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Present and future of EMDR in clinical psychology and psychotherapy, volume II

Edited by
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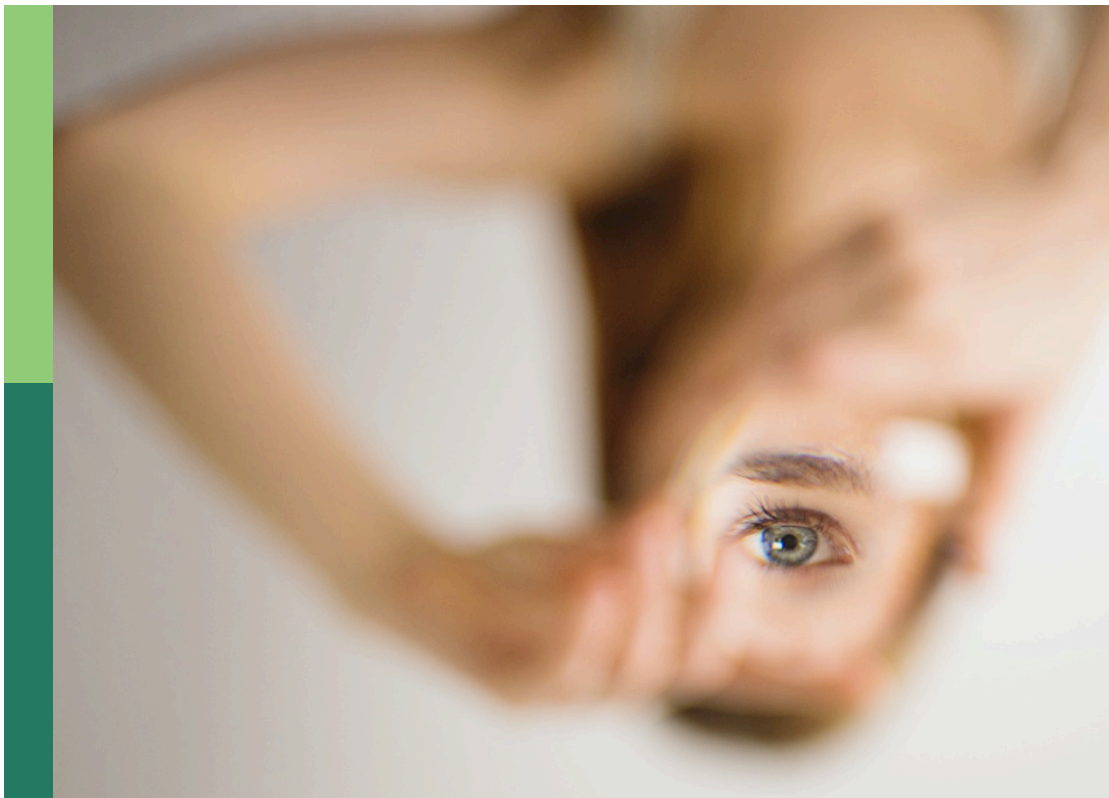
Published in
Frontiers in Psychology



ISSN 1664-8714
ISBN 978-2-83251-878-6
DOI 10.3389/978-2-83251-878-6

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Present and future of EMDR in clinical psychology and psychotherapy, volume II

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Citation

Castelnuovo, G., Onofri, A., Lee, C. W., Ostacoli, L., Stingl, M., eds. (2023). *Present and future of EMDR in clinical psychology and psychotherapy, volume II*. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-83251-878-6

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frontiers | Frontiers in Psychology

TYPE Editorial
PUBLISHED 24 February 2023
DOI 10.3389/fpsyg.2023.1138153

OPEN ACCESS

EDITED AND REVIEWED BY
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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 05 January 2023
ACCEPTED 01 February 2023
PUBLISHED 24 February 2023

CITATION
Onofri A (2023) Editorial: Present and future of EMDR in clinical psychology and psychotherapy, volume II.
Front. Psychol. 14:1138153.
doi: 10.3389/fpsyg.2023.1138153

