulties. So, during ELBW babies' hospitalization and at the moment of their discharge, hospital staff should pay special attention to both the infant's development and the parental affective state, in order to prevent the onset of depression or anxiety and to give a prompt intervention. Specifically, *ad hoc* interventions should be promoted to assess the risk of depressive or anxiety symptoms with adequate tools to give special support and treatment for symptomatology and to enhance parental functioning.

The longitudinal evaluation of mother–infant interaction in these dyads will help give a more comprehensive description of the long-term effects of depressive and anxious symptoms on interactive patterns, and if birth weight could act as a moderator in the relationship between maternal and infant interactive patterns.

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Attachment and parental reflective functioning features in ADHD: enhancing the knowledge on parenting characteristics

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Attention-Deficit/Hyperactivity Disorder (ADHD) is a disorder characterized by a chronic, pervasive, and developmentally inappropriate levels of impulsivity and in attention. It is associated with adverse academic and social functions and stress to families. Studies provide evidence that family variables are correlated with this disorder and that parenting styles play an important role in its complexity. However, a thorough investigation of the impact of parental affective and relational aspects on the ADHD child's areas of functioning is still needed. In designing future research on ADHD, we suggest to investigate parenting characteristics to a greater extent by adopting an attachment perspective with a focus on parental reflective functioning as it pertains to the child's ADHD clinical condition.

Keywords: parenting, ADHD, risk factor, attachment, reflective functioning

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Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder with characteristics of inattention, hyperactivity, and impulsivity. It shows great heterogeneity in symptoms and functioning (Wahlstedt et al., 2009). Beyond the core symptoms of ADHD, functional impairment in multiple contexts is integral to the diagnosis. Children with similar ADHD symptoms exhibit varying degrees of impairment across social, academic, and family contexts. It is now proven that hereditary factors are important in the etiology of ADHD and that neurobiological aspects are crucial in its definition (Thapar et al., 2013). Nevertheless, valuable longitudinal studies demonstrate how both genetic and environmental variables are intimately related and interact with each other, thereby influencing the expression of ADHD. In the last two decades, more attention has been paid to the investigation of environmental aspects playing a crucial role in ADHD. Strong correlations have been found between parenting and ADHD in children.

The diverse definitions of parenting can be organized into two dimensions. One pertains to parenting in terms of behaviors, practices or styles, and the other relates to attachment (Cummings and Cummings, 2002). According to previous studies, attachment has a quality that transcends the day-to-day interactions between parent and child. It is considered to be highly significant in the study of parenting. Findings on the association between parenting factors and occurrence of ADHD symptoms are particularly important because it is generally assumed that there is

considerable interaction between psychosocial influences and children's impairment in key areas of behavioral, cognitive, and psychosocial functioning (Bornstein, 2002). Moreover, considering that ADHD clinical condition can be extremely variable, it has been evidenced that parenting influences are crucial for understanding the factors that contribute to the behavioral expression and different developmental trajectories of ADHD (Sonuga-Barke and Halperin, 2010).

One aspect that has not yet been clearly elucidated is the role of the parent's attachment characteristics and specifically of parental reflective functioning. This characteristic is the parent's cognitive capacity in relation to attachment (Fonagy et al., 2002). The aim of this perspective is to raise awareness of the importance for investigating the influence of parent's attachment patterns and of parental reflective functioning. Parental reflective functioning is the parents' capacity to reflect upon their own and their child's internal mental experience. It is necessary for the development of cognitive abilities in the child and for promoting affect regulation and productive social relationships, which are impaired in ADHD children (Nijmeijer et al., 2008).

ADHD and Parenting Characteristics

The maternal hostility of non-biological (adoptive) mothers toward children with a biological predisposition for ADHD is predictive of an ADHD diagnosis (Harold et al., 2013). This concept emphasizes the impact of relational aspects on the development of ADHD. Other studies investigated the link between child ADHD with certain parenting characteristics such as higher levels of stress (Theule et al., 2010), marital discord (Wymbs et al., 2008), psychiatric disorders (Chronis et al., 2003), and authoritarian parenting style (Alizadeh et al., 2007). Specific parenting characteristics highly influence child ADHD's clinical severity, psychiatric comorbidity, and impaired functioning. For example, it has been shown that parenting styles significantly moderate the association of ADHD with other psychiatric symptoms. Specifically, a maternal overprotective parenting style interacts with ADHD symptoms to predict higher anxiety, depression, conduct disorder (CD), antisocial, and borderline symptoms, whereas paternal affection and warmth interact with ADHD symptoms to predict lower anxiety, reduced CDs, and fewer antisocial symptoms (Ni and Gau, 2015). Paternal warmth is also associated with greater peer acceptance and correlates negatively with peer rejection and problematic social behavior (Hurt et al., 2007).

A child's ADHD challenging behavior can reasonably have an impact on parent behavior and adjustment. Likewise, a parenting style may exacerbate the course of child's disorder. Over time, both child and parent may be reinforced for maladaptive behaviors, which strengthens the coercive style of relating. In this respect Taylor (1999) argues that ADHD symptomatology leads to critical expressed emotion (EE) from parents and inefficient coping strategies, which in turn contribute to the development of Oppositional Defiant Disorder (ODD). High levels of parental EE is a stressor for ADHD that leads to a larger cortisol response (Christiansen et al., 2010). This means that the development of oppositional behavior problems might be mediated by the stress-response to high EE. Also from the side of treatment there is evidence of this connection. For example, Schachar et al. (1987), investigating the effect of MPH treatment on overactivity and/or defiance, found an improvement of maternal warmth and a reduction of maternal criticism (a component of EE) in families of children who responded to methylphenidate.

Deault (2010) critically reviewed research studies concerning family characteristics associated with the development of internalizing and externalizing psychiatric comorbidities and functional impairments in children with ADHD. Interestingly, the risk and protective factors within the families of children with ADHD were emphasized. Moreover, new research directions were given for deepening our understanding of parenting characteristics that will help to trace the possible developmental pathways in such an extremely wide diversity of the disorder (Deault, 2010). It is clear that ADHD diagnosis alone is not predictive of the child's negative outcome highlighting the general importance of parent–child interactions on ADHD clinical condition (Gordon et al., 2006). In line with these assumptions, ADHD children, whose parents were highly critical and lacked warmth, had significantly higher levels of ODD and CD (Sonuga-Barke et al., 2009). In addition, with regard to the development of internalizing symptomatology, it has been found that an inconsistent parenting style was associated with a deteriorated ADHD clinical condition characterized by depressive symptoms. However, both parent management and locus of control were found to mediate the connection (Ostrander and Herman, 2006). Moreover, maternal anxiety and specific parenting practices such as over-protectiveness and lack of positive parenting, were associated with children's anxiety symptoms (Pfiffner and McBurnett, 2006).

These findings support the exploration of the impact of specific parenting characteristics on shaping the child's ADHD trajectory. Parenting includes many types of rearing behavior to study (Bornstein, 2002). Many different parenting variables have been shown to be predictors of ADHD (Johnston and Mash, 2001; Modesto-Lowe et al., 2008; Deault, 2010). However, to our knowledge there is no research on parental reflective functioning and its effect on the expression and development of ADHD.

Experimental Findings on ADHD in Translational Neuroscience

Recent experiments in animal models of disease (Francis et al., 1999; Champagne et al., 2003; Weaver et al., 2004) show the significant relevance of environmental factors. They suggest that both maternal and paternal experiences alter the development in their offspring (Curley et al., 2011a,b). However, in all mammalian species, there is an intense early period of maternal influence that is more significant than the paternal

one, demonstrating the mother–baby relationship is exclusive and greatly influential in the development of the offspring (Champagne et al., 2003).

In the last decade, numerous behavioral studies conducted on laboratory animals clearly demonstrated that maternal care plays a role in the epigenetic programming of genes function during early life (Weaver et al., 2004). Most of these studies have explored the effects of early life environment on stress programming through variations in the quality of early postnatal maternal care, including specific parenting behaviors. The results clearly support the view that mothering requires attentional commands to focus on infant and respond contingently to his needs. A mother must also have the cognitive capacity to switch her attention efficiently across many social and situational demands in highly stimulating environments while maintaining and manipulating information in her working memory to plan and guide mother–infant interactions (Barrett and Fleming, 2011). This critically important early social experience will constitute the basis of empathy and pro-social behavior in adult subjects. Similarly, the integrity of maternal behavior is linked to executive functions such as attentional set-shifting and prepulse inhibition (Lovic and Fleming, 2004; Afonso et al., 2007). Furthermore, it has been shown that rats' maternal deprivation is related to deficits in these executive function-processes (Lovic and Fleming, 2004; Burton et al., 2006; Garner et al., 2007).

Clinical studies for identifying biomarkers for developmental disorders in human patients are difficult to conduct because of ethical issues, lack of proper experimental control over the subject's environment and genetic background, and inaccessibility of brain tissue for analysis. In this regard, animal models are helpful and provide a complementary approach for understanding the processes by which maternal behavior during pregnancy and postpartum period influences the physiology and the psychosocial behavior of offspring. Aberrant maternal behavior during this period of development can result in the development of behavioral and emotional disorders that may persist into adulthood. Sterley and co-workers showed that life stress increases the risk of developing a psychiatric disorder later in life, possibly by altering specific neural networks that have also been implicated in ADHD (Sterley et al., 2013). In particular, in a validated rat model of ADHD, the spontaneously hypertensive rat, the characteristic hyperactive behavior was enhanced following maternal separation, and abnormally low levels of anxiety-like behavior were reduced even further, as measured by behavioral tests (Sterley et al., 2011).

The influence of maternal care on epigenetic modifications, gene expression, and neuroendocrine functions in offspring is complex. From an evolutionary point of view the impact of maternal behavior is critical since maternal care styles are transmitted across generations as an early model of social behavior. Therefore, although significant advances in understanding the origin of individual differences in behavior have been made, there are still many open questions on the link between maternal care and altered gene activity that should be explored using a multidisciplinary approach across animal species, when investigating on the causes of a disease.

ADHD, Attachment and Parental Reflective Functioning

Attachment theory can be conceived as an affect regulation theory (Mikulincer et al., 2003). According to this perspective, children with insecure attachment, who have difficulties in self-regulation, encounter difficulties in controlling their impulses in multiple contexts throughout their lives (Belsky, 1999). It has been observed that characteristics of insecure attachment resemble those of ADHD, including difficulties in emotional and behavioral regulation, such as impulse control, self-calming, persistence, and patience, as well as social difficulties (Clarke et al., 2002).

In the limited literature on attachment and ADHD, a predictive link between the two has been empirically observed. Specifically, a recent review has emphasized an association between ADHD and a lack of attachment competences (Storebø et al., 2013). Two main types of studies are identified in the field of attachment and ADHD. One type of studies is focused on attachment in ADHD diagnosed subjects. A second type of studies focuses on attachment in parents of ADHD siblings. Most of these studies were conducted by measuring the attachment patterns in adolescents or children with ADHD. There are only a few papers that explore parents' attachment characteristics and ADHD siblings.

Regarding the attachment in ADHD children it has been found that insecure attachment representation in adolescents is significantly related to an ADHD clinical condition characterized by major impairments in attentive abilities and impulsive regulation compared with securely attached adolescents (Guarino et al., 2012). Similarly, Scharf et al. (2014) suggested that insecure attachment styles in adolescence may serve as developmental precursors for ADHD symptomatology, rejection sensitivity, and social adjustment. Moreover, Scholtens et al. (2014) investigated ADHD symptoms in relation to attachment representations in children by using both attachment and non-attachment-related story stems. They found that insecurely attached children responded to non-attachment related story stems mostly incoherently and negatively. Specifically, insecure disorganized children received significantly higher ratings of ADHD symptoms, and their narratives had higher levels of negative content than did children classified as organized. There were no significant effects of attachment on conduct problems, vocabulary, disinhibition, sustained attention, or working memory deficits. Storebø et al. (2014) argue that treatment for ADHD must incorporate new social skills training which can help the children to deal with their attachment problems. Regarding the second type of studies, papers on parent's attachment styles and representations are scarce. Two case studies examined attachment and ADHD. One case study researched family dynamics and attachment strategies in a family with ADHD (Dallos and Smart, 2011). A second case study explored the possible effects of the insecure disoriented

attachment patterns of a child and of his mother with respect to ADHD (Crittenden and Rindal Kulbotten, 2007). The study of Kissgen et al. (2009) showed that maternal insecure attachment is associated with higher ADHD symptom load. Furthermore, maternal (but not paternal) attachment insecurity was found to be significantly associated with the severity of a clinical sample of toddlers' emotional and behavioral problems, such as hyperactivity and irritability (Karebekiroğlu and Rodopman-Arman, 2010). These findings suggest that studies on patterns of attachment of parents should be increased to better understand its relation with the ADHD child's clinical condition. In general, these findings suggest that children's and parent's attachment characteristics may play a role in the modulation of the clinical expression of the child's ADHD symptomatology and of its related impairments. Conway et al. (2011) showed that ADHD children experience higher incidences of chronic stress (environmental trauma) and greater disruptions in early attachment relations (attachment trauma) compared with non-ADHD counterparts. Moreover, similar to the observations in animal studies, it has been shown that early attachment deprivation predicted a worsening of ADHD symptoms in a later stage (Roskam et al., 2014). Elevated rates of attention deficit and overactivity have been noted in samples of institutionally reared children. There is some evidence that inattention and overactivity symptoms might constitute a specific deprivation syndrome in children with severe early deprivation when it is linked with attachment difficulties. Furthermore, it is not explicable as a secondary consequence of a cognitive deficit or on the basis of malnutrition (Kreppner et al., 2001). It has been suggested that this high comorbidity of attachment trauma with ADHD diagnosis or an ADHD-like symptomatology could indicate a possible impairment of mentalization during child's development (Conway et al., 2011). In fact, cognitive capacities seem to develop through early attachment relationships that create the opportunity for the child to learn about mental states and determine the depth to which the social environment can ultimately be processed (Fonagy et al., 2002). In that context, parental reflective functioning, the parent's capacity to reflect upon her own and her child's internal mental experience, promotes cognitive abilities in the child and seems to be an important aspect of parenting connected to attachment.

As children develop mentalizing capacities, they learn to adapt to different situations and be flexible in their responses. This ability to understand and interpret themselves and others within their environment "affects regulation, impulse control, self-monitoring, and the experience of self agency" (Fonagy and Target, 1998). It is interesting to note that all of the above-mentioned skills have been found to be impaired in children with ADHD (Conway et al., 2011). Nevertheless, the studies on parenting and attachment factors linked to ADHD have not extensively investigated the role of parental reflecting functioning relevant to ADHD. In addition, although ADHD is clearly associated with impairment in the social domain, studies investigating social cognition processes in ADHD and parenting aspects that impact on these abilities in ADHD children are inexplicably scarce. ADHD is associated with social cognition impairments, involving emotional face and prosody perception and there is also some evidence of theory of mind deficit and reduced empathy in ADHD subjects (Uekermann et al., 2010). In this context, we advise the unmet need of widening our knowledge of the impact of parental reflective functioning in ADHD children, in relation to attachment characteristics.

Conclusion

Although it is generally accepted that child ADHD is linked to specific parenting characteristics, parental attachment patterns should be analyzed to a greater extent. Several studies have evidenced an association between insecure attachment characteristics in children and adolescence with ADHD and their clinical condition. However, to our knowledge, little research is available regarding the exploration of the parent's attachment patterns, although intergenerational transmission of attachment patterns has been clearly established. This scarcity of research highlights the importance of deepening our understanding on mother's and father's attachment characteristics with their parental reflective functioning in relation to their child's ADHD clinical condition.

A core element of parent's reflective functioning involves their capacity to reflect upon the child's uniquely subjective intentions during moments of stress and conflict, opening the child's possibility to develop affect modulation (Fonagy et al., 2002; Slade, 2005). Moreover, parental reflective functioning allows the caregivers to contain the child's distress, giving rise to mutual regulatory processes that gradually increases the child's ability to self-regulate (Grienenberger et al., 2005). Alterations in this capability could possibly be a predictor of the quality of parent-child relation and a key factor in conceptualizing the risk and protective variables that shape ADHD pathways. We envision that by adopting an attachment perspective, this field of research may open new avenues for translational studies aimed at clarifying the psychobiological link between parenting characteristics and ADHD and it would promote the design of new therapeutic approaches for personalized interventions.

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Maternal depression and attachment: the evaluation of mother–child interactions during feeding practice

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Internal working models (IWMs) of attachment can moderate the effect of maternal depression on mother–child interactions and child development. Clinical depression pre-dating birthgiving has been found to predict incoherent and less sensitive caregiving. Dysfunctional patterns observed, included interactive modes linked to feeding behaviors which may interfere with hunger–satiation, biological rhythms, and the establishment of children's autonomy and individuation. Feeding interactions between depressed mothers and their children seem to be characterized by repetitive interactive failures: children refuse food through oppositional behavior or negativity. The aim of this study was to investigate parenting skills in the context of feeding in mothers with major depression from the point of view of attachment theory. This perspective emphasizes parents' emotion, relational and affective history and personal resources. The sample consisted of 60 mother–child dyads. Mothers were divided into two groups: 30 with Major Depression and 30 without disorders. Children's age ranged between 12 and 36 months The measures employed were the Adult Attachment Interview and the Scale for the Evaluation of Alimentary Interactions between Mothers and Children. Insecure attachment prevailed in mothers with major depression, with differences on the Subjective Experience and State of Mind Scales. Groups also differed in maternal sensitivity, degrees of interactive conflicts and negative affective states, all of which can hinder the development of adequate interactive patterns during feeding. The results suggest that IWMs can constitute an indicator for the evaluation of the relational quality of the dyad and that evaluations of dyadic interactions should be considered when programming interventions.

Keywords: depression, attachment, mother–child relation, feeding

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Introduction

Attachment theory (Bowlby, 1973) provides a useful interpretative model for describing how experiences in early childhood can influence the development of caregiving skills. Bowlby (1973) postulated that caregivers' Internal working models (IWMs), derived from the relationship with their own attachment figures during infancy and childhood, could directly influence their ability to respond sensitively to their children.

Maternal IWMs seem to be particularly relevant in pregnancy and early motherhood. Pregnancy may activate the women's identification with past significant others, in particular with their own mothers (Innamorati et al., 2010). More specifically, it has been underlined that the presence of a potentially positive maternal representation may be crucial (Stern, 1995) for the implicit regulation of both the remembered and current relationship to one's mother figure (Tambelli et al., 1995; Bifulco et al., 2002; Ammaniti et al., 2004).

Insecurity of attachment may also influence the way women subjectively experience their pregnancy, giving rise, for example, to ambivalent emotions toward the fetus and their future maternal role. This may be attributed to a reactivation of the future mothers' representations related to their childhood experiences. These experiences may emphasize feelings of incompleteness and inadequacy, potentially contributing to negative emotions, and even to depressive states (Gerlsma and Luteijn, 2000; Bifulco et al., 2004; Cassidy et al., 2010; Hammen et al., 2012). These processes may be more relevant for young mothers, considering that a strong association between insecurity of attachment and internalizing problems, including depression, has been found in adolescents and young adults (Allen, 2008; Sarracino et al., 2011).

A number of studies conducted during the last two decades focused on the role of maternal attachment insecurity as a moderator variable on maternal depression and its effects on the psycho-emotional development of children (see, for example, McMahon et al., 2015). These studies suggest that mothers' IWMs moderate the effect of maternal depression on their children's development (Reis and Grenyer, 2004; Stansfeld et al., 2008a; Niolu et al., 2010). McHale (2007) found that depressive symptoms in one of the caregivers constitutes a risk factor for the quality of caregiving. More in general, studies have highlighted how having families in which a member suffers from mental disorders represents a risk factor for the individual, although in interaction with other vulnerability factors (Andersson et al., 2003; Heron et al., 2004; Austin et al., 2007; Faisal-Cury and Rossi Menezes, 2007; Lee et al., 2007).

Mothers' psychopathology, and maternal depression in particular, may affect the development of the child directly or indirectly (Gross et al., 2008; Cho et al., 2015). Further, the chronicity and the severity of the disorder (Seifer and Dickstein, 2000; Grant et al., 2008) seem to have a greater impact than the diagnosis itself. In general, maternal depression is regarded as a "long-lasting vulnerability" (Karney and Bradbury, 1995), which may affect caregivers' abilities to cope with difficulties inherent to assuming a parental role. It may for instance increase the likelihood of interpreting events as stressful and terrifying.

Attachment theory (Ainsworth et al., 1978) introduced the concept of sensitive responsiveness to evaluate a mother's ability to intuitively identify and respond to the signals of her child with empathy. An updated version of this concept was proposed by Oppenheim and Koren-Karie (2009) and Quitmann et al. (2011), by referring to *insightfulness* as a specific caregiving skill that allows caregivers to take their children's point of view. This skill implies being able to form dynamic representations of one's child, within a relationship in which security and differentiation are facilitated. Depressed mothers, with specific deficits in *insightfulness*, may be confused by the emotional reactions of their children, and may be unable to distinguish between their own emotions and those of the children (Koren-Karie et al., 2002; Quitmann et al., 2011; Beebe and Lachmann, 2014). This distress may be pervasive and thus negatively influence their caregiving attitudes and behaviors (Agostini et al., 2014; De Campora et al., 2014).

Numerous studies highlighted that maternal depression, when associated with insecure attachment, can interfere with the quality of mother–child dyadic interactions (for a review, see Field, 2010). As suggested by several models and relevant empirical studies, in fact, the impact of maternal psychopathology on a child's affective development is not unidirectional. Instead the effect should be considered as the result of interactions, occurring within dyadic systems (Herwig et al., 2004; Hoffman et al., 2006; Beebe and Lachmann, 2014; McCullough and Shaffer, 2014). Tronick (2005), for example, proposed a model in which the caregiver–child dyad is considered to be an affective communication system, in which mutual regulations take place. The aim of the system is to realize a "conscious dyadic state," which is believed to influence the child's representations as well as its emotional and social development. According to Tronick (2005), depressed mothers are unable to understand their children's affective communications, and thus fail in attuning to these. Negative affects thus become pervasive within the dyad, stabilizing the negative affect within the child. The child will therefore interact negatively with the mother, and a mutual amplification of prolonged negative emotions will ensue. Depressed mothers thus tend to be less capable of communicating and sharing positive emotions, and more vulnerable to the distress of their infants (Goodman et al., 2011; Beebe and Lachmann, 2014). The depressed caregiver tends to discourage interactions with her child, and this may on the one hand not allow the child to integrate aspects of the relationship that are fundamental for personality-development; on the other hand, the caregiver may interfere with the child's avoidant behavior, as it seems to confirm the mother's sense of being unwanted. This, in turn, may reinforce the depressive condition by coloring it with feelings of aggression and rejection (Stansbury and Sigman, 2000; Cole et al., 2004).

The depressed mother's behaviors can vary: some depressed mothers are intrusive and shows angry facial expressions, while others expresses sadness and withdrawal. The studies of Tronick and Weinberg (1997) assessed the different effects on the child of at least two patterns of interaction of depressed mothers: intrusiveness and rage, and sadness and withdrawal. Both modes of interaction interfere with the process of regulation and constitute a rupture in inter-subjectivity. Intrusive mothers tend to treat their children severely, address their children with angry tones of voice, and actively interfere with their activity. In contrast, withdrawn mothers tend to interact to lesser degrees, are emotionally flat, not reactive and do not support their children's activities.

Tronick (2005) suggested that, when the experience of inter-subjectivity is distorted and marked by negative emotions, as in the case of the relationship of the child with a depressed mother, the child may incorporate elements of the mother's negative emotional states. More generally, the affective states and behaviors of the children with non-depressed mothers are described as being more vital, responsive and assertive, when compared with those of children of depressed mothers. These interactions in turn facilitate feelings of efficacy and adequacy in the caregiver that encourage shared experiences of mutual satisfaction. In contrast, the depressed mothers frequently describe their children as being less vital and introverted. In particular, the children of intrusive mothers avoid their mothers' gaze, rarely attend to objects, and rarely cry. On the contrary, the children of withdrawn mothers protest and tend to express their distress, suggesting that the withdrawn behavior has a particularly negative effect (Tambelli et al., 2010; Terrone and Santona, 2013). In the subsequent phases of development, the children of depressed mothers may show withdrawal, sadness and hostility, as well as externalizing problems such as aggression and anger (Weissman et al., 2006; Cho et al., 2015). The caregivers' negative expectations related to their parental role and behavior are thus confirmed (Stansbury and Sigman, 2000; Cole et al., 2004; Simonelli et al., 2008; Goodman et al., 2011).

In particular, dysfunctional behavioral patterns have been found to characterize feeding interactions between depressed mothers and their children. Clinical studies have shown that children of depressed mothers are often unable to regulate their feeding rhythm, and tend to reject feeding (Chatoor et al., 2000; Stein et al., 2001). In these situations, the dyads fails to establish the essential shared rhythm during feeding, and the children do not learn to regulate their growing needs of autonomy and agency. The caregivers, in these situations, may be extremely controlling, and even scold and criticize the children. Children may thus fail to learn strategies by means of negotiation, and this creates a conflict between their need of autonomy and their mother's rigidness (Chatoor et al., 2004; Haycraft and Blissett, 2008; Ammaniti et al., 2010).

Aims and Hypotheses of the Study

In line with the above-mentioned models and empirical research, this study aimed to explore the dimensions correlated with parenting skills in a sample of depressed mothers.

More specifically, we explored the differences between depressed and non-depressed mothers regarding the mothers' states of mind relative to attachment. Our hypothesis was that the clinical group would be more insecure on the Adult Attachment Interview (AAI) scales than the control group.

Second, we observed and coded mother–child interaction during feeding. Our hypothesis was that the dyads of the clinical group reported higher levels of problematic behavior, both for mothers and children.

A third aim was to investigate the maternal descriptions of their children. The hypothesis was that depressed mothers tend to have more negative representations of their children, describing them in terms of their lack of responsiveness and vitality.

Materials and Methods

Participants

Sixty mothers and their toddlers were recruited for the study. Thirty mothers, who satisfied the criteria for Major Depression of the DSM-5 (American Psychiatric Association, 2013) were recruited at the Psychiatric Unit of the University Hospital of "Tor Vergata" in Rome. The mothers were diagnosed by means of the DSM-5 (SCID-5). The depressed mothers were aged between 28 and 39 years ($M = 31.5$; $SD = 5.6$), with children aged between 12 and 36 months ($M = 26$; $SD = 2.9$). Thirty mothers were recruited in public nursery schools of Rome in order to constitute a non-clinical sample. The non-clinical participants were chosen in order to balance clinical mothers for gender and age of the children.

Gestation periods and children's psychomotor development were within the norm in both groups. Most children had been breast-fed (clinical group = 74%; control group = 78%).

Participants tended to be married (clinical group = 90%; control group = 93%), had a Secondary school Diploma (clinical group = 74%; control group = 70%) or a University degree (clinical group = 13%; control group = 15%) and belonged to a middle socio-economic group (clinical group = 69%; control group = 73%; the SES was assessed in accordance with Hollingshead's, unpublished manuscript criteria).

Variables and Measures

Assessment of the Attachment Patterns of Mothers

The attachment patterns of the mothers were evaluated by means of the AAI (George et al., 1985), a semi-structured interview, that assesses and classifies an adult's state of mind regarding attachment, by means of 20 questions. Participants are required to describe their relationships to caregivers mainly during childhood and support their assertions by recounting specific memories. Participants are also asked about events, activating the attachment system, such as separations from caregivers, any losses, or traumas. The interview also assesses the ability to reflect upon the effects of childhood experiences on development one's current personality and caregiving. The AAI is audio-recorded and transcribed verbatim. The AAI transcript is evaluated according to the system developed by Main et al. (2002), which consists in providing scores from 1 to 9 on two groups of scales. Five scales refer to "probable past experiences" (Loving, Rejection, Neglecting, Role Reversal, and Pressure to Achieve), and 11 scales evaluate the "state of mind" with respect to attachment (Idealization, Lack of Memory, Anger, Derogation, Passivity, Transcript Coherence, Mental Coherence, Metacognitive Monitoring, Fear of Loss, Unresolved Loss, Unresolved Trauma). The transcripts are then assigned to one of three main categories: secure-autonomous (*free-autonomous*, F/A), Insecure/Distancing (*dismissing*, Ds), Insecure/Concerned (*enmeshed*, E). There are two additional categories, the Unresolved/Disorganized relative to loss or trauma (*unresolved*, U) and Cannot Classify (*cannot classify*, CC) for unorganized states of mind.

Assessment of Mother–Child Feeding Interactions

The Observational Scale for Mother–Child Feeding Interactions (SVIA) measures a vast spectrum of interactive behaviors and identifies normal and/or risky relational modes in the dyad, during feeding (Lucarelli et al., 2002). The coding system of the Scale is applied to video-recordings lasting 20 min, during the feeding of a child, aged 1–36 months. Since the SVIA is applied to children aged 1–36 months, developmental differences in behavior are considered through specific age-appropriate items. The studies conducted to assess the psychometric properties of the US and Italian version of the Scale found a good inter-rater reliability and a satisfactory construct and discriminant validity (Chatoor et al., 1997; Lucarelli et al., 2002).

The Italian version of the Scale is composed of 40 items. Each item is scored on a four-point Likert scale (never, a few times, often, very often). The items are grouped in four subscales: Affective State of Mother (difficulties of the caregiver in expressing positive emotions and the frequency and quality of negative affects); Interactive Conflict (presence and intensity of conflictual exchanges within the dyad); Food Rejection Behavior on behalf of the child (single characteristics of the feeding patterns of the child, e.g., rejection of food, poor food intake, and difficult regulation of states during the meal); Affective State of the Dyad (problems in the mother–child relationship).

Assessment of Child Emotional/Behavioral Functioning

The Child Behavior Check List (CBCL), 1½–5 (Achenbach and Rescorla, 2001) assesses behaviors and emotions of children in a number of areas of their functioning. The data is provided by the parents, who evaluate the statements on the CBCL 1½–5. The daily activities assessed by the 99 items include interests, attention, fears, playing, interactions with peers and adults, anxiety, physical problems, moods, aggression, affective responses and reactions to change. These evaluations lead to an assessment on the following scales: Internalizing, Externalizing, and Neither Internalizing Nor Externalizing scales. The Internalizing scale includes Emotionally Reactive, Anxious/Depressed, Withdrawn, Somatic Complaints; the Externalizing scale includes Attention Problems and Aggressive Behavior. The Neither Internalizing Nor Externalizing scale identifies problems that are not exclusively associated with other symptoms on the Internalizing or Externalizing scales. Every item is scored on a three-point Likert scale (0 = not true, 1 = partly true, 2 = very true). The behaviors identified refer to observations that occurred not more than 2 months previously to scoring.

Procedure

All procedures followed were in accordance with the ethical standards of the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all adult participants.

The AAI and the CBCL 1½–5 were administered to all mothers. The administration and the coding of the AAI were carried out by psychologists, blind to the diagnoses of the mothers. Subsequently, the mother–child dyads were videotaped during mealtime for 20 min and they were coded using the SVIA. The videotapes were also assessed and coded by two independent researchers, blind to the diagnosis.

For our study, all the AAI's and the SVIA's were coded by certified coders, which are also author of this paper. For our study, all the AAIs were coded by a reliable coder. For inter-rater reliability, 30 interviews (50%) were also classified by another expert evaluator. Both coders were provided with AAI's reliability and unaware of the other data collected. Inter-rater agreement was 82.5% ($k = 0.62$, $p < 0.01$) for four-way classifications (free-autonomous, dismissing, entangled, unresolved). For the SVIA, 30 video-recordings (50%) were coded. Inter-rater agreement was 90% ($k = 0.85$, $p < 0.01$) on the four subscales: Affective State of Mother, Interactive Conflict, Food Rejection Behavior on behalf of the child, Affective State of the Dyad.

Data Analysis

The inferential analysis was carried out by means of permutation-based (i.e., non-parametric) univariate and multivariate tests (Pesarin, 2001). The approach was as follows: For each subscale, a univariate test was computed (10,000 random permutations). The MANOVA-like tests, which compare the measures (i.e., SVIA, CBCL, AAI and the subscales of AAI: Subjective experience, States of mind parents, and Overall states of mind) among the two groups, were obtained by means of non-parametric combinations of univariate tests (using the Fisher combining function), referring to the subscales of the measures themselves. The large quantity of tests performed required a correction of p-values for multiplicity. Furthermore, the analysis had a hierarchical structure for the overall, measures (i.e., SVIA, CBCL, and AAI) and subscales. The AAI had further levels: Subjective experience, States of mind, and Overall states of mind. The multiplicity correction was accomplished by the use of the min-p method (Westfall and Young, 1993) over all tests – i.e., both univariate and multivariate. To take into account the hierarchical nature of the analysis, the results will be discussed in a hierarchical order: if the overall adjusted-value was significant, the test for the three measures (i.e., SVIA, CBCL, and AAI) will be examined. Furthermore, the univariate tests for the subscales of each measure will be discussed only if the test of their associated measure was significant (e.g., the Loving-father scale is discussed as significant, only when the overall p-values of the Subjective experience scales on the AAI were significant after correction). The analysis continued hierarchically as long as all previous levels were significant after correction.

Note that the p-values related to measures (i.e., SVIA, CBCL, and AAI) were obtained by a combination of univariate tests on their subscales and not – for example – by comparing differences in frequencies of the clinical categories. The multivariate approach is usually more powerful than the latter and provides a more detailed understanding of the data.

To visually summarize the inferential results, we performed an explorative factor analysis on all (standardized) subscales, with principal components estimation method. Several considerations

can be drawn from the biplot of Factor 1 vs. Factor 2 – accounting for 18 and 10% of the total variance, respectively.

The depressed (green dots) and control mothers (blue dots) are clearly separated in the biplot. This confirms results of the inferential analysis that shows a strong significance in the overall comparisons of the two groups. The subscales that are significant in the inferential analysis are highlighted with red arrows in the biplot. For each arrow, the direction indicates – roughly – the group with higher value; for example, the SVIA factors and the Rejecting.mt/ft are right oriented, indeed the depressed group has higher values in these scales.

All analysis were performed with R software (R Core Team, 2015) using library flip (Finos, 2014).

Results

Descriptive Analysis of Attachment Models

For descriptive purposes, we present the distributions of the attachment models in the experimental and control group. The unresolved classifications for trauma or loss (U) and the unclassified attachment (CC) were coded and collapsed into one U/CC category. Generally, a prevalence of insecure models was found in the experimental group. The frequency of the secure state of mind/autonomous in the control group ($N = 18$; 60%) was higher than in the depressed mother group ($N = 10$; 33%). The distancing state of mind ($N = 10$; 33%) was higher in the experimental group than in the control group ($N = 5$; 17%). The depressed mothers also had a higher incidence of the unresolved/unclassified attachment models ($N = 5$; 17%), which is typical of clinical samples, than the non-clinical group ($N = 1$; 3%).

Statistical Analysis of the AAI Scales

The inferential analysis on the AAI scales highlighted significant differences between the experimental and control group, relative to the "Subjective experience" scale and the "Overall state of mind" scale, but not regarding the "Parents' state of mind" scale (see "**Tables 1** and **2**"). Concerning the Subjective experience scales, we found significant differences on the Father Loving scales, with the control group having higher mean scores. The depressed group had higher mean scores on the rejection scales of mother and father and on the neglecting scale for mother. Significantly higher mean scores were found in the control group for the following Overall state of mind scales: i.e., metacognitive abilities and derogation of attachment. Depressed mothers also had significantly higher scores on the Lack of Memory Scale than the control group mothers.

Mother–Child Feeding Interaction

The assessment of the mother–child food interaction, by means of the SVIA, evidenced that the dyads of the clinical group reported higher points than the control group in the following scales: Food Rejection Behaviors of the Child (SVIA factor1), Interactional Conflict (SVIA factor2), Affective States of the Mother (SVIA factor3), and Affective State of the Dyad (SVIA factor4). (See "**Tables 1** and **2**").

Emotional–Behavioral Problems in the Child

Higher mean scores on both the Internalization and Externalization scales (see "**Tables 1** and **2**") were found in the depressed group, when mothers evaluated their children's adaptation and daily functions. Finally, "**Figure 1**" indicates the results of the principal component analysis by means of a biplot. The biplot visualizes the inferential results already discussed in detail. The two groups (depressed in green, controls in blue) are almost completely separated on the plain of the first two components (i.e., a very significant overall p-value). The scales with significant differences among groups are represented by red arrows. The depression group had higher values (i.e., red arrows on the right) on the

TABLE 1 | Mean and SD of Control and Depression groups for each measures.

		Controls		Depression	
		Mean	**SD**	**Mean**	**SD**
Scale for Mother–Child Feeding Interactions (SVIA)	SVIA.factor1	8.30	2.22	13.97	3.91
	SVIA.factor2	6.13	3.29	14.10	3.71
	SVIA.factor3	9.63	4.38	14.77	4.66
	SVIA.factor4	3.27	2.42	6.67	3.88
Child Behavior Check List (CBCL)	Internal	14.60	4.67	8.03	4.02
	External	14.10	7.14	12.03	6.46
Adult Attachment Interview (AAI): subjective.experience	Loving.ft	5.35	1.30	2.62	1.41
	Loving.mt	4.38	2.28	2.93	1.19
	Rejecting.ft	1.60	0.84	3.28	1.87
	Rejecting.mt	1.59	0.84	3.18	2.33
	Role.ft	1.63	0.93	1.58	1.18
	Role.mt	1.92	1.37	2.12	0.99
	Preas.achieve.ft	2.80	1.01	2.08	1.73
	Preas.achieve.mt	2.37	1.50	1.45	1.25
	Neglecting.ft	2.60	1.74	3.50	2.46
	Neglecting.mt	2.05	0.79	3.98	2.67
AAI: states.mind. parents	Idealizing.ft	2.40	0.77	2.63	1.89
	Idealizing.mt	2.48	0.55	3.33	1.96
	Anger.ft	2.15	0.90	2.20	0.52
	Anger.mt	1.98	0.55	2.53	0.87
	Derogation.ft	2.73	0.75	3.22	1.59
	Derogation.mt	2.72	0.75	2.73	1.10
AAI: overall.states. mind	Global.Derogation	2.22	0.73	1.41	0.75
	Lack.memory	2.00	0.67	3.12	1.53
	Meta.cognition	3.12	1.22	1.77	0.75
	Passivity	2.85	1.15	2.73	1.36
	Fear.Loss	1.29	0.66	1.55	1.01
	U.abuse	2.47	0.81	1.96	1.50
	U.loss	1.68	0.47	2.28	1.54
	Coh.Trans	4.30	1.51	3.95	1.05
	Coh.Mind	4.68	1.09	3.97	1.17

TABLE 2 | Comparison of the Control and Depression groups: inferential results.

	Statistical test	Statistics	*p*-value	Adjustment:min P	Significance
Overall	Fisher	140.9281	0.0001	0.0025	**
SVIA	Fisher	36.1482	0.0001	0.0025	**
svia.factor1	*t*	6.9089	0.0001	0.0025	**
svia.factor2	*t*	8.8053	0.0001	0.0025	**
svia.factor3	*t*	4.4065	0.0001	0.0025	**
svia.factor4	*t*	4.0720	0.0002	0.0048	**
CBCL	Fisher	9.2103	0.0001	0.0025	**
internal	*t*	−1500.5228	0.0001	0.0025	**
external	*t*	−472.2458	0.2531	0.9313	
AAI	Fisher	94.1956	0.0001	0.0025	**
subjective experience	Fisher	49.4500	0.0001	0.0025	**
loving.ft	*t*	−7.8153	0.0001	0.0025	**
loving.mt	*t*	−3.0849	0.0032	0.0570	
rejecting.ft	*t*	4.4853	0.0002	0.0048	**
rejecting.mt	*t*	3.5195	0.0003	0.0066	**
role.ft	*t*	−0.1829	0.9054	0.9978	
role.mt	*t*	0.6480	0.5306	0.9917	
preas.achieve.ft	*t*	−1.9598	0.0522	0.5241	
preas.achieve.mt	*t*	−2.5763	0.0131	0.1976	
neglecting.ft	*t*	1.6411	0.1060	0.7655	
neglecting.mt	*t*	3.7835	0.0005	0.0109	*
states.mind.parents	Fisher	11.7444	0.0241	0.3078	
idealizing.ft	*t*	0.6175	0.5585	0.9917	
idealizing.mt	*t*	2.2896	0.0261	0.3214	
anger.ft	*t*	0.2633	0.8602	0.9978	
anger.mt	*t*	2.9275	0.0046	0.0785	
derogation.ft	*t*	1.5052	0.1391	0.8126	
derogation.mt	*t*	0.0687	0.9888	0.9978	
overall.states.mind	Fisher	33.0011	0.0001	0.0025	**
global.derogation	*t*	−6.6789	0.0015	0.0288	*
lack.memory	*t*	3.2099	0.0005	0.0109	*
meta.cognition	*t*	−5.1532	0.0001	0.0025	**
passivity	*t*	−0.3589	0.7605	0.9967	
Fear.loss	*t*	0.6225	0.4832	0.9917	
u.abuse	*t*	1.7404	0.2223	0.9204	
u.loss	*t*	1.5770	0.1306	0.8126	
coh.trans	*t*	−1.0403	0.3045	0.9500	
coh.mind	*t*	−2.4539	0.0191	0.2601	

*Used statistical test, computed test statistics, (unadjusted) p-values and adjusted p-values are reported for each subscale and each scale. *p < 0.05, **p < 0.01.*

following factors: *Rejecting.ft, Rejecting.mt, Neglecting.mt, Lack.memory, Svia.factor1, Svia.factor2*, *Svia.factor3*, *Svia.factor4*. On the contrary (red arrows on the left) they had lower values of *Neglecting.mt, Internal, Loving.ft, Global.Derogation, Meta.cognition*.

Conclusion

The main aim of our study was to analyze the attachment models of depressed mothers in order to understand the role of insecure models in defining parental competence.

The results confirmed that the *security* variable was a principal factor in differentiating the experimental and control group. Insecure states of mind relative to attachment were, in fact, higher in the group of depressed mothers. The analysis of the scales of the AAI identified major areas of vulnerability, which are connected to peculiar development paths in the depressed mothers. These were characterized by specific representational structures of attachment, formed during the emotional–relational interactions with their own caregivers (Steele and Steele, 2008).

In particular, the scales of AAI suggested that the depressed mothers of the experimental group perceived their fathers as having provided inadequate affective experiences, insufficient love, and in general, as having been a caregiver who was not emotionally supportive. Indeed, the Affective deprivation during infancy is a risk factor for the development of both

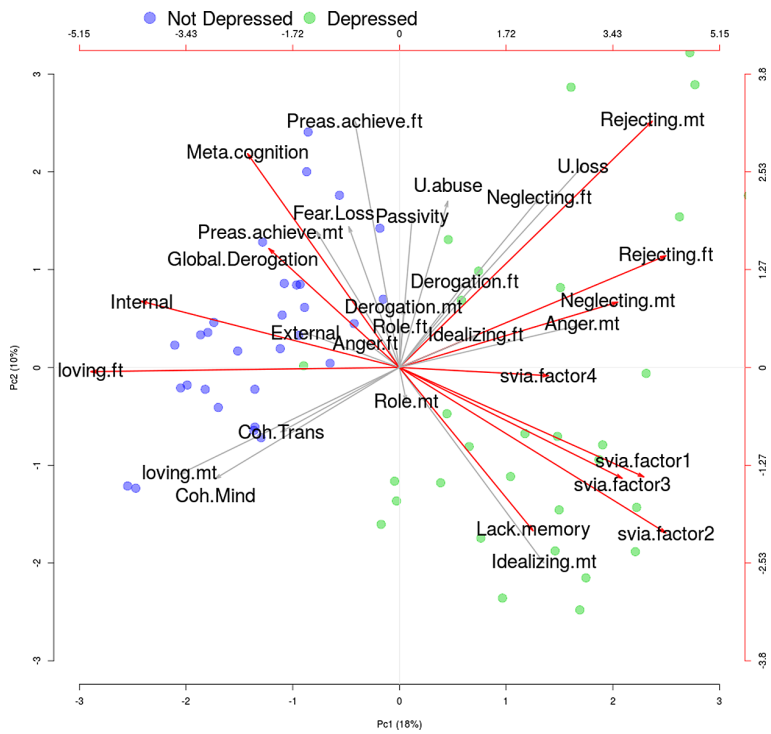

FIGURE 1 | Biplot of the factorial analysis (two factors). Subscales which significantly differs between groups after correction for multiplicity – as reported in **Table 1** – are highlighted with a red arrow. Not Depressed and Depression groups are marked in blue and green, respectively. More details are given in the text.

insecure attachment and depressive disorders (Bifulco et al., 2002). Retrospective studies suggest that experiencing affective deprivation, and perceiving and remembering inadequate paternal care, may compromise the relationship between fathers and daughters (Stansfeld et al., 2008b). This evidence suggests that both parents affect the IWMs of their children, albeit in different ways (Baldoni et al., 2009; Cummings et al., 2013). These participants, also represented both parents as having been rejecting, their mothers as neglecting, and thus less sensitive and attentive to their childhood needs. In our study, metacognitive knowledge was more deficient in depressed mothers. These mothers tended to limit the influence of their childhood relationships to caregivers on their current thoughts, emotions and personality organization. Attachment theory (Main et al., 1991) postulates, that this process occurs by means of the deactivation of the attachment system. These results suggest a number of considerations relative to maternal competence in depressed mothers. Representational models of attachment to one's own parents are thought to regulate the ability of parents to understand affective states in their children, as well as their responses to the children's signals. Attachment styles characterized by contradictions, distortions or negative emotions could thus interfere with maternal competence, in particular, with the process of recognizing and attuning to their children's needs (Fonagy and Target, 1997; Barone, 2007).

An unexpected result of the study was the significantly higher scores on the derogation of attachment scale found in the control group. Further research is needed to clarify this finding.

Emotional–Behavioral Problems in the Child

The other variables considered in our research were the emotional–behavioral problems of the children, as evaluated by their mothers. The results revealed that the depressed mothers reported a higher incidence of emotional–behavioral problems in their children, in particular regarding internalizing problems. This evidence is in line with previous studies, showing that parenting characterized by "affectionless control" (typical of depressed mothers) seems to contribute to the development of internalizing problems in the child (Wardle et al., 2001; Cicchetti and Toth, 2009; Goodman et al., 2011). These parents have been found to be less warm, less involved and less attentive to caring for their child, and even to openly express rejection. This parenting style may influence the emotional–behavioral styles of the children, affecting their ability to modulate sensorial input, to maintain calm and positive affective states and ultimately to self-regulate emotions and behaviors.

The evidence of the children's internalizing behaviors has to be placed in the context of significant relationships. This perspective, considers any kind of relational dysfunction as a predictive factor that can limit or distort the emotional–behavioral and social experiences of the child, putting at risk his adaptive potential in an everyday life context. In fact, depressed mothers tend to describe their children as relationally "difficult." This finding is particularly interesting since it suggests the role of the child as an active and competent partner, able to influence the relationship with the mother, and as being inevitably influenced, in a complex interactive system characterized by reciprocity and

mutual regulation (Chatoor et al., 2000; Goodman et al., 2011; Wynter et al., 2014).