Editorial: Present and future of EMDR in clinical psychology and psychotherapy, volume II

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KEYWORDS

EMDR therapy, EMDR research, eye movement desensitization and reprocessing, psychological trauma, PTSD, pandemic, COVID, Coronavirus

Editorial on the Research Topic
Present and future of EMDR in clinical psychology and psychotherapy, volume II

After the extraordinary success of the previous Frontiers Research Topic dedicated to "*Present and future of EMDR*" (∼500,000 views), this is a sequel to the same topic, and is a result of increasing interest in this pioneering psychotherapeutic approach.

In total, 16 articles have been published and five co-editors, 77 authors, and a very large number of reviewers actively collaborated and contributed to this Research Topic on an almost daily basis.

In particular, during the COVID-19 pandemic (a period characterized by a large number of people exposed to an ongoing trauma), many studies were carried out, which demonstrated the feasibility of EMDR therapy applied online (i.e., Perri et al., 2021).

This enormously contributed to EMDR gaining popularity among professionals and interested people alike, becoming more known among the scientific community.

Hence, in this special second Research Topic, readers can find a large number of innovative articles (Lazzaroni, Invernizzi et al.; Mischler et al.; Farrell et al.; Yurtsever et al.; Fernandez et al.; Faretta et al.; Lazzaroni, Tossi et al.) that document how EMDR therapy, applied during the Coronavirus period, helped to relieve stress in healthcare workers, patients, and their family members.

Immediately after its birth in the last decade of the last century, several meta-analyses investigated real evidence for EMDR therapy in treating post-traumatic stress disorder (PTSD) (Jonas et al., 2013; Watts et al., 2013; Chen et al., 2014, 2015; Wilson et al., 2018; de Jongh et al., 2019; Yunitri et al., 2020; Carletto et al., 2021).

Based on the outcomes of these investigations, EMDR was included in many international clinical guidelines and was even recognized by the World Health Organization in 2013 as well as finally being aknowledged as an elective treatment by the U. S. Veterans Affairs Department (2017).

In this special Frontiers Research Topic, scholars will find and appreciate several interesting articles dedicated to the field of trauma and stress-related conditions; from childbirth to traffic accidents and domestic violence (Brouwers et al.; Kranenburg et al.; Burak Yaşar et al.; Susanty et al.; Rodriguez-Garay and Mosquera).

It is of crucial importance to mention that, for the two last decades, the application of EMDR is no longer strictly limited to the treatment of PTSD: its feasibility has been expanded to the treatment of other psychiatric disorders and conditions (de Bont et al., 2013; Novo et al., 2014; Perez-Dandieu and Tapia, 2014).

In fact, the relevance of the so-called "post-traumatic psychopathological dimension" and the clinical importance of traumatic events or traumatic prolonged conditions, have been considered as crucial risk factors for the development of many different somatic and psychiatric disorders, especially if these occurred during infancy and childhood (Kim and Lee, 2016; Millan et al., 2017).

Based on this rather new awareness (the connection between somatic conditions and post trauma disorders), clinicians and researchers are revising their diagnoses of PTSD, allowing them to better address the seriousness of any somatic or psychiatric condition in a safer manner (Assion et al., 2009). This is probably one of the main reasons that persuaded many of them, all over the world, to consider EMDR as a useful therapy not only for PTSD but also for several other pscychological or psychiatric conditions.

Thus, the application of EMDR has been continuously growing, and, as a consequence, the need for more randomized controlled trials with it.

Therefore, many studies have recently investigated the effect of EMDR on other mental health conditions such as domestic violence, traumatic grief, traumatic cancer diagnosis, emergency situations, psychotic disorder, depressive and bipolar disorders, anxiety, addiction, and chronic pain.

The data available from studies on some of these disorders, for example, phobias (De Jongh and ten Broeke, 2007), present a consistent and relevant outcome, making it possible that, in future, EMDR will also be considered as an evidence-based therapy for these conditions.