Evaluation of the Mother–Child Feeding Interactive Patterns

To better understand the mutual influences that some factors may have within the dyad, this study also focused on the bidirectional interaction during an episode of feeding. The relational modes in the depressed mothers–children group revealed several dysfunctional interactions – namely, interactive conflictual behaviors, controlling behaviors of mothers, repeated communication failures, and negative involvement of couples in the feeding pattern of their children. We can hypothesize that these difficulties hinder the establishment of a stable biological feeding rhythm and as a consequence, the processes of autonomy and individualization (Chatoor and Ammaniti, 2007; Ammaniti et al., 2010). This data is consistent with the specific "intrusive" pattern described by Tronick and Weinberg (1997).

Specifically, these mothers showed a deficit in their attunement and a negative emotional involvement, characterized by emotional withdrawal, sadness, and anger. The feeding exchanges between the depressed mothers and their children was characterized by repetitive interactive failures, in which the child manifested oppositional behaviors such as the rejection of food (Stein et al., 2001; Lucarelli et al., 2003; Chatoor, 2012).

The depressed mother–child dyads have been found to have difficulties in expressing positive emotions, and in reciprocally interpreting signals (Tronick, 2005; Beebe and Lachmann, 2014). The dyadic interactions can become intensely conflictual and asynchronous (Radesky et al., 2013). The lack of attunement can generate defensive controlling strategies in depressed mothers, who have difficulties in modulating and negotiating the conflictual interactions with their children, thus facilitating the rejection of food (Chatoor et al., 2000; Stein et al., 2001; Ammaniti et al., 2010).

Mothers who show an excessive psychological control of the child seem to deny or not recognize the psychological autonomy and individuality of their children (Barber and Harmon, 2002; Kerig, 2003). Control becomes an educational strategy used by the parent to persuade the child to obtain certain results. Mothers can be intrusive, controlling, and overprotective (Pomerantz and Eaton, 2001; Grolnick et al., 2002), thus inhibiting their children's behavior and encouraging dependence. Parenting modalities can also be critical or openly rejecting, and the parent may control the feeding procedure without taking into account the child's signals, or may seem to worry excessively about the "mess" the child makes during the meal (Mills et al., 2007). The adoption of controlling behaviors on behalf of mothers may also limit their ability to be supportive, by allowing them to explore the environment and to make autonomous decisions as to when to start eating for example. This kind of support has repeatedly been linked to the development of autonomy in the child (Grolnick et al., 2002; Campbell et al., 2007).

Our study is also consistent with previous literature on the link between controlling and intrusive parenting and vulnerability to internalizing problems (Barber, 1996; Barber and Harmon, 2002; Grolnick, 2003). During feeding, in fact, the children of depressed mothers in our study tended to respond to the control and to the overprotection of their mothers with rejecting behaviors (refusing to open their mouth, crying when the food was presented, moving the food away or throwing food), withdrawn behaviors (open discomfort, falling asleep, and stopping to eat), or avoiding behaviors (avoiding eye-contact, stiffening when touched; Chatoor et al., 2000; Bryant-Waugh et al., 2010; Kerzner et al., 2015). In summary, the pattern that prevailed in our clinical group was that of the intrusive mother and withdrawn child, similar to the 'chase and dodge' pattern, described by Beebe and Lachmann (2014). It is possible that, in a larger sample, other dysfunctional patterns between mother and child may occur.

In conclusion, it is important to point out that in our data, mothers with major depression were also less flexible in adapting to the changes linked to parenthood. These major difficulties of adaptation to their new role could also lead to fractures in the interactive process, limiting competent interactions between mother and child, in which the child can self-regulate (Galloway et al., 2005; Kreipe and Palomaki, 2012). At the same time, these children were exposed to less warmth and more hostility. The mothers' psychopathology, in fact, may determine chronic depressive moods and thus expose the child to prolonged inadequate interactive modalities (Rothschild and Zimmerman, 2002).

Limits of the Study and Future Developments

The present study presents some limits. First of all, the size of our sample was not sufficient to draw conclusions regarding the complex interactions between the variables examined in our study. Secondarily, more recent studies and clinical practice strongly suggest considering the roles of fathers in family dynamics. Our study limited itself to mother–child interactions in order to be able to examine numerous variables within these dyads more extensively. Future research needs to integrate the father–child dyad, also in attachment terms. The assessment of the emotional-adaptive function of the children by means of a self-report questionnaire completed by mothers, also constitutes a limit. Although a part of the literature has insisted on the necessity to use objective instruments, or assessments administered by expert clinicians, it is also true that recent studies (for example, Bush et al., 2008) have suggested that mothers' points of view – including depressed and attachment-disorganized mothers –, provide useful information as to their emotions and the emotions that prevail within the dyads. Nevertheless, future studies should integrate observational methods to a greater extent.

Finally, our clinical observation supported the two patterns of interaction of depressed mothers – intrusiveness and rage, and sadness and withdrawal – identified by Tronick and Weinberg (1997). However, we did not include these two maternal patterns in our data analysis. In the future developments of the study we are planning a specific comparison of these two kinds of maternal patterns (and a comparison of these two patterns vs. a control group of no-depressed mothers).

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Neural basis of attachment-caregiving systems interaction: insights from neuroimaging studies

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The attachment and the caregiving system are complementary systems which are active simultaneously in infant and mother interactions. This ensures the infant survival and optimal social, emotional, and cognitive development. In this brief review we first define the characteristics of these two behavioral systems and the theory that links them, according to what Bowlby called the "attachment-caregiving social bond" (Bowlby, 1969). We then follow with those neuroimaging studies that have focused on this particular issue, i.e., those which have studied the activation of the careging system in women (using infant stimuli) and have explored how the individual attachment model (through the Adult Attachment Interview) modulates its activity. Studies report altered activation in limbic and prefrontal areas and in basal ganglia and hypothalamus/pituitary regions. These altered activations are thought to be the neural substrate of the attachment-caregiving systems interaction.

Keywords: attachment, caregiving system, limbic system, fMRI, orbitofrontal cortex, amygdala, trauma, AAI

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The Attachment System and the Caregiving System

Attachment theory (Bowlby, 1969) postulates that humans are born with a psycho-biological system that motivates them to seek proximity to significant others (in particular, the mother) in time of need, with the aim of acquiring a feeling of security. This system includes a variety of non-verbal expressions of neediness and desire for proximity such as crying and looking, as well as active approaching behaviors which aim to reestablish and maintain proximity, such as moving toward the caregiver and clinging (Ainsworth et al., 1978).

Bowlby (1969) also delineated the provisions that the mother should guarantee: proximity maintenance, when the child is in time of need; a physical and emotional safe haven, in which infant's distress may be alleviated; she should acts as a secure base, from which the child may face the outside world and to which he/she may return with the sense of being comforted if distressed and reassured if frightened.

Bowlby (1969, 1988) proposed that caregiving is the result of an organized behavioral system, which is reciprocal to – and evolved in parallel with – the attachment system (George and Solomon, 1996, 1999). The caregiving system aim is to promote proximity and comfort when the mother detects internal or external cues associated with situations that she perceives as stressing for the child.

In women, this system remains immature until late adolescence. During puberty and in late adolescence hormonal and neurobiological changes interact with environmental stimuli and prior attachment experiences (George and Solomon, 1996, 1999; Ammaniti et al., 2000; Grossmann et al., 2005) to push the caregiving system toward maturity.

The maternal caregiving system undergoes its greatest development during the transition to parenthood (pregnancy, birth, and the post-partum period; Ammaniti et al., 2014) with striking structural and functional changes, as a result of the large amounts of hormones secreted (Panksepp, 1998; Mayes et al., 2005). In particular, of greatest importance is the production of oxytocin which seems to motivate and maintain caregiving behaviors, strengthening maternal sensitivity to infant affective cues (Frewen and Lanius, 2006; Kinsley and Lambert, 2006; Rilling, 2013; Mah et al., 2015).

Affect Regulation and Attachment

A mother's capacity to regulate her child's emotions is crucial to his/her ultimate feeling of security (Ainsworth et al., 1978; Lyons-Ruth and Spielman, 2004). These processes are sustained by maternal sensitivity, i.e., the ability to understand the infant's feelings in order to respond to them in an appropriate way (Ainsworth, 1967, 1973; Ainsworth et al., 1978).

Fonagy et al. (1991a) have suggested that these sensitive responses are guided by maternal reflective functioning (RF) that is the capacity to ascribe the baby mental states (intentions, motivations, and feelings).

Early affective experiences are progressively internalized as internal working models (IWMs), which can be regarded as generalized representations of "lived experiences" (Bretherton et al., 1986; Bretherton, 1987), prototypical representations of the other and of the self, since they contain information about whether the attachment figure is perceived as a person who responds to calls for support or protection, and if the self is worthy of receiving help (Bowlby, 1969, 1973).

Repeated interactions with mothers who are emotionally available and sensitive facilitate the optimal functioning of the child attachment system, and promote the development of attachment security (Bowlby, 1973, 1988). Moreover, positive expectations about others' availability and positive representations of the self as competent and valued are formed, and affect-regulation strategies are organized around these positive beliefs.

Viceversa, when the mother proves not to be physically or emotionally available security is not attained and negative representations of the self and the other are formed (e.g., doubts about self-worth and worries about others' intentions). As a result, two strategies of affect regulation other than proximity seeking are likely to be adopted: *deactivation or hyperactivation* of the attachment system.

Deactivating strategies are used as "flight" reactions from a mother who is seen as emotionally unavailable (Main and Solomon, 1990). The child learns to hide or suppress the expressions of emotions that the mother does not tolerate (anxiety, fear, anger, or needs of consolation) and deals with threats and dangers autonomously, to avoid the frustration caused by maternal unavailability.

Conversely, hyperactivating strategies represent "fight" responses to unfulfilled attachment needs, acted when maternal responsiveness appears inconsistent, hesitant, or unpredictable (Mikulincer and Shaver, 2010): the child tends to amplify proximity seeking strategies to demand or force the mother to pay more attention to him/her (Main and Solomon, 1990; Mikulincer and Shaver, 2010).

Examining Individual Differences in the Attachment System: Attachment Models

Attachment models reflect ones' most accessible IWM and the typical functioning of ones' attachment system.

For early childhood, the Strange Situation Procedure (SSP; Ainsworth et al., 1978) is the most widely used to assess patterns of individual difference in attachment. By exposing infants to increasing challenges to the attachment system (i.e., the presence of a strange person and two short separations from the mother), the SSP originally classified infants in three categories: secure (tipe B, indicating successful proximity-seeking attempts and security attainment); insecure avoidant (type A, characterized by deactivating strategies); or insecure anxious-ambivalent (type C, characterized by hyperactivating strategies). Main and Solomon (1990) later added a fourth category, "disorganized/disoriented," defined by odd, awkward behavior and unusual fluctuations between anxiety and avoidance.

Internal working models are thought remain fairly stable throughout one's lifespan, guiding the individual's functioning and the construction of significant relationships, particularly parental one (Bowlby, 1988; Shaver and Mikulincer, 2002; Cassidy and Shaver, 2010)

Adopting a developmental and clinical approach, Main and Goldwyn (1984) developed the Adult Attachment Interview (AAI), which evaluates adults' mental representations referred to attachment relationships. AAI can be also coded in accordance with the Dynamic Maturational Model (DMM) of Attachment and Adaptation (Crittenden and Landini, 2011).

In the AAI, adults are asked to retrieve attachment-related autobiographical memories from early childhood and to evaluate these memories and their effects from their current perspective. In this way what is coded is the structural dimension of the transcript (that is, its "coherence" or "incoherence") and not its content. The classical AAI coding system classifies adults into three major categories, paralleling Ainsworth's infant typology: secure/autonomous with respect to attachment (F); Dismissing of attachment (Ds); Preoccupied with or by early attachments or attachment-related experiences (E). In the presence of unresolved responses regarding experiences of loss or trauma, transcripts can receive the additional classification of Unresolved/disorganized (U/d). Finally, when texts cannot be fitted to any organized AAI placement, the classification Cannot Classify (CC) is applied. Conversely, with the DMM,

patterns of attachment are considered to be 'self-protective strategies' that varied dimensionally (rather than categorically) in terms of the use of cognitive-contingent or affect-arousing information. Moreover, each individual is thought to have multiple "dispositional representations" that regulate behavior under different conditions. One novel construct within the DMM coding of the AAI is "reorganization," a process whereby speakers are actively changing their understanding of past and present experiences and moving toward attachment security.

The use of the AAI provided significant evidence for the intergenerational transmission of attachment, allowing the investigation of the dynamics through which IWMs (and its expression through the caregiving system) influence the child's attachment development (Main et al., 1985; Fonagy et al., 1991b).

Secure individuals have had infantile experiences with parents who guaranteed protection and emotional availability toward their attachment needs. They have worked out childhood relationships and recognize its relevant value for their-own personal history and their current mental state. When these individuals become parents, this personal orientation enables them to respond affectionately to their child's demands for safety. Thus, the child will internalize a feeling of security and relational trust.

Dismissing subjects, on the other hand, have had infantile experiences of refusal toward their emotional needs. They seem incapable of valuing their attachment relationships, they find it difficult to remember early relational experiences, and they do not show affective responses to their memory of early and painful situations. In such cases, defensive mechanisms of splitting and denial are used, in order to compensate for the affect dysregulation resulting from painful autobiographical memories, and maintain an idealized vision of the self and of others. The same defensive style will be noticeable in their children, who will tend to escape from self-involving affective interactions.

Preoccupied individuals seem incapable of de-identifying themselves from their own childhood relationships, since they are entangled in worried and angry feelings about parents. They appear hypersensitive to attachment experiences, and can easily retrieve negative memories but have trouble discussing them coherently without anger or anxiety. Children with preoccupied caregivers frequently show marked ambivalence toward them, since they seek a relationship and, at the same time, express anxiety, fear, and anger.

Individuals classified as unresolved are disoriented in their discussion about their childhood history of loss or trauma, as indicated by lapses in monitoring reasoning or discourse (Main and Hesse, 1990; Hesse and Main, 2000); moreover, their emotion regulatory strategies reflect a lack of resolution of these life events (Main and Hesse, 1990). Children of individuals classified as "unresolved" frequently show disorganized attachment, appear frightened and alarmed showing immobilized behavior and dazed appearance (Van IJzendoorn, 1995) caused by the caregivers' failure in monitoring children's behavior during interactions, and in regulating their signals of distress.

Insights from Neuroimaging Studies

In recent decades neuroscientists have been trying to investigate the neural bases of attachment and caregiving systems in humans mainly by using neuroimaging techniques functional magnetic resonance, (fMRI), enabling them to study the brain "in action" during different tasks.

Several fMRI studies have addressed these two systems. Those which have explored the attachment system have found activity in various areas, among which amygdala, anterior cingulum, stria terminalis, preoptic area, and basal ganglia (Bartels and Zeki, 2004; Gillath et al., 2005; Lemche et al., 2006; Coria-Avila et al., 2014). Partially overlapping areas have also been found to be related to the activation of the caregiving system, i.e., limbic and para-limbic areas, basal ganglia, medial prefrontal areas (orbitofrontal cortex and anterior cingulum) and midbrain nuclei (Leibenluft et al., 2004; Nitschke et al., 2004; Swain, 2008; Laurent and Ablow, 2012). So far, only a small body of research with fMRI has examined how the maternal attachment model affects the activity in brain areas during the activation of the caregiving system. Therefore, we will present scientific literature on the interaction between these two systems, by examining those experiments which have exposed women to infant stimuli activating the caregiving system and have studied the effect of attachment model on their brain activation (see **Table 1**).

To start we will briefly provide a description of the results obtained in these studies and then we will discuss common and discordant findings in the background of current theories on attachment and caregiving system.

The first study focusing on this issue was that of Strathearn et al. (2009). They examined 30 mothers and the difference in their reaction to exposure to pictures of crying, smiling and neutral faces of both their own and other children. By doing so they were able to test whether differences in attachment were related to brain reward areas activation and peripheral oxytocin response to infant cues. In this study authors focused on specific areas, i.e., the midbrain, striatum, prefrontal cortex (PFC) and the hypothalamus and found that mothers with secure attachment greatly activated for the own infant the frontopolar PFC bilaterally, the ventral striatum, and the oxytocin-associated hypothalamus/pituitary regions. Positively, activity in these last two regions was significantly higher in secure mothers, and correlated with peripheral oxytocin response to infant contact. Conversely, dismissing mothers greatly activated other parts of PFC, i.e., the dorsolateral and medial PFC, including the anterior cingulate cortex, as well as the uncus/enthorinal cortex. These results are in line with the finding that maternal plasma oxytocin concentrations are positively correlated with affectionate behavior toward the child, who (in turn) responds to this affection with positive parent-directed behaviors (Rilling and Young, 2014).

A second study by Riem et al. (2012) focused a priori on the activity of the amygdala in a group of 21 nulliparous women listening to infant crying. They found that those who had been classified as insecure (specifically *D*s and *E* coded subjects) greatly activated the amygdala when compared to secure women.

Coherently, the amygdala activity was negatively correlated with coherence of mind scores.

The important role of the amygdala was confirmed in a further study on mothers with unresolved trauma, who showed reduced bilateral amygdala response when viewing their own infants' sadness, when compared to happiness, with respect to mothers with no trauma (Kim et al., 2014).

Lastly, two other experiments, both by our group, have explored this field of research. In the first one (Lenzi et al., 2009) we examined 16 mothers with fMRI while observing/empathizing faces of their own child and those of someone else's child and found that the right anterior insula activity was directly correlated with maternal reflective function. In the second study (Lenzi et al., 2013) we studied a group of nulliparous women either with secure or dismissing model. Analysis revealed that dismissing women activated to a significantly greater extent in respect to secure ones several areas, i.e., frontal areas (bilateral somatomotor and premotor cortex, inferior frontal gyrus, left

TABLE 1 | Summary of fMRI studies on attachment-caregiving systems interaction.

Study	Task	Stimuli	Attachment Measure	Subjects	Analysis	Results
Kim et al. (2014)	Viewing	Own and other child pictures	AAI (DMM)	42 Mothers: 25 No trauma, 17 U, Unresoved trauma.	ROI in bilateral amygdale	No trauma or loss >*U* • Bil amygdala
Riem et al. (2012)	Listening	Crying child sound and control sound	AAI	21 Nulliparous women: 7 *F*, 4 *D*s, 4 *E*, 6 *U*.	ROI in bilateral amygdale	*D*s e *E* > *F* (crying > control sound): • R amygdala Negative correlation: R Amygdala and Coherence of Mind
Strathearn et al. (2009)	Viewing	Own and other child pictures	AAI (DMM)	30 Mothers: 15 *F*, 15 *D*s.	Whole brain and ROI in midbrain, striatum, prefrontal cortex (PFC), hypothalamus/pituitary regions	*F* > *D*s: • Bil frontopolar PFC • Bil orbitofrontal and medial PFC • L ventral striatum • L hypothalamus/pituitary region D_s > *F*: • Dorsolateral PFC • Medial PFC • R uncus/enthorinal cortex. • Bil insula • R anterior cingulate cortex Direct correlation: Hypothalamus/pituitary /ventral striatum and peripheral oxytocin responce
Lenzi et al. (2013)	Empathizing	Child pictures	AAI	23 Nulliparous woman: 11 *F*, 12 *D*s	Whole brain	D_s > *F*: • Bil somatomotor and premotor cortex, inferior frontal gyrus • R superior frontal gyrus • R superior temporal sulcus, temporal pole, hippocampus • L middle temporal gyrus, • L anterior cingulum • L posterior parietal cortex • Bil thalami • Bil precuneus *F* > D_s *(deactivation in* D_s*):* • medial orbitofrontal cortex • perigenual anterior cingulated cortex.
Lenzi et al. (2009)	Empathizing	Own and other child pictures	RF (AAI)	16 Mothers: 13 *F*, 3 *D*s	ROI	Direct correlation: Reflective Function with R anterior insula

F,secure/autonomous with respect to attachment; Ds, dismissing attachment; E, preoccupied with or by early attachments or attachment-related experiences; U, unresolved with respect to attachment trauma; DMM, coding method based on the Dynamic Maturational Model of Attachment and Adaptation; RF, reflective function; ROI, region of interest, R, right; L, left.

anterior cingulate cortex, and right superior frontal gyrus), temporal (right middle temporal gyrus, superior temporal sulcus and the right hippocampus and temporal pole), parietal (left posterior parietal cortex and bilateral precuneus). Moreover, the medial orbitofrontal cortex and the perigenual part of the cingulate cortex were more deactivated in dismissing women (**Figure 1**).

Discussion

It is worth acknowledging that in all of the aforementioned studies the attachment model has been coded with the AAI, according to the main literature in this field that consider it to be the gold standard method for exploring adult representation of attachment (i.e., IWMs). In particular Strathearn et al. (2009) and Kim et al. (2014) used the DMM as AAI coding system (Crittenden and Landini, 2011) whereas the other groups used the classic method described by Main and Goldwyn (1984). It is also worth keeping in mind that in two studies researchers studied nulliparous woman (Riem et al., 2012; Lenzi et al., 2013) whereas in the other they focused on mothers. This information is important because it could explain, at least in part, some of the different results found in these experiments.

An important data that emerge is that the limbic/paralimbic network seems to play an important role in the interaction between attachment and caregiving systems (**Table 1**). In particular data consistently showed within this network altered

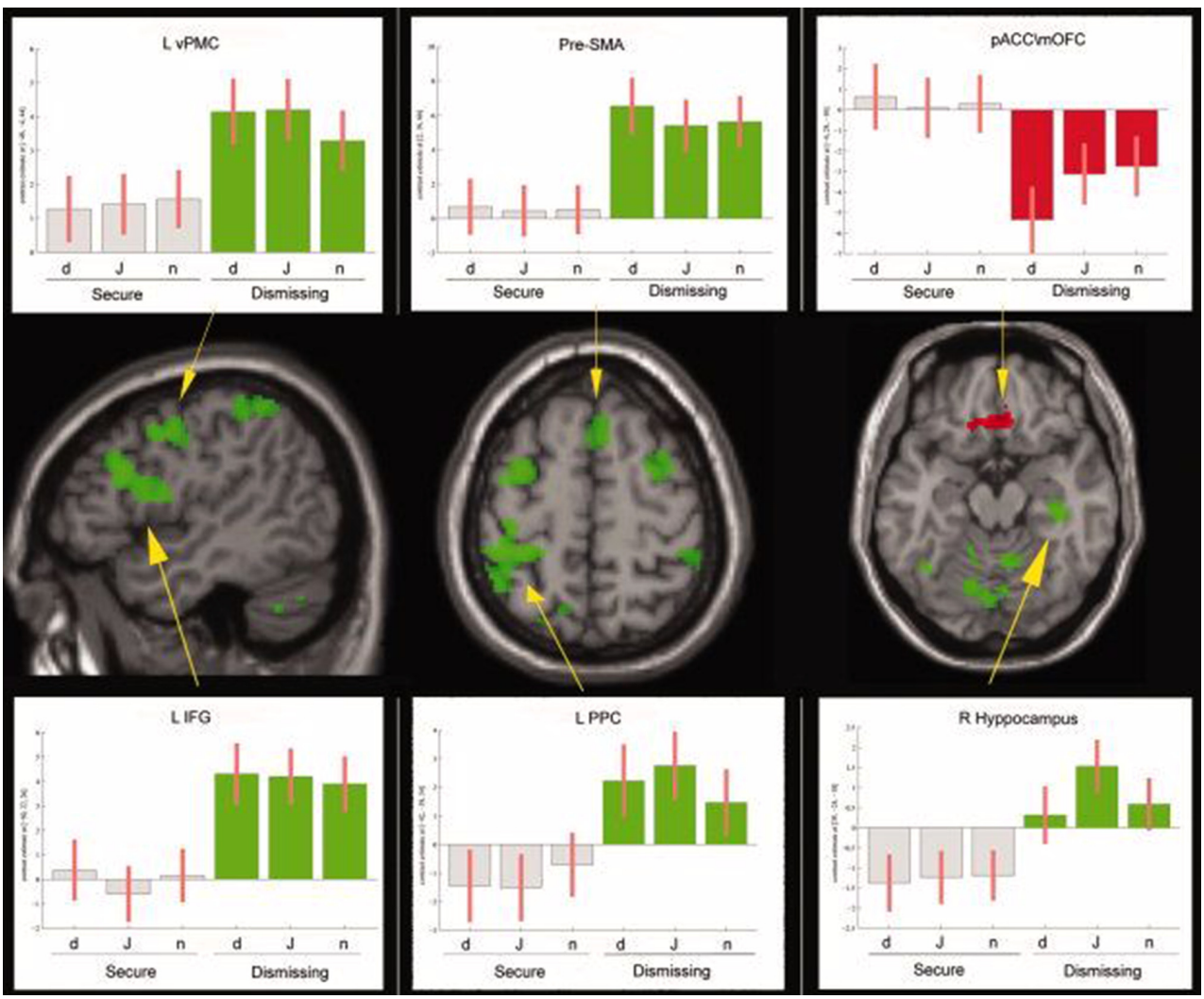

FIGURE 1 | From Lenzi et al. (2013). Empathizing task, $F > Ds$ and $Ds > F$ contrasts reported on the SPM T_1–WI standard template sections. Areas in green are those more active in *Ds* than in *F*. In red are shown those areas less active in *Ds* than in *F* (contrast $F > Ds$). For some areas we also show the corresponding signal plot. MNI coordinates are shown in brackets. All statistical maps are projected at a threshold of $P < 0.001$ uncorrected, corrected at the cluster level $P < 0.05$. a.u., arbitrary units, 90% confidence interval (C.I.); d, distress; j, joy; n, neutral; R, right; L, left; pre–SMA, presupplementary motor area; vPMC, ventral premotor cortex; IFG, inferior frontal gyrus; PPC, posterior parietal cortex; pACC/mOFC, pregenual anterior cingulate cortex, and medial orbitofrontal cortex. *Reproduced with permission*.

activation of the amygdala, the hippocampus, the uncus/entorinal cortex, the temporal pole and anterior cingulate cortex. Increased activity in all these areas has been found in most studies in dismissing and preoccupied, as compared to secure subjects (Lenzi et al., 2009, 2013; Strathearn et al., 2009; Riem et al., 2012). One study though reported reduced activity in the amygdala in mothers with unresolved trauma with respect to those without unresolved trauma (Kim et al., 2014).

Increased activation in limbic and paralimbic areas in insecure subjects is thought to represent the neural correlate of affective dysregulation possibly due to the reactivation of infantile memories of parental rejection toward their own attachment needs. This leads to negative experiencing of infant cues and of negative internal attribution to the nature of the infants signs of distress. This emotional dysregulation is also supported by our findings of increased activity in empathy-related areas, i.e., mirror areas (premotor cortices, inferior frontal gyrus), in dismissing women when observing/empathizing with infant faces (Lenzi et al., 2013).

Conversely, and apparently in contrast with other results, is the reduced response of the amygdala in subjects with unresolved trauma. Such reduced activation of the amygdala found by Kim et al. (2014) has been interpreted as emotional suppression to protect the mothers with unresolved attachment-related trauma from re-experiencing traumatic memories, akin to the so called "defensive numbing" that develops upon continued traumatization (Bowlby, 1988; Liotti, 2006).

Greater activity in the prefrontal cortices, basal ganglia, and hypothalamus/pituitary regions has been reported in secure women with respect to organized dismissing and preoccupied women (Strathearn et al., 2009; Riem et al., 2012; Lenzi et al., 2013) The greater activity in prefrontal areas, in particular orbitofrontal cortex and lateral PFC, likely represents the expression of increased activation of the attachment system. The basal ganglia increased activation suggests the involvement of the reward system, in line with the hypothesis that for securely attached women infant cues are salient signals able to reinforce and motivate the activation of the caregiving system. Last but not least is the finding of greater activity in secure women in oxytocin-associated areas, i.e., the hypothalamus/pituitary region, known to be strictly involved in promoting and maintaining maternal behavior (Rilling and Young, 2014). Activation of reward and oxytocin-associated brain areas is probably the substrate of the activation of a sensitive and efficient caregiving system, able to promote a secure attachment model in the offspring.

There are other contrasting results worth mentioning, i.e., the insula is more active in dismissing mothers in respect to secure mothers (Strathearn et al., 2009) but is also directly correlated to reflective function (Lenzi et al., 2009). These two studies were different in terms of aims and methods (in the second there was only one group of mothers and the aim was studying own versus other child neural response) but further studies focusing on the anterior insula should be conducted in order to explain the role of this area in the attachment and caregiving systems interaction.

Conclusion and Implications for Future Research

Research on neural bases of attachment-caregiving system interaction is still in its infancy and additional data is needed to confirm these findings in larger cohorts of women, possibly simultaneously including all of the different attachment models. Current fMRI literature is in line with data coming from clinical research on attachment suggesting emotional dysregulation and disturbed maternal caregiving in insecure organized women when compared to secure subjects and emotional numbing in those with unresolved trauma.

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Pattern of mother–child feeding interactions in preterm and term dyads at 18 and 24 months

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Literature on mother–child feeding interactions during the transition to self-feeding in preterm populations is lacking, particularly through observational methods. The present research study aims to look at the longitudinal patterns of mother–toddler feeding interactions, comparing preterm and full term dyads. To this end, a multi-method approach was used to collect data from 27 preterm to 20 full-term toddlers and their mothers. For each dyad, mother–child interactions were observed during the snack time at 18 and 24 months of age and then assessed through the Italian version of the Feeding Scale. Higher scores on the scale indicate a less healthy pattern of interaction. Additionally, at both points in time, mothers completed the *BDI-II* questionnaire as a screen for maternal depression and the child's developmental stage was assessed using the Griffiths Scales. A series of repeated measures Analysis of Variances were run to detect differences in feeding interactions between the two groups at the time of assessment. Our results show that preterm dyads report overall higher levels of maternal negative affection, interactional conflicts, and less dyadic reciprocity during the meal compared to full-term dyads. Additionally, longitudinal data show that dyadic conflict decreases in both groups, whereas the child's food refusal behaviors increase in the preterm group from 18 to 24 months. No differences were reported for both the BDI-II and the child's development for the two groups. The results reveal that regardless of maternal depression and the child's developmental stage, the two groups show different trajectories in the pattern of feeding interactions during the transition to self –feeding, at 18 and 24 months, with overall less positive interactions in preterm mother–child dyads.

Keywords: prematurity, mother–child interaction, Feeding Scale, feeding and eating disorders of childhood, maternal depression

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Introduction

Although transient eating difficulties are quite common in childhood and may be concurrent to life changes (Lindberg et al., 1991; Linscheid et al., 2009), it has been estimated that between 6 and 25–45% of children can experience eating disorders of various type and severity (Benoit, 2000; Lyons-Ruth et al., 2006; Bryant-Waugh et al., 2010). The risk and the complexity of eating problems are higher in the preterm born children population (Cerro et al., 2002; Pierrehumbert et al., 2003; Thoyre, 2007). These children are at risk for a number of developmental issues (Bhutta et al., 2002; Saigal and Doyle, 2008; Aarnoudse-Moens et al., 2009; McCormick et al., 2011) and nutrition has always represented a problematic area (Trombini, 2007). Preterm children might experience

difficulties in the development of feeding skills, such as disorganized sucking patterns, failures in breastfeeding (Zanardo et al., 2011; Torola et al., 2012), and problems in swallowing semi-solids and solids (Mathisen et al., 2000; Burklow et al., 2002; Dodrill et al., 2004). Prematurity might also impact the long-term feeding behavior of the child and several studies have pointed out an increased risk of developing eating disorders in individuals born preterm (Cnattingius et al., 1999; Mathai et al., 2013; Vasylyeva et al., 2013; Micali et al., 2015). Although the association between prematurity and eating disorders in adulthood is still controversial (Krug et al., 2013), there is agreement that problems with feeding in childhood might persist into adulthood and affect other aspects of health, setting long-term risk for eating disorders, emotional, and behavioral problems (Marchi and Cohen, 1990; Ammaniti et al., 2012). Considering the importance of the parent-child relationship in the development of an healthy eating behavior (Satter, 1990; Chatoor, 1996), the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood (DC: Zero To Three, 2005) highlights the importance of the early detection of feeding problems, such as Feeding Disorder of State Regulation and Feeding Behavior Disorders (Chatoor, 1996, 2002, 2009), in vulnerable populations. Preterm infants might experience difficulties in the regulation of hunger-satiety cycles (Schädler et al., 2007; Schmid et al., 2011) and might require more help from their parents to maintain a state of calm alertness for feeding. Studies on preterm mother–infant feeding interaction show that premature infants seem to be less responsive to their mothers and to experience less clear interactions during feeding compared to full-term infants (Davis et al., 2003; Singer et al., 2003). In turn, the high levels of distress and depression described in mothers of preterm infants (Carter et al., 2007; Vigod et al., 2009; Voegtline et al., 2010; Brandon et al., 2011) might affect maternal capacity to detect and sensitively respond to the child's cues during the interaction (Singer et al., 2003; Diego et al., 2006; Feldman and Eidelman, 2007; Agostini et al., 2014). Although findings are contradictory, several differences have been found in maternal interactive behaviors between full-term and preterm dyads (Bozzette, 2007; Korja et al., 2012). Mothers of preterm children have been described as more frequently overtly active and sometimes intrusive with their babies compared to mothers of full-term infants (Forcada-Guex et al., 2006; Feldman, 2007). Later, they seem to be less able to support the child's autonomous play (Potharst et al., 2012). Moreover, mothers of preterm children seem to be more concerned about their child's nutrition and weight gain than mothers of full-term children (Cnattingius et al., 1999; Cerro et al., 2002; Pierrehumbert et al., 2003), which in turn might influence maternal practices in feeding the child (Gueron-Sela et al., 2011). These contributions suggest that preterm mother–child dyads are at risk of experiencing early difficulties during feeding interactions. Feeding problems might occur as transactional or relational problems when the mother–child communication is impaired (Satter, 1990; Chatoor, 1996).

During the second year of life, as the child becomes increasingly physically and emotionally independent, the mother and the child must learn to negotiate a new reciprocal adjustment during feeding interactions (Lucarelli et al., 2003). The child shows the desire to feed him/herself and often rejects parent's help during the meal (Freud, 1965; Morton et al., 1996; Cerro et al., 2002). The caregiver takes part in this process, creating an attuned relationship to support the child's need for autonomy and his/her emotional-affective individuation (Spitz, 1957; Stern, 1985; Lichtenberg, 1989; Trombini and Trombini, 2007; Trombini, 2010). Failures in the mother–child communication might interfere with the transition to self-feeding and lead to highly conflictual interactions (Chatoor et al., 2000). For example, maternal excessive control and concerns related to the child's seeking of autonomy (e.g., messiness, exploration with food, food preferences) might trigger distress in the child and lead to the child's food refusal (Stein et al., 1999; Chatoor et al., 1998a, 2000; Trombini, 2010). Studies on mother–child feeding interactions in children with eating disorders have shown that conflicts are greater in these dyads compared to control dyads and are associated with maternal negative affect, low dyadic reciprocity, child's food refusal, opposition, and negativism (Chatoor et al., 1998a; Lucarelli et al., 2003; Ammaniti et al., 2004; Atzaba-Poria et al., 2010).

The transition to self-feeding might be a critical time for the onset of eating disorders in childhood (Chatoor, 1996, 2002) and might present challenges for preterm mother–toddler dyads. Parental concerns for the child's eating behavior may increase at this time (Morton et al., 1996; Cerro et al., 2002) and difficulties in supporting the child's autonomy in mothers of preterm children (Potharst et al., 2012) may affect the quality of mother–child feeding interactions, interfering with the transition to self-feeding. Despite this, to our knowledge, there is a lack of investigations focused on the quality of mother–child feeding interactions during the second year of life in preterm populations.

The present study aims to address this gap by using a multi-method approach to investigate the longitudinal characteristics of feeding interactions in both preterm and full-term mother–child dyads. Assessments were conducted at two points in time, 18 and 24 months of age (corrected age for preterm children), a crucial time for the observation of the child's developing eating autonomy. We expect the preterm group (PG) to show less positive mother–child feeding patterns compared to the full-term group and a higher rate of maternal and child's dysfunctional behaviors during the meal (maternal negative affection, interactional conflicts, food refusal by the child, and low dyadic contingency). We also expect these interactive patterns to remain consistent from 18 to 24 months of age.

The second aim of the study is to evaluate the possible effect of both maternal depression and the child's development on the quality of mother–child feeding interactions. With this regard, we expect the rate of maternal symptomatology to be higher in the PG, and preterm children to reach developmental milestones slower compared to full-term children.

Materials and Methods

Participants

The present study is part of a longitudinal project that involved preterm and full-term mother–child dyads from 18 to 30 months

of the child. The participants comprised 47 mother–toddler dyads (27 preterm, 20 full-term).

The PG was recruited at the Neonatal Unit of the Bufalini Hospital in Cesena (Italy). All children enrolled in the follow-up program of the hospital and born with a gestational age (GA) ≤32 weeks and/or birth weight (BW) ≤1500 g were considered eligible for the study. Preterm toddlers and their mothers were consecutively recruited over the period March 2013–December 2014. Exclusion criteria were: (a) child's major cerebral damage [intraventiricular haemorrhage (IVH) > III or IV grade, periventricular leucomalacia (PVL), retinopathy of prematurity (ROP), and hydrocephalus] or genetic syndrome; (b) parents' past or present psychiatric history or the presence of neurological disorders; (c) parents' past or present history of eating disorders (anorexia nervosa, bulimia nervosa, binge eating); (d) parent's lack of proficiency in the Italian language. Among 38 dyads recruited, seven dyads were excluded from the sample as not matching the criteria for the study: one child reported cerebral damage (IVH > III grade); five dyads were excluded due to the parents' lack of fluency in Italian, and one dyad due to the mother having a neurological disorder (multiple sclerosis). Four dyads dropped out after the first assessment. A total of 27 dyads were finally selected for the present research.

The mean GA of preterm children was 29.16 (SD = 1.99), and their mean BW was 1091.3 g (SD = 280.96). Fourteen children were males (51.9%) and 13 females (48.1%). The highest percentage of children was born with a cesarean (92.6%; $n = 25$) and only two with a spontaneous delivery (7.4%). Moreover, eight children (29.6%) were small for gestational age (SGA) and seven were twins (25.9%). All preterm mothers ($M_{\text{age}} = 38.5$, SD = 4.37 years) were employed, either married or cohabiting with the father of the child (88.5%), and most of them were Italian (85.2%). With regard to education, 47.8% had a high school diploma and 31.9% a university degree. Sixty-three percent of the mothers were primiparous at the time of the first assessment.

The group of full-term mother–child dyads (FG) was recruited from preschools in the area of Cesena (Italy) over the period April 2013–November 2014. As for the PG, exclusion criteria were: (a) child's birth complications, cerebral damage, disabilities, or genetic syndromes; (b) parents' past or present psychiatric history or the presence of neurological disorders; (c) parent's past or present history of eating disorders; (d) parent's lack of fluency in Italian. Twelve mothers declined their participation due to the inability to accommodate into the time schedule of the study. Twenty-one mothers accepted to take part in the project. Among these, one dyad was excluded from the sample due to major problems of the child (epilepsy). A final sample of 20 dyads was selected for the study.

All full-term children were born healthy, after 37 weeks of gestation ($M_{\text{GA}} = 39.69$, SD = 1.28), and with a BW over 2500 g ($M_{\text{BW}} = 3455.25$, SD = 462.79). Most children were born with a spontaneous delivery (60%). All mothers ($M_{\text{age}} = 36.9$, SD = 5.11 years) were married or cohabiting with the father of the child. Moreover, most of them were Italian (95%), employed (90%), primiparous (90%), and had a university degree (70%).

Measures

Demographic and Obstetrical Variables

Relevant data on the child (e.g., GA, BW, past and recent clinical history) were collected from the infant's medical records. Socio-demographic information about the mother (e.g., age, nationality, parity, level of education, marital status, occupation, past and present psychiatric and medical history, and occurrence of past or present eating disorders) was instead collected using an *ad hoc* designed questionnaire.

Mother–Child Feeding Interactions

The Feeding Scale (Chatoor et al., 1998b; Italian version SVIA-Scale di Sviluppo dell'Interazione Alimentare by Ammaniti et al., unpublished manuscript) was used to evaluate mother–child feeding interactions. The instrument is an observational scale, developed to be used from 0 to 36 months of age of the child, which allows the identification of the child's and the mother's dysfunctional behaviors during the meal through 46 items. The Italian version of the scale comprises four dimensions: Affective State of the Mother, Interactional Conflict, Food Refusal Behavior of the Child, and Affective State of the Dyad. Higher scores at each dimension indicate less healthy dyadic interactive patterns. The scale Affective State of the Mother measures the quality of maternal affect when feeding the child. High scores in this scale indicate a lack of pleasure and a prevalence of negative affect, such as sadness, anger, and distress. The scale Interactional Conflicts evaluates the presence of conflicts between the mother and the child during the meal. High scores in this scale indicate the presence of intrusive maternal behaviors (e.g., forcing the child to eat) while the child shows distress and avoidance during the feeding exchanges. The scale Food Refusal Behavior of the Child explores the characteristics of the child's eating behavior and emotions during the meal. High scores on the scale indicate a high frequency of food refusal behaviors such as rejecting food, spitting, crying, negativity, and opposition. The scale also examines the presence of non-contingent maternal behaviors. Finally, the scale Affective State of the Dyads evaluates the quality of affect in mother–child relationship. High scores indicate a negative affective experience for the dyad and low dyadic reciprocity. The mother does not support the child's autonomous initiatives, displaying controlling behaviors, insistent requests, and criticism, and the child responds showing distress and opposition.

The Feeding Scale showed good stability, inter-rater agreement and construct validity (Chatoor et al., 1997; Lucarelli et al., 2002). For the present study, Interclass Correlation Coefficient between the two raters ranged between 0.75 and 0.96 (mean = 0.90).

Child's Level of Development

The child's level of development was measured through the Griffiths Mental Development Scales (GMDS 0–2; Griffiths, 1996). The GMDS provides indication on the child's mental and psychomotor development. Five areas are evaluated through the following subscales: Motor Development (54 items), Personal-Social (58 items), Hearing and Speech (56 items), Eye-Hand Coordination (54 items), Performance (54 items). A general

quotient (GQ) score can also be computed from these five dimensions. Higher scores to each scale correspond to a superior development in a specific cognitive domain.

Maternal Depression

Maternal depression was evaluated with the Beck Depression Inventory (BDI-II; Beck et al., 1996; Italian version by Benvenuti et al., 1999). The BDI-II is a 21-item self-report, designed to assess the severity of depression in clinical and non-clinical populations. Each item is rated on a 4-point Likert scale ranging from 0 to 3; answers are given with reference to the previous 2 weeks. The BDI-II has high reliability and content validity, and it has shown to be effective in differentiating between clinical and non-clinical depression (Rickards et al., 2011).

In order to facilitate the analysis and to increase the sensitivity of the measure, for the purpose of the present study a general indicator of depressive symptoms was calculated as the average of the BDI-II scores between Time 1 (18 months after delivery) and Time 2 (24 months after delivery). This choice was supported by the high correlations (Cohen, 1988) between the two measurements both in the PG ($r = 0.83$, $p < 0.001$) and in the full-term group ($r = 0.78$, $p < 0.01$). Additionally, a cut-off score of 13 was used (low depression: 14–19; mild depression: 19–29; severe depression: 30–63; Beck et al., 1996).

Procedure

After approval was obtained by the ethic committee of the Department of Psychology, and informed written consent was signed by participants, all dyads were assessed at the Psychodynamic Research Laboratory "Anna Martini" of the University of Bologna (Cesena, Italy). The assessments were conducted at 18 and 24 months of the child (corrected age for preterm children) through the same multi-method procedure.

First, the feeding session was observed during the morning/afternoon snack time. Observations were scheduled in agreement with each mother in order to respect their child's eating habits. Prior to the assessment, mothers were instructed to bring the child's usual snack and to behave as they would normally do at home. Twenty minutes of feeding interaction were videotaped from behind a one-way mirror and later coded by two raters, blind to the child's condition, through the Feeding Scale. Secondly, a psychologist measured the child's level of development through the GMDS. Last, mothers were asked to complete the BDI-II.

Statistical Analysis

Differences between full-term and preterm mothers in demographic and obstetric variables, as well as differences between full-term and preterm children's level of development were investigated through a series of Chi-Squares and Student's *t*-tests. Repeated measures Analysis of Variance (ANOVA) was also used to evaluate differences in depression symptomatology between preterm and full-terms mothers at each time of assessment.

Pearson's correlation coefficients were calculated to test bivariate associations between the BDI-II and the Feeding Scales dimensions scores in each group at both Times 1 and 2. For each dimension of the Feeding Scale a within-between repeated measures ANOVA was run to test between groups (pre- vs. full-term dyads) differences in feeding interactions by time of assessment (18 and 24 months). Where a significant correlation emerged between the Feeding Scales and scores on the BDI, the latter were added as covariate to the model. Greenhouse–Geisser epsilon adjustment to the degrees of freedom was performed, when appropriate, and adjusted *p*-values are reported. In order to further analyze significant effects, Bonferroni correction for multiple comparisons was employed.

Results

Maternal Variables

Demographic characteristics of the study sample are displayed in **Table 1**. No significant differences emerged with the exception of parity [$X^2(1,47) = 4.42$, $p < 0.05$], as the percentage of multiparous women was significantly higher in the pre-term group (37%) than in the full-term group (10%).

Regarding maternal depression levels, no significant differences were observed for Group [$F(1,42) = 1.82$, $p = 0.18$,

TABLE 1 | Socio-demographic characteristics of the sample.

	Preterm group (PG; *N* = 27)	Full-term group (*N* = 20)	t/X^2
Child			
Gender, male, *n* (%)	14 (51.9%)	14 (70%)	1.571
Birth weight, mean ± SD	1091 ± 280.96	3455 ± 462.79	20.246***
Gestational age, mean ± SD	29.16 ± 1.99	39.69 ± 1.28	20.631***
Small for gestational age (SGA), *n* (%)	8 (29.6%)	0 (0%)	7.142**
Type of delivery, *n* (%)			15.195***
Spontaneous	2 (7.4%)	12 (60%)	
Cesarean	25 (92.6%)	8 (40%)	
Twins, *n* (%)	7 (25.9%)	0 (0%)	6.093*
Mother			
Mean age (in years), mean ± SD	38.5 ± 4.46	36.9 ± 5.15	1.146
Nationality, *n* (%)			1.164
Italian	23 (85.2%)	19 (95%)	
Foreign	4 (14.8%)	1 (5%)	
Civil status			2.469
Married or cohabiting	24 (88.5%)	20 (100%)	
Single	3 (11.5%)	0 (0%)	
Education, *n* (%)			4.366
Middle school certificate	3 (13%)	2 (10%)	
High school diploma	12 (47.8%)	4 (20%)	
University degree	12 (31.9%)	14 (70%)	
Occupation, *n* (%)			2.820
Employed	27 (100%)	18 (90%)	
Unemployed	0 (0%)	2 (10%)	
Parity, *n* (%)			4.417*
Primiparous	17 (63%)	18 (90%)	
Multiparous	10 (37%)	2 (10%)	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

$\eta_p^2 = 0.04$], Time [$F(1,42) = 0.09$, $p = 0.77$, $\eta_p^2 = 0.002$] and Time × Group variables [$F(1,42) = 2.43$, $p = 0.12$, $\eta_p^2 = 0.05$; see **Table 2**]. Maternal mean scores on the BDI-II for the full term group were 8.74 ± 6.91 at 18 months and 8.05 ± 6.90 at 24 months. PG scores were 6.67 ± 4.85 at 18 months and 5.60 ± 5.35 at 24 months.