Moreover, evidence has shown EMDR to be a promising effective therapy for depressive disorders (Hase et al., 2015; Valiente-Gomez et al., 2017).

As proof of this, readers can come across an interesting article in this Research Topic by Altmeyer et al. presenting how EMDR therapy leads to a high rate of remission and a decrease in the number of relapses in patients with depressive disorders.

Interestingly, EMDR also seems to constitute a helpful tool to promote psychological and somatic improvement in patients with organic diseases, for example, suffering from depressive symptoms as a consequence of heart attack (Behnammoghadam et al., 2015).

Regarding disorders other than PTSD, EMDR has also shown positive effects in improving OCD symptoms (Feske and Goldsteina, 1997; Nazari et al., 2011; Doering et al., 2013; Triscari et al., 2015). In terms of addictive disorders, alcohol dependence, and craving, EMDR has been able to facilitate a good outcome in this clinical population (Hase et al., 2008; Perez-Dandieu and Tapia, 2014).

It has also been considered a safe and effective therapeutic treatment in decreasing the intensity of conditions such as chronic back pain, which can affect a good portion of society at some stage in their lives and is always relevant.

Last but not least, the application of EMDR in psychotic disorders constitutes the opening of a new frontier in clinical research (Valiente-Gomez et al., 2017).

In summary, EMDR therapy can be seen as an useful tool and an appropriate therapy for various psychiatric conditions associated with PTSD, and as a safe treatment, with no relevant side effects (Feske and Goldsteina, 1997; Doering et al., 2013; Novo et al., 2014; Perez-Dandieu and Tapia, 2014; Hase et al., 2015; Triscari et al., 2015; van den Berg et al., 2015; Gerhardt et al., 2016).

Beyond the clinical point of view, interest in understanding how EMDR actually works (the neurophysiological pathways behind it) has greatly increased in recent years.

As highlighted by Castelnuovo et al. (2019) in their Editorial in the previous Research Topic on this field (*Present and future of EMDR*), two recent articles have gone a step further and are highly relevant to the field.

One, published in *Nature* by Baek et al. (2019), reveals EMDR's mechanism of action and neuroanatomical pathway using an animal model. The authors found that bilateral stimulation, as compared to controlled conditions, led to a clear and persistent decrease in fear behavior. Furthermore, the authors observed that bilateral stimulation increased neuronal activity in the superior colliculus and the mediodorsal thalamus, thus dampening the excitability of neurons in the basolateral nucleus of the amygdala.

The other article is a review published in *Neuron* by Maddox et al. (2019) on the encoding of aversive memory.

Also in this Research Topic, readers will find a very engaging paper on the neurophysiological mechanisms implicated in EMDR (Mattera et al.): it deeply investigates the PTSD mechanisms and hypothesizes how EMDR achieves trauma relief. The authors used a biologically inspired computational model, based on firing rate units, comparing data from patients treated with EMDR or prolonged exposure.

Finally, I would like discuss the innovative article by Hase and Brisch on EMDR and its therapeutic relationship. In this article, the two authors try to describe the therapeutic relationship in EMDR therapy from an attachment-based perspective. The authors conclude their article by describing EMDR therapy as a sensitive psychotherapy, discussing the implications for the treatment, training, and research.

Therefore, it is my absolute pleasure to present this second special Research Topic in *Frontiers in Psychology*, completely dedicated to EMDR.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Acknowledgments

We thank all the authors, researchers, and reviewers that have contributed to this second Research Topic on EMDR therapy.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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ORIGINAL RESEARCH
published: 25 August 2021
doi: 10.3389/fpsyg.2021.701381

Coronavirus Disease 2019 Emergency and Remote Eye Movement Desensitization and Reprocessing Group Therapy With Adolescents and Young Adults: Overcoming Lockdown With the Butterfly Hug

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OPEN ACCESS

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Reviewed by:
Mario Miniati, University of Pisa, Italy
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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *27 April 2021*
Accepted: *27 July 2021*
Published: *25 August 2021*