Child's Variables

Differences were observed between the two groups for children's weight and GA, and type of delivery (see **Table 1**), whereas no differences emerged for the child's gender [$X^2(1,47) = 1.57$, $p = 0.21$]. Results from *t*-test showed no differences in children's GQ levels measured through the Griffiths Scale at 18 months [$t(1,45) = -0.93$, $p = 0.36$] and at 24 months [$t(1,44) = -1.84$, $p = 0.07$]. At 18 months, the mean GQ score was 101.59 ± 9.84 in the PG ($N = 27$) and 104.10 ± 7.98 in the control group ($N = 20$). At 24 months, the mean GQ score was 103.38 ± 10.32 in the PG ($N = 26$) and 108.45 ± 7.64 in the control group ($N = 20$). As no differences emerged in the child's level of development, this variable was not taken into account in subsequent analyses.

Bivariate Relationships Among Study Measures

Pearson's coefficients indicated that scores on the BDI-II were positively correlated to the subscale Affective State of the Dyads at 18 ($r = 0.45$, $p = 0.01$) and, although marginally significant, at 24 months ($r = 0.39$, $p = 0.04$) in the PG. When checking for the control group no significant correlation emerged between symptoms of depression and scores on the subscales of the Feeding Scale at 18 and 24 months (all *p*s > 0.05).

Mother–Child Feeding Interaction

Table 2 shows mean scores on the Feeding Scale for each group. Results for the dimension Affective State of the Mother revealed a significant main effect of group only [$F(1,45) = 20.35$, $p < 0.001$, $\eta_p^2 = 0.31$], with mothers from the pre-term group scoring higher than mothers from the full-term group ($p < 0.001$). Regarding the dimension Interactional Conflict, main effects of group [$F(1,45) = 5.66$, $p < 0.05$, $\eta_p^2 = 0.11$] and time of assessment [$F(1,45) = 6.06$, $p < 0.05$, $\eta_p^2 = 0.12$] were detected. In this case, for both groups a significant decrease in Interactional Conflict scores from 18 to 24 months emerged ($p < 0.05$). However, the pre-term group reached higher scores at this dimension than the full-term group ($p < 0.05$), thus implying overall greater levels of interactional conflict between pre-term children and their mothers compared to full-term dyads (**Figure 1**). With respect to Food Refusal, only the interaction Time × Group was significant [$F(1,45) = 7.32$, $p = 0.01$, $\eta_p^2 = 0.14$]. Particularly, at 24 months preterm children showed significantly higher levels of food refusal than at 18 months compared to full-term children, whose

TABLE 2 | Mean scores and SD of the Feeding Scale at 18 and 24 months.

Measures	PG		Full-term group	
	18 months *M* ± SD	24 months *M* ± SD	18 months *M* ± SD	24 months *M* ± SD
Affective State of the Mother	8.33 ± 4.02	8.70 ± 3.79	5.40 ± 2.56	3.90 ± 2.69
Interactional Conflicts	9.19 ± 5.51	8.67 ± 4.82	7.85 ± 4.33	4.70 ± 2.40
Food Refusal Behavior of the Child	1.70 ± 1.61	2.30 ± 1.46	1.95 ± 2.18	1.30 ± 1.49
Affective State of the Dyad	2.56 ± 2.10	2.96 ± 1.60	2.15 ± 1.30	1.55 ± 1.53

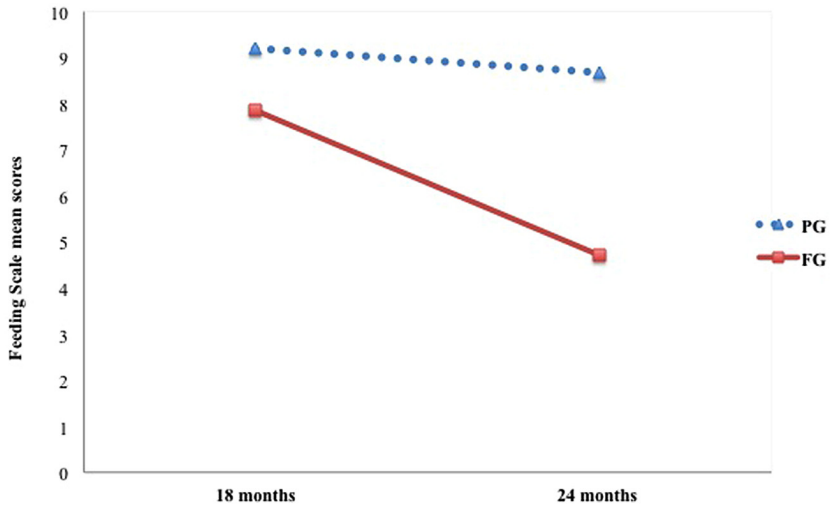

FIGURE 1 | Longitudinal trajectories in preterm and full-term dyads for the scale Interactional Conflict.

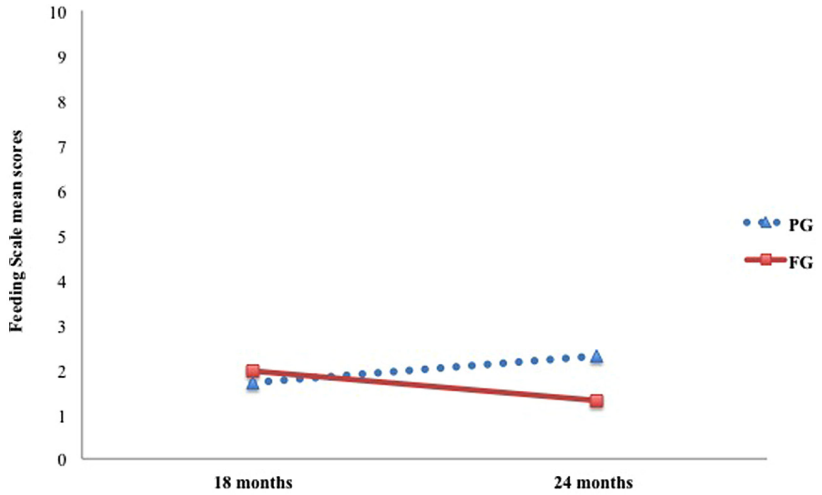

FIGURE 2 | Longitudinal trajectories in preterm and full-term dyads for the scale Food Refusal Behavior of the Child.

scores remained lower and almost unvaried between the two assessments (**Figure 2**).

Given that in the pre-term group a significant correlation between levels of maternal depression and Affective State of the Dyads was found, for this dimension of the Feeding Scale mean scores at the BDI were considered as covariate. After controlling for the effects of depression, results showed a significant main effect of group [$F(1,45) = 8.01$, $p < 0.01$, $\eta_p^2 = 0.15$], and mean difference revealed an overall worse affective state of pre-term compared to full-term dyads.

Discussion

The aim of this study was to explore the characteristics of mother–toddler feeding interactions between 18 and 24 months of age, comparing preterm with full-term dyads. Maternal depression and the child's developmental stage at both assessments were considered as additional influential variables.

Results partly confirmed our hypothesis. Main differences between groups emerged in three out of four dimensions of the Feeding Scale. Preterm mother–child dyads obtained significantly higher scores on the subscales concerning the mother (i.e., Affective State of the Mother), and the dyad (i.e., Interactional Conflict and Affective State of the Dyad), compared to full-term mother–child dyads. Group mean scores pertaining to the 'Affective State of the Mother' indicate that, compared to the full-term group, mothers of preterm children show more angriness, sadness and distress and less pleasure when feeding their child. Dyadic measures on the scales 'Interactional Conflict' and 'Affective state of the Dyad' indicate the presence of more frequent and intense dyadic conflicts, lack of reciprocity, and negative affect in preterm dyads than in full term ones. Specifically, our findings reveal that preterm mothers are more intrusive and controlling during feeding, and they support the child's autonomous initiatives less than full-term mothers. In turn, preterm toddlers show higher distress, avoidance and negativity compared to full-term children. This result indicates that preterm mother–toddler dyads, compared to full-term ones, show a higher risk of experiencing overall less positive and less contingent interactions during the meal. Consistent with our results, other studies have documented less contingent feeding interactions in preterm than in full-term dyads (Davis et al., 2003; Singer et al., 2003). Particularly, previous findings show that in the early postpartum period, preterm infants are less responsive to maternal cues during feeding compared to full-term babies (Davis et al., 2003; Singer et al., 2003). Singer et al. (2003) also suggest that maternal high levels of distress affect the mother's capacity to contingently and sensitively respond to the child's cues during feeding. Our findings seem to confirm these results, showing that a lack of dyadic contingency during feeding interactions might persist over time in preterm mother–toddler dyads.

Chatoor et al.'s (1998a; 2000) has highlighted that interactive conflicts during the meal and maternal difficulties in sensitively and contingently responding to their toddlers' feeding behavior can interfere with the successful transition to self-feeding and lead to feeding disorders through several pathways. Current research shows that both maternal psychopathology and the child's challenging temperament and behavior may hinder the creation of dyadic contingency during the interaction, leading to chronic mismatches between the toddlers' behavior and the parent's response, thus fostering negative affect and conflicts during feeding (Chatoor et al., 2000; Feldman et al., 2004; Ammaniti et al., 2010). It must be acknowledged that preterm children are at risk for regulatory, emotional, and behavioral problems such as negative mood, irritability, distractibility, and low tolerance to stimuli (Langkamp and Pascoe, 2001; Hughes et al., 2002; Weiss et al., 2004; Klein et al., 2013). Moreover, many preterm children suffered trauma related to medical intervention and invasive procedures (i.e., endotracheal

suctioning, intubation, nasogastric feeding tube) and might report gastro-esophageal reflux, oral-hypersensitivity or oral-motor difficulties (Dodrill et al., 2004; Torola et al., 2012). These factors might influence the child's attitude toward eating and lead to intense fear of food, food aversions, lack of hunger, or appetite (Chatoor, 2002). In turn, there is evidence of the association between children's eating behavior and their mothers' perception and feeding practices (Ramsay and Gisel, 1996; Chatoor et al., 2000). Therefore, the child's clinical history, his/her temperamental and behavioral characteristics might have influenced the pattern of feeding that we observed in preterm dyads. For this reason, the role of these variables should be explored in future studies.

Regarding the stability of the interactive feeding patterns observed over time, we found that the scores on the 'Affective State of the Mother' and 'Affective State of the Dyad' scales were fairly stable from the first to the second assessment. Contrarily, the time factor led to differences between the two groups with respect to the scale 'Interactional Conflict'. The scores of both groups in this dimension dropped from 18 to 24 months, indicating a progressive decrease in dyadic conflict levels. According to the Feeding Scale validation studies, the 'Interactional Conflict' scale score normally increases between 9–12 and 12–18 months of age, as the child starts spoon- and self-feeding, followed by a gradual decline in that score from 18 to 24 months of age onwards (Chatoor et al., 1997; Lucarelli et al., 2002). Our results seem to reflect a similar trend. Although mean scores of the PG remained significantly higher than those of the full-term group, the decrease of conflict in preterm dyads suggests an improvement in mother–child interaction. All preterm dyads participating in the study were involved in a follow up program aimed at monitoring and supporting the child's development from the time of discharge till they reached 30 months of age. This program included the provision of psychological and educational support to parents to promote their awareness and involvement in the child's care. The improvement observed could be influenced by the psychological support provided to the parents and to the children.

However, time also seemed to play a role in differences between the two groups on the 'Food Refusal Behavior' Scale. Scores of the PG significantly increased from 18 to 24 months, indicating a greater frequency and intensity of the child's protests and food avoidance behaviors. Differently, scores of the full-term group remained fairly low and stable over time. Literature shows that, usually, in healthy full-term dyads, dyadic reciprocity and maternal contingency increase, whereas dyadic conflict and food refusal behaviors gradually decrease from the first to the second year of life, reflecting an overall adjustment of feeding interactions as most of the issues related to autonomy are overcome (Lucarelli et al., 2003; Ammaniti et al., 2004). In our sample, the longitudinal trajectories observed in the PG seem to reflect a different trend. Even though dyadic conflict decreased, dyadic reciprocity, and maternal contingency remained low, and the child's food refusal behaviors increased. Hence, further longitudinal studies are needed to investigate the development of these interactive patterns over time and their impact on the child's subsequent eating behavior.

In our sample, the child's developmental level and the presence of maternal depression had no effect on the quality of mother–child feeding interactions, and this disconfirmed our second hypothesis. Additionally, our results showed that there were no significant differences between preterm and full-term toddlers' GQ scores at 18 and 24 months and that both groups were developing normally. These findings diverge from those of previous studies reporting lower GQ scores in preterm children compared to full-term children (Bhutta et al., 2002). However, several studies also highlight a broad inter-individual variability related to the severity of prematurity (i.e., extreme BW and GA, obstetric complication), which might increase the risk of negative neurodevelopmental outcomes (Marlow et al., 2005; Gianni et al., 2007; Claas et al., 2011; Sansavini et al., 2011; Stoinska and Gadzinowski, 2011; Biasini et al., 2015). These variables, which may intensify the differences observed between full term and preterm children, were not taken into account in the present study due to the small sample size. Moreover, our results could be partially explained considering the influential role of the follow-up intervention carried on with preterm children and their parents. Indeed, literature evidences the effect of similar interventions in promoting the child's positive cognitive development during early and middle childhood (Kaaresen et al., 2006; Melnyk et al., 2006; Orton et al., 2009).

Regarding the presence of maternal depression, our findings did not show any significant difference between pre- and full-term mothers. For both groups medium scores on the BDI were below clinically relevant levels, thus not providing support to our hypothesis. Most of the studies that detected a high risk of depression in mothers of preterm children have been conducted in the first year postpartum (Carter et al., 2007; Vigod et al., 2009; Voegtline et al., 2010) and less is known on the evolution of the symptomatology over time. Miles et al. (2007) found that levels of depression in preterm children's mothers tend to decrease from the first month post-partum to 6 months and then remain stable. Similar results were obtained by Singer et al. (1999), who found that distress levels for pre-term mothers decreased from the early postpartum to 3 years of age, thus reaching the same levels as mothers of full-term children. Our findings seem to support the hypothesis that the prevalence of maternal depression in the second year of the child's life may be less influenced by prematurity than in the early post-partum period. However, it must be noted that mothers participating in our research were mainly wealthy and educated women, married, or cohabiting with the father of the child. Previous studies show that the remission of depressive symptoms over time is lower in the presence of concurrent risk factors concerning the child, the mother, as well as the family (Poehlmann et al., 2009). Moreover, the support provided to parents of preterm children's might have promoted positive outcomes for the mothers' mental health, as well as for the child's cognitive development (Melnyk et al., 2006; Trombini et al., 2008; Montirosso et al., 2012; Weber et al., 2012). Future studies should control for the effects of psychological intervention with mothers of preterm children.

Last, a significant correlation between maternal depression and the dimension 'Affective State of the Dyad' of the Feeding Scale was found in the PG. High scores in this scale indicate

the dyad experience negative affective involvement, resulting from maternal difficulties in supporting the child's autonomous initiatives (controlling behaviors and criticism) and child's responses of distress and negativism. This result suggests an association between a greater depressive state and a diminished maternal capacity to detect and sensitively respond to the child's cues during the interaction, confirming previous studies (Singer et al., 2003; Diego et al., 2006; Feldman and Eidelman, 2007; Agostini et al., 2014). However, our data show no significant correlations in the full-term group. Hence, the association between depression and negative affective state of the dyad during feeding seems stronger when maternal depression and the child's prematurity co-occur. This result suggests the clinical relevance of monitoring maternal mental state in preterm dyads.

Some limitations of the study must be considered when interpreting our findings. First, due to the small sample size, all results should be replicated on larger samples. Second, we did not measure some characteristics of the child, such as temperamental difficulties and behavioral problems, which might have played a role on the pattern of feeding observed. Moreover, we lack data on the clinical history of preterm children, such as the presence of major aversive event or repeated noxious insults to the oropharynx or gastrointestinal tract (e.g., reflux, insertion of nasogastric feeding tube or endotracheal suctioning), which trigger intense distress in the infant or young child and might affect the pattern of eating (Chatoor, 2002). Last, the literature shows that maternal attitudes toward food and concerns about the child's behavior might influence her feeding practices (Agras et al., 1999; Stein et al., 1999; Gueron-Sela et al., 2011). Hence, these elements pertaining both preterm children and their caregivers should be taken into account by future investigations. Indeed, feeding interactions are part of the general relationship between the mother and the child, which is influenced by both parties' characteristics and histories (Satter, 1990; Chatoor, 1996). Taking into account these aspects and considering that the eating pattern in preterm dyads is the result of many combined factors, future studies should be directed to better evaluate the effect of the child's and the mother's characteristics on the pattern of feeding interactions observed in preterm dyads.

Despite some limitations, our findings show that preterm mother–toddler dyads experience less positive interactions during the transition to self-feeding compared to full-term mother–toddler dyads, displaying more maternal negative affect, dyadic conflicts and lack of reciprocity during the meal. Future data from the longitudinal study will allow a more thorough understanding of the evolution of the interactive patterns observed at 18 and 24 months over time and the related risk on the child's subsequent eating attitudes and behavior.

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The role of co-parenting alliance as a mediator between trait anxiety, family system maladjustment, and parenting stress in a sample of non-clinical Italian parents

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This study investigated the role of co-parenting alliance in mediating the influence of parents' trait anxiety on family system maladjustment and parenting stress. A sample of 1606 Italian parents (803 mothers and 803 fathers) of children aged one to 13 years completed measures of trait anxiety (State Trait Anxiety Inventory—Y), co-parenting alliance (Parenting Alliance Measure), family system maladjustment (Family Assessment Measure—III), and parenting stress (Parenting Stress Inventory—Short Form). These variables were investigated together comparing two structural equations model-fitting including both partners. A model for both mothers and fathers was empirically devised as a series of associations between parent trait anxiety (independent variable), family system maladjustment and parenting stress (dependent variables), mediated by co-parenting alliance, with the insertion of cross predictions between mothers and fathers and correlations between dependent variables for both parents. Results indicated that the relation between mothers and fathers' trait anxiety, family system maladjustment and parenting stress was mediated by the level of co-parenting alliance. Understanding the role of couples' co-parenting alliance could be useful during the family assessment and/or treatment, since it is an efficient and effective tool to improve the family system maladjustment and stress.

Keywords: co-parenting alliance, trait anxiety, parental stress, family maladjustment, structural equation modeling

Introduction

Parenting is a challenging process that involves complex variables not limited to caregiving activities (Bornstein, 2002). According to Belsky (1984) parenting behaviors are associated with three principal factors: child's characteristics, family dimensions, and parent's individual differences such as personality features and psychological resources. Personal differences would influence parenting competence more strongly than the other factors because they influence how people experience and respond to a wide variety of tasks (see, e.g., Caspi et al., 2005; Caspi and Shiner, 2006; Roberts et al., 2007). Furthermore, individual differences affect feelings and emotions toward parenting, and

parent's attributions to child behavior (Kochanska et al., 2004; Caspi et al., 2005; Belsky and Jaffee, 2006).

Co-parenting can be seen as a further indicator of parenting adjustment (Feinberg, 2003). Co-parenting (McHale, 1995; Feinberg, 2003) has been defined as a unique component of the marital relationship in which parents work together, or alternatively, struggle against each other when it comes to child rearing (McHale, 2007). Weissman and Cohen (1985) listed the following four characteristics for a good co-parenting alliance, which is one of the most important components of co-parenting: (1) both parents' investment in the child, (2) evaluating reciprocal involvement with the child, (3) respect for each other's judgment about child rearing, and (4) desire to communicate child-related information. Studies have shown how co-parenting alliance is positively associated with perceptions of parental support, marital relationship, as well as decreased stress, and, on the other hand, it has negative implications for parenting practices, and arguments about parenting practices (Abidin and Brunner, 1995; Sheras et al., 1998a,b; Stright and Bales, 2003; Schoppe-Sullivan et al., 2004; Askari et al., 2012; Kwan et al., 2015). A scarce level of co-parenting alliance influences family system adjustment and increases parenting stress (Morrill et al., 2010), defined as a feeling of poor parenting skills, a lack of freedom or restriction in certain aspects of the parent's life, and a lack of social support (Abidin, 1995; Deater-Deckard and Scarr, 1996; Margolin et al., 2001). Several studies have demonstrated the mediating role of co-parenting in family functioning (Bonds and Gondoli, 2007; Feinberg et al., 2007a; Kwan et al., 2015), and how co-parenting has the potential to enhance family functioning and parent adjustment (Feinberg and Kan, 2008). Although some variables may serve either a moderating or mediating function, mediators are conceptually difference from moderators (Baron and Kenny, 1986). Whereas moderators are features that belong to individual prior to stressors, mediators become individual's characteristics in response to stressors (Grant and McMahon, 2005).

Anxiety, besides being considered as a trait-stable indicator of parents' personality (Majdandžić et al., 2012), is seen as an indicator of parenting and co-parenting adjustment. Anxiety might undermine parents' ability to initiate and maintain positive affective interaction with other family members (i.e., the child, the partner); moreover, a disposition to experience anxiety might lead to intrusive and overprotective parenting. Studies have shown that anxious parents tend to report higher levels of parental distress and display higher levels of dysfunctional interactions (Dadds and Barrett, 1996; Hudson and Rapee, 2002). However, the extent to which specific parenting factors, and in particular trait anxiety, may affect family system have not been yet well assessed (Konold and Abidin, 2001; Majdandžić et al., 2012). Trait anxiety was also detected as an individual characteristic which impairs parenting alliance (Caldera et al., 2002). The links between parents' characteristics, co-parenting relations, family maladjustment and parenting stress have been traditionally examined separately for fathers and mothers. Little is known about the relative contributions of these variables in the context of broader family models (Morrill et al., 2010). As an example, Kwan and colleagues, (2015) showed that parenting correlates impact differently in mothers and fathers. Although theorists argue the need to give space to both parents views, previous studies have emphasized the lack of data from fathers in family research (Bornstein, 2002; Bonds and Gondoli, 2007; Feinberg et al., 2007b; Kolak and Volling, 2007). For these reasons, in the current study, mothers as well as fathers' contributions were taken into account.

Regarding possible clinical implication of the interplay between the dimensions discussed above, existing literature posited that articulation of adaptive family structure was determined by parents mental health and cohesiveness and it is strictly connected with the well-being of their children (Olson and Gorall, 2003). Disconnection and the lack of coordination between parents are some of the most important reasons for dysfunctional outcome in children since their first years of life (McHale et al., 2002).

The main purpose of our study was to empirically test the role of parental trait anxiety, mediated by co-parenting alliance on family system maladjustment and parenting stress, considering mothers and fathers simultaneously. To address this issue, structural equation modeling (SEM) was used to (a) test whether there exists a correlation between level of trait anxiety, co-parenting alliance, family maladjustment and parenting stress in fathers and mothers, (b) test whether mothers and fathers trait anxiety contributes to higher maladjustment and parenting stress as rated respectively by mothers and fathers, and (c) examine whether these hypothesized relationships were mediated by maternal and paternal co-parenting alliance. More specifically, the direct effect hypotheses supported that mothers and fathers' trait anxiety and co-parenting alliance would predict greater family maladjustment and parenting stress as rated by mothers and fathers (Bonds and Gondoli, 2007). Measures of the same variables in fathers and mothers were expected to be related. An indirect relationship between trait anxiety and family maladjustment via co-parenting alliance was expected. A model is proposed to represent the hypothesized direct and indirect relationships of each parent's trait anxiety and co-parenting alliance on parenting stress and family system maladjustment (**Figure 1**).

A parallel SEM was devised for both mothers and fathers and the contributions of both parents were simultaneously considered, being aware that empirical studies including members of the same parental couple are faced with the difficulty of studying data from non-independent members (Kenny et al., 2006).

Materials and Methods

Participants

The original sample included 956 parent couples. Statistical analyses, however, were carried out on the participants who filled the whole questionnaires. Self-reports of 153 participants showed one or more missing values, thus they were excluded. Missing data were especially due to slight parents' inattention in filling the questionnaires. The final sample included 1,606 parents, 803 mothers and 803 fathers. They were married heterosexual couples of children from infancy to early adolescence (1–13 years old). Due to the large life-span included, parents were assessed considering their child developmental stage: (a) preschool children (1–5 years old) and (b) school aged children (6–13 years old).

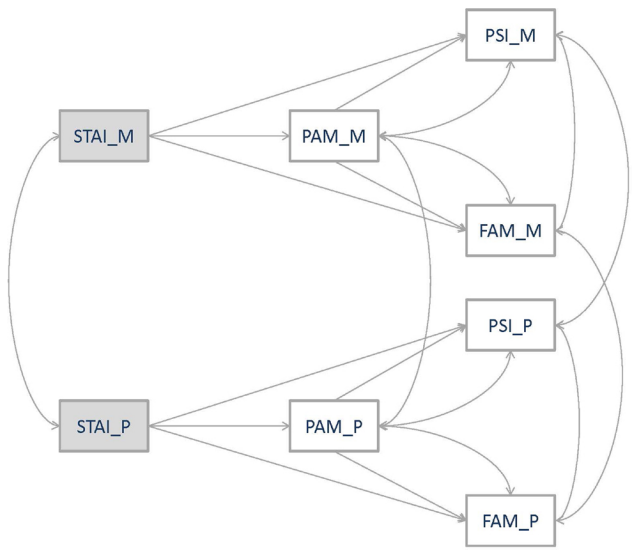

FIGURE 1 | Hypothetical model.

Families were primarily recruited through day-cares, nurseries and schools, and met the following criteria: (a) both mothers and fathers agreed to participate, (b) all participants completed the entire assessment phase (c) parents and children did not meet criteria for psychiatric diagnosis and were not under psychological treatment. The mean age of mothers and fathers in this sample was 38.6 (SD = 5.74) and 40.92 (SD = 6.32) respectively. All subjects were Caucasian and lived in different regions of North and Central Italy. Parents' socio-economic level, measured by SES (Hollingshead, 1975), was middle to upper for 91% of families, 7% had a medium to low socio-economic status and only 1% reported a very high level.

Procedures

This study was conducted in compliance with the ethical standards for research outlined in the *Ethical Principles of Psychologists and Code of Conduct* (American Psychological Association, 2010). Approval by the Ethical Committee for Psychological Research was obtained from the University of Padova. Participation in the study was solicited via leaflets. Questionnaires were then distributed to 30 nursery school, 16 kindergartens, 12 elementary schools and four high schools in urban and suburban, located in North and Central Italy. Parents written signed informed consent to participate in the study were obtained before data collection. They completed the questionnaires at home and returned them to the research team through their children in a close envelope. Confidentiality was assured by replacing participant's personal information with a numeric code. No incentives were awarded and voluntary participation was emphasized.

Measures

State-Trait Anxiety Inventory form Y (STAI-Y; Spielberger et al., 1970). This measure is the gold standard for assessing anxiety in adults. It measures state and trait anxiety trough 40 items (20 each one) on a 4-point Likert scale. The scale showed good psychometric properties (Barnes et al., 2002). The Italian normative data comes from a large sample of 2304 subjects aged 16 to 60 years (Pedrabissi and Santinello, 1989). The subscale for trait anxiety evaluation (STAI-t) was used in this study.

Parenting Alliance Measure (PAM; Abidin, 1999; Abidin and Konold, 1999; Konold and Abidin, 2001) was used to measure co-parenting alliance. This 20-item self-report instrument assesses the strength of the perceived alliance of parents of children aged from 1 to 19 years. It assesses the parenting aspects of a couple's relationship (e.g., how cooperative, communicative, and mutually respectful they are with regard to caring for their children). Parents responded to the items using a 5-points Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores reflecting stronger co-parenting alliance and reciprocity in the parental role. PAM showed good psychometric characteristics and has been found to be stable for both mothers and fathers (Konold and Abidin, 2001; Delvecchio et al., 2014). The Italian validation was carried out by Delvecchio et al. (2014).

Family Assessment Measure—III (FAM-III General Scale; Skinner et al., 1983) is a 50-item self-report measure of family system maladjustment. It provides a multi-rater assessment of family functioning across universal clinical parameters. Participants are asked to answer on a 4-point Likert scale from 3 (strong agree) to 0 (completely disagree). High total scores revealed a maladaptive family functioning. The current study took into account only FAM-III Total score, which assesses family system shared values, norms and goals. The questionnaire showed good internal consistency for the total score (Van Riper, 2000). Discriminant validity studies reported an adequate sensitivity of the scale for detecting high-risk families (Jacob, 1991; Alderfer et al., 2008). Laghezza et al. (2014) carried out the Italian validation.

Parenting Stress Index-Short Form (PSI-SF; Abidin, 1995) is a 36-item measure designed to assess the overall level of stress experienced by parents. Core assumption of PSI-SF suggests that the level of stress in the parent–child dyad is the result of child, parent, and situational characteristics. The scores are based on a 5-point ordinal Likert scale from 1 (it does not fit for me) to 5 (it corresponds well for me). All 36 items are summed to yield a total score for parenting stress, a measure of parental state of helplessness. The measure was validated in several countries showing good psychometric characteristics (Reitman et al., 2002; Deater-Deckard, 2004; Haskett et al., 2006; McKelvey et al., 2009). Guarino et al. (2008) carried out the Italian validation.

Data Analysis

The Statistical Package for Social Sciences (SPSS 21.0) was used to compute descriptive statistics, correlations, and to carry out analyses of variance (ANOVAs) on the overall score of trait anxiety (STAI-t), co-parental alliance (PAM), family system maladjustment (FAM-III) and parenting stress total scores (PSI-SF). SEM approach for observed variables was used to test the mediational effect of PAM on PSI-SF and FAM-III. LISREL 8 (Jöreskog and Sörbom, 1996) was used to estimate relations among the variables and assess model fit (Muthén and Muthén, 1998–2004). We also allowed for non-null correlations

TABLE 1 | Means and Standard deviations for STAI-t, PAM, FAM-III, and PSI-SF according to parental role, child's gender and age group ($N = 1606$).

	Parental Role				Gender				Age group			
	Mother ($n = 803$)		Father ($n = 803$)		Boys ($n = 396$)		Girls ($n = 407$)		(1–5 years) ($n = 422$)		(6–13 years) ($n = 381$)	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD	*M*	SD
STAI-t	40.55	7.20	38.16	6.96	39.33	7.01	39.38	7.35	39.27	6.97	39.45	7.41
PAM	85.48	10.13	85.85	9.75	86.01	9.58	85.32	10.30	85.80	8.95	85.92	10.46
FAM-III	32.79	10.57	33.00	11.10	33.13	10.89	32.67	10.78	31.90	10.48	34.00	11.13
PSI-SF	69.94	18.03	67.03	17.43	67.49	17.56	68.48	17.95	68.04	15.85	67.91	19.66

STAY-t, trait anxiety; PAM, co-parenting alliance; FAM-III, family system maladjustment; PSI-SF, parenting stress.

of errors among the same measures (i.e., mother and father) and within the same subject. Multiple criteria must be considered when evaluating model fit on the basis of various measures simultaneously, first, chi-square (χ^2). A solution fits the data well when χ^2 is not significant ($p \geq 0.05$). This statistic, however, is sensitive to sample size; it can lead to rejection of a model differing very slightly from data for large samples, and, conversely, it can result in the acceptance of a model with salient differences from data for small samples. Therefore, Schermelleh-Engel et al.'s (2003) suggestions were followed which consider adequate a Chi-Square/df ratio lower than 3. The fit of the model was also assessed with the Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI) and root mean square error of approximation (RMSEA; Kline, 2005). A CFI of 0.95 or above indicates a good fit, and below 0.90 indicates a poor fit. Also NNFI values greater than, or equal to, 0.95 indicate a good fit. If the RMSEA index is less than or equal to 0.05, the model is considered a good fit; values between 0.05 and 0.08 suggest reasonable error of approximation and if the index is greater than or equal to 0.10, the model is considered a poor fit. Finally, the choice of the best model was based on parsimony index, Akaike Information Criterion (AIC). The significance of the standardized path coefficients was determined by comparing the (absolute) t ratio to a critical t of 2.58 ($p \leq 0.01$). Therefore the overall fit of the models was determined by using a combination of the results from the fit indexes, the significance of standardized path coefficients, and the significance of the indirect effect.

Results

Preliminary Analyses

Internal consistency for STAI-t, PAM, FAM-III and PSI-SF total scores were indexed by means of Cronbach's alpha. Cronbach's alpha for the STAI-T was adequate for Mothers $\alpha = 0.69$ and for Fathers $\alpha = 0.70$. Cronbach's alpha for PAM were excellent (Mothers $\alpha = 0.93$ and Fathers $\alpha = 0.92$). FAM-III showed reasonable values (Mothers $\alpha = 0.75$; Fathers $\alpha = 0.76$). PSI-SF reported also high level of reliability (Mothers $\alpha = 0.93$ and Fathers $\alpha = 0.94$). Bivariate Pearsons' correlations revealed that all scores were not significantly associated with the length of the spouses' marriage, their income level, or either spouse's education level. Therefore, these demographic variables were excluded from the analyses. As a first step, possible significant influences due to parental role (fathers versus mothers), child's sex, and child age-group (preschool—1 to 5 years old-, versus school age—6 to 13 years old-) were assessed. **Table 1** shows the means for STAI-t, PAM, FAM-III, and PSI-SF total scores in the whole sample, for fathers and mothers, and according to child gender and age group (preschool versus school children).

TABLE 2 | ANOVAs for STAI-t, PAM, FAM-III, and PSI-SF with parental role, child's gender and age group as between subjects' variables ($N = 1606$).

	Parental role			Child's gender			Child's age group		
	$F_{(1,1605)}$	*P*	η_p^2	$F_{(1,1605)}$	*P*	η_p^2	$F_{(1,1605)}$	*P*	η_p^2
STAI-t	30.01	0.00	0.02	0.23	0.63	0.00	0.27	0.61	0.00
PAM	1.84	0.18	0.00	1.59	0.21	0.00	0.25	0.62	0.00
FAM-III	0.00	0.96	0.00	0.49	0.48	0.00	15.44	0.00	0.01
PSI-SF	6.15	0.01	0.00	1.49	0.22	0.00	0.03	0.86	0.00

STAY-t, trait anxiety; PAM, co-parenting alliance; FAM-III, family system maladjustment; PSI-SF, parenting stress.

Four analyses of variance (ANOVA) were performed on the total scores with parental role, children gender and age-group as between subject variables in order to verify if mothers and fathers showed similar levels of STAI-t, PAM, FAM-III and PSI-SF. According to Cohen's suggestions (Cohen, 1992), partial eta-square estimates were considered to be substantially significant only within 1–5% effect sizes. Results of the ANOVAs are reported in **Table 2**. No significant differences were found according to children's gender and age group for the considered variables. Focusing on parental role, the only significant result was found for STAI-t showing mothers reporting higher levels of anxiety than fathers, although their mean levels of trait anxiety were within the range of normative samples (Guarino et al., 2008). Furthermore, mothers reported higher levels of PSI-SF than fathers. However η_p^2 effect size of ANOVA was not within the 1–5% range, suggesting trivial results.

The Pearson product-moment correlations between STAI-t, PAM, FAM-III, and PSI-SF were computed separately for mothers and fathers to study the associations among these variables. The correlations were all significant ($p < 0.001$). Correlation effect size was classified (**Table 3**) according to Cohen (1988): low effect size, if the Pearson's *r* was lower than 0.30; medium effect size if *r* ranged between 0.31 and 0.50; and large effect size if *r* was higher than 0.50.

Medium effect size correlations were found for both parents between STAI-t and PSI-SF, suggesting that anxious parents tend

TABLE 3 | Correlations of STAI-t, PAM, FAM-III, and PSI-SF total scores for mothers ($N = 803$) and fathers ($N = 803$).

	1	2	3	4	5	6	7	8
1. STAI-t Mother	1							
2. STAI-t Father	0.32**	1						
3. PAM Mother	−0.34**	−0.27**	1					
4. PAM Father	−0.28**	−0.32**	0.51**	1				
5. FAM-III Mother	0.45**	0.25**	−0.44**	−0.28**	1			
6. FAM-III Father	0.31**	0.40**	−0.37**	−0.42**	0.51**	1		
7. PSI-SF Mother	0.44**	0.19**	−0.30**	−0.23**	0.48**	0.23**	1	
8. PSI-SF Father	0.32**	0.47**	−0.35**	−0.45**	0.32**	0.46**	0.50**	1

*STAY-t, trait anxiety; PAM, co-parenting alliance; FAM-III, family system maladjustment; PSI-SF, parenting stress. ** $p < .01$.*

to report higher levels of parental distress. As expected, PAM was negatively correlated with STAI-t, FAM-III, and PSI-SF.

SEM with Observed Variables

In the present study two structural equation models were carried out. Both parents' variables were inserted simultaneously within the two SEM tested. The first structural equation model (Model 1) was carried out to test the direct and indirect STAI-t effects as independent variable on FAM-III and PSI-SF path, with the insertion of PAM as a mediator factor. Correlations between dependent variables within the same parents were allowed. All standardized effects were significant. The CFI equal to 1.00 and the NNFI equal to 0.98 suggested a good fit. However, RMSEA equal to 0.123 and a ratio Chi-Square/df = 107.47/8 = 13.434 indicate a not adequate overall fit. Moreover, the presence of some not significant path coefficients underlined the need of a more adequate modified model with new paths of interactions between variables. Modification indices were taken into account in order to insert these new paths. These modifications led to Model 2. Model 2 was carried out starting from Model 1 structure with STAI-t as independent variable, PAM as mediator, FAM-III, and PSI-SF as predicted variables. However, in this model, mothers' and fathers' STAI-t was inserted as predictor of both mothers' and fathers' PAM. Direct and indirect predictions through PAM mediation of STAI-t were also considered. Not only mediational effects were considered for PAM but also its correlations with dependent variables of the same parent were taken into account. Correlations between FAM-III and PSI-SF were allowed within and between parents. The final model (Model 2) has been reached balancing among statistical requirements (e.g., modification indices) and interpretability of the resulting complex family system hypothesized and tested. **Figure 2** showed standardized indirect and direct coefficients. Model 2 fits the data reasonably well as indicated by multiple indicators of fit: ratio Chi-Square/df = 18.16/6 = 3.026, RMSEA = 0.050, CFI = 1.00, and NNFI = 0.98. To evaluate the improvement of the fit from Model 1 and Model 2 AIC values were also compared (lower indicates a better fit, Schermelleh-Engel et al., 2003). The index strongly decreases from 160.65 to 78.21 for Model 2.

All the path coefficients demonstrated statistical significance ($p \leq 0.001$). The results also showed that all the indirect effects between STAI-t, PAM, FAM-III, and PSI-SF were statistically significant both for mothers and fathers. Taken together, the results indicated that the relation between mothers' trait anxiety, as well as fathers' one, and family system maladjustment and parenting stress was mediated by co-parenting alliance level.

The model accounted for 13, 21, and 27% of the variance for mothers PAM, PSI-SF, and FAM-III, respectively. Among the fathers, the explained variance was 13, 25, and 15% for PAM, PSI-SF and FAM-III, respectively.

Discussion and Conclusion

This study investigated the complex interplay between parental individual trait anxiety, mediated by co-parenting alliance on family system maladjustment and parenting stress, in a large sample of non-clinical Italian parents. Both parents were invited to take part in the study.

Results highlighted the good psychometric characteristics of the measures, showing adequate reliability for each selected tool. Moreover mothers and fathers appeared to be quite similar in terms of parental role, and according to their children's age and gender.

Previous studies supported the idea that individual characteristics, such as trait anxiety, undermine family system, and that a scarce level of co-parenting alliance increase the risk of family maladjustment and parenting stress (Morrill et al., 2010). Starting from these theoretical-empirical bases, a structural equation model (Model 1) was hypothesized with the simultaneous insertion of both mothers and fathers variables. Because goodness of fit indices was not always satisfactory, a second model (Model 2) was carried out according to modification indices. In this model data fit was considered good and significantly higher than Model 1. Although, in an exploratory way, this model supported the ecologically complex interplay between trait anxiety, co-parenting alliance, family system maladjustment and parenting stress. Model 2 supported that trait anxiety—in mothers as well in fathers—was significantly predictive of the co-parenting alliance, for both partners. This result pointed out how each parent should account of the shared behaviors and practices of the couple that built the sense of co-parenting alliance.

Results of the current study have several important practical implications. Often family clinicians treat parent couples that are distressed in their co-parental relationship, which is often reinforced by powerful family dynamics. After assessing the family's strengths and weaknesses, knowledge of this model could provide useful indications about which subsystem to target. For example, if the couple is primarily struggling with parenting stress, it may be effective to focus on their co-parental cohesion (in addition to parenting training), but it may also be effective to assess if parental stress was also undermined by parent personal anxiety. Furthermore, the viability of the model suggests that targeting couples' co-parenting alliance could be an efficient and effective tool to influence family system maladjustment and stress. In other words, co-parenting interventions could have the power to contribute in diminishing their anxiety and stress. Prior research has demonstrated that co-parenting alliance is indeed a malleable construct, making such interventions feasible and practical (Cummings and Wittenberg, 2008; Feinberg and

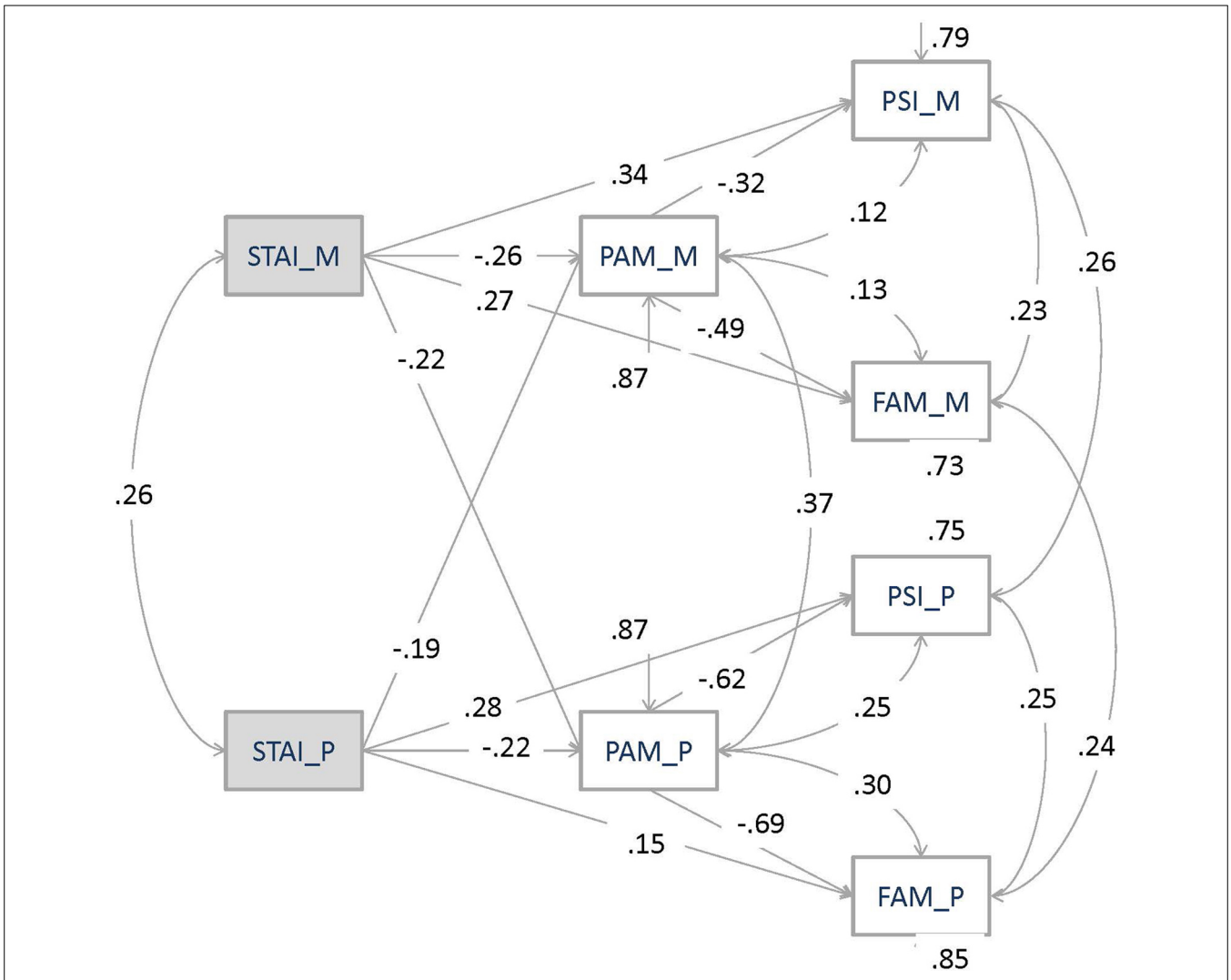

FIGURE 2 | Co-parenting alliance as a mediator of the effect of parental trait anxiety on family system maladjustment and parenting stress.

Kan, 2008). On the other hand, this amplified influence of co-parenting underscores the risks of leaving ineffective co-parenting unaddressed, because co-parenting dynamics have been shown to remain remarkably stable over time without intervention (McHale and Kuersten-Hogan, 2004). Given the systems focus on the field of family psychology, future family interventions, such as co-parenting treatments, may increasingly be developed to address multiple subsystems simultaneously.

Although the present study was carried out on a large sample of Italian parents, some limitations of this study must be considered in interpreting findings and proposing future lines of inquiry. The sample was quite homogeneous racially and socioeconomically, and reported being fairly satisfied in each of the family domains. For this reason, the generalizability of results is limited. It is important to investigate these effects in parents from more diverse and more highly distressed populations. Future studies should be carried out also with low-income, psychologically disadvantaged or high risk families in order to test the stability of the model tested, since characteristics like poverty, poor social milieu, psychological distress were found to affect the quality of parenting (Russel et al., 2008; Ciciolla et al., 2014).

The current design can only speak for the relationships between key variables, rather than comment on causal pathways. This conservative approach is appropriate given the exploratory nature of the project. The present study did not test the direction of causality among the variables of interest. These relationships should be examined in the context of a longitudinal study, which could provide stronger evidence of directionality or causality. Furthermore, it is of note that husbands and wives reported anxiety, co-parenting, and family system maladjustment and parenting stress quite differently, therefore, we were unable to constrain the parameter paths to equal each other in the models. Although a family-systems approach benefits from analytical methods such as those that incorporate both partners simultaneously, it is undoubtedly important to investigate gender differences as well. For instance, our finding that fathers' family subsystems are more highly correlated, and accounted for more of the variance in their other subsystems than

mothers' ones, implies that gender differences are relevant in these processes. Further research may provide additional information about these gender differences. Additionally, this study used self-report measures only, making it difficult to separate true associations from common method variance. Data should be gathered using various methodologies in order to elucidate patterns accounting for the associations among these individual—and marital—level variables. This study examined only parenting variables. No attention was given to marital variables or to the "third part," the child. Further explorations on the relationship between maternal and paternal measures involved in this study are necessary, mother and father measures of the parents' involvement with the child, and measures such as child's anxiety. The results may provide valuable contributions to the growing field of co-parenting research and the complex model empirically tested raises important practical implications for family system clinicians. This is one of the first studies according to our knowledge that investigates a path model of the interrelationships between anxiety, co-parenting alliance, family system maladjustment and parenting stress side-by-side. The model demonstrates the need for new conceptualizations of the co-parenting subsystem role to continue expanding our understanding of families. Researching the many roles of the co-parenting process for fathers and mothers has a theoretical and clinical importance that could contribute to this progress. Although preliminarily, this study empirically tested the variables simultaneously in a well-fitting model for mothers and fathers. The fitness of the model added empirical data, which supports the flexible and multiple roles that co-parenting can play in overall family systems. In conclusion, this exploratory study on Italian families provided new evidence to empirically support a developmental ecological model of mother's and father's views of themselves and their families.

Clinicians working with families need to recognize that parental interactions, which include the parents' coparental capacities, reveal unique and important dimensions about the family's functioning and health. Clinical evidence indicated that the presence of severe disengagement in the parental relationships has a great impact on psychosocial well-being of parents themselves and children. For these reasons, prevention and intervention programs tailored on children psychology health need to take into account also family assessment in terms of family functioning and alliance. Existing literature suggest that those data show an incremental value in understanding child maladaptive behaviors.

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METHODS
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Parents' perception of children's fear: from FSSC-IT to FSSC-PP

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Studies involving parents' reports about children's fears and multiple informant comparisons are less extended than investigations on children's self-reporting fear schedules. Starting with the Italian version of FSSC-R, the FSSC-IT, the main aims of this study were to adapt a schedule for parents' perception of their children's fear: the FSSC-Parent Perception. Its psychometric properties were examined in a large sample of parents ($N = 2970$) of children aged 8–10 years. Exploratory and confirmatory factorial structures were examined and compared with the Italian children's ones. Mother vs. father, children's gender and school age group effects were analyzed. The confirmatory factor analysis confirmed a four correlated factors solution model (Fear of Danger and Death; Fear of Injury and Animals; Fear of Failure and Criticism; Fear of the unknown and Phobic aspects). Some effects related to child gender, age group, mother vs. father, were found. The FSSC-PP properties supported its use by parents to assess their children's fears. A qualitative analysis of the top 10 fears most endorsed by parents will be presented and compared with children's fears. Clinical implications about the quality of parent-child relationships where discussed, comparing mothers and fathers, and parents' perception about daughters' and sons' most endorsed fears.

Keywords: FSSC-R, FSSC-IT, children's fear, parent's perception, validation study

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Introduction

According to many authors, normal fears can be considered as an adaptive response, since they motivate attempts to protect from a real or imagined treat (Fisher et al., 2006; Muris, 2007). Childhood fears, as an integral part of normal development, have been widely assessed (Fisher et al., 2006; Verhulst and Van Der Ende, 2006). One of the most used tools to assess normative description of child fears is the Fear Survey Schedule for Children (FSSC; Ollendick, 1983). This schedule and its revised forms (FSSC-II, FSSC-R; Gullone and King, 1997; Gullone et al., 2000; Burnham, 2005; Fisher et al., 2006; Serim-Yıldız and Erdur-Baker, 2013) show the most robust psychometric properties (Svensson and Ost, 1999; Bokhorst et al., 2008; Salcuni et al., 2009; Di Riso et al., 2010; Burkhardt et al., 2012).

Many studies have considered parents as experts for their child's outward behaviors and internal thoughts and emotions, such as fear (Wren et al., 2004; Achenbach, 2006; Weems et al., 2008; De Los Reyes et al., 2010; Muris et al., 2010). Reliance on parental reports, generally regarding anxiety or internalized difficulties, has been based primarily on the assumption that children lack the cognitive sophistication to respond appropriately in a schedule or interview format (Grills and Ollendick, 2003; Achenbach, 2006). Most studies concerning parent-child agreement have been

carried out based on structured clinical interviews (for a review see Rapee et al., 1994; Nauta et al., 2004; Achenbach, 2006), then using questionnaire reports (Gullone, 2000; King et al., 2006; Davis et al., 2009; Salcuni et al., 2009; Di Riso et al., 2010; Muris et al., 2010; Serim-Yıldız and Erdur-Baker, 2013). Self-report measures seem to be the most useful and consistent way to focus on fears. Bondy et al. (1985) study was one of the first indicating parents provide an accurate assessment of their children's fears (Scherer and Nakamura, 1968). However, generally, only mothers or parents' (mothers and fathers' together) reports have been considered (Bouldin and Pratt, 1998; Treutler and Epkins, 2003; Muris et al., 2005, 2010; Weems et al., 2008). Only few papers compared the role of parent (mother vs. father) in modeling children's fears, indicating that mothers' fear expression is correlated to children's (Muris et al., 1996; Achenbach, 2006). Only one study has found that fathers reinforce gender stereotypes more than mothers do, in particular for females (Ruble et al., 1988).

Furthermore, to the best of our knowledge, no confirmative studies have been carried out on tools devoted to assess children's fears from parents' perspective, and in particular using the Fear Survey Schedule for Children and its versions. To date, the only one study assessing the structural validity of a parent measure designed to evaluate children's fears was Bouldin and Pratt's (1998) one, who developed the Fear Survey Schedule for Children-II Parent version (FSSC-IIP), to assess fears in preschool children. The authors reported an explorative factor analysis (EFA) with an eight-factor solution including four factors that are conceptually very similar to those obtained by Gullone and King (1997) with the FSSC-II child-version.

In order to fill these gaps, the main aim of the current study was to design and validate a self-report questionnaire suitable for completion by parents assessing their children's fears, starting from the Italian version of the FSSC-R, the FSSC-IT (Salcuni et al., 2009). Thus, the Fear Survey Schedule for Children-Parent Perception (FSSC-PP) would represent the parent version of the FSSC-IT. A majority of the previous confirmative studies on the FSSC-R revealed a four or five factor structure, with only few exceptions (e.g., four-factor structure: Arrindell, 2003; Salcuni et al., 2009; five-factor structure: Ollendick, 1983; Ollendick et al., 1989; Svensson and Ost, 1999; Bokhorst et al., 2008 e.g., seven-factor structure: Mellon et al., 2004). For this reason, for the Italian FSSC-PP a four or five factor structure solution was expected.

Since literature suggests that girls' report significantly higher fears than boys (e.g., Gullone and King, 1997; Westenberg et al., 2004; Muris, 2007) and older children show less fears than younger ones (e.g., Gullone, 2000; King et al., 2006; Davis et al., 2009; Salcuni et al., 2009), studies of children as informants have shown that children's gender and age are associated significantly with different factor scores: girls' fears are always significantly higher than boys' (e.g., Gullone and King, 1997; Westenberg et al., 2004; Muris, 2007) and several studies have found a normative developmental change for which older children reported significantly fewer fears than younger children (e.g., Gullone, 2000; King et al., 2006; Davis et al., 2009; Salcuni et al., 2009). We assumed that parents' perception of girls' fears would be significantly higher than for boys' (Bondy et al., 1985; Silverman and Nelles, 1988; Bouldin and Pratt, 1998; Grills and Ollendick, 2003; De Los Reyes et al., 2010) on all the expected factors. However, due to the narrow age-range of the considered sample (8–10 year olds), no significant age group differences were expected.

Last but not least, in order to further investigate each parent's contribution to children's fears assessment, the present study included mothers, as well as fathers ($N = 2970$) in the same percentage and possible differences within them were evaluated.

Materials and Methods

Participants

The participants were 1485 Caucasian parental couples ($N = 2970$) of 8–11 year-old school children from mainstream classrooms. The overall response rate of parents who agreed to participate in the study was approximately 78%. Mothers were aged 29–49 years (Mean age 39 years and 7 months, $SD = 4.37$ months) and fathers 28–53 years (Mean age 41 years and 1 month, $SD = 5.37$ months). Parents' socio-economical level, measured by SES (Hollingshead, 1975), was medium. The mean value of educational level of mothers and fathers was 3.78 and 3.91, respectively, (some years of high school) and their occupational level was 4.50 and 6.01, respectively (clerk level). Parents gave their written informed consent to participate in the study and also gave consent for their children. The child group (1392 girls and 1578 boys) comprised 1008 subjects aged 8 years, 870 children aged 9 years and 1092 children aged 10 years.

Measure

The Italian Fear Survey Schedule for Children (FSSC-IT; Salcuni et al., 2009; Di Riso et al., 2010) is the Italian translation of the FSSC-R (Ollendick, 1983), an 80-item self report, in which no items were changed, except for item 73 where "Russia" was substituted with "Iraq" (Salcuni et al., 2009). The FSSC-IT was back-translated following international guidelines (Van De Vijver and Hambleton, 1996). Previous studies had not used the FSSC-IT with parents. In the present study, the FSSC-IT was distributed to parents and their children. Parents were required to rate their children's level of fear on a three-point scale. Items were scored as: none (1), some (2), and a lot (3), as in the original FSSC-R version (Ollendick, 1983). Italian psychometric studies of the FSSC-IT, and the literature on this tool, show high degrees of internal consistency, test-retest reliability, and construct validity, confirming previous literature findings (Ollendick, 1983; Ollendick et al., 1989, 1991; Mellon et al., 2004; Muris, 2007; Bokhorst et al., 2008; Salcuni et al., 2009; Di Riso et al., 2010). Internal consistency across gender and age group was supported, Cronbach's alpha for the entire schedule was $\alpha = 0.96$ and $\alpha = 0.95$–0.96 for boys and girls in each age group.

Procedures

Prior to conducting the study, approval was obtained from the Local Ethics Committee and informed written consent (Italian law 196/03) was obtained from each participant. Questionnaires

were then distributed to 12 primary schools in urban, suburban, and rural areas of Northern Italy. Questionnaires for parents were delivered through the school. Written instructions explained the questionnaire rating system to parents, specifying that there were no right or wrong answers. Parents were asked to indicate how they think their children think and feel.

The original data set included 3126 parents. Statistical analyses, however, were not performed on the part of the sample where values were missing in the schedule. About 2.5% of the parental couples ($n = 156$) were excluded from the research sample because of missing values or when one parent did not answer the questionnaire. For this reason, the sample analyzed included only 2970 parents, half mothers and half fathers. In order to study the structural validity of this instrument, a series of factor analyses were performed. Data were randomly split into two groups, each with approximately 50% of participants. Half the mothers involved in the study were randomly selected as well as half the fathers to make up the first group (calibration sample $N = 1482$; 716 mothers and 766 fathers of 8–10 year-olds: 694 boys and 806 girls); the remaining participants made up the second group (validation sample: $N = 1488$; 769 mothers and 719 fathers of 8–10 year-olds: 791 boys and 679 girls). We assured no more than 2% of the parents were matched rating the same child on each group. Exploratory factor analyses were conducted on the first sample, the calibration sample. Confirmatory factor analyses were then conducted on the validation sample. Groups were balanced for parents' gender [$\chi^2_{(1)} = 0.486, p = 0.794$] and children's age group [$\chi^2_{(2)} = 1.64, p = 0.44$].

In order to assess the construct validity of the FSSC-IT on parent's perception of their children's fears, an Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were used. The goal of the EFA was to reduce the numerous variables (items) measured to fewer more reliable latent constructs, not generally driven by *a priori* theory. The goal of the CFA is to test a theory when the analyst has an adequate rationale regarding the structure of the data. The appropriate use of both methods involves a series of fundamental decisions that directly affect results and interpretations. Exploratory factor analyses (EFA) of the calibration sample were carried out referring to guidelines recommended in Gorsuch (1997) and Fabrigar et al. (1999). A principal component analysis (PCA) with Varimax and Promax rotation was conducted. To determine the number of factors, multiple decision rules were considered (Bentler, 1995; Hu and Bentler, 1999). The screen test (Cattell, 1966), and considerations from previous research were used to determine the number of factors to retain. When interpreting the factors, salience was defined as a loading on a factor $\geq$0.35. The rule for the number of loadings on each factor was followed (Gorsuch, 1997). Since the factors obtained with the EFA were correlated, a confirmatory factor analysis (CFA) approach was later performed using LISREL8 (Jöreskog and Sörbom, 1996–2001) to determine if the nested model (with correlated factors), derived from the theoretical model found with the Promax EFA, showed a good fit with data. All analyses were performed on the variance-covariance matrices (Cudeck, 1989) and via the maximum likelihood procedure. The item parcels procedure was used to examine the model structure in order to reduce error rates (Little et al., 2002).

The following fit indices were considered by taking into account the rule of thumb cut-off criteria proposed by Schermelleh-Engel et al. (2003): chi-square (χ^2), a solution fits the data well when χ^2 is not significant ($p \geq 0.05$). The Comparative Fit Index (CFI) and the standardized root mean square residual (SRMR) were calculated. CFI should be 0.97 or higher for a good fit; the higher these values, the better the fit (Schermelleh-Engel et al., 2003). The SRMR should be <0.05 for a good fit (Schermelleh-Engel et al., 2003).

To explore possible influences, an analysis of variance (ANOVA) was performed on the Overall Fear Level score and on the factor scores with parental role (mother vs. father), child's gender and age group as between subjects variables.

Finally, the factor structures identified were compared with those for children (Salcuni et al., 2009) and the qualitative analysis of the 10 most endorsed fears of parents will be presented and compared with those of children (Di Riso et al., 2010).

Results

The exploratory factor analysis (EFA) was conducted in a two-step process. Step 1: the principal component analysis, conducted on the Pearson intercorrelations, using the initial communality estimates, determined that all values were well below one, indicating the absence of multicollinearity and singularity. In accordance with the Cattell (1966) scree test and previous research, a four-factor structure could be identified, accounting for about 33% of the total variance. Step 2: a principal component analysis was performed with oblique rotation using the Promax method as well as orthogonal rotation with the Varimax method. The two factor structures showed conceptually very similar factors. The Promax rotation reached a simple structure, less items loaded on two factors. The results of these analyses are reported in **Table 1**.

The correlations between the factor scores for the Varimax and Promax often showed a medium (0.30–0.40) to high (>0.50) effect size according to Cohen (1988). The Promax EFA structure was chosen for this reason. This solution included 65 items loading the factors (>0.35). The contained factors are conceptually very similar to those found in the literature, so it was decided to retain the original names of factors (Svensson and Ost, 1999; Bokhorst et al., 2008; Salcuni et al., 2009). The criteria used for interpreting the rotated factor pattern was as described above. Factors identified were: Factor 1 Fear of Death and Danger (19 items), Factor 2 Fear of Injury and Animals (11 items), Factor 3 Fear of Failure and Criticism (16 item), Factor 4 Fear of the unknown and Phobic aspects (19 item). Reliabilities of the four dimensions were calculated using Cronbach's alpha. This produced good coefficients (Factor 1 = 0.91; Factor 2 = 0.83; Factor 3 = 0.86; Factor 4 = 0.80). The effect size of the correlation between EFA factors was medium (0.30–0.40) or high (>0.50) according to Cohen (1988).

The goodness of fit of the four-factor model found with EFA was tested in a CFA on the validation sample, using the

TABLE 1 | Questionnaire items and corresponding factor loadings from the EFA rotated pattern matrix.

Items	Factor loadings			
	Factor 1	Factor 2	Factor 3	Factor 4
FACTOR 1 DEATH AND DANGER				
41. Being hit by a car or truck	0.833	−0.100	0.079	−0.135
20. Bomb attack, being invaded	0.741	−0.068	−0.079	−0.033
34. Fire, getting burned	0.739	0.080	0.035	−0.168
76. Not being able to breathe	0.724	−0.247	0.003	0.166
58. Falling from high places	0.717	−0.083	0.043	0.088
70. Germs or getting a serious illness	0.707	−0.124	−0.001	0.037
73. Iraq	0.691	−0.190	−0.097	0.082
59. Getting a shock from electricity	0.654	0.018	−0.039	0.026
72. Earthquakes	0.598	0.052	−0.055	0.084
32. Guns	0.585	0.140	−0.077	−0.041
35.Getting a cut or injury	0.545	0.190	0.139	−0.174
26. A burglar breaking into our house	0.530	0.084	0.096	−0.053
56.Deep water or the ocean	0.498	0.017	−0.101	0.190
18. Bears or wolves	0.487	0.387	−0.114	−0.118
10. Getting lost in a strange place	0.480	0.118	0.098	−0.018
07. Sharp objects	0.420	0.228	0.037	−0.052
33. Being in a fight	0.400	0.109	0.116	−0.009
09. Dead people	0.358	0.240	−0.039	0.056
49. Strange-looking people	0.357	0.135	0.156	0.096
FACTOR 2 INJURIES AND ANIMALS				
47. Ants or beetles	−0.106	0.775	−0.041	0.007
25. Spiders	−0.077	0.722	−0.041	−0.008
30. Bats or birds	−0.002	0.716	−0.026	0.006
04. Lizards	−0.177	0.697	0.094	−0.073
79. Rats or mice	0.145	0.692	−0.048	−0.093
11. Snakes	0.246	0.643	−0.085	−0.170
78. Worms or snails	−0.092	0.614	−0.005	0.078
21. Getting an injection from a nurse or doctor	0.003	0.496	0.059	−0.003
50. The sight of blood	0.098	0.428	0.143	−0.003
52. Nasty-looking dogs	0.260	0.392	0.029	−0.074
08. Having to go to hospital	0.286	0.357	0.060	0.001
FACTOR 3 FAILURE AND CRITICISM				
66. Making mistakes	0.030	−0.059	0.726	−0.006
31. My parents criticizing me	0.047	−0.044	0.684	−0.101
40. Failing a test	−0.149	0.085	0.682	−0.006
29. Getting poor marks for school work	0.175	−0.009	0.665	−0.116
48. Being criticized by others	−0.091	0.128	0.621	0.063
05. Looking foolish	−0.065	0.065	0.573	−0.072
28. Being called unexpectedly by the teacher	0.082	−0.121	0.570	0.080
44. Having my parents argue	0.233	−0.072	0.563	−0.133
64. Getting punished by my father	0.204	−0.072	0.530	−0.090
80. Taking a test	−0.147	0.057	0.526	0.258
24. Being teased	0.023	0.158	0.500	0.012
54. Getting a school report	0.101	−0.160	0.490	0.094
03. Getting punished by mother	0.065	0.028	0.486	−0.078
46. Having to perform in front of others	−0.160	0.079	0.453	0.289
15. Being sent to the head teacher	0.316	−0.088	0.414	−0.127
01. Having to talk to the age group	−0.165	0.047	0.375	0.218
FACTOR 4 FEAR OF THE UNKNOWN AND PHOBIC ASPECTS				
74. Lifts and elevators	0.233	−0.175	−0.131	0.590
23. High places like mountains	0.163	−0.005	−0.032	0.498
62. Being alone	0.137	0.061	−0.049	0.493
71. Closed spaces	0.388	−0.068	−0.091	0.484
16. Riding on the train	−0.024	−0.024	−0.032	0.469
02. Riding in the car or bus	−0.053	−0.044	0.002	0.458
75. Dark places	0.115	0.225	−0.051	0.444
60. Going to bed in the dark	0.042	0.280	−0.138	0.432
68. Loud sirens	0.139	0.127	−0.028	0.424
55. Getting a haircut	−0.158	−0.062	−0.048	0.419
36. Being in a big crowd	0.213	−0.040	0.085	0.411
27. Flying in a plane	0.186	−0.015	−0.057	0.410
67. Detective movies	0.017	0.194	−0.058	0.397
17. Being left at home with the baby-sitter	−0.102	0.024	−0.017	0.394
63. Having to wear clothes different from others	−0.061	−0.063	0.219	0.392
42. Having to go to school	−0.161	−0.122	0.210	0.386
65. Having to stay after school	0.197	−0.238	0.201	0.380
69. Doing something new	−0.248	0.080	0.293	0.371
19. Meeting someone for the first time	−0.030	0.155	0.232	0.352
Eigenvalues	16.224	4.137	3.544	2.553
Percentage of variance	20.279	5.171	4.430	3.191

The number preceding each item represents item position in the sequence of the administered questionnaire.

item parcels procedure. The model evaluated had four latent variables, corresponding to dimensions found in the exploratory Promax factor analysis, and 17 indicators. The indicators were the aggregation of the 65 items in parcels following the procedure of item-to-construct balance suggested by Little et al. (2002). Five parcels were produced for the first and fourth factors, four for the second and three for the third factor. All factors were allowed to correlate and no errors were included in the model. The goodness of fit indices showed that the four-factor model was appropriate for explaining the data. The model with four latent variables showed an excellent fit: $\chi^2_{(113)} = 798.73$, $p = 0.00$; CFI = 0.98; SRMR = 0.04. Although the χ^2 was significant, the other indices satisfied the respective rules of thumb. Factor loadings were all significant ($p < 0.001$) and higher than 0.60. The model produced is presented in **Figure 1** with parcel loadings and errors.

The CFA model defined a four correlated factor model with 65 items, called the Fear Survey Schedule for Children-Parent Perception (FSSC-PP). A second-order analysis was carried out by examining the correlations among the first-order factors to

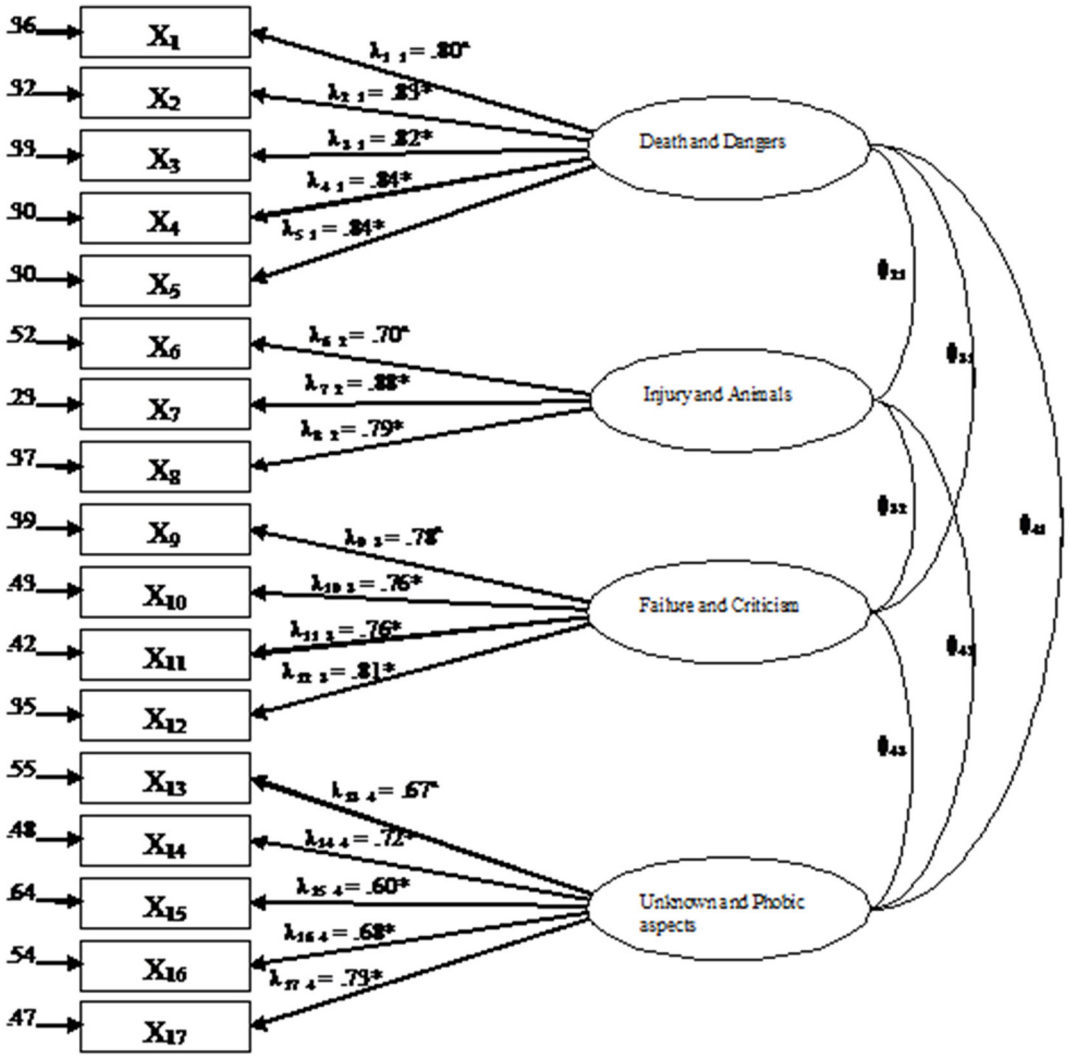

FIGURE 1 | Standardized path coefficients for CFA model of fear. Correlations between the four factors are reported in **Table 2**. Each indicators(X) represent a parcel. [a]fixed parameter; *$p < 0.001$.

TABLE 2 | CFA correlations (coefficients) between the four dimensions of fear.

Factor	1	2	3
1. Death and dangers			
2. Injury and animals	0.63*		
3. Failure and criticism	0.46*	0.44*	
4. The unknown and phobic aspects	0.57*	0.58*	0.53*

*$p < 0.001$.

test the presence of an Overall Fear Level on 65 items for evaluating children's fears. Indices showed that the parcel model fitted the data well: $\chi^2_{(115)} = 821.18$, $p \leq 0.00$; SRMR = 0.05; CFI = 0.98. Factor loadings were all significant (>0.60) as well as a relation of each dimension on the FSSC-PP Overall Fear Level ($p < 0.001$) (range 0.47–0.78).

An analysis of variance (ANOVA) was performed on the total sample, on four-factor scores and the Overall Fear Level on the saturated 65 items, with children's gender and age group, and mother vs. father as between subject variables. The significant results of the ANOVA are summarized in **Table 3**.

Parents reported a significantly higher level of fears for girls than for boys in all factors and in Overall Fear Level (**Table 4**). Although some age differences, some mother vs. father differences and some interactions between variables were significant, a partial eta-square estimate was not within the significant range (1–5% effect sizes). **Table 4** reported means and standard deviations for children according to gender.

In the present study, using the FSSC-IT to assess parents' perceptions of their children's fears, a four-factor solution was found. The four factors obtained were similar to the most frequent factors found in the literature (Ollendick, 1983; Ollendick et al., 1989, 1991; Svensson and Ost, 1999;

TABLE 3 | Analysis of Variance for principal effects of parental role (mothers vs. fathers), child's gender and age group (N = 2970) (interactions are not included).

Factor	Mothers vs. fathers			Child's gender			Child's age group		
	$F_{(1, 2970)}$	p	η^2 Part	$F_{(1, 2970)}$	p	η^2 Part	$F_{(1, 2970)}$	p	η^2 Part
1 Death and danger	2.07	0.15	0.001	144.85	0.0001	0.047	3.64	0.026	0.002
2 Injuries and animals	0.001	0.098	0.000	20.13	0.0001	0.007	2.35	0.096	0.002
3 Failure and criticism	4.01	0.045	0.001	309.35	0.0001	0.095	7.98	0.0001	0.004
4 Fear of the unknown and phobic aspects	0.071	0.790	0.000	63.21	0.0001	0.021	2.39	0.092	0.002
Overall fear level	0.013	0.909	0.000	178.68	0.0001	0.057	1.63	0.167	0.001

TABLE 4 | Boys' and girls' means and standard deviations on FSSC-PP factors and overall fears level.

Factor	Gender			
	Boys (N = 1578)		Girls (N = 1392)	
	M	*SD*	*M*	*SD*
1 Death and danger	17.95	8.72	21.63	8.54
2 Injuries and animals	11.72	5.96	12.66	5.54
3 Failure and criticism	7.48	4.37	10.37	4.77
4 Fear of the unknown and phobic aspects	5.98	4.71	7.40	5.13
Overall Fear Level	43.13	18.84	52.06	18.39

TABLE 5 | Coefficient of congruence values comparing the FSSC-PP and the FSSC-IT.

Factor FSSC-PP	Factor FSSC-IT (Salcuni et al., 2009)	Coefficients of congruence
I (Death and danger)	I (Death and danger)	0.981
II (Injuries and animals)	II (Injuries and animals)	0.989
III (Failure and criticism)	III (Failure and criticism)	0.994
IV (Fear of the unknown and phobic aspects)	IV (Fear of the unknown)	0.864

Bokhorst et al., 2008; Salcuni et al., 2009). Despite these similarities, the factors obtained saturated a different number of items and presented a different rank order, in particular, if compared with other Italian work with the FSSC-IT (Salcuni et al., 2009).

A close comparison between the FSSC-IT structure analysis (Salcuni et al., 2009; Di Riso et al., 2010) and the FSSC-PP showed a factorial structure similar, but not the same as, that regarding Italian children (Salcuni et al., 2009). First, the CFA model considered 65 items, instead of the original 80 (Ollendick, 1983) or 60 (Salcuni et al., 2009), which were highly loaded on the exploratory factor analyses of the four factors. In this paper, we considered a 0.35 saturation instead of 0.40 (Salcuni et al., 2009). Comparing the item distribution in the FSSC-PP and FSSC-IT per factor, with 36 items overlapping, some differences were also found in rank order of saturations. To determine whether the FSSC-PP was measuring similar constructs found in Italian children (Salcuni et al., 2009; Di Riso et al., 2010), coefficients of congruence (Robert and Escoufier, 1976) between the factors obtained through principal component analysis with varimax rotation in the present sample of scores, and those reported by Salcuni et al. (2009) were reported (**Table 5**).

The first 10 fear items that parents most frequently endorsed with "a lot" (3) are presented in **Table 6**, both for the overall sample and separated for mothers and fathers. Items are listed in decreasing order according to the percentage of overall sample.

The top 10 fears are quite common in mothers and fathers, with minimal differences in rank order. Most of them loaded in Factor 1 Fear of Danger and Death, and 3 items on Factor 2 Fear of Injuries and Animals. Item 15 was an exception, loading both in Factors 1 and 3 for FSSC-PP, as in FSSC-IT (Salcuni et al., 2009; Di Riso et al., 2010). The comparison on item saturation in the two samples reached a 0.987, very high congruence coefficient (Robert and Escoufier, 1976).

A comparison between the distribution of the most endorsed fears items in FSSC-PP and in that for children, in particular the FSSC-IT (Di Riso et al., 2010), showed that the distribution of the top 10 items was similar to many previous studies with children, in various countries (Ollendick et al., 1991; Varela et al., 2008).

Compared with children, parents presented, as expected, a generally lower percentage of level 3 in their scoring. According to the literature, children most frequently indicate "a lot" in their evaluation of fear (Ollendick et al., 1991; Varela et al., 2008). In particular, a previous study with Italian children (Di Riso et al., 2010) showed the frequency of score 3 ranged from 61.4 to 41%, in contrast with parents for whom the range was 57 to 31.3%. Seven of 10 items are the same in both the children's and parents' questionnaires, although the rank order did not correspond entirely. Three of the items which parents scored as "a lot" when considering their children's fears, did not appear in the 10 most-endorsed items for children: 2 were for Factor 2 in FSSC-PP but Factor 1 of FSSC-IT (11, Snakes; 52, Nasty-looking dogs) and one was not included in any factor (8, Having to go to hospital). The 3 items children considered particularly fearful, which parents did not (Di Riso et al., 2010), belonged to Factor 1 in FSSC-IT and in FSSC-PP (20, Bomb attacks, being invaded; 58, Falling from high places; and 73, Iraq).

Discussion

The present study examined a factorial structure and the psychometric properties of the Fear Survey Schedule for Child

TABLE 6 | Most frequently endorsed fears with greatest intensity for overall sample (*N* = 2970), mothers (*N* = 1485) and fathers (*N* = 1485).

Item number	Loading on factor	Overall sample		Mothers		Fathers	
		Freq.	%	Freq.	%	Freq.	%
26. A burglar breaking into your house	1	1693	57	880	59.3	813	54.7
10. Getting lost in a strange place	1	1483	49.9	774	52.1	709	47.7
41. Being hit by a car or truck	1	1409	47.4	723	48.7	686	46.2
34. Fire, getting burned	1	1382	46.5	688	46.3	694	46.7
20. Not being able to breathe	1	1256	42.3	653	44	603	40.6
11. Snakes	2	1090	36.7	526	35.4	564	38
52. Nasty-looking dogs	2	973	32.8	482	32.5	491	33.1
72. Earthquakes	1	978	32.9	479	32.3	499	33.6
8. Having to go to hospital	2	948	31.9	498	33.5	450	30.3
15. Being sent to the principal	3–1	931	31.3	492	33.1	439	29.6

Parent Perception (FSSC-PP) in a large non-clinical sample of Italian parents of children, aged between 8 and 10 years. This is the first study that has involved both Italian parents of children in this specific age group.

The FSSC-PP questionnaire has 65 items, compared with 80 items in the original FSSC-R (Ollendick, 1983), and could be more suitable for completion by parents when assessing their children's fears. Results from the CFA report a model with four correlated factors, very similar to that found in the literature for children (Ollendick, 1983; Ollendick et al., 1989; Svensson and Ost, 1999; Muris and Ollendick, 2002; Bokhorst et al., 2008; Salcuni et al., 2009). The four-factor item distribution (65 items with 0.35 or higher saturation) was substantially the same as reported in the literature (Muris and Ollendick, 2002; Muris, 2007). Salcuni et al. (2009) using the FSSC-IT, identified a five-factor structure, although only four factors could be interpreted since the fifth was loaded by few items, most of which also loaded on other factors. In the present study, the FSSC-PP yielded four somewhat similar, but not equivalent factors. Although the factors presented the same names, with the exception of the fourth, they each saturated a different number of items, and presented some differences in rank distribution. The coefficients of congruence comparing the pairs of factors were calculated and they met the a priori criterion of 0.90 for all Factors, but the Factor 4. This finding suggests the factorial structure is appropriate for the scores of Italian parents.

Correlations between the four dimensions also suggested the existence of a high-order anxiety factor, that is a single and multifaceted dimension of fear that might be useful for both research and clinical purposes (Muris, 2007). Cronbach's alpha ranged from 0.91 to 0.80, and this supports the use of the Overall Fear Level score and factors in further investigations and assessment of fears in children (Muris and Ollendick, 2002).

In terms of gender differences, as expected, girls were always perceived as significantly more fearful than boys (Mellon et al., 2004; Muris, 2007; Bokhorst et al., 2008; Di Riso et al., 2010). Age group differences, parental role (mother vs. father) and interaction between independent variables, although significant, were not robust. It should be noted, however, that the study only considered a narrow age band, whereas studies which have found age differences have included a larger age sampling, with adolescents as well as younger children. The effect of gender was significant and strong ($\eta^2 > 0.005$) for all the Factors and for the overall fears level score. As expected child's gender also played a fundamental role in parental perception of children's fears (Bondy et al., 1985; Silverman and Nelles, 1988) and parental perception of girls' fears was higher than for boys' ones. One possible explanation for this finding may be found in gender differences, which appear to be related to parental rearing practices that differ for girls and boys, as well as the willingness of girls to report fears more readily than boys (Ginsburg and Silverman, 2000; Muris et al., 2005). In particular, we found both mothers and fathers contribute to the gender stereotyping of their children for each kind of fear. It seems that mother and fathers, equally, send and receive subtle messages regarding gender, and about what is expected and accepted for each gender. These messages are then internalized by the developing child (Arliss, 1991). Gender role stereotypes are well established in early childhood and messages about what is appropriate are so strong, that even when children are exposed to different attitudes and experiences, they revert to stereotyped choices. Gender stereotypes and biases seem to occur within the family setting, influencing parents both overtly and covertly in their representation of children's worries and fears.

In a comparison of parents' and children's questionnaires, differences in the top 10 fearful items showed parents' concerns were mostly focused on real everyday life fearful events, such as animals or injuries, even children were mostly impressed by general external and violent events, connected maybe with television news, such as war, bombing or accidental falls from high places. Moreover, top 10 most endorsed fears in children's reports belonged to first factor of FSSC-IT, which included only death and danger fears: instead it was not for parents whom top 10 includes fears of animals and of social situation.

This finding could be explained as a normal difference in an adult's vs. child's way of categorizing events. Parents (asked to score as if they were their children) considered their children to be more able than they were, to differentiate between real

and immediate dangers instead of imaginary and distant dangers. This finding was in line with the literature which documents the not-perfect parent-child agreement on multiple informant studies (Bondy et al., 1985; Cole et al., 2000; Grills and Ollendick, 2003; Bögel and Van Melik, 2004; Foley et al., 2004; Nauta et al., 2004; Wren et al., 2004; Achenbach, 2006; De Los Reyes et al., 2010).

Clinical implications of this study focused on the possibility to assess the gap between children fears and parents' perception of their children's fears, considering first of all the importance of parental alliance to any kind of treatment or intervention that professionals might start with patients in developmental age (Gardner and Shaw, 2008); any kind of intervention on children "requires assessment of the presenting problems in the context of family and caregiver influences, as well as the child's development and physical health" (Gardner and Shaw, 2008, p. 887). Being aware of the level and the quality of their child's emotional problem—such as fear or phobia—could be useful to help parents to understand the gap between their parental perception of child's fear and child's fear evaluation. Parenting intervention is generally the treatment of choice for any kind of developmental problem: increasing in parents their comprehension of children point of view about their fears, and showing how parents themselves tends to considered their children to be more able than they were, to differentiate between real and immediate dangers instead of imaginary and distant dangers, can be the base of therapeutic alliance with parents. This could be considered the starting point to support both clinical compliance and parenting strategies in helping parents to cope with particularly fearful children: clinical fears schedule for children (FSSC-IT) and for parents (FSSC-PP) might be compared and proposed to the attention of parents. Sharing diagnosis and assessment data and making sense of a problem (Finn, 2007), reduce parental blame and guilt (Gardner and Shaw, 2008) and improve the effectiveness of parenting interventions for possible emotional or behavioral problems (Turner et al., 1994; Kerwin, 1999; Turner and Sanders, 2006). Parental involvement in cognitive-behavioral interventions (Ollendick and King, 1998) as well as in psychodynamic approach (Finn, 2007; Tharinger et al., 2009) is useful with children, especially where parents are very anxious (Barrett et al., 1996), and may be helpful, for example, starting from FSSC results and more endorsed fears, using pictures and drawing techniques (Hirshfeld-Becker and Biederman, 2002) and sharing the assessment videos (Finn, 2007) to help children and their parents with discussions about emotions and fears.

This paper leaves many questions to be answered in future studies. Some limits of the present study must be summarized. The effect of variables in socio-economical status were not controlled, and no effect size was calculated. The use of fear measures must rely on a proven capacity of the instruments to measure factors that are not dependent on cultural or linguistic contexts. An important prerequisite for carrying out confirmatory factor analyses across national samples is the demonstration of the cross-national stability of the dimensional of fears involved. This study does not make a contribution to cross-cultural psychology, confirmatory factor analyses need to be carried out with different samples to verify the present model.

Furthermore this study only involved parents of 8–10 year olds. Samples of Italian early adolescents or adolescents should be used in future studies. This study also involved a community sample so the findings cannot be generalized to clinical samples.

Multiple informant agreement with questionnaires, in particular, has been studied less, even if it is suggested that pulling together different sources of information derived from questionnaires could give a more reliable and valid source of information. Most of the studies have been carried out on informants' agreement with the factor structure of parents' and children's questionnaires, especially on anxiety symptoms (Cole et al., 2000; Grills and Ollendick, 2003; Achenbach, 2006), and different factor structures were found. It could be very interesting to focus future studies on parent-child comparison in a multiple-informant prospective on fears perception.

Finally, an important field to explore in order to explain some differences between informants' data, could be the correlation between parents' fears and parents' perception of their children's fears. In order to explain these results further, future studies need to focus on other moderating variables, such as parental fears linked with children's fears, parental attribution styles, gender role orientation evaluation, and others. Future research into the relationship between normal fear experiences and other developmental experiences (e.g., parenting styles and family experiences) as well as other individual difference variables is required.

In sum, this paper is a first attempt to assess the factorial structure, reliability, and validity of the FSSC-PP when administered to a large non-clinical group of Italian parents. The results supported the FSSC-PP general model with four correlated factors evidencing similarities with previous studies of children's FSSC-IT (Salcuni et al., 2009; Di Riso et al., 2010) and FSSC-R (Bokhorst et al., 2008). In conclusion this study highlights the importance of involving parents as informants in children's fear assessment, to contribute to an early screening of normal fears and prevent psychopathological risk.

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When parenting fails: alexithymia and attachment states of mind in mothers of female patients with eating disorders

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Introduction: In recent years alexithymia and attachment theory have been recognized as two parallel research lines trying to improve the information on the development and maintenance of eating disorders (EDs). However, no research has analyzed these constructs among patients' families. In this study we compared alexithymia and attachment in mothers of patients with EDs and a control group. Further, we hypothesized that mothers of daughters with EDs with insecure and unresolved states of mind will reported high levels of alexithymia. Lastly, we explored the daughters' evaluations of maternal alexithymia.

Methods: 45 mothers of ED women and 48 mothers of healthy controls ($N = 93$) matched for age and socio-demographic variables were administered by the Toronto Alexithymia Scale-20 (TAS-20) (S), while two sub-groups of "ED" mothers ($n = 20$) and "non-ED" ones ($n = 22$) were assessed by the Adult Attachment Interview (AAI). Moreover, the Observer Alexithymia Scale (OAS) was administered to the daughters for evaluating maternal alexithymia.

Results: Regarding alexithymia, no differences were found between ED and non-ED mothers according to the TAS-20, while ED mothers showed more unresolved AAI classifications than non-ED mothers. No correlations were found between the TAS-20 and the AAI. Lastly, ED mothers were evaluated more alexithymic by their daughters with the OAS than those in the control group, and their alexithymic traits were significantly correlated with dismissing states of mind (idealization and lack of memory) in the AAIs.

Discussion: Our results highlighted an interesting discrepancy among mothers with ED daughters between the low level of alexithymia provided by their self-reports and the high level of alexithymia observed by their daughters, although the OAS showed severe methodological limitations. Maternal attachment states of mind characterized by the lack of resolution of past losses could be connected to a confusing and incoherent quality of parenting.

Keywords: parenting, eating disorder, alexithymia, attachment states of mind, mothers

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Introduction

Eating disorders (EDs), including anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED), are types of psychopathologies associated both with alexithymia and with attachment difficulties (O'Shaughnessy and Dallos, 2009; Zachrisson and Skårderud, 2010; Laghi et al., 2012; Nowakowski et al., 2013). Although, over the years, clinical research from psychoanalytic (Granieri and Schimmenti, 2014), systemic (Selvini Palazzoli, 1963–1995; Minuchin et al., 1978), and also cognitive-interpersonal perspectives (Schmidt and Treasure, 2006) has focused on the role played by family dynamics in the development and maintaining of an ED, very few empirical studies analyzed alexithymia and attachment representations among parents of ED patients.

Alexithymia is defined as a deficit in affect regulation, specifically referring to difficulty identifying feelings and distinguishing them from bodily sensations stemming from emotional activation, difficulty in describing their feelings to others, limited imaginative processes ("poverty of imagination"), and externally oriented cognitive style related to the stimulus (Lane et al., 2000; Luminet et al., 2006). An increasing body of clinical and empirical literature has established that patients with each type of ED (AN, BN, and BED) show higher level of alexithymia than control (non-clinical) samples, even if depressive symptoms are controlled (Cochrane et al., 1993; Jimerson et al., 1994; De Panfilis et al., 2003; Speranza et al., 2005). Alexithymia of women with ED did not correlated with their body mass index (BMI; Schmidt et al., 1993), suggesting that the high level of alexithymia of anorexic patients should not be considered an effect of starving on cognitive functioning. Specifically ED patients express *difficulty in describing feelings* (Speranza et al., 2005; Kiyotaki and Yokoyama, 2006), and especially *difficulty in identifying feelings* that emerges as the most significant predictor of the treatment outcomes (De Panfilis et al., 2003; Quinton and Wagner, 2005; Speranza et al., 2005, 2007; Kiyotaki and Yokoyama, 2006). In most studies, alexithymia was measured by the Toronto Alexithymia Scale (TAS; Taylor et al., 1985), a self-report questionnaire and its 20-item short-version (TAS-20; Bagby et al., 1994a,b), which has been already validated in Italy (Bressi et al., 1996).

Although a growing body of literature has focused on individual alexithymia among ED patients, there are only scarce and conflicting studies on alexithymia in their families. In Dahlman's (1996) first study, the mothers of anorexic patients displayed more alexithymic (as measured by the TAS-20) than control mothers, but this result has not always been completely confirmed in subsequent studies. Guttman and Laporte (2002) found that families of women with borderline personality disorder (BPD) had the highest global scores for alexithymia on the TAS-20, followed by those with daughters with restricting-type AN and then by those without clinical problems. In Espina (2003), the parents of daughters with ED (with AN-restrictive subtype, AN-bulimic subtype, and BN) showed higher scores on the TAS-20 and its factors than the parents of control women. However, in a recent study, Balottin et al. (2014) analyzed alexithymia in anorexic adolescent patients and their parents by administering two measures: the TAS-20 and the Toronto Structured Interview for Alexithymia (TSIA; Caretti et al., 2011). Using latent-trait Rasch analysis, Balottin et al. (2014) found significant discord between the two measures: the clinical interview allowed detection of a greater level of alexithymia compared with the self-report. Indeed, in their adult parent sample in particular, no family had high alexithymic scores; as much as 75% of the families scored very low, based on the answers provided by the subjects in the TAS-20.

Recently a new questionnaire has been developed in which participants' alexithymia is evaluated by their significant others: the Observer Alexithymia Scale (OAS; Haviland et al., 2001, 2002). The OAS was used with ED patients (Berthoz et al., 2007) showing acceptable discriminant validity and interrater reliability: patients' OAS scores were higher than scores reported for people-in-general samples and lower than those for outpatient clinical samples. Moreover, no statistically significant OAS and TAS-20 score differences were found across diagnostic subgroups (AN restrictive type and BN), and OAS and TAS-20 total scores were moderately, positively, and significantly correlated. To our knowledge, there is no study which has measured the parental alexithymia of ED patients with the OAS.

However, the use of the OAS for assessing alexithymia is still controversial. On the one hand, both the French (Berthoz et al., 2005) and Chinese (Yao et al., 2005) translations of the OAS, administered large samples of non-clinical university students, supported that this measure appears to be a reliable and valid observer-rated alexithymia measure, and confirmed its five-factor model (distant, uninsightful, somatizing, humorless, and rigid). The authors (Berthoz et al., 2005; Yao et al., 2005) reasonably recommend that researchers collect both self- and observer-rated alexithymia data and, when possible, obtain observer reports from more than one person. On the other hand, the Dutch version of the OAS (Meganck et al., 2010), administered both to clinical and non-clinical samples, revealed adequate internal consistency and test–retest reliability, whereas inter-rater reliability, factorial validity, and concurrent validity were insufficient, inducing the authors to not recommend the OAS as an alternative alexithymia measure.

In the last 20 years, the attachment theory (Bowlby, 1973, 1988) has also received increasing attention from clinicians and researchers in the field of EDs, producing enough clinical studies so that three reviews have recently been published (O'Shaughnessy and Dallos, 2009; Zachrisson and Skårderud, 2010; Cavanna et al., 2012). Attachment researchers have specifically examined the association between attachment representations, usually defined as internal working models (IWMs), and ED diagnoses (Steele and Steele, 2008; Bakermans-Kranenburg and van IJzendoorn, 2009). Up to now, studies with ED patients have showed that their IWMs were characterized by an *over-representation of insecurity*, ranging from 70 to over 90% (Ward et al., 2001; Barone and Guiducci, 2009; Dias et al., 2011). Most studies reported high prevalence of the *dismissing* type (Cole-Detke and Kobak, 1996; Ward et al., 2001; Delogu et al., 2008; Barone and Guiducci, 2009; Delvecchio et al., 2014), characterized by a state of mind tending to minimize, derogate, and normalize attachment experiences and relationships, although other studies found both dismissing and entangled

patterns (Ramacciotti et al., 2001; Zachrisson and Kulbotten, 2006). A high proportion of *entangled* subjects, characterized by a state of mind tending to emphasize attachment experiences and relationships in an angry, passive, or preoccupied manner, was specifically associated with both the purging sub-type of AN (Dias et al., 2011) and BN (Candelori and Ciocca, 1998). Furthermore, an *over-representation of unresolved loss and/or abuse* (Zachrisson and Kulbotten, 2006; Ringer and Crittenden, 2007; Barone and Guiducci, 2009; Delvecchio et al., 2014) was found, identified by local and trauma-specific disorganized speech when discussing these distressing events, such as collapse of the reasoning and discourse monitoring abilities. Most of these studies used the Adult Attachment Interview (AAI, George et al., 1985/1996) considered the "gold standard" (Bakermans-Kranenburg and van IJzendoorn, 2009) measure to assess attachment states of mind, intended as narrative IWMs of attachment.

Although attachment concepts also extend to the effectiveness in working with families, only a few studies analyzed attachment of parents with ED children. Tereno et al. (2008) found that patients' mothers had insecure attachment styles measured by self-reports (the Adult Attachment Scale, AAS-R; Collins and Read, 1990), and, specifically, the mothers of control groups exhibited higher security than mothers of anorexic patients and lower avoidance than mothers of bulimic patients. Only two studies used the AAI with parents of ED women. Ward et al. (2001), examining the attachment status of mothers patients with severe AN using the AAI, found 83% of insecure attachment states of mind (70% dismissing) and high incidence of unresolved loss (67%) together with high levels of idealization and low levels of reflective functioning. The authors suggested that difficulty in emotional processing, exemplified by unresolved loss, idealizing defense, and poor reflective functioning, may be transmitted from mothers to daughters from childhood and act as a risk factor for the development of AN (Ward et al., 2001). These results were rather confirmed by Delogu et al. (2008) who found a prevalence of unresolved states of mind in the AAIs of mothers of anorexic adolescents and a prevalence of insecure states of mind (dismissing and entangled) among their fathers. None of these studies included control samples matched on demographic variables.

Several studies have focused on the links between alexithymia and attachment styles, measured exclusively by self-reports (Montebarocci et al., 2004; Wearden et al., 2005) in antisocial behavior (Bekker et al., 2007), alcoholic inpatients (De Rick and Vanheule, 2006), mood symptoms (Troisi et al., 2001, but only two studies examined patients with ED; Sorrentino et al., 2004; Keating et al., 2013). Sorrentino et al. (2004) found significant correlations between insecure attachment style, measured by the Attachment Style Questionnaire (ASQ, Feeney et al., 1994), alexithymia (by the TAS-20) and symptomatology in 56 ED patients, suggesting that alexithymia might be a mediating factor between insecure attachment style and psychopathology. A recent study (Keating et al., 2013) testing a model in which alexithymia mediates the relationship between attachment insecurity and body esteem and measuring by self-reported questionnaires among 300 women with ED, showed that attachment avoidance had an indirect, negative relationship to body esteem through alexithymia.

However, although in recent years alexithymia and attachment theory have been two parallel research lines that have tried to improve the information on the development and maintenance of EDs, up to now, no research has analyzed these concepts among patients' families by investigating adult attachment representations with the AAI and testing whether ED daughters would consider their parents alexithymic, which could improve our knowledge about the functioning of this specific group of parents.

This study aimed at comparing mothers of daughters with ED diagnoses to a control group of mothers drawn from general population and matched on age, daughter's age, socio-economic status (SES), and educational level. First, we hypothesized that the mothers of ED patients would show both higher levels of alexithymia and higher rates of insecure or unresolved attachment states of mind than controls. Second, we hypothesized that mothers of clinical group with high level of insecure and unresolved states of mind would show high levels of alexithymia. Lastly, only at explorative level, we investigated whether the ED daughters would tend to assess their mothers as more alexithymic than controls, and whether maternal alexithymia—measured by the daughters' reports—would correlate with maternal attachment states of mind.

Materials and Methods

Participants

Overall, 93 participants were involved: 45 mothers of female patients primarily diagnosed with an ED (23 with AN, 22 with BN) and 48 mothers of women without clinical symptoms, who had similar socio-demographic characteristics. The study included only female participants because women have great propensity to develop an ED. Given the few studies on parents of ED patients, we decided to focus only on mothers.

Mothers of ED patients were recruited through an Eating Disorder Center (EDC) of the 3rd Health District in Genoa (northern Italy) at the first contact with the EDC's personnel. The inclusion criteria for selecting the sample were: daughters with a primary diagnosis of ED (AN and BN) as outlined in the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV, American Psychiatric Association, 2000), aged between 16 and 25 years, and parents' consent to participate in the study. The exclusion criteria were the following: another major diagnosis (e.g., psychotic disorders, mental retardation), onset of eating problems longer than 24 months, previously or currently receiving psychotherapeutic or medical treatment, or requiring hospital income.

Families of the control group were voluntarily recruited from the general population through public advertisement in high schools and colleges and came from a similar socio-cultural background of family of ED women. The inclusion criteria for the control group were the following: daughters' age similar to that of the patients in the ED group, daughters should have never received psychotherapeutic or medical treatment for psychiatric symptoms, and no member of the nuclear family with a current or past history of severe physical or mental disorder.

The mothers of ED women were from 44 to 54 years old ($M = 49$, SD $= 4.67$). A total of 29.2% of them had attended secondary school, 45.8% graduated high school, and 25% obtained at least college degree. A majority, 71% of mothers, belonged to intact families and they were married and living with their daughter's fathers. Their educational level and SES were coded using the Four-Factor Index of Social Position ($M = 45$, SD $= 28.44$, Hollingshead, 1975). No differences were found between ED's and non-ED's mothers with respect to the following socio-demographic variables: daughter's age, maternal age, educational level, SES and family structure (all p values ranged from 0.36 to 0.88). All the participants were Caucasian, born and living in the northwest of Italy and belonged to the middle class.

Of the 93 families who participated in the alexithymia measurement, only two subgroups of the clinical group and control mothers (respectively $n = 20$ and $n = 22$) agreed to participate in the AAI. Reasons for not participating were lack of interest, long traveling distance, difficulties with being audiorecorded, time constraints, and health problems in the family. Respondents who dropped out did not differ on background and study variables, which confirmed the absence of selective attrition with respect to SES, educational level, family structure, and alexithymia scores (p values ranged from 0.18 to 0.75).

Measures

Socio-demographic Data

Participants answered socio-demographic questions to divulge the following personal and family data: date of birth (participants and daughters), family structure, educational level, type of work, presence of psychiatric diagnosis, and psychotherapeutic or medical treatment received by nuclear family members.

Clinical Status of Daughters

For the clinical group, the ED diagnoses for daughters of the participants were confirmed by the Structural Clinical Interview for DSM-IV Axis I Disorders—(SCID-I; First et al., 1994), Italian version (Mazzi et al., 2000), which is a semi-structured diagnostic interview for the assessment of the primary DSM-IV Axis I disorders. It is divided into the following six self-contained modules: mood episodes, psychotic symptoms, psychotic disorders, mood disorders, substance use disorders, and anxiety, adjustment, and other disorders (First et al., 1994). One recent reliability study of the SCID-I (Lobbestael et al., 2010) reported reliability for categorical constructs, such as the DSM-IV diagnoses being assessed by the SCID, ranging from $k = 0.60$ to 0.83, according to the type of disorders.

Maternal Alexithymia

Alexithymia was measured through the Toronto Alexithymia Scale—20 items (TAS-20; Bagby et al., 1994a; Bressi et al., 1996), a self-report scale using a 5-point Likert scale according to which the subject provides an answer on how much he or she agrees with each item (1 = *strongly disagree*; 2 = *mildly disagree*; 3 = *neither agree nor disagree*; 4 = *mildly agree*; 5 = *strongly agree*). There are five items that are negatively keyed (items 4, 5, 10, 18, and 19). Examples of items are "I am often confused about what emotion I am feeling," "I am able to describe my feelings easily (reversed)," "I prefer talking to people about daily activities rather than their feelings."

The total alexithymia score is the sum of responses to all 20 items, while the score for each subscale factor is the sum of the responses to that subscale. The three subscales of the TAS-20 are (1) *difficulty identifying feeling* (7 items–1, 3, 6, 11, 9, 13, 14), (2) *difficulty describing feelings* (5 items–2, 4, 7, 12, 17), (3) *externally-oriented thinking* (8 items–5, 8, 10, 15, 16, 18, 19, 20). The TAS-20 provided cut-off scoring: participants scoring equal to or less than 51 are rated non-alexithymic, participants scoring between 52 and 60 are considered as borderline (possible alexithymia), and those with scores equal to or greater than 61 are alexithymic.

Research using the TAS-20 has demonstrated its good internal consistency (Cronbach's alpha = 0.81), test–retest reliability (0.77, $p < 0.01$) and adequate levels of convergent and concurrent validity. The three factor structure was found to be theoretically congruent with the alexithymia construct, and the stability and replicability of the three factors have been demonstrated across clinical and non-clinical populations using confirmatory factor analysis (Parker et al., 1993; Bagby et al., 1994a).

Maternal Attachment States of Mind

The attachment states of mind were assessed by the AAI (George et al., 1985/1996), an hour-long, semi-structured interview composed of 20 questions. The interviewers inquired about participants' relationships with their attachment figures during childhood and early attachment experiences, such as illness, upset, separation, loss, etc, asking to provide specific episodes to support their general memories. They also asked participants to reflect both on how attachment experiences had influenced their adult personality and the reasons for parents' behavior toward them during childhood.

The AAIs were transcribed verbatim and coded on the corollary Adult Attachment Scoring and Classification System designed by Main et al. (2002) by certified and expert coders. The AAI coding system employs 17 ordinal scales of 1-9 points each, organized into two groups: (1) *subject's inferred childhood experience* (loving, rejecting, neglecting, role reversal and pressure to achieve, each one related both to the mother and father) and (2) *current attachment states of mind* both related to the parents (idealization, anger, and derogation) and global (coherence of transcript, coherence of mind, lack of memory, metacognition, passivity, fear of loss, unresolved loss, and unresolved abuse). Therefore five *attachment classifications* are obtained: three organized -free/autonomous (F/A), dismissing (Ds), and entangled (E)- and two not organized -unresolved with respect to loss/abuse (U) and cannot classify (CC)- that could be added to the three main ones. These latter were often considered together in an unorganized (U/CC) group (Bakermans-Kranenburg and van IJzendoorn, 2009).

With regard to the psychometric properties of the AAI classifications, both the reliability (e.g., short-term stability, inter-rater consistency) and the discriminating validity with respect to gender, verbal intelligence, memory, cognitive complexity, social desirability, and overall social adjustment have been demonstrated (Bakermans-Kranenburg and van IJzendoorn, 1993; Crowell et al., 1996).

In our study, only a subgroup of 42 participants (20 mothers of ED patients and 22 control mothers) agreed to be interviewed thorough the AAI. All the transcripts were rated by a skilled coder, blind to the diagnosis and the clinical status of the participants. To obtain a reliability assessment, a second expert coder independently rated a random sample of 20 AAIs (48%), yielding a significant kappa coefficient ($k = 0.80$; $p < 0.001$) for four-way classifications (F/A, Ds, E, and U/CC).

Maternal Alexithymia Reported by Daughters

The alexithymia of the mothers was also assessed by the OAS Haviland et al. (2000), which was filled in by their daughters. Although our study shows some important methodological limits about the use of the OAS—above all, the lack of a third observer's evaluation (e.g., husbands, etc)- we decided to include this measure because a broad description of the participants' alexithymia can be clinically useful (Meganck et al., 2010), as suggested in research and clinical practice (Berthoz et al., 2007).

The OAS consists of 33 items (15 items negatively keyed) which takes raters approximately 15 min to complete. Item content is based on 13 alexithymia experts' consensus definition of alexithymia (Haviland and Reise, 1996). The original English version of the OAS was translated into Italian by means of a translation and back-translation procedure following the guidelines of the International Test Commission (Hambleton, 1994). The OAS was translated into Italian by three English translators, native Italian speakers, who were also researchers familiar with the alexithymia concept (independent translations), the result being a negotiated Italian translation. The OAS-I was back-translated, and modifications were made in consultation with the OAS's primary author (Haviland et al., 2000). The final version was approved by Haviland, the three original translators and a native English speaker fluent in Italian.

Each item is rated on a 4-point Likert scale from 0 (never, not at all like the person) to 3 (all of the time, completely like the person). Examples of items are "She is good at managing interpersonal relationships (reversed)," "She often speaks of physical pain or discomfort," "She has difficulty finding the right words to describe her feelings." The OAS global scores can range from 0 to 99, with high scores indicating greater alexithymia than low scores. The OAS consists of five subscales: distant, uninsightful, somatizing, humorless, and rigid.

Despite the above-mentioned methodological issues, the OAS scores demonstrated adequate internal consistency with Cronbach's alpha coefficient from $\alpha = 0.84$ (Haviland et al., 2000) to $\alpha = 0.88$, (Yao et al., 2005), good stability (test–retest reliability) with a 2-week interval coefficient from 0.87 (Haviland et al., 2001) to 0.90 (Yao et al., 2005), acceptable interrater reliability with an intra-class correlation coefficient from 0.68 (Berthoz et al., 2007) to 0.78 (Yao et al., 2005).

Procedure

The psychiatrist and psychologists of the EDC were informed by the research team about the selection criteria and they contacted us every time suitable families were interested to be involved in the study. The SCID-I (First et al., 1994) was administered to the outpatients to confirm their ED diagnosis. The mothers of patients who participated in the study attended two sessions at the EDC: After the first, they filled out several questionnaire, including the TAS-20 (Bagby et al., 1994a; Bressi et al., 1996), and their daughters completed the OAS (Haviland et al., 2000). At the second one, the AAI was administered only to the mothers who attended the whole procedure.

The control group had been informed—through the initial advertising—that our research team needed families with daughters between 16 and 25 years old without physical or psychological pathology to participate as a control group in a clinical study. If they wanted to participate and they passed the selection criteria, we proceeded to evaluate the maternal study variables as we did with the clinical group. This study was part of a larger research project investigating family and individual characteristics in different groups of ED patients.

At the end of the assessment, we offered a report containing a synthesis of the outcome from each instrument (TAS-20, OAS, and AAI) to the participants who completed the whole procedure. Written informed consent was obtained from all participants. The study was previously approved by the Regional Ethics Committee.

Statistical Analysis

The results were analyzed using the Statistical Package for the Social Science (SPSS, Version 21.0; IBM Corp., Armonk, NY, USA). Some data analysis was carried out by categorizing the AAI classifications in one of the following two-way systems: secure (F/A) vs. insecure (Ds, E, U, and CC) and organized (F, Ds, and E) vs. unorganized (U and CC) categories and by using more powerful statistical tests. We used primarily non-parametric tests (e.g., Mann–Whitney U, Spearman's rho, Fisher's Exact test, etc), which are appropriate for statistically testing small samples, such as for this pilot study. The level of significance for all analyses was $p < 0.05$.

Results

Background Variables

The total TAS scores and the AAI classifications (both the two-way systems F/A vs. non-F/A and U/CC vs. non-U/CC) were not correlated with the following background variables: participants' age, education level, SES, and family structure (p values ranging from 0.14 to 1.0). The total OAS score was not correlated with the following background variables: age and education level of daughters, SES, and family structure (p values ranging from 0.23 to 0.79). No differences emerged between daughters with AN and BN diagnoses with respect to their mothers' AAI classifications and TAS and OAS scores (p values ranging from 0.14 to 0.83).

Alexithymia and attachment states of mind: comparison between mothers with "ED" daughters and mothers with "non-ED" daughters.

As **Table 1** shows, no differences emerged, either in the total TAS-20 scores or in the three subscales of the TAS-20 among the two groups of mothers. The mothers of the daughters with EDs did not present a prevalence of alexithymia measured by the

TABLE 1 | TAS-20's scores and prevalence of alexithymia in ED and control group.

	ED mothers (*n*=45)	Non-ED mothers (*n*=48)	*Mann Whitney U*	*p*
	M (SD)	*M* (SD)		
Total TAS	44.50 (8.10)	45.85 (12.81)	861.500	.88
Difficulty Identifying Feeling	14.70 (6.7)	14.05 (6.3)	875.500	.97
Difficulty Describing Feelings	13.54 (4.4)	13.58 (5.1)	865.000	.90
Externally-Oriented Thinking	17.26 (5.1)	18.22 (4.8)	772.000	.38
	N %	*N* %	*Chi Square (df)*	*p*
Alexithymia > 61	4 (9%)	8 (17%)		
Alexithymia borderline between 52–60	2 (4%)	9 (19%)	4.28 (2)	.12
No alexithymia < 51	39 (87%)	31 (64%)		

TAS compared to control mothers, and showed even less presence of borderline and over cut-off scores, although no significant differences were found (**Table 1**).

As mentioned above, a subgroup of 20 patient's mothers and 22 of the control group mothers completed the AAI. The results were reported in **Table 2**. No participants were classified as CC and none of the controls was U.

The difference between the two groups of mothers on four-way AAI classification approached significance using Exact Chi Square. Given the small number of participants, we also compared the two groups of mothers on the two-way systems. No differences were found with respect to the F/A vs. non-F/A (Ds, E) classifications among the two groups of mothers with Fisher Exact test.

However, mothers of ED patients showed a higher prevalence of not-organized (U) vs. organized (F/A, Ds, and E) classifications than control mothers. Finally, mothers of ED patients indicated higher scores on the unresolved loss scale (Mann-Whitney $U = 153.00$, $p < 0.01$) and lower on the coherence of mind scale (Mann-Whitney $U = 145.00$, $p < 0.05$) than mothers of women without clinical symptoms.

Correlations between alexithymia and attachment in mothers with ED patients.

We did not find significant correlations between the global and subscales' scores of the TAS-20 and AAI states-of-mind scales among mothers of daughters with ED (Spearman rho between −0.02 and 0.34, *p*-value ranging from 0.17 to 0.94).

Maternal alexithymia as reported by their daughters: comparison between "ED" and "non-ED" daughters and correlations with attachment states of mind.

As **Table 3** shows, mothers of patients with EDs were more highly assessed in total alexithymia and were more distant and humorless than control group mothers, according to their daughters' observations.

Instead, we found significant correlations between the global and subscales' scores of the OAS and the AAI states-of-mind scales. Specifically, as showed in **Table 4**, mothers with higher maternal idealization in the AAI were assessed by their ED daughters as more uninsightful and those with higher scores both on the scales of fathers' idealization and lack of memory were rated as more alexithymic.

Discussion

In this study, we first compared alexithymia and attachment states of mind in a group of mothers of patients with EDs matched to a control group of mothers for socio-demographic variables.

Our hypothesis was that mothers of patients with EDs would show higher levels of alexithymia but, contrary to our expectations, this was not confirmed. This result, on one hand, did not support findings from Espina (2003) who found that mothers of daughters with ED show higher scores in the TAS-20 and its factors than the controls. On the other hand, our result may be in line with those from Balottin et al. (2014) that highlighted very low levels of alexithymia among mothers of anorexic patients when they were measured by the TAS-20, which increased considerably when alexithymia was assessed via the TSIA clinical interview. In our study, noting the low percentage of alexithymia in the group of mothers of the clinical group (9.1%), we may argue that the social desiderability could have played a role in the self-evaluations reported by the mothers. Social desiderability could be increased by both the feelings of guilt and fear of judgment often reported by mothers of patients with EDs (Espindola and Blay, 2009) triggered by the context in which the research assessment were performed, that is, in the ED center where their daughters were in therapeutic treatment. We agree with Balottin et al. (2014) when they suggest "that a sense of deep crisis and distress for the daughter's condition can lead parents to adopt denial and massive defensive attitudes toward self-administered questionnaires" (p. 1947). In this line, further studies could also integrate an evaluation of an alexithymia adding interview, like the TSIA, administered by trained clinicians. Otherwise, if we would consider maternal alexithymia also as a reactive state to stress (secondary alexithymia) and associated with the pathology of their daughters (Espina, 2003), low scores attributed to the mothers of ED patients in our study could be explained by the rather recent diagnosis of their daughters. Future longitudinal studies should collect data on alexithymia of mothers from the onset of their daughters' ED across the time.

Regarding attachment, our hypothesis that mothers of ED patients would show higher rates of insecure and unresolved attachment states of mind (both categories and scales) than controls, was only partially confirmed. In line with our expectations, we found that mothers of ED daughters showed both significantly more unresolved AAI classifications and higher scores on the lack of loss resolution scale compared to control mothers. Contrary to our expectations, the percentage of insecure attachment classifications (65%) was not found to be significantly higher compared to control mothers (45%), although we found significantly lower scores on the coherence of mind scale among mothers of ED patients. Our results support findings from another Italian study that explored mothers' AAIs of adolescent females with AN and found high rates of unresolved loss or trauma status

TABLE 2 | AAI categories of ED mothers and control group.

	F	Ds	E	U	Four group χ^2 (df = 3)	Three group χ^2 (df = 2)	F vs. nonF Fisher Exact	U vs. nonU Fisher Exact
ED mothers ($N = 20$)	7 (35%)	5 (25%)	3 (15%)	5 (25%)	7.13, $p = 0.07$	2.99 $p = 0.26$, (ns)	$p = 0.17$ (ns)	$p = 0.02$
Non-ED mothers ($N = 22$)	12 (55%)	8 (36%)	2 (9%)	0 (%)				

TABLE 3 | OAS's scores of ED mothers and control group (daughter's reports).

	ED mothers ($n = 45$)	Non-ED mothers ($n = 48$)	*Mann Whitney U*	*p*
	M (SD)	*M* (SD)		
Mother total OAS	43.80 (15.24)	35.31 (13.79)	722.000	0.01
Distant (mother)	13.98 (6.77)	9.85 (5.34)	644.000	0.00
Uninsightful (mother)	9.19 (5.24)	7.96 (5.09)	939.000	0.35
Somatizing (mother)	5.11 (3.37)	4.42 (3.08)	964.500	0.47
Humorless (mother)	6.85 (3.62)	4.84 (3.2)	720.500	0.01
Rigid (mother)	6.81 (3.49)	5.96 (3.04)	833.000	0.11

TABLE 4 | Correlations between the AAI scales of states of mind and the OAS scores.

AAI states of mind	OAS scores	Spearman's rho
Idealization of mother	uninsightful	0.49*
Idealization of father	alexithymic	0.58*
Lack of memory	alexithymic	0.56*

*$p < 0.05$.

(35%, Delogu et al., 2008). The English study on mothers with anorexic daughters by Ward et al. (2001) instead highlighted a very low level of free/autonomous classifications (only 2%) and a very high level of unresolved status (67%). Like Ward et al. (2001) reported, inclusion was limited to cases of women with AN symptoms severe enough to need hospitalization, which may have hypothetically selected a more insecure group of mothers. Furthermore, mothers with ED daughters appear to be more insecure and unresolved than those in the results from international and Italian meta-analyses of the AAI of "non-clinical" mothers (Bakermans-Kranenburg and van IJzendoorn, 2009; Cassibba et al., 2013). Therefore, our results confirm that unresolved states of mind play a relevant role, not only in the ED patients as several studies have already demonstrated (Ramacciotti et al., 2001; Zachrisson and Kulbotten, 2006; Ringer and Crittenden, 2007; Barone and Guiducci, 2009; Delvecchio et al., 2014), but also among their mothers. This finding deserves special attention given the link between mothers' unresolved loss and both frightened and frightening parenting behaviors, which were considered by researcher and clinicians as relevant risk factors with respect to the children's psychological adjustment in the developmental stages (Cowan et al., 1996; Schuengel et al., 1999; Jacobvitz et al., 2006; Ballen et al., 2007). Some authors suggested that maternal unresolved loss may be considered a severe difficulty in emotion regulation inside children–parent relationships (Cavanna et al., 2012). Specifically for these mothers with unresolved loss, when the attachment system is activated by their children, they become absorbed in their own internal and unelaborated fears, resulting in a confusing and unpredictable parenting style that does not allow their children to learn how to regulate attachment emotions, such as fear and anxiety (Cavanna, 2007). Furthermore, a theme of unresolved loss would be consistent with the older clinical literature, which emphasizes early separation difficulties in the etiology of EDs (Ward et al., 2001). Our study can not allow us any speculation about the links between mothers' attachment states of mind and the onset of an ED in their daughters; however, an ever-increasing literature has pointed out that having mothers with free-autonomous and resolved states of mind exert positive influences on their children both in biological (Cassidy and Shaver, 2008) and adoptive families (Steele et al., 2003; Pace et al., 2012). We would suggest that enhancing attachment security and reducing unresolved losses in mothers with ED daughters should be considered one of the key points to address in the treatment of families with these patients, especially for those who are adolescents. The combination of low ability to organize an attachment relationship history in a coherent, balanced, and integrated narrative, and the lack of integration of past experience of mourning for mothers of ED patients needs to be addressed during therapeutic work with this clinical group of patients.

Our second hypothesis was that high levels of insecure states of mind would be correlated with high levels of alexithymia in mothers of ED daughters but, contrary to our expectations, we did not find any correlations between self-reported evaluation of alexithymia (TAS-20) and attachment states of mind (AAI). This finding needs to be further investigated in next research because it did not support previous studies with ED samples which revealed strong correlations between alexithymia and attachment measured by self-reports (Sorrentino et al., 2004; Keating et al., 2013). Moreover, the only study which used the AAI and the TAS-20 with a clinical sample with idiopathic spasmodic torticollis (Scheidt et al., 1999) showed that externally oriented thinking was positively correlated with dismissing attachment, and both externally oriented thinking and difficulty in communicating feelings were inversely correlated with secure attachment.

Finally, only as esplorative hypothesis, we investigated the patients' evaluations of maternal alexithymia. First, we found that

women with EDs evaluated their mothers as more alexithymic and particularly more distant and lacking a sense of humor than control women. Second, we found significant correlations between the ED daughters' reports of their mother's alexithymia (OAS) and scales associated with dismissing classifications of the maternal AAI, such as idealization and lack of memory. We would suggest wariness in interpreting our data by the OAS that cannot be considered as a reliable measure of maternal alexithymia for the following reasons. First, as Yao et al. (2005) recommend, obtaining observer reports from more than one person would have decisively provided more reliable data, while in our study it was not possible to have a second rater in addition to the daughters (e.g., husband, relative, close friend), to measure the mothers' alexithymia. Second, we may speculate that patients with ED could be themselves highly alexithymic, as a wide literature review has highlighted (Nowakowski et al., 2013) and, therefore, by definition probably they are not able to provide a proper assessment of their mothers' alexithymia. Third, an evaluation of the personality of the observers (ED and control daughters) is missing, as well as a self- and observer-reported evaluation for another independent clinical construct (e.g., anxiety, parental bonding, anger, etc). All these methodological limitations restricted the generalizability of our results that went indeed uncontrolled for the "observer" factor. Moreover, these limitations did not allow us to understand whether it is the daughter's (biased) point of view that makes mothers of ED patients more alexithymic than those of control participants, as well as whether the clinically relevant problem (mother's alexithymia) is specifically related to the alexithymia dimension or rather generally linked to the overall perception of the young patients about their mothers. However, beyond these highly relevant methodological limitations, from a clinical perspective, our finding with the OAS could indicate the perception that patients with EDs have of their own mothers as distant, namely lacking in interpersonal skills and affection expressions, humorless and globally alexithymic. Regardless from the actual level of maternal alexithymia, this result offers some clinical suggestions about the *inner parent* (uneasy with emotions, cold, and not playful) that these vulnerable young women have brought inside themselves.

Furthermore, our results seem to indicate that a mother with a dismissing state of mind, who tends to deactivate attachment-based feelings, experiences, and needs through minimizing and normalizing strategies, such as idealization and insistence on lack of recall, is seen by her daughter with ED as a parent with alexithymic traits. In particular, these mothers were perceived as unable to form insights, as tending to remain confused when faced with difficult situations, as frustrated when facing uncertainty, and as unable to explain their strong emotions or understand their own needs. This result deserves to be explored in future studies using self- and other- assessments both for alexithymia and attachment, including questionnaires, interviews and projective measures (Delvecchio et al., 2014).

Limitations

Beyond the above-mentioned limitations about the OAS, this study presents several limits. First of all, because of the cross-sectional nature of the research design, we cannot make causal inferences about associations among alexithymia, attachment states of mind, and ED diagnoses. Future studies using longitudinal designs are needed to understand directional relationships among these factors. Second, the current study involved a small sample of mothers of ED girls who were outpatients in assessment phase at the time of the study, thus results from the current work may not be representative of the general ED population. Moreover, as a consequence of the small sample size, we did not differentiate between mothers of AN (restrictive and bulimic) and BN patients. Future research should involve a larger sample of mothers of ED patients and differentiate among the clinical subgroups (AN and BN) and include BED (Laghi et al., 2014, 2015). A third limitation is the absence of another non-ED psychiatric control group: although we have compared our results with mothers of "non-clinical women," it could be argued that our findings relate to mothers of psychiatric patients in general rather than to those with EDs in particular. Further research should also address the central question of whether our findings about maternal alexithymia and attachment in this clinical group are general or specifically explain EDs. Finally, we included in our studies only assessments of mothers; as O'Shaughnessy and Dallos (2009) pointed out, fathers have largely been neglected from this area of research and further study is needed to understand the dyadic nature of alexithymia and attachment theory in both parents.

Conclusion

The design of our study could be considered a pilot framework for future research employing larger samples of ED patients and analyzing alexithymia and attachment of their parents. We hope that our results can contribute to reducing the great risk of "blaming the mothers" that is sometimes implied in describing and interpreting connections among parental alexithymia, attachment, and psychopathology, as Zachrisson and Skårderud (2010) have suggested. Far from inducing a sense of guilt and making causal accusations upon mothers, we would suggest that involving them in the treatment of ED patients and addressing the daughter's perception of their alexithymia together with maternal lack of coherence and unresolved loss could be beneficial for the entire family. This type of therapeutic intervention could represent the starting point both to build a more intense parent-daughter relationship and to facilitate the development of patient's solid autonomy.

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Parent-infant interactions in families with women diagnosed with postnatal depression: a longitudinal study on the effects of a psychodynamic treatment

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Background: Several studies have shown a connection between mothers with postnatal depression (PND) and emotional-behavioral problems in their children. Mothers' psychopathology may impair interactional patterns with children and these outcomes can be influenced by father's psychopathological symptoms. The primary aim of the study was to assess over time parent-infant interaction in families where mothers have experienced PND and have received psychological treatment during the child's first year of life considering the severity of parents' psychopathological symptoms and children's temperament.

Methods: Three groups of families were involved: families with mothers with PND wherein both parents followed a psychological treatment (TxMF); families with mothers affected by PND wherein only the mother followed the treatment (TxM) and control families wherein the mothers did not have a psychopathological diagnosis and did not receive any treatment (Con). The families were assessed at two time points through Symptom Check-List-90-Revised (SCL-90-R), Questionari Italiani Temperamento (QUIT) and the video-recorded procedure observing mealtime Scala di Valutazione Interazioni Alimentari (SVIA).

Results: Parents in the TxMF group had significantly lower SVIA scores (i.e., less maladaptive) at T2. TxMF group scored lower at T2 at SCL-90-R, whereas TxM showed no significant differences between T1 and T2. Involvement of fathers in the treatment was important to improve the psychopathological symptoms of both parents and the quality of interactions with their children.

Keywords: parent-infant interactions, post-partum depression, fathers, psychodynamic treatment, temperament

Introduction

Postnatal depression (PND) and its possible consequences for both the child's emotional adaptive functioning and the relational patterns in mother–child dyads have been examined thoroughly in recent international studies (Korja et al., 2008). Epidemiological data show that ∼13% of women suffer from symptoms of PND which do not improve or may worsen in the first few weeks after

giving birth; these symptoms can also appear in the period immediately before the birth (Séjourné et al., 2012), as specified in the recently updated Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association [APA], 2013). Research in this field has, thus far, focused mainly on the severity of mother's psycho-pathological symptoms associated with a PND diagnosis (Sutter-Dallay et al., 2011) and only recently has the work been expanded to consider possible paternal contributions to risk and protection factors (Paulson and Bazemore, 2010; Cimino et al., 2014).

The large amount of research on mothers to date has highlighted the relationship between a PND diagnosis and emotional and behavioral problems in children during their development, especially with respect to externalizing syndromes (Madigan et al., 2007). Cicchetti and Rogosch (1996), however, have proposed a multifinality model that suggests that maternal depression can generate maladaptive outcomes in children, manifested as externalizing as well as internalizing syndromes, and can generally be associated with altered emotional functioning in children. Postnatally depressed mothers who show withdrawn interaction with their children seem more likely to have offspring manifesting internalizing functioning characterized by withdrawal, anxiety and somatic complains, while PND mothers' intrusive behaviors seem to foster externalizing problems such as aggressive behaviors in their children (Goodman et al., 2011, 2015).

Coherently with the above research, specific characteristics of mother-infants interactions have been studied and there is a consensus in the literature that early exchanges between mothers with PND and their infants are characterized by reduced face-to-face interaction, reduced frequency of positive facial expressions and of fluid and contingent turn-taking, such as during meals (Ammaniti et al., 2012). The quality of feeding interactions between parents and their children during the first years of life have been defined as proxy for more global quality of parent-infant interactions since these exchanges constitute fundamental relational experiences having weight on adaptive or maladaptive child's development (Field et al., 2006). In an intersubjective perspective, the quality of parent-infant interactions during feeding or play not only have effect on children's development and psychological wellness, but it also depend on the capacity of the parent of adapting and modulating the specific characteristics of the child, such as his/her temperament, behavior and general psychological functioning (Stern, 1995; Cerniglia et al., 2014a). The characteristics of the interaction between mothers with PND and their children often correlate with the mother's difficulties with establishing a syntonic relationship with her child, a circumstance which can contribute to the development of insecure attachment patterns (Madigan et al., 2007).

On the other hand, several authors have shown the importance of considering additional risk factors that may lead to emotional problems in children whose mothers have PND, such as the presence and especially the severity of maternal psychopathological symptoms associated to PND. Besides, it has been shown that maladaptive outcomes in children of mothers with PND may be linked to father-infant interactions characterized by asynchrony, scarce involvement, and an absence of sharing positive affective bonds (Dietz et al., 2009; Beebe et al., 2012). The international literature suggests that the emotional-adaptive difficulties in parental interactions (e.g., during play or mealtime) with children whose mothers have received a psychiatric diagnosis can be influenced by the severity of their father's psychopathological symptoms (Pinquart and Teubert, 2012). Hence, it has been underscored how useful it would be to consider the presence of psychopathological symptoms in fathers, whenever these cannot be classified within a specific nosographic category (Cimino et al., 2013). It has also been emphasized that temperamental and individual factors in children (as perceived by the parents) can interact with parents' emotional problems and contribute to the onset of psychological difficulties in the children and to the development of difficulties in parent–child dyadic relationships with both parents as well as the triadic one (Klein et al., 2009). In this paper we refer to Rothbart et al. (2000) definition of temperament as biologically based and relatively stable over time but modifiable by development and experiences in the environment.

With regards to the treatment of maternal PND, Murray et al. (2010) studied the improvements in mother-infant relationships and infant developmental outcomes subsequent to different intervention approaches (Cognitive Behavioral Therapy, Counseling and Psychoanalytic Therapy). All the treatments in this study produced short-term benefits on mothers' depression, but there was scarce evidence of benefits to maternal mood at follow-up. Interestingly, this study also demonstrated that although psychological treatments were effective in treating maternal depression, no positive effect was found in terms of observed mother-infant interactions, infant negative emotionality, and infant attachment security (Cooper et al., 2010).

Field (2010) suggested that such treatments should involve not only mothers with PND, but rather the whole family group. In fact, it has been proposed that not only do the mother's psychopathological symptoms improve with whole family treatment, but also that reduction of the father's psychopathological risk (which may intensify during the postpartum period) can improve the children's psychological wellbeing and the quality of the dyadic mother–child exchanges (Goodman, 2008; Edmondson et al., 2010; Lucarelli et al., 2013). Although recent literature and research have convincingly demonstrated that considering paternal psychopathological risk and its effects on children development in families with mentally ill mothers can guarantee better results on the family psychological wellness, several mental health services continue to offer treatment plans addressing mothers only, excluding fathers from intervention polices (Ramchandani et al., 2013; Werner et al., 2015).

Materials and Methods

The general objective of this work was to assess the quality of mother-infant and father-infant interactions in families in which the mother has PND and has followed a psychodynamic

treatment during the child's first year of life. The following three participant groups were compared: families with maternal PND wherein the mother and father followed a psychodynamic treatment during the child's first year of life (TxMF); families with maternal PND wherein only the mother followed a psychodynamic treatment during the child's first year of life (TxM); and control families wherein the mothers do not have a psychopathological diagnosis and parents did not receive any kind of treatment (Con). (See **Table 1** for demographic characteristics of the sample).

The primary objective of this study was:

(a) To assess changes or stability in the quality of relational mother-infant and father-infant exchanges during meals in the three groups;

The secondary objectives of the study were:

(b) To assess changes or stability in the severity of psychopathological risk (in terms of global functioning) of mothers and fathers in the three groups;
(c) To compare longitudinally the temperamental characteristics of children in the three groups as perceived by their parents.

Subjects and Procedure

Over a 1-year period, 293 families expecting a baby addressed a network of public consultants in Central Italy following a program to accompany them to the child's birth and into parenthood. To establish a baseline of parental psychopathological risk before birth, we administered the Symptom Checklist-revised (SCL-90-R) to all parents at the sixth month of pregnancy. For this study, we excluded families with other children ($N = 104$). After the child's birth, we excluded families if the mother and father were not handling personally the child's care and nutrition (for example delegating the child's feeding to grandparents because mothers and fathers are at work during the day; $N = 31$). In the remaining sample group ($N = 158$), 87 mothers were diagnosed with PND without comorbidity by psychiatrists from the various consultant offices, according to the DSM-5 criteria (American Psychiatric Association [APA], 2013) within the first 4 weeks of the child's life, 49 mothers received a different diagnoses ($N = 11$ anxiety disorder; $N = 8$ borderline personality disorder; $N = 16$ PND with a comorbid anxiety disorder, and $N = 14$ nutritional disorder) and were suggested to follow treatments that were not included in this study, and 22 mothers received no diagnosis [and constituted Control Group (Con)]. Among the families with mothers with PND a cohort of 52 families elected to accept the assessment and treatment plan, while 35 families refused to participate in the study. Of the 52 families that commenced with the intervention, eight did not adhere to the treatment ($N = 2$ moved to another city after two treatment sessions; $N = 6$ families did not keep their appointments after the first session), yielding a drop-out of 15.3%. Only those families who followed the program continuously to its conclusion were included in the data analysis ($N = 44$). The families were randomly assigned (by computer software which was blind to socio-demographical and psychological characteristics of the global sample) to different treatment plans: $N = 22$ families were assigned to an intervention involving both parents (TxMF), and $N = 22$ involving only the mother (TxM). None of the parents in Group TxMF, Group TxM, and Control Group (Con) exceeded cut-offs for the Italian population at SCL-90-R (Prunas et al., 2012) administered at sixth month of pregnancy of the mother.

The network of public consultants offered the families of Group (TxMF) and Group (TxM) a supportive, relationship-based, parent-infant intervention, which was developmentally based and infant-oriented, promoting positive parent-infant interactions. The intervention was drug-free and included 15 meetings (two sessions a month; 1 h per session). The same treatment technique was proposed to TxMF and TxF Groups but, when both parents were involved, part of the session was dedicated to confronting mothers and fathers' characteristics in interacting with their child. The clinical équipe was composed of five psychologists within the public health care system specifically trained for treatment techniques described by Cramer et al. (1990), Stern (1995) in which an understanding of the parents' representation of her infant and her relationship with their infant was promoted by exploring aspects of the parents' early experiences with their own families. The health care public services where the sample was recruited chose to offer this specific treatment to their patients because a robust literature demonstrated its high efficacy on families with women with PND (Nylen et al., 2006; Cooper et al., 2010).

The groups were evaluated through the tools described below at two time points with an inter-evaluation interval of ∼9 months. The first time point (T1) was when the children were 3 months old (preceding the start of intervention in TxMF and TxM) and the second time point (T2) was when they were 12 months old (immediately after treatment conclusion).

The research described here was approved by the Ethical Committee of the Psychology Faculty at Sapienza, University of Rome, before the start of the study and in accordance with the

TABLE 1 | Demographic characteristics of participants by group.

Group	*N*	Gender	Mean age ± SD			
			Mothers, y	Fathers, y	Infants at T1, mos.	Infants at T2, mos.
TxMF	22	11 M, 11 F	31.9 ± 1.8	35.5 ± 2.2	3.1 ± 0.3	12.2 ± 0.6
TxM	22	11 M, 11 F	31.7 ± 1.9	36.2 ± 1.8	3.2 ± 0.2	11.9 ± 0.4
Con	22	11 M, 11 F	31.2 ± 2.0	38.1 ± 3.2	3.4 ± 0.3	12.1 ± 0.5

Declaration of Helsinki. Written informed consent was obtained from each of the study participants.

Tools

All parents were administered both at T1 and T2 through the *90-item Symptom Checklist-revised* (SCL-90-R; Derogatis et al., 1973) and an Italian questionnaire on temperament [*Questionari italiani del temperamento* (QUIT); Axia, 2002] independently. For the present study we considered only the Global Severity Index (GSI) as an index of general psychopathology, since recent international research has doubted the validity of the SCL-90-R subscales and recommend the use of GSI (Müller et al., 2011). Also, mother-infant and father-infant nutrition interactions were video-recorded and evaluated with the "*Scala di Valutazione dell'Interazione Alimentare*" (SVIA; Lucarelli et al., 2002).

Symptom Check-List-90-Revised

The SCL-90-R is a self-report questionnaire that gives a standardized measure of the current psychological and/or psychopathological status of a subject that can be applied to normal or psychiatric adult and adolescent populations. It provides a wide range of information on the current subjective experience of psychological wellbeing and distress, and serves as a screening tool in both clinical and research settings. The scores obtained are interpreted based on nine primary dimensions: (1) *somatization,* (2) *obsession compulsion,* (3) *interpersonal sensitivity,* (4) *depression,* (5) *anxiety,* (6) *hostility,* (7) *phobic anxiety,* (8) *paranoid ideation,* and (9) *psychoticism.* It includes a GSI that is used to determine severity and degree of psychological distress with respect to the nine primary dimensions measured. Prunas et al. (2012) demonstrated satisfactory internal consistency of the Italian version of the SCL-90-R in adolescents and adults (α coefficient, 0.70–0.96) with a clinical cut-off score ≥1 in GSI indicating psychopathological risk (Prunas et al., 2012).

Questionari Italiani Temperamento

The QUIT is a 60-item parent questionnaire that was validated in an Italian sample across four age bands: 1–12 months, 13–36 months, 3–6 years, and 7–11 years. It investigates six dimensions referring to the child's temperament as perceived by the parents: (1) *level of motor activity*, (2) *attention capacity*, (3) *inhibition to novelty*, (4) *social orientation* (readiness for socialization), (5) *positive emotionality*, and (6) *negative emotionality*. The questionnaire shows good internal consistency for the 1–12-month age band (Cronbach's α, 0.59–0.71; Axia, 2002) and in the present study mothers' and fathers' independent questionnaire responses have been shown to have good agreement (Pearson's $r = 0.87$) in all three Groups (TxMF, TxM, Con).

Scala di Valutazione Interazioni Alimentari

The SVIA is the Italian adaptation of the Feeding Scale (Chatoor et al., 1997) that can be applied to children that are 12–36 months old. It measures interactive behaviors and identifies normal and/or risky relational modes between a parent and child during feeding exchanges (Lucarelli et al., 2002). Parent-infant interactions during feeding are recorded for at least 20 min, and then a wide range of interactive mother-infant behaviors are coded and evaluated.

The SVIA consists of 41 items distributed among four subscales: (1) *Parent's affective states* (index of the parent's affective states); (2) *Interactive conflict* (index of interactions characterized by conflictual, non-collaborative, and non-empathetic communication); (3) *Food refusal behavior* (habits associated with challenged status regulation during meals and with limited food consumption); and (4) *Dyad's affective state* (index of the extent to which the infant's feeding patterns are, or are not, the result of an interactive regulation to which both partners contribute). The scores, measured on 4-point a Likert Scale ranging from 0 to 3 (none, a little, quite a bit, a lot), for each subscale were compared with standard values from the Italian standardized sample.

Inter-evaluator agreement for SVIA items is generally good to excellent (Pearson r values, 0.7–1.0 for group of 182 normal infants and 0.9–1.0 for a group of 182 infants with nutritional disorders). And the instrument shows good reliability, in terms of internal consistency (Cronbach's α, 0.79–0.96).

Data Analysis

Scores were compared between the groups with analyses of variance (ANOVAs) for repeated measures. The time elapsed between the two administrations (from T1 to T2) was treated as a within-subject factor and the belonging to a research groups was treated as a between-subjects factor. Bonferroni's and Scheffè's *post hoc* tests were applied. The calculated p values are reported with their respective F statistics and degrees of freedom (df), with values <0.05 being accepted as significant. Mean values are reported with SDs. A power analysis was conducted accordingly to Cohen's (2013) suggestions, α was set at 0.05 and a power of 0.832 was obtained with a large effect size of ($f^2 = 0.40$).

All statistical analyses were performed by SPSS version 18.0.

Results

Most of the families recruited for the study (88%) had a middle socio-economic status (Bornstein and Bradley, 2014; Hollingshed, unpublished), and a large majority (92%) were intact family groups in which the child was the firstborn for both parents. The families were 91% Caucasian and 71% relied on more than one income. All of the babies were breastfed and formula fed (mixed fed) and all of the fathers took part in the children's caretaking and feeding routine.

Longitudinal Assessment of the Quality of Relational Mealtime Exchanges by Group

An ANOVA revealed main effects of group (all $p < 0.001$) and time point (all $p < 0.001$) on all four SVIA subscale scores for mothers in the TxMF group. Bonferroni's *post hoc* tests demonstrated that mothers in the TxMF group had significantly lower scores (i.e., less maladaptive) at T2 versus T1 for all four subscales: *mother's affective state*; *interactive conflict*; *food refusal*; *dyad's affective state*. The subscale scores of the mothers in the

TxM and Con groups did not differ significantly between T1 and T2. The mothers' average scores for each SVIA subscale at T1 and T2, F and η^2 values are reported in **Table 2**.

An ANOVA also revealed main effects of group (all $p < 0.001$) and time point (all $p < 0.001$) on fathers' scores for all four SVIA subscale scores. Similar to our findings with the mothers, we observed that fathers in the TxMF group had significantly lower scores (i.e., less maladaptive) at T2 versus T1 for all four subscales: *father's affective state*; *interactive conflict*; *food refusal*; *dyad's affective state*. The subscale scores of the fathers in the TxM and Con groups did not differ significantly between T1 and T2. The fathers' mean scores for each SVIA domain at T1 and T2, F and η^2 values are shown in **Table 3**.

For the present study, inter-rater agreement between the two coders (who were specifically trained psychologists who were blind to group status) was good (Pearson *r* values, 0.8–0.9).

Longitudinal Evaluation of Mothers' and Fathers' Psychopathological Risk Profiles by Group

An ANOVA of the SCL-90-R GSI scores for mothers across groups and time points revealed a significant main effect of time point ($p < 0.01$) and a significant time point × group interaction ($p < 0.001$). Scheffè's *post hoc* tests showed that mothers in both of the treatment groups, TxMF (I–J = 0.3836; $p < 0.05$) and TxM (I–J = −0.7824; $p < 0.001$), had higher GSI scores than mothers in the Con group across both time points (**Table 4**). Importantly, the GSI score for the TxMF became significantly lower (i.e., less maladaptive) than for the TxM group at Time 2 (I–J = −0.3988; $p < 0.05$). **Table 4** shows means and η^2 values.

Likewise, an ANOVA of the SCL-90-R GSI scores for fathers across groups and time points revealed a significant main effect of time point ($p < 0.05$) and a significant time point × group interaction ($p < 0.001$). Scheffè's *post hoc* tests showed that the mean GSI scores for the TxMF group (I–J = 0.3715; $p < 0.05$) and for the TxM group (I–J = −0.7631; $p < 0.001$) were higher than those for the Con group across both time points. Similar to our observations with the mothers' GSI scores, only fathers in the TxMF group showed a decrease (i.e., less maladaptive) in GSI score from T1 to T2 (I–J = −0.3916; $p < 0.05$) (**Table 4**).

Longitudinal Evaluation of Infants' Temperamental Characteristics by Group

There was strong agreement (Pearson's $r = 0.87$) between mothers and fathers regarding their infants' temperament evaluations on the QUIT. Therefore, combined group mean scores for both parents were submitted to an ANOVA for each of the six domains of the QUIT, with group and time point as independent variables. The mean ± SD and η^2 values obtained for each domain for each group by time point are reported in **Table 5**. We observed a main effect of time point on the following QUIT domain scores, namely *social orientation* ($p < 0.001$), *motor activity* ($p < 0.01$), *negative emotionality* ($p < 0.05$), *attention* ($p < 0.01$). Time point × group interactions were also observed for these same five domains: *social orientation* ($p < 0.001$); *motor activity* ($p < 0.01$) *negative emotionality*

TABLE 2 | Mean Scala di Valutazione Interazioni Alimentari (SVIA) subscale scores ± SD, *F* and η^2 at T1 and T2 by group for mothers.

SVIA	TxMF				TxM				Con			
	T1	T2	Fisher *F* test	η^2	T1	T2	Fisher *F* test	η^2	T1	T2	Fisher *F* test	η^2
MAS	24.07 ± 2.18	15.13 ± 1.86	$F_{1,39} = 220.81^{**}$	0.42	23.87 ± 2.39	24.09 ± 2.02	$F_{1,39} = 60.45$	0.03	14.6 ± 1.59	15.11 ± 1.85	$F_{1,39} = 80.98$	0.07
IC	22.47 ± 1.83	7.57 ± 1.65**	$F_{1,39} = 791.79^{**}$	0.35	22.22 ± 2.00	21.7 ± 2.05	$F_{1,39} = 146.56$	0.05	7.21 ± 1.34	7.35 ± 1.54	$F_{1,39} = 166.71$	0.07
FR	12.77 ± 1.61	7.09 ± 1.19**	$F_{1,39} = 171.12^{**}$	0.48	12.59 ± 1.65	13.00 ± 1.19	$F_{1,39} = 46.87$	0.08	6.86 ± 1.36	7.07 ± 1.17	$F_{1,39} = 61.36$	0.08
DAS	15.17 ± 1.51	3.99 ± 0.68**	$F_{1,39} = 920.04^{**}$	0.46	15.23 ± 1.43	14.93 ± 1.76	$F_{1,39} = 341.23$	0.02	3.84 ± 0.62	3.90 ± 0.57	$F_{1,39} = 189.53$	0.05

** $p < 0.001$. *MAS, mother's affective state; IC, interactive conflict; FR, food refusal; DAS, dyad affective state.*

TABLE 3 | Mean SVIA subscale scores ± SD, F and η^2 at T1 and T2 by group for fathers.

SVIA	TxMF				TxM				Con			
	T1	T2	Fisher *F* test	η^2	T1	T2	Fisher *F* test	η^2	T1	T2	Fisher *F* test	η^2
FAS	23.46 ± 2.66	14.89 ± 2.00**	$F_{1,39} = 148.16^{**}$	0.61	22.04 ± 2.69	22.41 ± 2.82	$F_{1,39} = 71.32$	0.03	15.21 ± 1.82	15.10 ± 2.10	$F_{1,39} = 86.78$	0.04
IC	21.48 ± 2.67	7.77 ± 1.60**	$F_{1,39} = 360.60^{**}$	0.45	20.67 ± 2.50	20.82 ± 2.30	$F_{1,39} = 189.73$	0.05	7.42 ± 1.51	7.75 ± 1.45	$F_{1,39} = 172.13$	0.06
FR	12.62 ± 1.76	6.88 ± 1.18**	$F_{1,39} = 176.65^{**}$	0.55	12.10 ± 1.51	12.23 ± 1.54	$F_{1,39} = 89.12$	0.06	7.08 ± 1.18	6.91 ± 1.18	$F_{1,39} = 95.49$	0.07
DAS	14.83 ± 1.96	4.04 ± 0.60**	$F_{1,39} = 532.58^{**}$	0.38	13.37 ± 1.63	13.85 ± 1.63	$F_{1,39} = 223.41$	0.02	3.88 ± 0.59	4.02 ± 0.55	$F_{1,39} = 198.21$	0.03

** $p < 0.001$. *FAS, father's affective state; IC, interactive conflict; FR, food refusal; DAS, dyad affective state.*

TABLE 4 | Mean GSI scores ± SD and η^2 from the SCL-90-R for mothers and fathers by group.

Group	Parent	Mean GSI score ± SD		
		T1	T2	η^2
TxMF	Mother	1.11 ± 0.63	0.46 ± 0.25*	0.61
	Father	1.03 ± 0.55	0.48 ± 0.25*	0.36
TxM	Mother	1.15 ± 0.61	1.21 ± 0.59	0.06
	Father	1.07 ± 0.60	1.23 ± 0.59	0.04
Con	Mother	0.37 ± 0.27	0.43 ± 0.26	0.03
	Father	0.34 ± 0.19	0.43 ± 0.25	0.05

*Cut-off for psychopathological risk in Italian population is ≥1 for men and women (Prunas et al., 2012). *p < 0.05.*

($p < 0.001$) *attention* ($p < 0.05$). Scheffe's *post hoc* tests further showed that, at T2, the TxM group had higher (i.e., more maladaptive) QUIT scores than the TxMF and Con groups in the domains of *motor activity* (TxMF: I–J = 0.37, $p < 0.001$; Con: I–J = 0.44, $p < 0.001$) and *negative emotionality* (TxMF: I–J = 0.4, $p < 0.01$; Con: I–J = 0.4, $p < 0.01$). Meanwhile, the TxM group had lower (i.e., more maladaptive) QUIT scores than the TxMF and Con groups in the domains of s*ocial orientation* (TxMF: I–J = −1.12, $p < 0.001$; Con I–J = −1.19, $p < 0.001$) and *attention* (TxMF: I–J = −0.34, $p < 0.05$; Con I–J = −0.38, $p < 0.01$).

Discussion

The present study examined how two psychological 1-year treatment protocols, mother and father involvement versus mother involvement only, affected the quality of mother-infant and father-infant interactions in families in which the mothers had PND. Our results indicate that involvement of fathers was important for general treatment efficacy. We observed marked improvements in the TxMF group toward Con levels that did not occur in the TxM group. Our results indicate that a 1-year psychological intervention approach can reduce the severity of psychopathological risk of both parents when the treatment involves both parents, as in the TxMF group. On the contrary, treatment of the mother alone in the TxM group did not yield significant changes in psychometric scores. These findings are consistent with previous research (Goodman et al., 2011) showing that short-term intervention is only effective if the whole family nucleus is involved. Programs involving only the mother may be effective only if they are instituted for an extended period of time (Nylen et al., 2006). Our findings support prior research showing an association between a mother's PND and the severity of father's psychopathological symptoms. Furthermore, Dietz et al. (2009) found that fathers' psychopathological symptoms moderated the relationship between maternal PND and infants' behavioral problems in cases of mild to moderate maternal depression symptoms. Indeed, Jaffee et al. (2003) described the combination of maternal depression with paternal psychopathology as a "double checkmate" for children that are already at risk for maladaptation.

Our Con group was composed of women who, although not diagnosed with NPD, were apparently facing emotional difficulties in adjusting to parenthood. They exhibited normal-quality interactive patterns with their children during meals. However, their SVIA scores were 2–3 SDs from the norm, underscoring how even in the absence of clinical-level diagnosable symptoms, the transition to parenting can be challenging. Indeed, the incidence of affective disorders increases during the prenatal period for both mothers and fathers by 2 or 3 times with respect to the general population (Baldoni and Ceccarelli, 2010).

Our results point to temperamental difficulties perceived by parents in the children of mothers who have PND; this finding is aligned with prior studies demonstrating more complicated than normal temperamental characteristics in the children of depressed parents (Cutrona and Troutman, 1986; Beck, 1996; Bruder-Costello et al., 2007). Interestingly, we observed an improvement in social orientation domain scores on the QUIT for the TxMF group, but not for the TxM group. This dissociation supports the notion that maternal depression can impact the nature and quality of parent–child interactions and, by extension, the perception of child's temperament (Murray and Cooper, 2003; Hanington et al., 2010). Furthermore, it has been suggested that depression weakens parents' abilities to regulate their children's emotions (Lovejoy et al., 2000). Our findings support the view that PND treatment should address both parents-infant relationships and not only the mother (Forman et al., 2007).

TABLE 5 | Questionari Italiani Temperamento domain mean scores ± SD and η^2 values by time point for each study group and for a normative standard population (from Axia, 2002).

Subscale	TxMF			TxM			Con			Normative standard
	T1	T2	η^2	T1	T2	η^2	T1	T2	η^2	
Motor activity	3.24 ± 0.22	2.88 ± 0.29***	0.46	3.23 ± 0.25	3.25 ± 0.23	0.08	2.9 ± 0.45	2.82 ± 0.36	0.09	3.63 ±0.70
Attention capacity	2.97 ± 0.46	3.34 ± 0.36*	0.65	2.93 ± 0.46	3.00 ± 0.37	0.02	3.32 ± 0.36	3.38 ± 0.36	0.07	3.75 ±0.72
Inhibition to novelty	3.40 ± 0.28	3.35 ± 0.33	0.08	3.37 ± 0.45	3.44 ± 0.22	0.04	3.48 ± 0.29	3.47 ± 0.33	0.08	2.53 ±0.83
Social orientation	2.91 ± 0.25	4.08 ± 0.26***	0.57	2.87 ± 0.31	2.96 ± 0.27	0.05	4.06 ± 0.3	4.16 ± 0.27	0.04	4.07 ±0.65
Positive emotionality	3.30 ± 0.65	3.27 ± 0.37	0.06	3.39 ± 0.52	3.45 ± 0.51	0.08	3.47 ± 0.30	3.35 ± 0.30	0.06	4.44 ±0.72
Negative emotionality	3.82 ± 0.65	3.42 ± 0.38**	0.61	3.83 ± 0.34	3.82 ± 0.35	0.05	3.35 ± 0.42	3.42 ± 0.30	0.08	1.97 ±0.61

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.*

In this way, we expect that early PND treatments for families should yield benefits for the children and their interactions with their parents.

Some authors suggest that differences in infants' affective lives demonstrated at 3–6 months of age by way of mother-infant interaction assessments can provide an index of how the relationship is developing. It has been further suggested that such data can be combined with data describing negative affective experiences and self-regulatory behaviors to predict parent–child attachment quality at 12 months of age (Tronick et al., 1982; Cohn et al., 1991; Braungart-Rieker et al., 2001).

Many women in industrialized countries develop subclinical depression symptoms during the postnatal period, though they do not meet the DSM-5 criteria for PND (Weinberg et al., 2001; Austin et al., 2010; Cooper et al., 2010; Goodman and Tyer-Viola, 2010). The presence of depression symptoms correlates with negative consequences for children including the development of insecure attachment patterns in children, difficulties in cognitive and emotional development, and subsequent social and behavioral difficulties (Field, 1995; Grace et al., 2003; Tronick and Reck, 2009; Cerniglia et al., 2014b).

In a recent study of mothers with PND, Nanzer et al. (2012) found that short-term parent–child treatments with a psychodynamic approach seem to be particularly appropriate for the perinatal period because they are focused on parenthood and on the difficulties faced in relation to the identity change that becoming a parent brings. The authors found that by discussing and modifying distorted maternal representations, treatment can reduce the mother's sense of guilt and depression and anxiety symptoms related to it. By concentrating on the representations connected to maternity, such treatments lead mothers to be more open to investigate their inner world during this transformative phase of life.

Our study has some limitations. Firstly, we did not obtain psychopathological profiles of the fathers through clinical interviews, as was done with the mothers. We also did not assess the children's emotional adaptive functioning profiles nor the parents' couple functioning in terms of relationship satisfaction. Nevertheless, there was strong agreement (Pearson's $r = 0.87$) between mothers and fathers regarding their infants' temperament evaluations on the QUIT, which is at least an indirect sign of no significant marital conflict between parents. Finally, the sample homogeneity in terms of race and geographical origin does not enable wide generalizations of the results to the general population to be made.

Conclusion

The aforementioned limitations notwithstanding, this work adds knowledge to the PND literature by way of demonstrating that the specific short-term psychological treatment involving both parents (which has been considered in the present study) is more effective than treatment involving the mother alone. Additionally, this work provides information about the characteristics of mother-infant and father-infant dyadic interactions in families with a mother diagnosed with PND, in contrast to most previous studies that focused on assessing the stability or changes in psychopathological symptoms.

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Children's mental representations with respect to caregivers and post-traumatic symptomatology in Somatic Symptom Disorders and Disruptive Behavior Disorders

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Introduction: In line with literature, the quality of adult–infant interactions and mental representations of the caregivers play an essential role in influencing the children's well-being. Many studies focused the attention on the role of attachment for a better evaluation of child psychopathological outcomes. The flexibility of the child's attachment model gives the opportunity to parents to be helped in modifying their own caregiving quality, encouraging the reflection on the children's state of mind with respect to attachment. The aims of this study were to evaluate: (1) the attachment models in young patients diagnosed with Disruptive Behavior Disorders (DBDs) and Somatic Symptoms Disorders (SSDs); (2) the levels of post-traumatic symptomatology; (3) the association between the attachment models and post-traumatic symptomatology.

Methods: Forty Italian patients, aged from 8 to 15, recruited at Gaslini Paediatric Hospital of Genoa, previously diagnosed with SSD ($N = 20$) and DBD ($N = 20$) were assessed using the Child Attachment Interview (CAI), the Separation Anxiety Test (SAT), the Trauma Symptom Checklist for Children (TSCC-A). Socio-demographic data were collected.

Results: In both the clinical samples, the findings on the distribution of attachment models showed a significant presence of insecure attachment with respect to both parents in more than a half of the patients and high levels of disorganized attachment. No significant differences between DBD and SSD samples were found on post-traumatic symptomatology (Post-Traumatic Stress and Dissociation). Significant differences were found on Depression, Anxiety, and Fantasy subscales.

Discussion: This study can provide a detection of dysfunctional aspects in clinical populations. The findings suggest that the quality of the attachment to parents may be a fundamental element to better assess SSD and DBD in children and adolescents. Clinical implications of this study aimed at improving parental caregiving are highlighted.

Keywords: mental representations, post-traumatic symptomatology, parent–child relationship, disorganized attachment, Somatic Symptom Disorder, Disruptive Behavior Disorder

Introduction

One of the widely documented findings on child psychopathology is the consistent relation between the quality of parental caregiving and child psychopathological outcomes in terms of externalizing as well as internalizing problems (Campbell et al., 2010; Manongdo and García, 2011; Wang et al., 2013). Studies have found empirical support to the most influential theories of etiological contributors to child psychopathology, considering three main dimensions (Lecompte and Moss, 2014; Yap and Jorm, 2015): (1) parental aspects, e.g., parenting style and parental interaction; (2) child characteristics, e.g., temperament, neurobiological aspects; (3) attachment relationship quality.

The extensive research on attachment provides a scientific foundation for positing relational as well as biological contributors to many forms of child psychopathological outcomes as well as their association with parent–child relationship and parental qualities of care, such as availability, or neglect, rejection, etc. In line with the growing literature on the neurobiological correlates of attachment, the links among parental maladaptive caregiving, children's attachment disorganization, and psychopathological outcomes, are current objects of investigation.

Early attachment experiences have a long-term impact on the child's mental health because the emotional and behavioral regulatory patterns developed within the parent–child relationship influence the way children express their emotions and behaviors (Groh et al., 2012). Caregivers guide their children in exploring emotions and thoughts, thereby assisting them in the organization of their emotional experience, and in the development of social abilities (Thompson, 2008). Moreover, parent–child interactions shape children's 'Internal Working Models' (IWMs), defined as script-like representations of secure base experience (Bowlby, 1982). Attachment patterns are adaptive responses to a caregiving environment and are designed to promote the child's safety.

It is attested that positive aspects of parenting, such as warmth, positive involvement, and secure child–parent attachment are linked to psychological well-being and positive adaptation of the child (Boeldt et al., 2012). Studies have shown that children who have experienced supportive and sensitive care and positive interactions with their parents are more likely to develop a secure attachment (Cyr et al., 2010; Dubois-Comtois et al., 2011, 2013). They are also more socially adapted and tend to use more effective emotion regulation strategies than their insecure peers (Easterbrooks et al., 2012). Other studies have found that the parents' ability to manage the child's behavior while responding in an emotionally attuned way is associated with lower levels of child negative behavioral and more positive socio-emotional outcomes (Mikulincer and Shaver, 2012).

Alternatively, children experiencing unavailable care and involved in disrupted parent–child interactions are more likely to develop insecure attachment and emotional dysregulation (Azak et al., 2012). It is attested that experiences of neglectful and frightening care in childhood can be considered chronic interpersonal traumas. These experiences leave the child with little possibility of attaining affective security (Carpenter and Chung, 2011) because, in these situations, the caregiver is often both the source of alarm and the one who should be providing comfort. These conditions compromise the child's ability to predict parental behavior and to develop his/her sense of efficacy. Among these insecure attachment patterns, the disorganized one is considered to be the most at-risk for developmental psychopathology (Solomon and George, 2011). Children showing a disorganized attachment are unable to successfully use their caregivers to regulate emotion and behavior, having experienced traumatic states, such as frightening and/or frightened behavior in their distressed caregivers (Lyons-Ruth and Jacobvitz, 2008; Scott et al., 2011).

The relationship between attachment disorganization and dissociative symptomatology is consistent throughout the lifespan (West et al., 2001; Haltigan and Roisman, 2015). Researchers have reported three main frequent elements in children with disorganized attachment (Hesse and Main, 2000; Liotti, 2011): (1) the collapse of the controlling strategies; (2) the reactivation of the disorganized IWM in the form of bizarre and contradictory behaviors; (3) the possibility to be caught in dissociative experiences. Moreover, literature shows that multiple exposures to trauma and ruptures of attachment relationships are associated with *post-traumatic symptoms*, including difficulties in the regulation of affect and behavior, anger, anxiety, depression, post-traumatic stress, dissociation and somatization (Putnam, 1997; Dutra et al., 2009; Kugler et al., 2012; Zaccagnino et al., 2015).

While literature on the influence of quality of parental care on child development and psychopathology in infancy and childhood is widespread, the investigation of attachment relationships in middle childhood (usually aged 8–12 years-old) and early adolescence (13–15 years-old) shows inconsistent data. Middle childhood is a particularly challenging period in which parental caregiving is subject to numerous transformations. In this period, parents have to face challenges arising from both maturational changes, and from new social demands (Collins et al., 2005). According to Collins et al. (2005), "these changes inevitably alter the amount, kind, content, and significance of interaction between parents and children" (p. 73). The most important changes are due to: (1) the growth in knowledge and in cognitive competences in children, (2) the expansion of social networks and the new value of relationships with peers (Kerns and Richardson, 2005). However, it is attested that, in middle childhood, the perception of parents as sources of both emotional support and instrumental help remains typically stable during this age.

Studies on attachment during middle childhood and early adolescence confirm that secure attachment is associated with greater resilience and lower levels of internalizing and externalizing problems (Fearon and Belsky, 2011; Groh et al., 2012). On the contrary, attachment disorganization and controlling strategies are linked to higher levels of anxiety and maladaptive socio-emotional functioning (Goldwyn et al., 2000; Moss and St-Laurent, 2001; Moss et al., 2006). As Moss et al. (2006) stated: "there is still considerable ambiguity concerning associations between attachment and behavior problem risk,

particularly with respect to the role of different insecure classifications in predicting level and type of problem behavior. This is particularly true of middle childhood, a period during which fewer studies have been conducted and in which none have used a comprehensive self-report measure of behavior problems" (p. 428).

Several aspects could explain the paucity of studies on middle childhood (Kerns, 2008). First, attachment in middle childhood can be investigated using narratives [e.g., the Child Attachment Interview (CAI)], projective tests [such as the Separation Anxiety Test (SAT)] and questionnaires (such as the Security Scale). These measures capture different attachment dimensions (e.g., representations, perceptions, behaviors). Second, another source of inconsistent data in literature is the use of perceptions of child behavior from their significant adults (e.g., mother, teacher). Studies have shown that external observers may underestimate the internalizing symptoms because of the children's reluctance to share these problems; or, on the contrary, they may overestimate externalizing symptoms (Youngstrom et al., 2000). Third, another critical aspect is that those measures considered to be appropriate during the latter half of middle childhood may not be equally sensitive and valid at younger ages, and vice versa. Finally, several attachment measures fail to catch attachment disorganization, the attachment pattern which is more capable to predict subsequent psychopathological outcomes. For these reasons, a multi-level assessment becomes particularly important for the detection of psychopathological outcomes in middle childhood.

In summing up, the attachment framework has the potential to give further understanding of the relationship between interpersonal trauma and psychopathology in the middle childhood (Fowler et al., 2013). The purpose of this study is to investigate attachment representations and post-traumatic symptoms in two groups of children: children with an *internalizing* problem, Somatic Symptom Disorder (SSD); and children with an *externalizing* problem, Disruptive Behavior Disorder (DBD). SSD is characterized by multiple and variable physical symptoms without demonstrable pathophysiological processes, accompanied by thoughts, feelings, and unusual behaviors in response to symptoms. Neurologic symptoms that are not identified by a clear organic cause, as well as psychogenic headaches and generalized pain are included in this category (American Psychiatric Association [APA], 2013). Literature has shown that this psychopathological disorder is associated with insecure attachment in childhood, especially with Insecure-Resistant attachment style (Waller et al., 2004; Kozlowska and Williams, 2009). Moreover, it has been sustained that disorganized attachment is moderately associated with internalizing symptoms (Borelli et al., 2010; Brumariu and Kerns, 2010; Madigan et al., 2013). DBD includes Oppositional-Defiant Disorder and Conduct Disorder, and involves several problematic behaviors and antisocial activities (American Psychiatric Association [APA], 2013). It is associated with Avoidant attachment style (DeKlyen and Greenberg, 2008; Fearon et al., 2010; Fearon and Belsky, 2011). Other research findings have indicated the role of attachment disorganization in predicting externalizing problems in infancy and middle childhood (Green et al., 2007; Bureau et al., 2009; Borelli et al., 2010).

The objectives of the present study are:

(1) To evaluate the attachment representations with respect to parents in two middle childhood and early adolescence risks samples. Our hypotheses are to find*: (a) an over-representation of Insecure and Disorganized attachment in the overall sample; (b) an over-representation of Preoccupied attachment in SSD subjects than in DBD subjects; (c) an over-representation of Dismissing attachment in DBD subjects than in SSD subjects.*
(2) To evaluate post-traumatic symptomatology in these two groups of clinical samples. Our hypotheses are that *compared to DBD sample, SSD sample would show marked levels of post-traumatic symptomatology, in areas like Anxiety, Depression, Anger, Post-Traumatic Stress, and Dissociation*.
(3) To investigate the relation between attachment models and post-traumatic symptomatology. Our hypothesis is that *subjects with Disorganized attachment would report higher levels of post-traumatic symptomatology.*

Materials and Methods

Participants

The participants were 40 children and adolescents, previously diagnosed with SSDs ($n = 20$) and DBDs ($n = 20$), according to DSM 5 criteria (American Psychiatric Association [APA], 2013) by three child mental health specialists. The present study adopted the following *exclusion* criteria: (a) diagnosis of any psychotic disorder and/or (b) mental retardation, (c) drug treatment or psychotherapeutic treatment. Inclusion criteria were the age between 8 and 15, and fluency in the Italian language.

All the participants were Italian, born and living in the North–West of Italy. SSD participants were 50% female and their average age was 11.99 (SD = 2.25). DBD participants were 20% female and their average age was 11.35 (SD = 1.90). 80% of SSD and 75% of DBD subjects were living with both parents. 25% of SSD mothers and 15% of SSD fathers had a college degree. Similarly, 20% of DBD mothers and 10% of DBD fathers had a college degree. The socio-economic status (SES) of the samples was similar: in both groups 65% of the parents had a SES between 15000 and 36000 euros.

Measures

Child Attachment Interview (Target et al., 2003) is a semi-structured interview designed to assess the youth's mental representations with respect to their parental attachment figures. The youth is asked to describe relationship qualities with mother and father (e.g., "Can you tell me three words to describe your relationship with your mum, what it's like to be with her?"), what happens when the parent gets angry with the youth, when the youth is ill, when hurt and when upset, and to provide specific examples of each scenario. It is conceptually based on the Adult Attachment Interview (AAI;

George et al., 1985). The interview is videotaped and transcribed verbatim.

The CAI coding and classification system comprises of different subscales, all designed to assess the child's overall current state of mind with respect to attachment, as reflected in both narrative and non-verbal behavior. The subscales include emotional openness, balance of positive and negative reference to attachment figures, Use of Examples, Involving Anger, Idealization, Dismissal, Resolution of Conflicts, and Overall Coherence. A score between 1 and 9 is assigned for each of the scales, based on a careful analysis of the narrative. According to the scoring on these subscales, the child's attachment classification with respect to each caregiver is established, on "two way" classification (Secure-Insecure), "three way" classification (Secure, Dismissing, Preoccupied) and/or "four way" classification (Secure, Dismissing, Preoccupied, Disorganized). Each youth is assigned to one attachment classification for each parent.

This interview has previously been used with clinical and non-clinical populations (Target et al., 2003). High test–retest reliability of both scale scores and attachment classifications was demonstrated 3 months (α's 0.74–1.00) and 1 year later (α's 0.72–0.79). Internal consistency of the scale scores (α's ranged from 0.84 to 0.92 for two-way) inter-rater reliability (0.92 for two-way) and validity of the measure have been determined (Target et al., 2003; Shmueli-Goetz et al., 2008). CAI classifications correlated with the child's attachment security as measured in the SAT, maternal AAI classification and measures of social functioning (Shmueli-Goetz et al., 2008). CAI classifications are not related to age, sex, SES, ethnicity, verbal IQ, expressive language ability or whether the child lives with one parent or two (Target et al., 2003).

In this study, the interviews were separately coded by two independent coders who were trained by Shmueli-Goetz et al. (2008), and had obtained reliability certification. Coefficient kappa was calculated as an estimate of agreement. For two-way classifications with respect to the mother (Secure- Insecure) the coders' agreement was 91.6% ($\kappa = 0.79$, $p < 0.00$). For two way classifications with respect to the father, the coders' agreement was 92,3% ($\kappa = 0.81$, $p < 0.00$).

Separation Anxiety Test (Klagsbrun and Bowlby, 1976; Attili, 2001) is a semi-projective test for children and adolescents designed to assess children's responses to scenes depicting separations from their parents. It consists of six pictures, which were labeled as "mild" or "severe" separations on the basis of the existing scoring system. The examiner describes what happens before each separation, and then follows up with questions about what the pictured child feels, why the child feels that way, and what the child will do. The pictures are gender-based. The child's responses to the SAT are audiotaped and transcribed verbatim.

In this study, the procedure used to code SAT is the Attili (2001) coding system. A scoring ranging from −2 to +2 is attributed to each of the following eight subscales: Attachment, Loss of Self-esteem, Hostility, Trust himself, Avoidance, Anxiety, Anguish, and Confusion. On the basis of the scorings on these subscales, one of the following attachment classifications is established: Secure, Ambivalent-Anxious, Anxious-Avoidant, Disorganized, and Confused attachment.

The SAT is widely used and has good psychometric properties, including convergent validity and discriminant validity, internal consistency, and predictive validity (Attili, 2001). To test its concurrent validity, the Attili's modified Italian version of SAT was compared with the test by Klagsbrun and Bowlby (1976). Within a sample of 83 subjects (4.4–9.3 years-old) Spearman test showed a correlation coefficient $r = 0.77$ ($p < 0.00$). Predictive validity calculated on 44 children and their mothers revealed an agreement with maternal attachment representations assessed by the AAI of 87.8% ($\kappa = 0.67$, $p < 0.00$) on the security-insecurity dimensions; and of 80.8% ($\kappa = 0.57$, $p < 0.01$) on the AAI "Unresolved state of mind" and the SAT "Disorganization" (Zaccagnino et al., 2005). Test–retest reliability was calculated on 18 subjects who were tested twice with an interval of 2 months. The Spearman coefficient for the overall scores of the four attachment categories was $r = 0.75$ ($p < 0.00$; Attili, 2001).

In this study, two independent coders scored the test. The coders agreement was of 82% ($\kappa = 0.67$, $p < 0.00$).

Trauma Symptom Checklist for Children (TSCC-A; Briere, 1996) is a 44-item child-report evaluating the post-traumatic symptomatology of children between 8 and 16 years-old. The detection of a cluster of psychological consequences that might have been triggered by traumatic events, such as physical and sexual abuse, major loss, peer-to-peer bullying, and experiencing the ravages of natural disaster is studied. The child is asked to score responses on a four-point Likert Scale ranging from 0 to 3. Two validity scales (Under-response and Hyper-response) and five clinical scales (Anxiety, Depression, Anger, Post-Traumatic Stress, and Dissociation) are obtained.

The Anxiety scale includes items that measure the level of the child's generalized anxiety, hyperactivity, worries, and fear. High scores would reveal either anxiety or hyperactivity problems related to post-traumatic stress disorder. The Depression scale consists of items pertaining feelings of sadness, unhappiness, loneliness, etc., while the Anger scale is made up of items detecting feelings, thoughts and behavior expressing anger; high scores would show the presence of aggressive and hostile behaviors. The items of the Post-Traumatic-Stress scale are referred to specific post-traumatic symptoms such as intrusive thoughts, sensations and memories of early sorrowful events that can cause either anxious distraction or irritability in the children. The Dissociation scale has two subscales: Fantasy and Overt Dissociation. This scale captures the possible dissociative symptomatology; high scores would display diminished sensitiveness toward the environment, emotional detachment and the tendency to remove any affective aspect at cognitive level.

The questionnaire has been translated and validated in Italian (Di Blasio et al., 2011). It has good psychometric properties including convergent and discriminant validity (Lanktree et al., 2008), internal consistency and predictive validity (Sadowski and Friedrich, 2000). In particular, the instrument demonstrates a good level of validity (range from 0.55 to 0.88) and each scale shows adequate internal reliability (average $\alpha = 0.85$).

Procedure

Recruitment of the samples was carried out at Gaslini Hospital of Genoa (Italy). The study was previously approved by the Gaslini (IRCSS) Ethics Committee and data was collected for a whole year (2014). All participants and their families were informed about the aims and the procedures of the study. They submitted their written informed consent and were advised about their option of withdrawal at any time. The child's assessment was conducted in a private room at the hospital and the duration of a single meeting was about 1 h and 15 min; in the same meeting in another room, parents were answering questions to collect data on socio-demographic variables. At the end of the assessment, we offered a report with a synthesis of the outcomes of each measure to the participants who completed the whole procedure. None of the children was in any kind of psychotherapeutic treatment or drug treatment at the time of the study. No case of dropout was registered.

Participation was voluntary and data was kept confidential by replacing the participants' names with an alphanumeric code. All procedures and materials complied with the official directions established by the American Psychological Association. This study was part of a larger research project that investigates family and individual characteristics in child psychopathology.

Statistical Analysis

The data was analyzed using the Statistical Package for the Social Science (SPSS, Version 21.0; IBM Corp., Armonk, NY, USA). Demographic variables were described using descriptive statistics (frequencies and percentages for the categorical variables, and mean and standard deviation for the continuous variables). Frequency analysis was used to test nominal and categorical variable distribution; the chi-square test and the Fisher exact test were used to test nominal and categorical variables; the independent sample test was used to compare the means in two independent samples. Results were considered statistically significant when 'p' was ≤ 0.05.

Results

Preliminary analyses were addressed to determine the possible presence of significant differences between the two groups on the socio-demographic variables. No significant differences were found between SSD and BDB samples, with respect to the socio-demographic variables of 'age,' 'sex,' 'type of family' (participants living with both parents, parents divorced, a parent deceased, etc.), 'SES,' 'parent's age,' and 'parent's educational level' (see **Table 1**). Only the 'family composition' (number of components in the family) showed marginally statistically differences between the two groups. Specifically, BDB sample consisted of more only child (50%) than SSD sample (15%; Fisher Exact Test, $p = 0.06$).

Attachment Representations with Respect to Parents in SSD and DBD Samples

In the evaluation of the attachment representations in these two middle childhood and early adolescence risk samples, we aimed at verifying: (1) the presence of an over-representation of Insecure and Disorganized attachment in the overall sample; (2) the presence of an over-representation of Preoccupied attachment in SSD subjects than in DBD subjects; (3) the presence of an over-representation of Dismissing attachment in DBD subjects than in SSD subjects.

In the overall sample of 40 clinical subjects, the majority of children were classified as Insecure with respect to both mother and father (75 and 71.8%, respectively). On the three-way classification (Secure, Dismissing, Preoccupied), a predominance of the Dismissing classification was found (50% for mother and 51.3% for father). The frequency of Preoccupied attachment was of 25% with respect to mother and 20.5% with respect to father. On the four-way classification (Secure, Dismissing, Preoccupied, Disorganized), children classified as Disorganized were 45% with respect to mother and 43.6% with respect to father (see **Table 2**). This high presence of an over-representation of Insecure and Disorganized attachment in the overall sample confirmed our first hypothesis.

As shown in **Table 2**, the concordance of attachment with respect to mother and to father was very high in these samples (96.1%, $\kappa = 0.94$). Only one child was coded as Insecure with respect to mother and Secure with respect to father (5%). On the four-way classification, all children coded as Disorganized with one parent were also Disorganized with the other parent.

Examining the differences between the two clinical groups (see **Table 2**), SSD and BDB samples did not show statistically significant differences in the attachment distribution ($p > 0.68$). Specifically, Preoccupied attachment was not more frequent in SSD subjects than in DBD subjects. In fact, the frequency of

TABLE 1 | Socio-demographic characteristics of the two sample groups (DBD and SSD).

Characteristic	DBD sample ($n = 20$)	SSD sample ($n = 20$)	Independent samples t-test/Fisher's exact test
Mean age in years (SD)	11.35 (1.90)	11.99 (2.25)	$t(38) = -0.97$, $p = 0.34$, *ns*
% Boys	75	50	$F(1,40) = 0.19$, *ns*
%Traditional family	75	80	$F(2,40) = 0.29$, *ns*
% Only children	50	15	$F(4,40) = 0.06$, *ns*
% Middle class (SES = 15000€–36000€)	65	65	$F(3,40) = 1.00$, *ns*
Mother's mean age in years (SD)	47 (14.12)	43 (9.90)	$t(36) = -1.42$, $p = 0.16$, *ns*
% Mother's education (degree)	25	20	$F(5,40) = 0.48$, *ns*
Father's mean age in years (SD)	49 (8.48)	46 (15.56)	$t(34) = -0.74$, $p = 0.46$, *ns*
% Father's education (degree)	15	10	$F(4,40) = 0.75$, *ns*

TABLE 2 | Distribution of attachment classification (four-way) in both samples (DBD and SSD).

	Attachment classification with respect to mother				Attachment classification with respect to father			
Samples	**Secure *n* (%)**	**Dismissing *n* (%)**	**Preoccupied *n* (%)**	**Disorganized *n* (%)**	**Secure *n* (%)**	**Dismissing *n* (%)**	**Preoccupied *n* (%)**	**Disorganized *n* (%)**
DBD ($n = 20$)	4 (20)	5 (25)	2 (10)	9 (45)	5 (25)	5 (25)	1 (5)	9 (45)
SSD ($n = 20$)	4 (20)	6 (30)	1 (5)	9 (45)	4 (21)	6 (31.6)	1 (5.3)	8 (42.1)
Total	8 (20)	11 (27.5)	3 (7.5)	18 (45)	9 (23.1)	11 (28.2)	2 (5.1)	17 (43.6)

Preoccupied attachment with respect to mother was low at 5% for SSD subjects and 10% for DBD subjects. This datum is not in line with our hypothesis of a higher percentage of Preoccupied attachment for SSD subjects. Moreover, we found that the Dismissing attachment was not more frequent in the DBD sample. The frequency of the Dismissing attachment with respect to both mother and father was of 20% for BDB and 30% for SSD sample. This datum is not in line with our expectations of a wider percentage of Dismissing attachment in DBD sample.

Comparing this sample with other clinical samples (Shmueli-Goetz et al., 2008), our findings showed statistically significant differences in the attachment distribution on the four-way ($p = 0.00$) and on the presence of Disorganized attachment pattern ($p = 0.00$). Also comparisons with normative samples (Shmueli-Goetz et al., 2008) attested the presence of statistically significant differences in the attachment distribution on the three-way ($p = 0.00$).

Table 3 reports data on attachment classifications obtained by SAT. As specified in the introduction, the critical period of middle childhood and early adolescence makes the study of attachment a continual challenge in terms of tools. The introduction of another attachment measure, the SAT (Klagsbrun and Bowlby, 1976; Attili, 2001), gives us another lens for analyzing the differences in the attachment distributions of these two clinical samples. In the overall sample of 40 clinical subjects, the two-way attachment distribution (Secure-Insecure) was the following: 52.5% was Insecure and 47.5% Secure. Disorganized attachment was found in 22.5% of the overall sample.

The presence of an over-representation of Insecure and Disorganized attachment in the overall sample confirmed our first hypothesis also with another measure of attachment. However, comparing attachment classifications on CAI and SAT, we found 22.5% of discordance on the two-way classification (Secure-Insecure). This datum suggests the importance of considering the CAI and SAT findings separately, due to the focus on different aspects of attachment.

Also with respect to this attachment measure, no significant differences were found between SSD and DBD samples. Specifically 50% of BDB and 45% of SSD were classified as Insecure. 25% of BDB and 20% of SSD were classified as Disorganized. As reported in **Table 3**, on the SAT subscales, no statistically significant differences were found between the two groups (Fisher's Exact Test, $p = 0.31$).

Post-Traumatic Symptomatology

In the evaluation of post-traumatic symptomatology, we hypothesized the presence of more marked levels of post-traumatic symptomatology in the SSD sample, in the areas of Anxiety, Depression, Anger, Post-Traumatic Stress, and Dissociation.

Considering the overall sample of 40 clinical subjects, children did not reach clinical cut-off on the subscales of post-traumatic symptomatology. Thus, in contrast with our hypothesis, marked levels of post-traumatic symptomatology were not reported by these samples. **Table 4** reports the differences between the two groups (p-values ranging from 0.01 to 0.79). No significant differences emerged on the subscales of Dissociation, Anxiety, and Post-Traumatic Stress. On the contrary, significant differences were found on Depression, Anger, and Fantasy subscales. DBD sample reported significantly higher scores on all these scales than SSD. Comparing these data with the literature (Kugler et al., 2012), our hypothesis that SSD had marked levels of Anxiety and Dissociation was not confirmed.

TABLE 3 | Separation Anxiety Test (SAT's) scores for DBD and SSD samples.

SAT subscales	DBD sample ($n = 20$) Mean (SD)	SSD sample ($n = 20$) Mean (SD)	Independent samples t-test
Attachment	4.35 (2.37)	3.50 (2.37)	$t(38) = 1.13$, $p = 2.64$
Loss of self-esteem	−0.30 (0.73)	−1.00 (1.65)	$t(38) = 1.73$, $p = 0.09$
Hostility	−0.30 (0.73)	−0.25 (0.55)	$t(38) = -0.24$, $p = 0.81$
Trust himself	1.00 (1.78)	1.00 (1.86)	$t(38) = 0.00$, $p = 1.00$
Avoidance	−2.20 (2.24)	−2.00 (2.97)	$t(38) = -0.24$, $p = 0.81$
Anxiety	0.75 (0.64)	0.75 (0.79)	$t(38) = 0.00$, $p = 1.00$
Anguish	−0.40 (0.82)	−0.10 (0.45)	$t(38) = -1.43$, $p = 0.16$
Confusion	−0.40 (1.05)	−0.40 (1.05)	$t(38) = 0.00$, $p = 1.00$

TABLE 4 | Trauma Symptom Checklist for Children (TSCC's) scores for DBD and SSD samples.

TSCC subscales	DBD sample ($n = 20$) Mean (SD)	SSD sample ($n = 20$) Mean (SD)	Independent samples t-test
Anxiety	53.00 (12.04)	50.15 (9.91)	$t(38) = 0.82$, $p = 0.42$
Depression	54.95 (11.14)	47.95 (9.05)	$t(38) = 2.18$, $p = 0.03$*
Anger	60.10 (14.10)	48.85 (10.61)	$t(38) = 2.85$, $p = 0.01$*
Post-traumatic stress	54.15 (13.59)	48.45 (10.52)	$t(38) = 1.48$, $p = 0.15$
Dissociation	51.80 (8.53)	48.60 (7.63)	$t(38) = 1.25$, $p = 0.22$
Overt dissociation	50.55 (8.00)	49.90 (7.71)	$t(38) = 0.26$, $p = 0.79$
Fantasy	52.90 (10.32)	46.35 (8.41)	$t(38) = 2.20$, $p = 0.03$*

*$p < 0.05$.

Attachment and Post-Traumatic Symptomatology

In the evaluation of the relation between attachment and post-traumatic symptomatology, we were interested in verifying whether subjects with Disorganized attachment would present higher levels of post-traumatic symptomatology. Disorganized attachment was associated with some subscales of post-traumatic symptomatology (p-values ranging from 0.00 to 0.86; see **Tables 5** and **6**). Specifically, in the BDB sample, the presence of Disorganized attachment with respect to mother has been significantly linked to higher levels of Overt Dissociation ($p = 0.00$). In the SSD sample, the presence of Disorganized attachment with respect to mother has been significantly linked to higher levels of Anger ($p = 0.02$). As shown in **Table 4**, on the other subscales, the presence of Disorganized attachment would suggest higher levels of post-traumatic symptomatology, but it is not statistically significant. Findings on the relationship between attachment Disorganization with respect to father and post-traumatic symptomatology showed similar results (see **Table 6**).

Finally, we examined the associations between SAT attachment classifications (in terms of organized attachment patterns or disorganized attachment patterns) and post-traumatic symptomatology. Findings showed significant differences only in the Dissociation subscale ($p = 0.04$) and in the Over dissociation subscale ($p = 0.00$).

Specifically, among the DBD subjects, the presence of Disorganized attachment has been significantly linked to higher levels of Overt Dissociation ($p = 0.03$). Among the SSD subjects, no significant differences have been reported (see **Table 7**).

Discussion

Attachment framework has produced a solid research on the association among parenting, parent–child interaction and child development. However, a need to extend research to the middle childhood and early adolescence is a current challenge. This study aimed at adding further evidence to the complex influence of

TABLE 5 | Relations between attachment classifications to mothers using CAI and post-traumatic symptomatology in the two clinical samples.

	Attachment classifications to mothers (four way)					
	DBD sample ($n = 20$)		SSD sample ($n = 20$)		t-test DBD sample	t-test SSD sample
TSCC subscales	Organized model	Disorganized model	Organized model	Disorganized model		
Anxiety						
Mean (SD)	54.27 (13.30)	51.44 (10.88)	46.45 (8.95)	54.67 (9.55)	$t(18) = 0.51$, $p = 0.61$	$t(18) = -1.98$, $p = 0.06$
Depression						
Mean (SD)	54.27 (13.81)	55.78 (7.40)	47.09 (11.27)	49.00 (5.77)	$t(18) = -0.29$, $p = 0.77$	$t(18) = -0.46$, $p = 0.65$
Anger						
Mean (SD)	60.64 (15.43)	59.44 (13.19)	44.18 (8.13)	54.56 (10.86)	$t(18) = 0.18$, $p = 0.86$	$t(18) = -2.44$, $p = 0.02$*
PTS						
Mean (SD)	53.36 (16.22)	55.11 (10.40)	48.00 (8.90)	49.00 (12.77)	$t(18) = -0.28$, $p = 0.78$	$t(18) = -0.20$, $p = 0.84$
Dissociation						
Mean (SD)	48.64 (7.34)	55.67 (8.65)	45.64 (8.38)	52.22 (4.87)	$t(18) = -1.97$, $p = 0.06$	$t(18) = -2.08$, $p = 0.06$
Overt dissociation						
Mean (SD)	46.18 (5.19)	55.89 (7.74)	47.45 (8.08)	52.89 (6.45)	$t(18) = -3.35$, $p = 0.00$**	$t(18) = -1.63$, $p = 0.12$
Fantasy						
Mean (SD)	53.45 (52.2)	52.22 (10.38)	43.82 (9.18)	49.44 (6.58)	$t(18) = 0.26$, $p = 0.80$	$t(18) = -1.54$, $p = 0.12$

*$p < 0.05$; **$p < 0.00$.

TABLE 6 | Relations between attachment classifications to fathers using CAI and post-traumatic symptomatology in the two clinical samples.

	Attachment classifications to fathers (four way)					
	DBD sample ($n = 20$)		SSD sample ($n = 20$)		*t*-test DBD sample	*t*-test SSD sample
TSCC subscales	Organized model	Disorganized model	Organized model	Disorganized Model		
Anxiety						
Mean (SD)	54.27 (13.30)	51.44 (10.88)	46.45 (8.95)	54.50 (10.20)	$t(18) = 0.51$, $p = 0.61$	$t(17) = -1.83$, $p = 0.08$
Depression						
Mean (SD)	54.27 (13.81)	55.78 (7.40)	47.09 (11.27)	48.38 (5.83)	$t(18) = -0.29$, $p = 0.77$	$t(17) = -0.29$, $p = 0.77$
Anger						
Mean (SD)	60.64 (15.43)	59.44 (13.19)	44.18 (8.13)	54.63 (13.64)	$t(18) = 0.18$, $p = 0.86$	$t(17) = -2.31$, $p = 0.03$*
PTS						
Mean (SD)	53.36 (16.22)	55.11 (10.40)	48.00 (8.90)	49.13 (13.64)	$t(18) = -0.28$, $p = 0.78$	$t(17) = -0.29$, $p = 0.83$
Dissociation						
Mean (SD)	48.64 (7.34)	55.89 (7.74)	45.64 (8.38)	51.50 (4.66)	$t(18) = -1.97$, $p = 0.06$	$t(17) = -1.78$, $p = 0.09$
Overt dissociation						
Mean (SD)	46.18 (5.19)	55.89 (7.74)	47.45 (8.08)	52.75 (6.88)	$t(18) = -3.35$, $p = 0.00$**	$t(17) = -1.50$, $p = 0.15$
Fantasy						
Mean (SD)	53.45 (10.38)	52.22 (10.84)	43.82 (9.18)	48.13 (5.62)	$t(18) = 0.26$, $p = 0.80$	$t(17) = -1.17$, $p = 0.26$

*$p < 0.05$; **$p < 0.00$.

TABLE 7 | Relations between attachment classifications using SAT and post-traumatic symptomatology in the two clinical samples.

	Attachment classifications on SAT					
	DBD sample ($n = 20$)		SSD sample ($n = 20$)		*t*-test DBD sample	*t*-test SSD sample
TSCC subscales	Organized model	Disorganized model	Organized model	Disorganized model		
Anxiety						
Mean (SD)	54.27 (12.65)	49.20 (10.21)	52.00 (10.02)	42.75 (5.31)	$t(18) = 0.81$, $p = 0.43$	$t(18) = 1.76$, $p = 0.09$
Depression						
Mean (SD)	54.20 (12.11)	57.20 (8.23)	49.13 (9.72)	43.25 (2.99)	$t(18) = -0.51$, $p = 0.61$	$t(18) = 1.17$, $p = 0.26$
Anger						
Mean (SD)	59.20 (13.37)	62.80 (17.51)	50.00 (11.16)	42.25 (7.41)	$t(18) = -0.48$, $p = 0.63$	$t(18) = 0.97$, $p = 0.35$
PTS						
Mean (SD)	55.33 (13.58)	50.60 (14.52)	49.19 (11.36)	45.50 (6.40)	$t(18) = 0.66$, $p = 0.51$	$t(18) = 0.62$, $p = 0.54$
Dissociation						
Mean (SD)	49.80 (7.29)	57.80 (9.96)	47.81 (8.06)	51.75 (5.25)	$t(18) = -1.95$, $p = 0.07$	$t(18) = -0.92$, $p = 0.37$
Overt dissociation						
Mean (SD)	48.33 (6.05)	57.20 (10.08)	48.50 (7.63)	55.50 (5.80)	$t(18) = -2.40$, $p = 0.03$*	$t(18) = -1.70$, $p = 0.11$
Fantasy						
Mean (SD)	52.33 (10.57)	54.60 (10.50)	46.81 (9.15)	44.50 (4.93)	$t(18) = 0.42$, $p = 0.68$	$t(18) = 0.48$, $p = 0.64$

*$p < 0.05$.

parental care on child psychopathological functioning in this age group. The aim was to evaluate children's mental representations with respect to caregivers and post-traumatic symptomatology in two clinical samples aged 8–15 years-old: the first sample was diagnosed as having an internalizing disorder, the SSD, and the second sample was diagnosed as having an externalizing disorder, the DBD.

These samples showed a particularly interesting attachment distribution. Considering the three-way classification, which refers to the Secure, Dismissing and Preoccupied attachment, we found that Secure attachment representations with respect to mother were only 25% (28.2% with respect to father). On the contrary, Dismissing attachment representation with respect to mother was found in 50% of the samples (51.3% with respect to father). The Preoccupied classification with respect to mother was found in 25% of subjects (20.5% with respect to father). The latter attachment classification seems to be in line with the main literature assessing attachment in clinical samples

while the Dismissal pattern was over-represented (Shmueli-Goetz et al., 2008; Fearon et al., 2010; Fearon and Belsky, 2011; Lecompte and Moss, 2014). Considering Disorganized attachment (with the four-way classification), we found that children with Disorganized attachment were 45% with respect to mother and 43.6% to father.

Our first hypothesis, that our risk samples were more frequently classified with Insecure and Disorganized attachment to caregivers, has been largely confirmed. This datum is in line with other studies sustaining that insecure attachment is over-represented in clinical samples, especially the Dismissing pattern (Shmueli-Goetz et al., 2008). Examining literature, in fact, it is widely attested that in normative samples the attachment distribution using CAI is around 66–64% of Secure, 30% of Dismissing, 4–6% of Preoccupied, while in clinical samples it is around 77% of insecure with respect to both mother and father, with a predominance of the Dismissing strategy (56 and 62%, respectively; Shmueli-Goetz et al., 2008). In fact, we have verified that are statistically significant differences between our sample and the Shmueli-Goetz et al. (2008) sample, where only under 10% was coded as Disorganized with at least one parent. However, comparing samples from different studies contain several limitations due to the fact that: (1) "clinical" samples are often composed by a heterogeneous group of children with different psychopathological conditions (DeKlyen and Greenberg, 2008; Shmueli-Goetz et al., 2008; Fearon et al., 2010; Fearon and Belsky, 2011); (2) in other studies focused on internalizing and externalizing disorders, attachment is not measured with CAI, but mostly with other self-report measures (e.g., Inventory of Parent and Peer Attachment; Armsden and Greenberg, 1987).

We would suggest from this datum that the evaluation of attachment models in specific psychopathological conditions is particularly useful to add information on attachment representations in middle childhood. Our distribution seems to attest the presence of a *severe clinical sample*. However, considering the attestation of the links between attachment disorganization and subsequent psychopathological outcomes, and observing findings from other studies (with lower levels of disorganization; e.g., Green et al., 2007; Shmueli-Goetz et al., 2008; Bureau et al., 2009; Borelli et al., 2010; Brumariu and Kerns, 2010; Madigan et al., 2013), further investigation on specific psychopathological conditions would be favorable.

Another surprising finding concerns the differences between the two clinical samples. Even though psychological disease is expressed in different ways, through *body* in SSD and through *acts* in DBD, these psychopathologies presented a greater similarity as compared to the state of mind with respect to attachment. Differently from the literature (Waller et al., 2004; Kozlowska and Williams, 2009), especially in SSD sample, Preoccupied attachment to caregiver was underestimated. However, it is notable that Shmueli-Goetz et al. (2008) and Zaccagnino et al. (2015) considered the low percentage of the Preoccupied classification as possibly linked to the difficulties in identifying elements of attachment preoccupation using narratives in middle childhood. Dismissing attachment had similar frequency in both samples (25% in BDB sample and 30% in SSD sample on the four-way classification). This datum is not in line with our expectations of a wider percentage of dismissing attachment among DBD subjects. In fact, the same over-representation of Dismissing attachment among SSD subjects remains to be further addressed. Nevertheless, as previously underlined, the percentage of Dismissing attachment is still high among our participants.

Due to the critical period of middle childhood and early adolescence – which the study of attachment continues to prove a challenge in terms of tools – we used a projective measure to assess attachment representation, the SAT. Findings have been in line with those of CAI, showing a wide presence of attachment insecurity in the two clinical samples. However, comparing attachment classifications on CAI and SAT, we found 22.5% of discordance on the two-way classification (Secure-Insecure). This datum showed the importance of considering the CAI and SAT findings separately, due to the focus on different aspects of attachment. In fact, it is notable that SAT is not a measure of attachment classification itself, but it captures separation anxiety from caregivers. Moreover, the classification system we used in this study (Attili, 2001) was not comparable with other SAT scoring systems where the Disorganized attachment was not identified.

Literature has indicated that attachment disorganization in clinical samples is linked to dissociative symptomatology (Cassidy and Shaver, 2008; Liotti, 2011). Thus, we were interested in exploring the association between attachment disorganization and post-traumatic symptomatology in these two clinical samples. Results showed that DBD subjects with Disorganized attachment showed significantly higher levels of Overt Dissociation than DBD subjects with other attachment patterns. SSD subjects with Disorganized attachment showed significantly higher levels of Anger. On the other aspects of post-traumatic symptomatology, the presence of Disorganized attachment classification is not particularly significant. This datum did not totally confirm our hypothesis, where we expected higher significant differences on the basis of literature (Putnam, 1997; Dutra et al., 2009; Kugler et al., 2012). For example, Kugler et al. (2012) had indicated that SSD sample would report both increased anxiety and marked levels of post-traumatic arousal symptomatology. In our samples, Post-Traumatic Stress and Dissociation did not show significant differences between DBD and SSD samples, while significant differences were found on Depression, Anxiety, and Fantasy subscales. Other studies (Dutra et al., 2009) have suggested that children who have experienced lack of parental affective involvement, may be at a particularly elevated risk for dissociation. Nevertheless, our findings did not indicate high level on dissociation in middle childhood and early adolescence. It is notable, however, that probably the aspects of relational trauma linked to dissociative symptomatology are difficult to capture combining a narratological measure of attachment representations with a self-report measure of the intensity of a perceived symptomatology. Further research to better examine this topic in middle childhood is needed. The same findings were found for the DBD sample using SAT, while in the SSD subjects no significant differences have been found.

These overall findings support that children with severe psychopathological conditions are more likely to have Insecure and Disorganized attachment in middle childhood. Literature shows how these conditions are strictly linked to unavailable care and involved in disrupted parent–child interactions (Azak et al., 2012). Thus, the quality of adult–infant interactions represents a critical context in which child adaptation problems could be evolved, and the attachment representations play an essential role in influencing child psychopathology development. It is also important to note that a mother's insecure attachment style contributes to the understanding of variance in her estimated incompetent parenting, although it has no direct link to disorders in her offspring (Bifulco et al., 2009).

This study also suggests that, in order to better support these kinds of difficult parent–child interactions, it is necessary that intervention programs are addressed not only for the improvement of the parent–child relationship, but also the possible presence of disorganized attachment should be carefully considered. The flexibility of the children's attachment models gives the opportunity to help parents change their own care-giving quality, encouraging reflections on children's state of mind with respect to attachment (Regev and Snir, 2014). Nevertheless, parent management and treatments that are increasingly used in less severely damaged populations, may not be fully effective in severe clinical conditions. In the latter cases, the possible impact of disorganization may open up new important possibilities for specific modes of treatment for these families. Incidence of parental "frightening/frightened" behaviors may be reduced by powerfully reinforcing parental attention on the child in the present and encouraging reflections on children's state of mind with respect to attachment (Solomon and George, 2011).

This work contains some evident limitations. Firstly, the sample size is a methodological limit; a bigger sample size might be useful in order to further elaborate our results. Secondly, this study does not include another measure of child symptomatology, but patients have a previous diagnosis according to DSM 5 criteria (American Psychiatric Association [APA], 2013) carried out by expert child mental health specialists. The measure of post-traumatic symptomatology with a self-report measure is probably not enough to clarify these connections. Thirdly, we have included only assessments of children in our study; considering the potential usefulness to connect child psycho-emotional condition to quality of parental care, further studies need to evaluate parents' attachment states of mind and their psychopathological status. However, these limitations have the potential to encourage future studies on the several aspects we have highlighted.

This pilot study is the first contribution to the analysis of the role of attachment in middle childhood and early adolescence in two typical psychopathological conditions. Our findings support the role of attachment as an underlying construct for understanding child functioning given a number of psychiatric disorders. Further research on attachment disorganization could help improve clinical formulations and etiological models, and might identify a new direction in the field of family intervention programs.

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Emotional availability: theory, research, and intervention

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Attachment theory (Bowlby, 1969) and its limitations are first described. Next, emotional availability (EA; Biringen et al., 1998; Biringen, 2008) is introduced as an expansion upon the original conceptualization of the parent–child attachment relationship. As a construct and as a measure, EA considers the dyadic and emotional qualities of adult–child relationships. EA is predictive of a variety of child outcomes, such as attachment security, emotion regulation, and school readiness. Recently developed programs to enhance adult–child EA are described.

Keywords: emotional availability, attachment, intervention, emotional availability scales, psychology for clinical settings

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Attachment Theory and Research

Bowlby (1969) proposed attachment theory, which posits that the bond between a mother and her infant is based on an emotional connection. Attachment theory also argues that the attachment bond serves an evolutionary purpose, promoting the survival of the vulnerable infant by protecting him from danger and ensuring that his social and emotional needs are met (Bowlby, 1969). When an infant becomes fearful or distressed, his primary attachment figure serves as a source of comfort, and he learns to turn to that person in times of need. Furthermore, as the preference for the primary attachment figure develops, the infant also exhibits stranger anxiety, or fear and mistrust of unfamiliar adults. The emergence of such behaviors serves an evolutionary purpose because it parallels the infant's increasing mobility, thus protecting the infant from potential dangers in the environment. Therefore, the infant uses his mother as a secure base as he explores and learns about his environment, "checking in" with her periodically.

Attachment Styles

Ainsworth (1967) pioneered the first and most widely used measure of attachment, called the Strange Situation Procedure (SSP; Ainsworth et al., 1978), which assesses the attachment style of infants between the ages of 9 and 18 months. The procedure consists of several separation and reunion episodes with the mother, infant, and an adult stranger. The behaviors displayed by the infant during the separations and reunions are used to classify the infant into one of three styles: secure, insecure-avoidant, or insecure-anxious (Ainsworth et al., 1978). Infants with a secure attachment explore in the presence of their mother, protest when she leaves, regulate their emotions successfully during the separation, and greet the mother with joy when she returns. Infants with an insecure-avoidant attachment interact little with their mothers and react minimally when she leaves and returns. Infants with an insecure-anxious attachment explore the toys very little, are highly distressed when their mothers leave, and when mothers return, they approach her but angrily reject her comfort. Later research by Main and Solomon (1990) revealed a fourth attachment classification: disorganized. These infants behave unusually during the SSP, appearing disoriented,

confused, detached, fearful, or angry. Disorganized attachment most often develops in cases of severe neglect, abuse, or domestic violence, but it is also seen in children with developmental disabilities and, less frequently, in normative samples (Cassidy and Shaver, 2008).

Limitations of Attachment Theory and its Measures

Although attachment theory defines a parent–child bond as emotional, its assumptions largely focus on survival behaviors, and its most prominent assessment tool, the SSP, focuses entirely on infant behaviors during a mild stressful situation. However, the bond between a mother and her child certainly extends far beyond these behaviors. This fact is evident upon watching any mother–child pair interact. There are, of course, the predictable behaviors associated with survival-based attachment: infant exploration, periodic "check-ins" throughout the exploration, maternal comforting in distress, infant wariness of strangers, and infant distress upon separation. However, mothers and their infants also share an intense *emotional* connection. When the infant fusses, the mother furrows her brow in genuine concern and immediately looks for a way to remedy the distress; when the mother miraculously reappears from behind her hands in a game of peek-a-boo, the infant is gleefully surprised. These emotional expressions are not accounted for in the traditional attachment account because they extend beyond behaviors associated with separation. Furthermore, they do not only occur in stressful contexts like the separation-reunion paradigms of the Strange Situation. Rather, these emotions are seen in the regular, everyday, including positive and playful, interactions between mothers and their children. Therefore, the emotional connection in a caregiver-child relationship is clearly evident, and, furthermore, a healthy range of emotional expression is important to child development and well-being (Biringen and Easterbrooks, 2012).

Although attachment measures, such as the SSP, assess child behaviors and reactions to a caregiver, they rarely consider how child qualities evoke different behaviors in the caregiver. Each child is born with qualities that can alter how a mother (or father) responds to him. For example, studies suggest that infant irritability can evoke lower levels of sensitivity in the mother, contributing to a higher likelihood of insecure attachment (e.g., Susman-Stillman et al., 1996), and others conducted in the field of adoption show a significant and moderate effect of temperament on promoting children's secure attachment (Lionetti, 2014). Thus, the development of healthy attachment bonds depends on the mother's qualities as well as the child's qualities, including temperament and other evocative effects.

The original conceptualization of attachment focused largely on the relationship between mothers and infants during the first year of life. In subsequent years, attachment theory has been expanded to attachment relationships in childhood (i.e., Waters et al., 1985; Main and Cassidy, 1988; Greenberg et al., 1993), in couples with atypical parental roles such as adoptive parents (Lionetti et al., 2015), in adulthood (i.e., George et al., 1984), and between romantic partners (Tatkin, 2005; Johnson, 2012). However, the assessments used for infants, children, and adults differ significantly in their methods. Furthermore, although attachment theory assumes that an individual's attachment style remains stable across the lifepan, a recent longitudinal study (Groh et al., 2014) found no evidence of continuity from infant attachment classification to adult attachment classification. This lack of continuity could be due to lawful discontinuity (Weinfield et al., 2000), or because of changes in measures. Therefore, no single attachment measure can account for the quality of relationships across the lifespan.

Finally, attachment theory focuses largely on the parent–child relationship, so it does not account for the quality of other relationships in children's lives. For example, children frequently interact with teachers, siblings, babysitters, and friends, and these relationships have an increasing effect on children's lives as they get older. However, viewing all of these significant relationships as attachment *per se* may not be accurate.

Additionally, many family theories emphasize the importance of viewing the family as a dynamic system, with each member affecting the other and the larger system (e.g., Bateson, 1972; Haley, 1976; Whitaker and Bumberry, 1988; Guttman, 1991; Satir et al., 1991). While attachments can and should be viewed from a family systems lens, it becomes difficult to understand the contributions of each family member, when the measures represent the behaviors and/or views of one individual member (e.g., SSP). Thus, attachment theory's focus on the individual's behaviors and/or views limits its potential to assess the wide variety of relationships in children's lives, as well as the complexity of the family as a whole.

Emotional Availability

Emotional availability (EA) refers to the ability of two people to share a healthy emotional connection, and it thus elucidates the emotional and dyadic quality of relationships. It expands upon the behaviors associated with attachment by including the dyadic, emotional, and structural characteristics of a relationship. The dyadic quality of EA considers the perspectives of both the adult and child, rather than prescribing specific behaviors that may be influenced by cultural biases. This characteristic allows it to be observed and measured in any context or culture. Additionally, because EA considers the emotional climate of the relationship, it offers richer information about the relationship. The EA framework also accounts for the adult's ability to provide structure within the relationship by guiding the child's learning and supporting his or her autonomy. Furthermore, EA can be observed across a wide range of child ages, from birth to age 14 (Biringen and Easterbrooks, 2012). Theoretically, the system can also be used beyond this age period.

Although the term "emotional availability" has been used in the field of psychological research since the 1970s (Mahler et al., 1975), a validated measure of the construct was only developed in the last 20 years. The EA assessment, developed by Biringen et al. (1998) and Biringen (2008), consists of six scales, four of which measure the adult's emotions and behaviors, and two of which measure the child side of the interaction. The adult dimensions are sensitivity, structuring, non-intrusiveness, and non-hostility. The child dimensions are responsiveness and involvement. Each

dimension is measured using a Likert-type continuous scale that assigns a score between 1 and 7. Assessing the perspective of both the adult and the child is beneficial, both to reflect that adult–child relationships are bidirectional, as well as to capture any possible differences between the adult and child.

Sensitivity consists of the behaviors and emotions used by an adult to create and maintain a positive, healthy emotional connection with the child. Recent research in neuroscience indicates that infants of sensitive mothers (using the EA system) are more responsive to happy than neutral faces (Taylor-Colls and Fearon, 2015). This finding is consistent with the emphasis of the EA system not only on response to stress but also to enjoyable times.

Structuring refers to the capacity of an adult to support the child's learning and guide him or her toward a higher level of understanding. An optimally structuring adult not only teaches and helps the child, but also permits a degree of autonomy so that the child can learn independently. In order to be successful, the adult must meet the child at his or her current level of understanding and use both verbal and non-verbal strategies to guide the child.

Non-intrusiveness refers to the ability of an adult to follow the child's lead during play and avoid interfering. A non-intrusive adult does not interrupt the child physically or verbally, limits commands, permits the child age-appropriate levels of independence, and withdraws when the child is seeking such independence.

Non-hostility refers to whether or not the adult is able to regulate his or her own negative emotions to avoid expressing these toward the child. A failure to effectively regulate emotions leads to the adult demonstrating covert and/or overt hostility. Covert hostility consists of the less-obvious expression of negative emotions, such as impatience, frustration, and boredom. Overt hostility consists of behaviors such as negative statements toward the child, physical aggression, and threats of separation.

Child responsiveness to the adult and child involvement of the adult encompass the child's degree of EA with the adult. A highly responsive child interacts with the adult when she reaches out and clearly enjoys doing so. A highly involving child invites the adult to join her play and talks to the adult. Both responsiveness and involvement are balanced with the child's desire to pursue autonomy and explore the environment. Furthermore, children who are appropriately involving and responsive rarely connect with the adult through negative emotions and behaviors, such as anxiety, whining, throwing tantrums, or acting out. Thus, the child's side of the relationship is an important clue to overall relationship health, one that is not often available by only observing the parent's side of the relationship.

The six dimensions of EA account for the dyadic quality of parent–child relationships and the variety of behaviors and emotions of this quality. Thus, we argue that adult sensitivity is not the only factor that contributes to the relationship's health. Interestingly, a recent study by Licata et al. (2015) found that child involvement was related to maternal sensitivity and higher left frontal activation of the brain, as measured with the electroencephalogram. However, child responsiveness was related to maternal sensitivity, but not neurological activation. Thus, this study shows the importance of differentiating among EA dimensions, as well as how the complexity of parent–child interactions extends beyond attachment behaviors.

Emotional availability is a broad-based, easily applicable, and user-friendly way to understand a myriad of relationships (Biringen et al., 2014). While all six dimensions of EA are important in the description of the overall quality of the parent–child relationship, the system also summarizes these six qualities and offers a measure of attachment. This measure of attachment is the Emotional Attachment and EA Clinical Screener (EA2-CS). EA2-CS is scored on a 100-point scale, divided into 4 categorical zones (Emotionally Available; Complicated; Detached; and Problematic/Disturbed) that map onto the four attachment categories. Early studies on the EA2-CS show that it is associated with attachment styles, as measured by the Attachment Q-Sort (Baker and Biringen, 2012) and the Diagnostic Classification 0-3 Parent-Infant Relationship Global Assessment Scale (DC 0-3 PIRGAS; Espinet et al., 2013). Recent studies have been testing—through randomized control trials with attachment-based interventions—its contribution in assessing positive parenting in adoptive families (Barone et al., 2015). A paper on the relations between the EA2-CS relations and the Adult Attachment Interview and the SSP is in progress.

Can the Parent Look Good Without the Child?

In a dyadic relationship, the participants influence each other in a bidirectional manner. Sometimes parents are very sensitive and responsive, but the child may not react accordingly. Biringen et al. (1998) argued that, essentially, the parent cannot be considered highly sensitive unless the child is emotionally responsive to him or her. However, parental qualities as well as child qualities are certainly viewed in their own right. A child who avoids a well-meaning, positive mother can be given low scores, while such a mother would show a much higher profile of scores. In two studies on adoptive families, often the child and parent EA scores were quite different (Baker et al., 2015; Barone et al., 2015). In fact, Barone et al. (2015) reported that in 22% of the adoptive dyads each member scored in a different EA2-CS zone from the adoptive mother.

Emotional Availability and Child Outcomes

Emotional availability in parent–child relationships predicts a wide range of child outcomes. First, EA significantly relates to child attachment security, both with parents and professional caregivers (Easterbrooks and Biringen, 2000; Altenhofen et al., 2013).

Additionally, EA has been linked to child emotion regulation. Specifically, in a sample of low-income mother–child pairs, children who experienced higher EA in their relationship demonstrated superior emotional control in a challenging situation (Little and Carter, 2005). Another study found that higher levels of sensitivity predict better regulation of stress responses among highly inhibited children (Kertes et al., 2009).

A longitudinal study of EA (Moreno et al., 2008) found that maternal EA at 15 months predicted child expressive language

abilities and child EA at age two. Additionally, child EA at age two predicted child empathy toward both the mother and other adults at age four (Moreno et al., 2008). Studies on EA in preschool-aged children have demonstrated that higher parent–child EA predicts fewer problems and higher social competence in preschool and during the transition to kindergarten (Biringen et al., 2005; Howes and Hong, 2008). Specifically, in a study by Biringen et al. (2005) higher mother–child EA in the year leading up to kindergarten predicted lower child aggression, victimization, internalizing problems, and externalizing problems during the transition to kindergarten. Furthermore, in a sample of Mexican-heritage families in the U.S., mothers' sensitivity and structuring when the child was three predicted children's pretend play and social competence during preschool (Howes and Hong, 2008). These studies, among many others, have demonstrated that EA is predictive of a variety of child developmental outcomes.

Emotional Availability in Other Relationships

Emotional availability lends itself well to research on a variety of different relationships. First, the construct can easily be applied to relationships in families. Family systems theory (Bateson, 1972; Haley, 1976) views families as dynamic systems in which individuals interact to influence one another and the family as a whole. EA accounts for these dynamic interactions between members in the context of the family system (e.g., mother with child 1, mother with child 2, father with child 1, father with child 2, even mother with father, and so on, Biringen, 2008), albeit at the dyadic levels within the larger family system.

Emotional availability encompasses more than parent–child relationships. For example, a group in Sweden is investigating the therapist-client relationship in terms of EA (Söderberg et al., 2013). Other studies are examining EA in romantic couples (e.g., Derr-Moore, 2015). Recent therapist and couples conceptualizations and versions facilitate this work (cf. Biringen, 2008).

Interventions

Numerous studies using a variety of prevention/intervention approaches have investigated whether EA can be altered; see Biringen et al. (2014) for a systematic review. Most recently, a longitudinal randomized control trial study testing the effectiveness of the Video Feedback Intervention for promoting Positive Parenting and Sensitive Discipline (VIPP-SD; Juffer et al., 2008) in adoptive families found a significant effect of the VIPP-SD on mother–child EA in the first 2 years after adoption (Barone et al., 2015). In a separate study with adoptive families, Baker et al. (2015) used the EA Intervention with group-format distance technology (i.e., Skype) to connect the mothers to the facilitator as well as group members. The study documented enhancement in maternal perceptions as well as observed EA between adoptive mother and child. Both studies demonstrate a growing awareness and promise of evidence-based post-adoption programming and the feasibility of altering EA in relationships where a child's signals may be difficult to interpret.

Additional implementation of the EA Intervention has been reported with low SES and high SES groups using an in-person group format with findings of lower parental stress and/or depressive symptoms, as well as enhanced observed EA (Biringen et al., 2010). The program was also implemented in-person with childcare professionals in a one-on-one coaching context; in this study, the treatment group showed significant improvements in adult–child EA and attachment style as compared to a non-treatment control (Biringen et al., 2012).

An additional program to enhance EA in the family system is called *Love Now, Success Later (LNSL)* and is currently being tested. This program targets couples when mothers are in their third trimester of pregnancy. This program includes a video-based educational component about attachment and EA, as well as mindfulness practice, such as 3-min breathing and kindness practice. The mindfulness practices help individuals regulate negative affectivity and stress during pregnancy and the postpartum period. The goal of LNSL is to build expectant mothers' and fathers' skills that will help them promote a secure attachment and high levels of EA with one another and with the new baby; those who have participated report high levels of engagement and satisfaction. We are interested in whether the program will help regulate the stresses of pregnancy and enhance attachment to the unborn baby as well as prepare couples as a family unit for the challenges of the postpartum period. We are also interested in whether the emphasis on stress regulation through mindfulness practice may lead to babies who are easier to be with (in the sense of crying, feeding, and sleeping).

Conclusion

The field of attachment research acknowledges that there are many important aspects of parent–child relationships. The various dimensions of EA can serve to capture these additional aspects. Including EA as an indicator of the quality of parent–child relationship allows for the behavior of both the parent and child to be measured, with acknowledgment that the view of the parent may not be the view of the child on all occasions. Including this construct in a battery of assessments provides both a measure of parent–child relationship quality as well as a new measure of the attachment. This framework also has been useful in intervention work to promote parent and child well being.

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Methylation of *NR3C1* is related to maternal PTSD, parenting stress and maternal medial prefrontal cortical activity in response to child separation among mothers with histories of violence exposure

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Prior research has shown that mothers with Interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) report greater difficulty in parenting their toddlers. Relative to their frequent early exposure to violence and maltreatment, these mothers display dysregulation of their hypothalamic pituitary adrenal axis (HPA-axis), characterized by hypocortisolism. Considering methylation of the promoter region of the glucocorticoid receptor gene *NR3C1* as a marker for HPA-axis functioning, with less methylation likely being associated with less circulating cortisol, the present study tested the hypothesis that the degree of methylation of this gene would be negatively correlated with maternal IPV-PTSD severity and parenting stress, and positively correlated with medial prefrontal cortical (mPFC) activity in response to video-stimuli of stressful versus non-stressful mother–child interactions. Following a mental health assessment, 45 mothers and their children (ages 12–42 months) participated in a behavioral protocol involving free-play and laboratory stressors such as mother–child separation. Maternal DNA was extracted from saliva. Interactive behavior was rated on the CARE-Index. During subsequent fMRI scanning, mothers were shown films of free-play and separation drawn from this protocol. Maternal PTSD severity and parenting stress were negatively correlated with the mean percentage of methylation of *NR3C1*. Maternal mPFC activity in response to video-stimuli of mother–child separation versus play correlated positively to *NR3C1* methylation, and negatively to maternal IPV-PTSD and parenting stress. Among interactive behavior variables, child cooperativeness in play was positively correlated with *NR3C1* methylation. Thus, the present study is the first published report

to our knowledge, suggesting convergence of behavioral, epigenetic, and neuroimaging data that form a psychobiological signature of parenting-risk in the context of early life stress and PTSD.

Keywords: PTSD, glucocorticoid receptor (*NR3c1*), fMRI, parenting, interpersonal violence, early life stress, epigenetics, methylation

Introduction

Posttraumatic stress disorder (PTSD) is a form of psychopathology that is typically characterized by dysregulation of the hypothalamic pituitary adrenal (HPA) axis. In the face of perceived danger that does not extinguish over time, the HPA axis must produce circulating glucocorticoids in order to mobilize energy to fuel the organism's fight or flight response to traumatic reminders and to regulate its overall stress response. It is known that chronic HPA axis dysregulation that leads to excessive exposure of developing brain areas to glucocorticoids is deleterious to the organism (Sorrells and Sapolsky, 2007).

Hypothalamic pituitary adrenal axis dysregulation can lead to: (a) excessive glucocorticoid secretion in response to stressors (i.e., hypercortisolism), (b) lack of circulating cortisol and diminished reactivity to stressors (i.e., hypocortisolism), as a consequence of the system's depletion or as a protective adaptation to a persistently threatening environment. Both of these possible outcomes are likely determined by multiple factors such as the nature of the traumatogenic event, its onset, duration, and chronicity as well as the onset, duration, and chronicity of the PTSD and its comorbidity.

Several studies have shown that PTSD following acute "single-event" type trauma such as car accidents or natural catastrophes is generally associated with elevated baseline cortisol and high reactivity to trauma-evocative stimuli in the laboratory (Pervanidou et al., 2007). PTSD that develops in the wake of repeated childhood maltreatment and domestic violence, or adult exposures to domestic violence or combat, has been associated with hypocortisolism (Elzinga et al., 2008). This hypocortisolism is observed at baseline, over the diurnal curve and in response to trauma-evocative stimuli in the laboratory (Daskalakis et al., 2013). Whether there are sensitive periods during development during which individuals are more vulnerable to stress-induced HPA axis dysregulation in one direction or the other remains to be established. With this in mind, Yehuda et al. (2000, 2007) have suggested that hypocortisolism is linked to maternal PTSD and transmission of vulnerability for PTSD via fetal programming that renders the infant vulnerable himself to develop PTSD. This hypothesis has stimulated interest in examining the possibility of non-genomic (i.e., epigenetic) transmission of adaptation to traumatogenic environments across generations (Yehuda et al., 2014a).

Researchers have begun to turn their attention to epigenetic factors involved in HPA axis response and adaptation to stressors by studying the methylation status of genes involved in HPA regulation. These genes include the promoter region of *NR3C1* gene coding for the glucocorticoid receptor. Greater methylation has been linked to decreased *NR3C1* mRNA transcription and protein levels in the hippocampus, a key structure involved in decreasing stress-induced HPA axis activation and, peripherally, in blood lymphocytes and saliva (McGowan et al., 2009; Tyrka et al., 2012; Weder et al., 2014).

Two papers involving a sample with a primary diagnosis of combat-related PTSD have demonstrated an inverse association between the severity of PTSD symptoms and the degree of methylation of the promoter region of the glucocorticoid receptor *NR3C1* (Yehuda et al., 2013, 2014b). In contrast, a study focused on women with histories of maltreatment and borderline personality disorder found that a history of maltreatment, and particularly of sexual and emotional abuse, was associated with greater methylation of the promoter region of the *NR3C1* gene (Perroud et al., 2011). These findings have been replicated in at least two subsequent studies with a focus on different forms of adverse events such as childhood physical abuse (Tyrka et al., 2012; Romens et al., 2014).

These studies that have looked at adverse early life events such as childhood physical and sexual abuse have focused on diverse samples including healthy individuals (Tyrka et al., 2012) and women with borderline personality (Perroud et al., 2011) but have not systematically looked at the effect of possible PTSD and how PTSD might be related to methylation patterns. Adults who have experienced childhood physical and sexual abuse are, upon exposure to interpersonal violent (IPV) events during adulthood, more likely to develop PTSD (Breslau et al., 2014). It is thus important to examine the relationship of *NR3C1* methylation to adult IPV-PTSD.

Relatively few studies have examined the impact of maternal PTSD. Studies that have focused on maternal IPV-PTSD have nevertheless shown a number of converging findings. Namely, maternal PTSD is associated with less sensitive maternal behavior that reflects more maternal avoidance and decreased responsiveness to child social bids (Cohen et al., 2008; Schechter et al., 2008, 2010). Maternal IPV-PTSD severity and atypical maternal behavior were both shown to be associated with low salivary cortisol baselines and blunted stress reactivity (Schechter et al., 2004; Crockett et al., 2013).

A study of maternal neural response to silent video stimuli depicting child separation as a stressful condition versus quiet play as a non-stressful control-condition showed decreased medial prefrontal cortex (mPFC) activity and increased entorhinal cortex activity among IPV-PTSD versus non-PTSD mothers (Schechter et al., 2012). Moreover, the severity of maternal PTSD has been associated with young children's dysregulated aggression and increased anxiety, social withdrawal, and avoidance of interpersonal conflict in play following from story-stem completion (Schechter et al., 2007). Yet no published paper to our knowledge has heretofore demonstrated associations between maternal trauma and related psychopathology, HPA axis dysregulation as marked by altered methylation of the *NR3C1*

gene, and maternal-child behavior, as related to neural activity in response to parenting stress -relevant stimuli.

We hypothesized that *NR3C1* methylation would inversely correlate to IPV-PTSD severity and would positively correlate to degree of activity in brain regions implicated in emotion regulation, such as the mPFC. We further hypothesized that maternal PTSD severity, *NR3C1* methylation, and maternal neural activity in response to separation-stress stimuli would predict greater parenting stress and disturbance of mother–child interactive behavior as measured by maternal sensitivity and child cooperativeness during play.

Materials and Methods

Participants and Procedures

The study protocol was approved by the institutional review board of the University of Geneva Hospitals and in accordance with the Helsinki Declaration (World Medical Association, 1999).

Inclusion and exclusion criteria were as follows: biological mothers were included in the study if they had lived with their child for the majority of the child's life since birth. Due to physiological measurements taken that could be altered by hormonal changes associated with pregnancy and breastfeeding, women who were in either category were not accepted into the study until 30 days after they had stopped breast-feeding. Children were included in the study if they were 12–42 months of age at the time of scheduled mother–child behavioral observations. Women and their children were recruited by flyers posted at the University of Geneva Hospitals and Faculties of Medicine and Psychology as well as at community agencies such as neighborhood centers, daycares, and schools. In order to ensure adequate representation of women with violence exposure and PTSD, recruitment efforts were targeted to programs serving women seeking professional help or shelter following domestic violence exposure. All comers were screened. Fathers and other romantic partners of mothers were not seen in the study given concerns over safety and maintenance of trust for women who had experienced partner violence. Thus data about fathers were obtained by maternal report rather than from the fathers themselves.

Within 1 month after the screening visit, participants completed two videotaped visits over the ensuing 1–2 months period. During the screening visit, following informed consent, mothers were given a socio-demographic and life-events interview followed by several self-report questionnaires. During the next visit, mothers were interviewed without their child present, with a focus on the mother's mental representations of her child and relationship with her child, an elaboration of her traumatic life-events, followed by structured diagnostic interviews and a series of dimensional measures. Then, 1–2 weeks later, mothers were asked to bring their child to the lab for a mother–child interaction procedure otherwise known as the "Modified Crowell Procedure" (Zeanah et al., 2000). This procedure involves free play, separation–reunion, structured play, repeated separation–reunion and exposure to novelty (i.e., the entrance of a masked clown and noise-making, robotic toys such as a dinosaur and jumping spider toy). This mother–child interaction procedure was followed by administration of measures focusing on the child's life events, psychopathology, and social–emotional development. Saliva samples were taken from mothers and children for measurement of cortisol and DNA extraction (as described in more detail below) prior to the Modified Crowell Procedure, immediately afterward and then 30 and 60 min later. After each of these visits, mothers received 50 Swiss francs along with a small book or toy for their child following the parent–child visit.

All mothers were invited to complete the MRI 2–4 weeks after the clinical interview and mother–child observations. Mothers who consented and were eligible for MRI were scanned at the hospital-based neuroimaging center. There they first completed routine pre-scanning questionnaires. After a clinician and neuroimaging specialist-guided orientation to the MRI scanner and scanning process, mothers participated in the fMRI protocol as described below, followed by a post-scanning semi-structured clinical interview to probe mothers' experiences in the scanner (Schechter et al., 2012).

Out of 70 mothers and children who were screened and provided informed consent, four mothers had a full-PTSD diagnosis or clinically significant symptoms (subthreshold) primarily due to a non-IPV traumatic event (i.e., medical–surgical event, accident, natural disaster, etc.) and were thus excluded from the present analyses. Thus, 66 French-speaking mothers (ages 18–45 years) and children (ages 12–42 months) participated. For a subset of 49 mothers, datasets including successful DNA extraction from saliva and maternal sensitivity coding were available. Out of these 49, 4 participants were excluded due to lack of sufficient DNA quality to permit acquisition of *NR3C1* methylation data. This left 45 participants for data analysis, who were identified as "IPV-PTSD mothers" ($n = 28$) or "non-PTSD controls" ($n = 17$), as described below.

Measures

Socio-Demographic Variables and Life-Events

During the screening session we conducted an interview with the mothers using the Geneva Socio-demographic Questionnaire (GSQ; Sancho Rossignol et al., unpublished) which was adapted from the Structured Clinical Interview for the DSM-IV (First et al., 1995) and developed for the present study in order to obtain a detailed overview of the parents' socioeconomic status, characteristics, and history of the mother–partner relationships, and exposure to stressful life-events [i.e., interpersonal violence (IPV), substance abuse, economic difficulties, immigration, physical and mental health problems and interventions, and child protective and judicial services involvement]. The family socio-economic status (SES) was calculated using the Largo Index (Largo et al., 1989), which is a well-validated SES index used in pediatric research in Switzerland that takes into account both parental educational attainment and occupational status.

IPV and Other Traumatic Life Events

History of traumatic events during childhood was assessed via the Brief Physical and Sexual Abuse Questionnaire (BPSAQ;

Marshall et al., 1998), and supplemented for other events during adulthood with the Traumatic Life Events Questionnaire (TLEQ). The TLEQ assesses 22 life events that could fulfill the "A-Criterion" for the DSM-IV diagnosis of PTSD. The TLEQ shows stability and convergent validity across various studies (Kubany et al., 2000). Twelve items that asked for the same events as the BPSAQ were eliminated from the TLEQ. Scoring of the BPSAQ was undertaken as described in a previous paper by the first author (Schechter et al., 2005). The severity of physical violence of the mother's partner and herself in the context of her adult romantic relationships was measured via the Conflicts Tactics Scale 2 Short Version (CTS2; Straus and Douglas, 2004). This well-validated measure consists of 20 items that ask about tactics used by the participant's partner and herself in order to resolve relational conflict including physical aggression along a seven-point scale.

Maternal Psychopathology

During the first videotaped interview IPV-exposed and non-IPV-exposed mothers underwent a variety of psychometric evaluations including the Clinician administered PTSD scale (CAPS; Blake et al., 1995) to assess lifetime PTSD and the Post-traumatic Symptom Checklist -Short Version (PCL-S) to assess current PTSD symptoms (Weathers et al., 2001). Participants with no IPV and no PTSD symptoms on both measures were coded as having the minimum score of 16. Participants with IPV exposure but no PTSD symptoms were coded as having 17.

For categorical analyses, mothers met criteria for violence-related PTSD if their DSM-IV A-criterion trauma was of a violent nature (i.e., due to child physical or sexual abuse or family violence exposure and/or adult physical or sexual assault).

Three groups of participants were then identified based on whether the participant fully met DSM-IV diagnostic criteria for lifetime PTSD on the CAPS and current PTSD with a score of 40 or more on the PCL-S for symptoms occurring within the past month ($n = 17$; Blanchard et al., 1996). A second group that met full criteria for lifetime diagnosis on the CAPS and yet had significant clinical symptoms of PTSD without meeting full diagnostic criteria for current PTSD (PCL-S score of 31–40) was identified as "subthreshold" for current PTSD ($n = 11$). Participants who did not meet criteria on either measure were considered to be "non-PTSD" controls ($n = 17$). Of note, many non-PTSD controls as shown in **Table 1B** were also exposed to IPV and had some PTSD symptoms that were not clinically significant enough to put them into the subthreshold group. For group comparison, full-criteria for diagnosis and subthreshold groups were combined into a clinical IPV-PTSD group referred to in this paper as "IPV-PTSD mothers" ($n = 28$) to be compared to "non-PTSD controls" ($n = 17$).

Parenting Stress

Parenting Stress was measured via the Parenting Stress Index—Short Form (PSI-SF; Abidin, 1995). This score includes items related to distress that parents feel in relation to their role as a parent and in light of other personal stressors, as well as parent–child relationship dysfunction, and child behavior that poses difficulty to parents. The PSI-SF has 36 items and each item is assessed on a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). It is a standardized instrument with a validated French translation. The PSI-SF shows high internal consistency (Cronbach's alpha = 0.92; Abidin, 1995).

Observed Maternal and Child Behavior

Maternal sensitivity and child cooperativeness were measured via structured behavioral observations during 5 min of mother–child play. Two blind raters who were psychologists trained to reliability on the CARE-Index (Crittenden, unpublished) coded the maternal and child behaviors. The coding procedure focused these raters' attention on seven aspects of maternal and child behavior, concerned with affect (facial expression, vocal expression, position and body contact, expression of affection), and "cognition" (i.e., temporal order and interpersonal contingency such as pacing of turns, control of the activity, and developmental appropriateness of the activity). Each aspect of behavior was evaluated separately. The scores were then summed to generate the maternal sensitivity and child cooperativeness scale scores. Both scores have a range from 0 to 14, with zero being dangerously insensitive/uncooperative to point of disruptive or unengaged, 7 being normally sensitive/cooperative, and 14 being outstandingly sensitive/cooperative. Inter-rater reliability was excellent (ICC = 0.86). The Infant and Toddler versions of the CARE-Index are well-validated (Farnfield et al., 2010; Kunster et al., 2010).

fMRI Stimuli, Study Design, and Data Acquisition

fMRI stimuli were drawn from mother–child interaction sequences of free-play and separation embedded within the 25-min mother–child interaction (i.e., Modified Crowell Procedure) as described above. A research assistant who was blind to case-control status among mothers' own children selected the silent excerpts for the fMRI stimulus of play and separation: mothers viewed the play-excerpt that was observed to show the most joy and reciprocally the separation excerpt that showed the strongest child emotional response in terms of negative emotion and distressed behavior.

Mothers viewed six different, silent, 30-s video-excerpts of three children, each during the two conditions (separation and play): (1) own child, (2) unfamiliar boy, and (3) unfamiliar girl. The unfamiliar children conditions were obtained by filming two mothers and their children who did not participate in the study.

The fMRI study design consisted of two runs, each lasting 15 min, and each containing three blocks during which mothers viewed all six 30-s video excerpts, in a pseudorandom order, counterbalanced within and across runs. Thus, mothers viewed each of the six 30-s film clips six times. Each sequence was preceded by a 2-s white board either saying "mother and child play" or "child during separation." In order to maximize the likelihood that participants would actually watch the stimuli, we also filmed participants' eye gaze with an eye tracker (Eye-Trac 6, Applied Science Laboratories, Bedford, MA, USA) during the scan. Detailed image acquisition and pre-processing are described in the Supplementary Materials. After the MRI visit, mothers received 200 Swiss francs.

Out of the 45 mothers included in the clinical assessments, two participants were not eligible for MRI scanning for medical reasons, two participants refused participation in an MRI scan, three participants were excluded due to excessive movement in the scanner (2) or technical problems during scanning (1). One participant was excluded due to abnormal brain anatomy (i.e., structural damage in prefrontal and occipital areas) that resulted from traumatic brain injury and consequent neurosurgery following a motor-vehicle accident during childhood. This resulted in 37 participants (16 mothers with IPV-PTSD, 6 subthreshold, and 15 non-PTSD controls) being included in the analysis of fMRI data.

Acquisition of Saliva and Extraction of DNA

In preparation for saliva sampling, participants were told not to eat or drink for 1 h prior to their parent–child lab visit as described above. The samples were taken via a Salivette® cotton swab (Sarstedt, reference number 51.1534, www.sarstedt.com) which participants were asked to keep in their mouth for 3 min. The cotton was then placed in a labeled plastic tube and frozen at −30°C until extraction. Saliva used for DNA extraction was drawn from the first saliva sample that had been taken prior to the mother–child interaction procedure whenever possible. DNA extracted from saliva (Cao-Lei et al., 2014; Weder et al., 2014) as well as buccal cells (Lowe et al., 2013) has been only recently found to be reliably comparable to that extracted from blood cells with particular reference to peripheral measurement of methylation of the *NR3C1* gene. To confirm this relationship, we compared blood and saliva samples for mean total percentage of *NR3C1* methylation in 15 pregnant women who gave informed consent for blood and saliva sampling in a concurrently running study by our research lab, and using the same methods for sampling and extraction as described below. The correlation of the blood lymphocyte and saliva-derived values indeed showed a robust, positive correlation ($r = 0.60$, $p = 0.02$; Sancho Rossignol et al., 2014). Genomic DNA was extracted from the Salivette® cotton swab using the DNA extraction kit produced by GE Healthcare (RPN8501), the quantity of DNA was assessed with Qubit (The Qubit® 2.0 Fluorometer, Invitrogen) and the quality was verified on gel electrophoresis.

NR3C1 Methylation Status

The extracted DNA was then treated with sodium bisulfite in order to convert unmethylated cytosine residues to uracil using EpiTect Bisulfite Kit (Qiagen, CA, USA) according to the manufacturer's protocol. The converted DNA was eluted in 20 μl of Elution Buffer (10 mM Tris-HCl, pH 8.5). Two microliter of the post bisulfite-treated DNA were used for subsequent PCR amplification.

The PCR amplifications aimed at pyrosequencing were performed starting from 100 to 140 ng of bisulfite-treated DNA. The PCR conditions were 94°C for 15 min, followed by 50 cycles of 94°C, 30 s, 52°C, 30 s, 72°C, 40 s, and by a 72°C 10 min final extension step.

The sequence of the oligonucleotides, within *NR3C1* (GenBank #AY436590) is the following: NR3HumF: 5′-TTTGAAGTTTTTTTAGAGGG-3′ and NR3HumR: 5′-biotin-7-CCCCCAACTCCCCAAAAA-3′ (adapted from Oberlander et al., 2008). Amplification resulted in a 403 bp fragment (position−3485 to −3082). The reactions were performed with a PCR reaction mixture (total volume 16 μl) containing oligonucleotides at 0.5 mM concentration and 7.5 μl of HotStarTaq Master Mix (Qiagen, CA, USA). The biotinylated PCR products were purified using streptavidin-sepharose beads (Amersham) and sequenced using the PSQ 96 Gold reagent kit (Biotage AB, Uppsala, Sweden) with the following primer: NR3HumS1: 5′-GAGTGGGTTTGGAGT-3′.

The degree of methylation at each CpG site was determined automatically by the Pyro Q-CpG Software using the C over T pics intensities that were produced at the 13 different CpG sites (Biotage AB, Uppsala, Sweden). The CpG3 and CpG4 are located within the binding motif for NGFI-A (Oberlander et al., 2008) and corresponds to the numerated CpG37 and CpG38 in another study (McGowan et al., 2009). The assay was performed in triplicate. We controlled for the quality of these data by analyzing five different human methylated standards (0, 25, 50, 75, and 100%) deriving from the commercial unmethylated (0%) and methylated (100%) genomic DNA products (EpiTect PCR Control DNA, Qiagen). Control samples that were 0 and 100% methylated were bisulfite converted independently. And each clinical sample and its replicates were also converted independently. Pearson correlations of the theoretical methylation percentages with the observed methylation percentages were significant for all 13 CpG sites tested (Supplementary Figure S1).

Data Analysis

Differences between IPV-PTSD mothers and non-PTSD controls were analyzed with Mann–Whitney *U* tests for continuous variables (e.g., child age) and chi-square tests for categorical variables (e.g., mother's physical abuse as a child). Associations between *NR3c1* methylation and nine continuous measures (e.g., maternal PTSD severity, parenting stress, degree of maternal sensitivity) were tested using Spearman correlations (r_s) whenever at least one variable was not normally distributed and Pearson correlations (r) in all other instances. The only variables that met the normality assumption among these nine were the mean percentage of *NR3c1* methylation (Shapiro–Wilk statistic = 0.979; $p = 0.505$) and the Parenting Stress Index score (Shapiro–Wilk statistic = 0.977, $p = 505$). The Bonferroni correction was applied to adjust for multiple tests. In line with our *a priori* hypotheses, two different linear regression models were used to explore the combined effects of maternal PTSD symptom severity and mean total percentage of *NR3C1* methylation on parenting stress, as well as maternal PTSD symptom severity, reported parenting stress, and maternal *NR3c1* mean methylation on child cooperativeness. All analyses were performed using SPSS Versions 19 and 22 (IBM, Armonk NY, USA). Significance level was set at 0.05 (two-tailed tests).

Procedures Specific to fMRI Data

Preprocessing of the acquired Images is described in the Supplementary Materials.

In first level analysis, we produced a contrast between the average neural activity in response to separation among all children as compared to scenes of play. In second level analysis we then applied Pearson correlations to examine the associations between this contrast and mean NR3C1 methylation within a whole-brain analysis (Bogdan et al., 2013).

A cluster-extent based thresholding approach was used to correct for multiple comparisons created by the high number of voxels analyzed. A Monte Carlo simulation using Slotnik's method (Slotnick et al., 2003) with 10,000 iterations indicated that a false–positive probability of 0.05 was achieved when applying the condition that each regional cluster must include at least 27 contiguous voxels (3mm*3mm*3mm) with an uncorrected p-value of <0.005.

For our whole-brain analysis, the threshold of significance was thus defined as an uncorrected $p < 0.005$ with at least 27 contiguous voxels necessary to constitute a significant finding.

Procedures Specific to Epigenetics

For variables and brain activity clusters that were significantly correlated to the mean percentage of methylation of *NR3C1*, we performed additional *post hoc* tests for associations with percentages of methylation at each of the 13 CpG sites. Non-parametric Spearman correlation coefficients were used, because the methylation of the individual CpGs was not normally distributed given that many participants had no methylation at a given CpG site (all 13 Shapiro–Wilk statistics <0.856, $p < 0.001$).

Results

Characteristics of Participants

Comparison of IPV-PTSD mothers ($n = 28$) and non-PTSD mothers ($n = 17$) indicated no group differences for maternal age, child age, or gender, SES, and maternal drug and alcohol abuse history (see **Table 1A**). Differences between groups were significant in terms of IPV trauma, psychopathology, parenting stress, and maternal behavior (**Table 1B**). IPV-PTSD mothers had more severe current and lifetime PTSD symptoms ($p < 0.001$). They were much more likely to have been physically abused ($p = 0.006$) and exposed to domestic violence as children ($p = 0.015$), but not sexually abused ($p = 0.163$) as children under the age of 16. However, even within the non-PTSD control group, 29% of mothers had been physically abused as children and 35% had experienced IPV as adults, although not generally at the hands of their partner. In keeping with the fact that recruitment efforts were in part organized around domestic violence agencies and related services, 82% of IPV-PTSD vs. 0%

TABLE 1A | Differences between mothers suffering from Interpersonal violence-related posttraumatic stress disorder (IPV-PTSD) and non-PTSD controls.

	IPV-PTSD ($n = 28$) Median (SD)	Controls ($n = 17$) Mean (SD)	Mann–Whitney test z-value/ Pearson chi-square	p
Maternal age (in years)	35.1 (5.8)	35.5 (5.5)	−0.29	0.77
Child age (in months)	27.0 (8.6)	28.2 (8.7)	−0.44	0.66
Child gender (percentage of boys)	50%	59%	0.56	0.33
Socio-economic status (SES; low values indicate higher status)	5.2 (2.1)	4.4 (1.9)	−1.22	0.22
Maternal drug and alcohol abuse history	24%	21%	0.053	0.82

The current PTSD symptom severity was measured with the Post-traumatic Symptom Checklist -Short Version (PCL-S). The lifetime PTSD symptom severity was measured with the Clinician Administered PTSD Scale. Parenting stress was measured with the Parenting Stress Index—Short Form (PSI-SF), and partner aggression was measured with the Conflict Tactics Scale (CTS). SD are shown in parentheses where applicable.

TABLE 1B | Socio-demographic differences between mothers suffering from IPV-PTSD and non-PTSD controls.

	IPV-PTSD ($n = 28$) Mean (SD)	Controls ($n = 17$) Mean (SD)	Mann-Whitney test z-value/ Pearson chi-square	P
Current PTSD symptom severity	40.6 (10.3)	16.4 (0.3)	5.63	<0.001
Lifetime PTSD symptom severity	85.4 (19.5)	19.0 (6.3)	5.64	<0.001
Physical abuse as a child	71%	29%	7.56	0.006
Sexual abuse as a child	21%	6%	1.94	0.163
Exposed to domestic violence as a child	61%	24%	5.88	0.015
Experienced sexual and/or physical assault by partner as an adult	82%	0%	28.56	<0.001
Experienced sexual and/or physical assault by non-partner as an adult	82%	35%	10.13	0.001
Any kind of interpersonal violence as a child (experienced physical or sexual abuse and/or exposed to domestic violence)	89%	47%	9.64	0.002
Severity of current/last partner physical aggression	4.5 (8.8)	0.0 (0.0)	2.85	0.004
Parenting stress	42.8 (15.4)	35.0 (14.2)	1.69	0.091
Maternal sensitivity	5.0 (1.3)	6.1 (1.0)	2.56	0.011
NR3c1 methylation (%)	3.8 (1.8)	5.3 (2.0)	2.26	0.013

SD are shown in parentheses.

of non-PTSD mothers experienced partner violence as adults and all mothers with IPV-PTSD had experienced at least one type of violence as adults. As **Table 1B** shows, the IPV-PTSD group had experienced more severe IPV as adults than non-PTSD controls on the Conflict Tactics Scale ($p = 0.004$). IPV-PTSD mothers were somewhat more stressed as parents on the Parenting Stress Index, even though statistical significance was not reached ($p = 0.091$); and they were significantly less sensitive during play with their children ($p = 0.011$).

NR3C1 Methylation

As indicated in **Table 1B**, IPV-PTSD mothers were characterized by a significantly lower mean percentage of methylation of the *NR3C1* gene.

Associations of *NR3C1* gene methylation with continuous measures are shown in **Table 2**. Mean percentage of methylation was significantly and negatively correlated with severity of maternal exposure to child physical abuse, maternal current PTSD severity and parenting stress, but not maternal sensitivity. In order to investigate more precisely the negative correlation between parenting stress and *NR3C1* methylation, we performed correlations for each subgroup of participants. The negative correlation between parenting stress and *NR3C1* methylation was primarily driven by maternal IPV-PTSD ($n = 20$, $r = -0.529$, $p = 0.017$) and subthreshold ($n = 7$, $r = -0.764$, $p = 0.046$) groups, rather than by the HC ($n = 17$, $r = 0.060$, $p = 0.820$). Mean percentage of methylation at CpGs sites 3, 4, 5, and 11 was correlated to parenting stress (CpG3: $r_s = -0.291$, $p = 0.06$; CpG4: $r_s = -0.266$, $p = 0.08$; CpG5: $r_s = -0.358$, $p = 0.02$; CpG11: $r_s = -0.522$, $p < 0.001$) as shown in Supplementary Table S1. Only the association between CpG 11 and parenting stress withstood Bonferroni corrections for multiple tests. No specific CpG was correlated to IPV-PTSD symptom severity.

TABLE 2 | Correlations with *NR3C1* mean methylation.

	Correlation coefficient with *NR3c1* mean methylation	Significance (*p*)
Socio-economic status	**$r_s = -0.361$**	**0.016**
Physical abuse as a child (BPSAQ, Brief Physical and Sexual Abuse Questionnaire)	**$r_s = -0.347$**	**0.020**
Sexual abuse as a child (BPSAQ)	$r_s = 0.094$	0.560
Severity of partner physical aggression (CTS)	$r_s = -0.202$	0.194
Current PTSD symptom severity (PCL-S)	**$r_s = -0.489$**	**0.002[a]**
Parenting Stress (PSI-SF)	**$r = -0.436$**	**0.003[a]**
Maternal Sensitivity (CARE-Index)	$r_s = 0.265$	0.078
Child Cooperativeness (CARE-Index)	**$r_s = 0.375$**	**0.011**

Associations of NR3C1 gene methylation with socio-economic and clinical measures (n = 45), r = Pearson correlations (only applied if both variables passed normality tests), r_s = Spearman correlation, [a]p < 0.05 after Bonferroni correction for multiple tests.
Bolded values represent significant findings.

As detailed in Supplementary Table S2, we next explored via regression analysis if maternal *NR3C1* methylation would remain significantly associated with parenting stress ($\beta = -0.44$, $p = 0.003$) after controlling for maternal IPV-PTSD symptoms. Indeed, this association did remain significant ($\beta = -0.40$, $p = 0.006$). We also tested whether the association of maternal *NR3C1* methylation with observed child cooperativeness in play ($\beta = 0.39$, $p = 0.009$) would remain significant after controlling for maternal IPV-PTSD symptoms and parenting stress. This association, however, no longer remained significant after controlling for those two variables ($\beta = 0.19$, $p = 0.265$).

fMRI Results

We first examined the relationship of maternal PTSD severity and parenting stress to neural activity to test if affected brain-areas associated with *NR3C1* methylation would also be associated with observable clinically relevant dysfunction (**Table 3** and Supplementary Table S3). Maternal PTSD severity correlated negatively with activity in the mPFC and the dorsolateral prefrontal cortex (dlPFC) as shown in **Table 3**. As shown in **Table 3** and **Figure 1**, the degree of parenting stress correlated negatively with neural activity in the ventromedial prefrontal cortex (vmPFC; $r = -0.410$, $p = 0.013$) and the dorsomedial prefrontal cortex (dmPFC; $r = -0.546$, $p = 0.001$).

We next examined the relationship of percentage of methylation of *NR3C1* to maternal clinically—relevant neural activity in response to mothers' viewing of their own child and unfamiliar children in separation versus play. As shown in **Figure 2** and **Table 3**, the mean percentage of methylation of the *NR3C1* gene positively correlated with activity in the vmPFC, dmPFC, and left dlPFC, as well as the precuneus and thalamus. Thus, all three of the brain areas that showed significant relationships to parenting stress were also significantly related to the percentage of methylation of the *NR3C1* gene peripherally, and in corresponding directions of effect (i.e., less dmPFC and vmPFC activation with greater maternal PTSD severity and parenting stress, and less methylation of the *NR3C1* gene).

In order to understand better the relative importance of different factors, we then extracted the average activity of the clusters found in the whole brain analysis of the correlation with *NR3C1*. For each cluster, we performed a regression analysis in which neural activity was the dependent variable and *NR3C1* methylation and reported parenting stress were the independent variables. Within this model, *NR3C1* methylation but not parenting stress was a significant predictor of neural activity in the dlPFC and vmPFC clusters. Parenting stress but not *NR3C1* methylation was a significant predictor in the dmPFC cluster (see Supplementary Table S3).

In order to better understand the origins of these effects, we performed *post hoc* Spearman correlations of the mean percentage of (1) methylation at each of the 13 tested CpG sites of the NR3C1 gene and (2) neural activity in the different brain-region clusters (**Figure 2**, together with Supplementary Figures S2 and S3). None of these associations withstood Bonferroni corrections for multiple tests. Mean methylation at CpG4 was correlated with neural activity in the vmPFC ($r_s = 0.313$,

TABLE 3 | Mean percentage of methylation of *NR3C1* correlated with BOLD activity when mothers watch separation vs. play scenes.

Cluster size	MNI location of the peak voxel			Regions comprised in this cluster	Correlation of cluster activity with *NR3C1*				
	x	*y*	*z*		*r*-value within: IPV-PTSD Subthreshold HC	*p*-value within: IPV-PTSD Subthreshold HC	Correlation of cluster activation with *NR3c1* methylation	Correlation of cluster activation with parenting stress	Correlation of cluster activation with current PTSD symptom severity
199	12	53	−11	vmPFC, OFC, right gyrus rectus	0.529 0.925 0.219	0.043 0.003 0.432	$r = 0.591$ $p < 0.001$	$r = -0.410$ $p = 0.013$	$r_s = -0.368$ $p = 0.012$
127	−24	29	55	Left dlPFC	0.619 0.826 0.259	0.014 0.022 0.352	$r = 0.548$ $p < 0.001$	$r = -0.462$ $p = 0.005$	$r_s = -0.497$ $p = 0.002$
32	−51	11	43	Left dlPFC, cortex left precentral gyrus	0.647 0.899 0.302	0.009 0.006 0.275	$r = 0.552$ $p < 0.001$	$r = -0.246$ $p = 0.148$	$r_s = -0.399$ $p = 0.014$
34	−6	53	13	dmPFC	0.487 0.922 0.180	0.066 0.003 0.522	$r = 0.495$ $p = 0.002$	$r = -0.546$ $p = 0.001$	$r_s = -0.356$ $p = 0.030$
30	15	−25	19	Thalamus	0.359 −0.132 0.662	0.189 0.777 0.007	$r = 0.493$ $p = 0.002$	$r = -0.308$ $p = 0.068$	$r_s = -0.370$ $p = 0.024$
64	−27	−49	49	Left precuneus, posterior cingulate cortex	0.450 0.634 0.587	0.093 0.126 0.021	$r = 0.527$ $p = 0.001$	$r = -0.438$ $p = 0.008$	$r_s = -0.392$ $p = 0.016$

dlPFC, dorsolateral Prefrontal Cortex; dmPFC, dorsomedial Prefrontal Cortex; HC, healthy controls; IPV-PTSD, mothers with interpersonal violence related post traumatic stress disorder; OFC, orbitofrontal cortex; vmPFC, ventromedial Prefrontal Cortex, r = Pearson correlation, r_s = Spearman correlation, p = significance value.

$p = 0.03$), and the dlPFC ($r_s = 0.313$, $p = 0.06$). In addition, mean methylation of CpG5 was correlated with neural activity in the dlPFC ($r_s = 0.299$, $p = 0.07$). Finally mean methylation at CpG11 was correlated with neural activity in the vmPFC ($r_s = 0.388$, $p = 0.02$) and the dlPFC ($r_s = 0.332$, $p = 0.01$).

Discussion

Results of this study have demonstrated important, convergent associations between the mean percentage of methylation of the promoter region of the *NR3C1* gene and the following key variables: maternal IPV-PTSD, parenting stress, and neural activity in cortical regions that are implicated in emotion regulation; namely, the vmPFC, dmPFC, and dlPFC. These areas are similarly associated with parenting stress and maternal PTSD symptom severity in response to stressful silent video stimuli of a routine relational stressor (i.e., mother–child separation) versus less stressful silent video stimuli (i.e., mother–child play).

Lower neural activity in the prefrontal cortex and greater parenting stress were both associated with a lower mean percentage of methylation overall. Given sample-size limitations and the number of comparisons necessary to examine all 13 CpG sites, it was not surprising that none of the associations to CpG sites with neural activity remained significant after Bonferroni correction for multiple comparisons. About the contribution of the differing CpGs, we can thus only speculate with the severe limitation of uncorrected correlations. Those CpG correlations suggested that several CpG sites including CpG4, CpG5, and CpG11 might be associated to neural activity in several key prefrontal regions such as vmPFC and dlPFC within a larger sample and should be studied further in the future. Of note, CpG4 would be functionally relevant since it is located within the binding site of the nerve growth factor induced protein A (NGFI-A; Oberlander et al., 2008; McGowan et al., 2009). NGFI-A binding leads to an increase in *NR3C1* expression and methylation decreases expression of *NR3C1* (McGowan et al., 2009).

While methylation of the *NR3C1* gene was not significantly associated with maternal sensitivity, the overall mean percentage of methylation of *NR3C1* (as well as at the CpG4 and 11 sites) were negatively associated with parenting stress and positively associated with observed child cooperativeness during play. The overall mean percentage of methylation of *NR3C1* together with maternal current PTSD symptom severity accounted for 22.5% of the variance of parenting stress.

The present study is thus the first to our knowledge to link findings within different psychobiological domains (i.e., post-traumatic stress, relational, or "parenting" stress, epigenetics linked to the HPA-axis stress response, and neural activity) in support of the notion that *NR3C1* epigenetic signatures that are characterized by low-methylation might denote risk to the early mother–child relationship. Risk to the early mother–child relationship was marked by increased parenting stress, which in turn might increase the risk for developmental psychopathology in her child. IPV-PTSD mothers with lower *NR3C1* methylation had a greater tendency to report more subjective parenting stress. Increased parenting stress was significantly associated with less

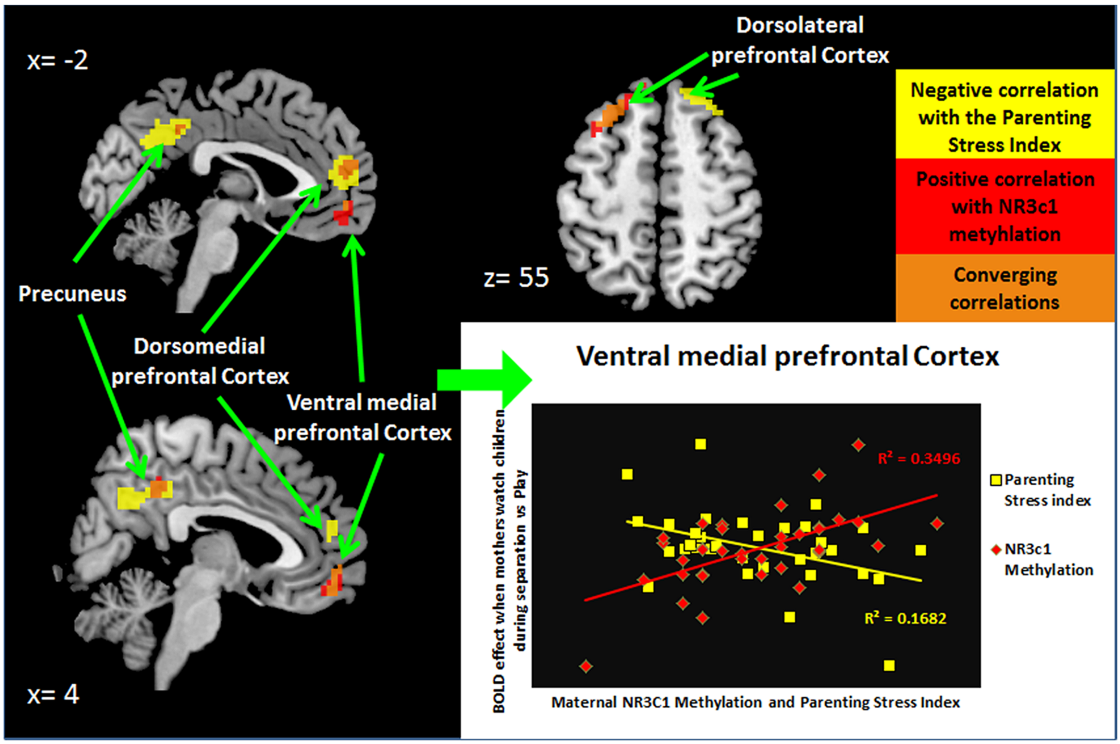
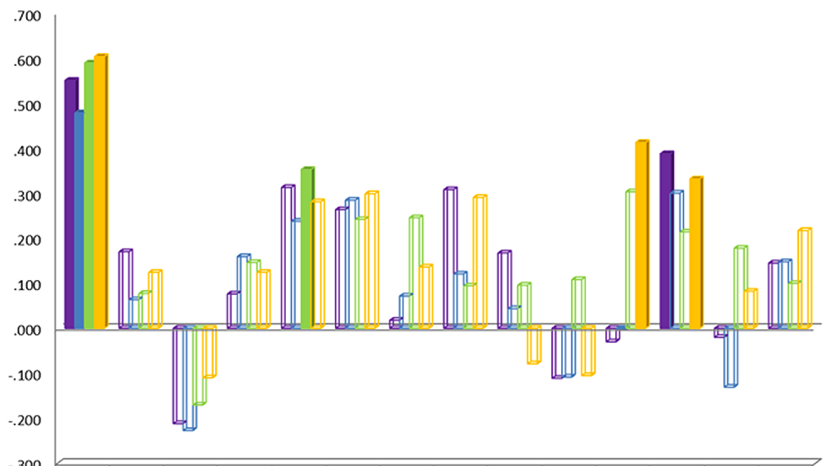


FIGURE 1 | *NR3C1* methylation correlated to functional brain activity when mothers see children during separation compared to play.



	NR3C1	CpG1	CpG2	CpG3	CpG4	CpG5	CpG6	CpG7	CpG8	CpG9	CpG10	CpG11	CpG12	CpG13
vmPFC	.551	.170	-.212	.076	.313	.264	.018	.308	.167	-.111	-.030	.388	-.020	.145
dmPFC	.479	.064	-.227	.159	.238	.285	.071	.121	.044	-.109	-.003	.300	-.131	.148
dlPFC cluster 1	.590	.077	-.171	.146	.353	.242	.246	.094	.096	.108	.304	.214	.178	.100
dlPFC cluster 2	.604	.124	-.110	.124	.281	.299	.136	.291	-.079	-.105	.413	.332	.082	.218

FIGURE 2 | Spearman correlation between neural activity in prefrontal cortex regions during separation vs. play and CpG methylation of the *NR3c1*.

maternal vmPFC and dmPFC on fMRI. A subsequent regression analysis (see Supplementary Table S3) suggested that neural activity in several regions (dlPFC, vmPFC, OFC) was at least as well predicted by *NR3C1* methylation as by reported parenting stress, suggesting a link between HPA axis physiology and brain processing of stimuli triggering parenting stress. These results echo findings by the corresponding author from a previous study with a different sample (Schechter et al., 2012). In that study, IPV-PTSD mothers reported experiencing significantly more stress upon viewing video excerpts of parent–child separation

versus play which corresponded to less medial prefrontal cortical activity than among non-PTSD controls in response to the same stimuli.

The association in the present paper between corticolimbic dysregulation and *NR3C1* methylation supports the hypothesis that a maternal endophenotype which carries a low mean percentage of *NR3C1* methylation is likely to be associated with parenting stress and that parenting stress, coupled with maternal IPV-PTSD likely adversely impacts the quality of maternal behavior (i.e., maternal sensitivity and responsiveness to child bids for joint attention; Schechter et al., 2010). Difficulty in parental regulation of normative aggression in early childhood has been shown to be a potent risk factor for subsequent conduct disorder (Cote et al., 2006). At least one prior study has noted dysregulated aggression as well as anxiety, avoidance, and hypervigilance to danger in the child, as being associated with greater maternal IPV-PTSD severity (Schechter et al., 2007). Further study is needed to see if this tendency is greater among children whose mothers have a particular epigenetic signature.

In the present study, the severity of IPV-PTSD was linked not only to the severity of adult partner violence, but also to the severity of mothers' childhood exposure to physical abuse. Given that the methylation of the *NR3C1* gene is known to be a biological signature for early life stress (McGowan et al., 2009), we cannot exclude that maternal history of childhood physical abuse is driving the convergence of findings. The complexity of the mothers' history, involving multiple exposures and the development of PTSD symptoms, given our limited sample size, does not allow us to tease apart these different life-event and psychopathology variables. We can say, however, that the present study did not replicate the direction of effect of prior studies that looked at retrospective assessment of early life adversity using a self-report questionnaire rather than a clinical interview to review early life events (Perroud et al., 2011) or in the post-mortem study that did use a clinical interview to review life events but within a limited sample of male subjects who had committed suicide and who were described as having major depression as a primary diagnosis (Dumais et al., 2005;McGowan et al., 2009). In the Perroud et al. (2011) study, childhood exposure to sexual and emotional abuse were associated with increased mean percentage of methylation on the *NR3C1* gene's promoter region, thus a positive association, among women primarily with borderline personality disorder, many with comorbid major depression.

A negative association between percentage of methylation on the *NR3C1* gene's promoter region and post-traumatic stress disorder has been established in prior studies of combat veterans who clearly experienced violence but whose early life-histories are unclear (Yehuda et al., 2014b). Our finding that the severity of maternal PTSD was inversely correlated with the degree of methylation of the *NR3C1* promoter region suggests that the effect in either direction is a biological signature of early life stress, but that the direction of effect is most likely dependent on how the exposure is processed by the organism. In other words, the psychophysiology of PTSD as a particular reaction to early adverse life events plays an important role in the direction of effect.

Socio-economic status correlated with methylation of the *NR3C1*. It is beyond the scope of this study to determine whether we might expect SES to be serving as a marker for more severe, earlier onset, and more chronic histories of adverse life-events linked with lower SES, or if, alternatively, the epigenetic signature is tied to lower SES as a marker of impaired functioning or another confounding variable.

Limitations

One methodological limitation of this study is that hydroxy-methylation of cytosine was not discriminated from methylation of cytosine in bisulfite-pyrosequencing (Huang et al., 2010).

An important limitation of this study is that by its cross-sectional design, we could only measure associations rather than prediction and direction of effects. For example, it could be the case as has been postulated (Engel et al., 2005) that low percentage of methylation *NR3C1* epigenetic signature could represent an effect of fetal programming and be a risk factor for the development of PTSD rather than an associated feature or effect of PTSD. Similarly, as noted above, we cannot tease apart whether early and chronic exposure to physical abuse and domestic violence alone might be necessary and sufficient to generate the epigenetic signature if occurring during a sensitive window of development, or if while necessary, it remains insufficient, and the development of PTSD is necessary.

Finally, sample size in the present study provided limited statistical power to study the interplay between numerous factors such as relationships to the CpG sites without the potential for Type I error. Structural equation modeling was thus not feasible, yet would be a useful method for future studies with a larger sample size.

Clinical Implications

The present paper is consistent with prior clinical research findings that mothers with IPV-PTSD, who often suffer from early onset, repetitive, and chronic exposures to violence, report greater stress in parenting their very young children. This parenting stress and the maternal PTSD that contributes to it, have a negative effect on maternal sensitivity. This paper has shown that there are endophenotypic differences or biological signatures both at the level of epigenetics, namely methylation of the glucocorticoid receptor *NR3C1* and at the level of neural activity, principally decreased activity of the vmPFC, dmPFC, and dlPFC in response to viewing mother–child separation versus play, which serve as markers for parenting stress among the traumatized mothers who participated. These biomarkers will be tested in ongoing research to see if they can serve as clinical indicators of risk and of potential change with intervention.

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Supplementary Material

The Supplementary Material for this article can be found online at: http://journal.frontiersin.org/article/10.3389/fpsyg.2015.00690/abstract

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The calming effect of maternal carrying in different mammalian species

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Attachment theory postulates that mothers and their infants possess some basic physiological mechanisms that favor their dyadic interaction and bonding. Many studies have focused on the maternal physiological mechanisms that promote attachment (e.g., mothers' automatic responses to infant faces and/or cries), and relatively less have examined infant physiology. Thus, the physiological mechanisms regulating infant bonding behaviors remain largely undefined. This review elucidates some of the neurobiological mechanisms governing social bonding and cooperation in humans by focusing on maternal carrying and its beneficial effect on mother–infant interaction in mammalian species (e.g., in humans, big cats, and rodents). These studies show that infants have a specific calming response to maternal carrying. A human infant carried by his/her walking mother exhibits a rapid heart rate decrease, and immediately stops voluntary movement and crying compared to when he/she is held in a sitting position. Furthermore, strikingly similar responses were identified in mouse rodents, who exhibit immobility, diminished ultra-sonic vocalizations and heart rate. In general, the studies described in the current review demonstrate the calming effect of maternal carrying to be comprised of a complex set of behavioral and physiological components, each of which has a specific postnatal time window and is orchestrated in a well-matched manner with the maturation of the infants. Such reactions could have been evolutionarily adaptive in mammalian mother–infant interactions. The findings have implications for parenting practices in developmentally normal populations. In addition, we propose that infants' physiological response may be useful in clinical assessments as we discuss possible implications on early screening for child psychopathology (e.g., autism spectrum disorders and perinatal brain disorders).

Keywords: maternal carrying, mother–infant interaction, mother–child relations, mother–infant bonding, transport response, attachment

Introduction

In an early formalization of the Attachment Theory, Bowlby (1958) described five patterns of behavior (sucking, clinging, following, crying, and smiling) as automatic responses that promote caregiver–infant bonding. Later, in a more definitive formalization of the Attachment Theory,

Bowlby (1969) postulated that, at some stage in the development of the behavioral system responsible for attachment, proximity to mother becomes a set-goal. In this theorization, the five patterns are still held to be of great importance because they represent a way to maintain maternal proximity. However, Bowlby (1969) describes how other behaviors may also serve the same function of maintaining maternal proximity. For example, the infant cooperation toward maternal carrying (Esposito et al., 2013) may increase maternal proximity and ultimately mother–infant bonding. In this review, we will summarize studies which have been conducted since the 1950s that have focused on infant postural response to maternal carrying across mammalian species (from rodents, to big cats and humans), and describe the recent findings on infant physiological responses to maternal carrying in human infants and in mice.

The Calming Effects of Maternal Carrying in Humans

Human caregivers commonly soothe babies by carrying them in our arms, in a sling, or in a stroller while walking and/or rocking them. However, whether infant carrying has a calming effect has been controversial (Hunziker and Barr, 1986; Walker and Menahem, 1994; St. James-Roberts et al., 1995). In a randomized controlled trial on 99 mother–infant dyads, Hunziker and Barr (1986) found that the typical amount of crying could be reduced by supplemental carrying, that is, increased carrying throughout the day in addition to that which occurs during feeding and in response to crying. They concluded that supplemental carrying modifies "normal" crying by reducing the duration and altered the typical pattern of crying and fussing in the first 3 months of life. Furthermore, it was speculated that the relative lack of carrying in our society may predispose normal infants to crying and colic (Hunziker and Barr, 1986). However, two subsequent studies did not find a beneficial effect of supplementary carrying. Walker and Menahem (1994) studied the role of supplementary carrying. Forty-three typically developing infants were randomly assigned to an intervention or control group. Infants in the intervention group were carried by their mothers in a soft ventral baby sling for at least 2 h a day, and their crying and behavior patterns were documented in a 24-h diary at 1, 2, 4, 6, and 8 weeks of age. There was no statistical difference between the two conditions (Walker and Menahem, 1994). This was corroborated by St. James-Roberts et al. (1995) who also did not find any differences in amounts of crying and fussing. These findings have been taken to suggest that supplementary carrying cannot be used as a primary, preventative intervention to reduce infant crying (St. James-Roberts et al., 1995). However, these three studies measured the total amount of crying and "supplementary" carrying by relying on parental diaries, rather than direct observation, and the relationship found between crying and carrying was analyzed through correlations in hour-order time bins. No distinction was made in the parental reports between mobile carrying and simple holding without movement. In more recent works from our group (e.g., Esposito et al., 2013; see also Cadena, 2013; Gammie, 2013), we have contributed to this debate, suggesting three main experimental changes (compared to the previous studies). First, we use direct, real-time measures of both mothers' actions and infants' responses. Second, we use multiple methods for analyzing infant physiological and psychological responses (including electrocardiogram and audio/video monitors). Third, we define "carrying" (which includes holding and walking) in a way that clearly distinguishes it from just stationary holding. With these advances, we find a clear and significant decrease in infant voluntary movement, heart rate, and crying when infants are carried rather than held in a sitting position (see **Figure 1**).

The Calming Effects of Maternal Carrying in Other Mammals

In many mammalian species with altricial young, the mother carries her offspring by mouth to transport them for various reasons, such as to conceal them while she forages for food, or to move nests, or away from danger. In a variety of mammalian species such as cats (Schaller, 1972), rodents (Eibl-Eibesfeldt, 1951; Zippelius, 1971), and primate (Sauer, 1967; Wilson et al., 2000, 2008), infants assume a passive and compact posture with their hind legs drawn up while being carried. This postural regulation has been studied experimentally in laboratory rats as "transport response" (Brewster and Leon, 1980; Wilson et al., 1984). However, until recently, there has not been comparative studies of this phenomenon in mammalian species, nor detailed investigations into quantitative measurements for immobilization during carrying and physiological aspects of the phenomenon.

New studies have investigated maternal retrieval behavior and pup's calming response from a different perspective, examining them as a mutually dependent, dynamic process (Esposito et al., 2012, 2013; Yoshida et al., 2013). To explore this dyadic interaction in detail, we created a new experimental task of "maternal rescue of pups from a cup" (see **Figure 2A**), which is meant to mimic a challenging situation in the wild. Pups were placed in a plastic cup and their mother had to retrieve the pups from a cup back to the nest. Employing the "maternal rescue of pups from a cup" method, and the experimenter's manual carrying procedure (by holding the small amount of skin at the nape of the neck, mimicking the maternal oral grasp; see **Figure 2B**), we examined the mouse pups' response to maternal carrying, and found that pups, similar to human infants, immediately show a reduction in crying, body movement and heart rate during carrying (Esposito et al., 2013; see also Bizzego et al., 2014, for data modeling infants' heart rate variability during maternal carrying). Therefore, in both mouse pups and human infants, carrying induced a similar calming responses in the offspring, even though maternal carrying methods differed, We also investigated the upstream and downstream neural systems that regulate the pups' calming response using pharmacologic and genetic interventions (Esposito et al., 2013). We found that somatosensory and proprioceptive inputs are necessary to elicit the response. Furthermore, parasympathetic and cerebellar functions mediate cardiac and motor output respectively. Pups' loss of the postural regulation hindered the effectiveness of their mother's rescue, suggesting a functional significance for the identified calming response. We postulate that the calming response supports an affiliative mother–infant

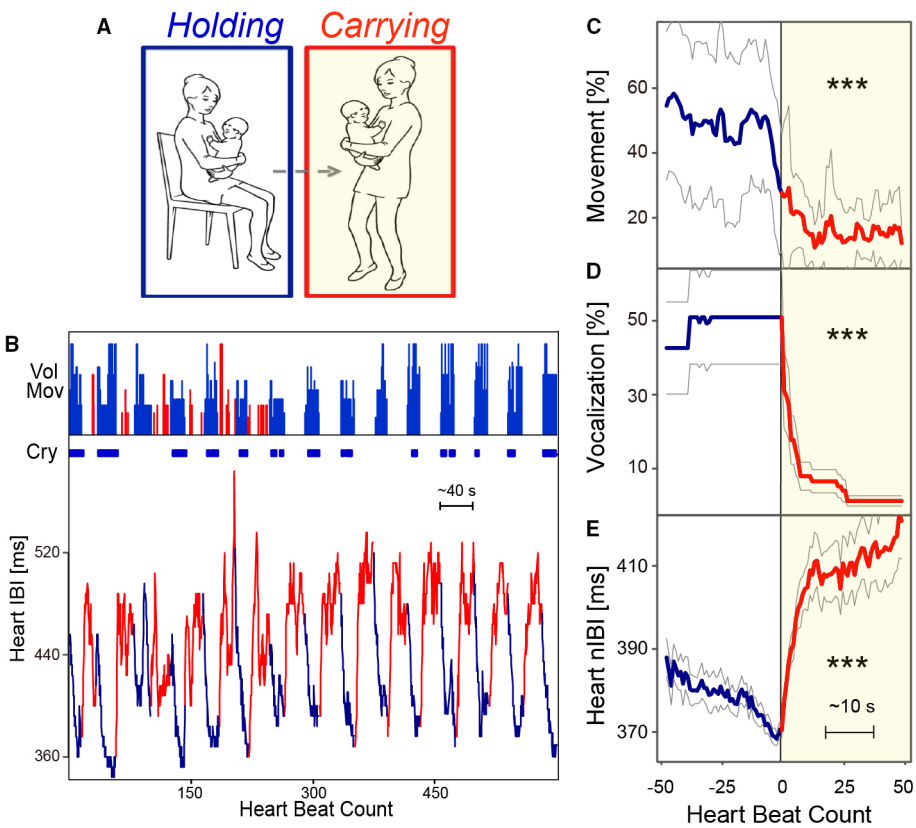

FIGURE 1 | Carrying-induced calming responses in human infants. (A) Behavioral task of holding (blue) and carrying (red with yellow background) by the mother–infant dyad. **(B)** An example of the task consisting of repetition of holding and carrying. Each condition lasted approximately 20 s. Amount of voluntary movement, presence of crying, and the interbeat interval (IBI) of the infant are presented. **(C–E)** Time course of voluntary movements **(C)**, crying **(D)**, and the normalized IBI (nIBI) **(E)** of the holding-carrying transition of 12 human infants under 6 months of age. Extracted and reproduced from Esposito et al. (2013). $***p < 0.001$.

relationship, and increases the infant's chance of survival during emergencies.

Following up on our findings, we subsequently redescribed the pup's calming response composed of several behavioral and physiological changes as "Transport Response" (with capitalization showing respect for the previous study by Brewster and Leon, 1980) by examining how and when each behavioral and physiological change emerge in preweaned laboratory mice (Yoshida et al., 2013). Our ontogenic analyses revealed that mouse Transport Response is confined within a specific postnatal time window subdivided into four phases. In the first phase, which takes place approximately during the first postnatal week, the pups only show a reduction in ultrasonic vocalization without clear immobilization and postural changes. In the second phase, which takes place approximately during the second postnatal week, there is greater passivity, which includes heart rate reduction, robust immobilization and a relative insensitivity to the environment. In the third phase, which lasts from the end of the second postnatal week to the first few days of the third week, the pups weigh about a quarter of what their mothers weigh. Passive immobilization along with active postural regulations, including limb ventroflexion and body compaction, may be required for the mother to carry her pup efficiently. In addition, apparent analgesia was observed during the Transport Response. One of the possible function of the analgesia is that, with increased pain tolerance, pups are able to maintain calmness and remain immobilized, which aids in fast relocation via maternal oral transport during emergencies such as nest destruction (Brewster and Leon, 1980). During the last phase, which corresponds to the remainder of the third postnatal week, the pups' mobility became more mature and their eyelids are fully opened, so that they were able to visually orient and travel by themselves. The pups' immobilization response declines and reach the adult levels by the time of weaning. Correspondingly, the mice mothers refrain from orally retrieving its pups.

Taken together, the data the mouse Transport Response changes in accordance with the physical maturation of the pup. The Transport Response is a filial reaction to maternal carrying which ultimately increases the probability of the pups' own survival.

Evolutionary Basis of Infant Calming Responses to Maternal Carrying

Maternal touch and rhythmic rocking (vestibular-proprioceptive stimulation) is calming to both human infants (Vrugt and Pederson, 1973; Gray et al., 2000) and mouse pups (Esposito et al., 2013;

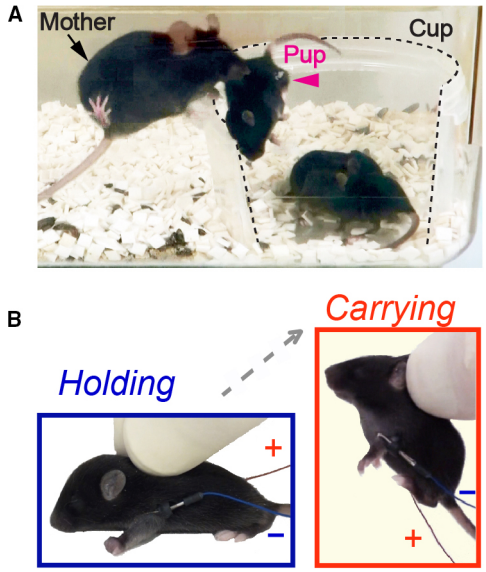

FIGURE 2 | Carrying-induced calming responses in mouse pups. **(A)** The behavioral task of maternal rescue, in which a laboratory mouse mother (arrow) rescued her pup (arrowhead) from a transparent plastic cup fixed in the home cage. **(B)** Manual holding (blue) and carrying (red) of a mouse pup with two electrodes (+ and −) for ECG recording. Extracted and reproduced from Esposito et al. (2013).

Yoshida et al., 2013). Indeed animal studies find that the tactile sensation from maternal grasp and proprioception are required to elicit the carrying-induced calming responses. Extrapolating from this, walking for humans may be the most ethologically similar stimulation as it contributes both tactile sensory input and ambulatory motion, which may render walking more effective in calming infants than other kinds of rhythmic motion such as mechanical rocking.

Therefore, the infant calming responses may have the evolutionary function of increasing the survival probability of the infant in cases of emergency escape by the mother–infant dyad and ultimately work to support the mother–infant relationship. Conservation of this calming response in altricial mammalian species supports the adaptive value of this behavior in mother–infant relationship and, as a consequence, infant survival (Eibl-Eibesfeldt, 1951; Sauer, 1967; Brewster and Leon, 1980).

Implications for Parental Practices

The identified effects of carrying on parasympathetic activation and cry reduction are significant and robust, so a brief period of carrying could be effective in soothing infants who are distressed by transient aggravations such as vaccinations or frightening noises. However, because the calming effect is only limited to the period of ambulatory carrying, the infant may resume crying if the underlying aggravation remains after the carrying ends, like hunger or chronic pain. A scientific understanding of infants' physiological response could prevent parents from overreacting to infants' crying. Such understanding would be beneficial to parents by reducing frustration, because unsoothable crying is a major risk factor for child abuse (Reijneveld et al., 2004).

Implications for Developmental Psychopathology

Understanding how infants respond physiologically to caregiver holding may have useful applications in the field of child psychopathology as an assessment tool. Very early malfunctioning of the infant responses to maternal carrying can potentially be used as an early biomarker of autism spectrum disorders (ASDs), and may also provide an opportunity for an early estimation of the prognosis for infants with perinatal brain disorders (PBDs, i.e., Cerebral Palsy).

Atypical Response to Maternal Carrying as Early Biomarker of Autism Spectrum Disorders

Autism spectrum disorders is a severe lifelong developmental disorder with a very high prevalence (affects 1 out of 88 infants) and is characterized by difficulties in social interaction and communication, as well as by repetitive behaviors and restricted interests. Many studies have highlighted that early diagnosis can lead to a substantial improvement in the life conditions of people with ASDs (Yirmiya and Charman, 2010). For this reason, the search for early biomarkers of the syndrome is extremely important, and is made even more pertinent by the consideration that current diagnosis methods are based on behavioral observation and can be reliable only when the child has at least 18 months of age. An interesting observation related to maternal carrying is that parents of infants with ASD report that their infants have difficulties in adjusting their body to being held (Kanner, 1943; Teitelbaum et al., 1998, 2004; Esposito et al., 2009, 2011; Esposito, 2011; Esposito and Paşca, 2013), and their parents sometimes make remarks such as, "I feel as if I were holding a stone or a sac of flour, not a baby." Moreover, the neural systems regulating the responses to maternal carrying have also been implicated in the neuropathology of ASDs, such as cerebellar structure (Bauman and Kemper, 2005) and in sensory integration (Minshew et al., 2004). Thus it would be an interesting future research direction to examine whether the atypicality in the responses to maternal carrying may be an early biomarker of ASD.

Autonomic Response to Maternal Carrying as Early Prognosis Estimator of Perinatal Brain Diseases

Perinatal brain diseases pertains to the period immediately before and after birth, and they may have very different causes (i.e., from infection or problems during parturition). PBDs are a very heterogeneous group of conditions that may cause various disabilities in development. The long-term prognosis of PBDs are difficult to predict, and exploration of good estimator of the prognosis of the disease would be of great medical implications. To aid in this endeavor, we plan to test whether the calming response to maternal carrying may be used as a measure of infants' sensory and/or

autonomic reactivity, and may somehow improve the prognosis of acquired PBD. We hypothesize that children with autonomic nervous system dysregulation, which has a more severe prognosis, may show atypicality in the autonomic response (specifically the parasympathetic modulation of Heart Rate) to maternal carrying from early postnatal months.

Conclusion

Attachment theory postulates that mothers and their infants possess some basic physiological mechanisms that favor their caregiver–infant dyadic interaction and bonding. In this review, we describe studies on infant calming responses to maternal carrying across different species of mammals. In line with the predictions of the Attachment theory, we demonstrate that carrying-induced calming consist of a canonical set of behavioral and physiological responses in altricial mammalian infants which functions to facilitate an effective mother–infant relationship. Taking the lead from John Bowlby's work, we believe that integrating studies from both psychological and physiological domains will provide better understanding into behaviors that create a manageble and rewarding caregiver–infant interaction, which may ultimately contribute to a good attachment relationship.

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