Citation:
Lazzaroni E, Invernizzi R, Fogliato E, Pagani M and Maslovaric G (2021) Coronavirus Disease 2019 Emergency and Remote Eye Movement Desensitization and Reprocessing Group Therapy With Adolescents and Young Adults: Overcoming Lockdown With the Butterfly Hug. Front. Psychol. 12:701381. doi: 10.3389/fpsyg.2021.701381

The coronavirus disease 2019 (COVID-19) pandemic has represented an individual and collective trauma with an impact on mental health. Restrictive measures such as lockdowns have increased risk factors for the development or triggering of various psychopathologies. Timely psychological intervention has constituted a protective factor that has been indicated as a form of prevention. The main objective of this study was to measure changes in the levels of traumatic stress and anxiety in a clinical population of adolescents and young adults aged 13 to 24 years – already assisted by the local primary and specialty care services before the pandemic – following a trauma-focused psychotherapeutic group intervention according to the eye movement desensitization and reprocessing protocol, conducted remotely before the end of the first lockdown. The Impact of Event Scale-Revised (IES-R), State-Trait Anxiety Inventory (STAI) scales, and the Emotion Thermometer were administered pre- and post-treatment. At the end of the treatment, the Post-Traumatic Growth Inventory (PTGI) questionnaire was administered. The results show that there was a significant improvement pre- and post-intervention in the scores of the scales STAI, IES-R, and Emotion Thermometer with a reduction in post-traumatic symptoms related in particular to the domains of intrusiveness and hyperarousal. The domain of avoidance was less significantly modified by therapy. This overall clinical improvement did not correlate with any of the demographic variables of the sample. In addition, the results show a significant positive global perceived change (PTGI) that did not correlate with the reduction of anxiety or post-traumatic symptoms measured by the other self-report scales. The explored use of telemedicine has revealed a valuable clinical opportunity.

Keywords: COVID-19, lockdown, EMDR, telemedicine, adolescence

INTRODUCTION

On March 11, 2020, the WHO announced the first pandemic caused by a coronavirus. Many countries declared a state of emergency and took strict public health measures to prevent the spread of the virus, to the point of locking down cities (Ellis et al., 2020). In Italy, the lockdown for the coronavirus disease 2019 (COVID-19) pandemic began on March 9, 2020 and ended on May 18, 2020.

Physical isolation, in association with economic instability, fear of the spread of the infection, and uncertainty about the future, has had a profound impact on global mental health, imposing a reorganization of clinical activity (Invernizzi et al., 2020; Li et al., 2020) and defining new research horizons (Brooks et al., 2020; Holmes et al., 2020).

A survey on the mental health of the general population in China 2 weeks after the COVID-19 outbreak showed that about one-third of participants reported a moderate to severe level of anxiety (Wang G. et al., 2020) and about 40% of young people showed a tendency to present psychological problems (Liang et al., 2020a, p.1165). In particular, those who had shown higher levels of psychological distress, such as anxiety, depression, and fear, were more likely to develop symptoms of post-traumatic stress disorder (PTSD; Liang et al., 2020a, p. 1165; Wang W. et al., 2020; Xi et al., 2020). Lifestyle changes and fear of being infected caused anxiety and depressive disorders (Chen et al., 2020). Similar results had already been found in studies conducted on individuals who had been quarantined following the 2003 severe acute respiratory syndrome (SARS) epidemic. These subjects presented a much higher prevalence of symptoms of anxiety, stress, depression, irritability, insomnia, and post-traumatic symptoms than the non-quarantined subjects (Brooks et al., 2020).

This study aimed at investigating how the traumatic nature of the pandemic impacted on adolescents and young adults of a clinical population as individuals and as a community, considering that their developmental phase involves, by its nature, a strong investment in formative tasks related to the interaction with peers and future planning (Oosterhoff et al., 2020).

What happened to young people living in an emergency situation in which they had to face a lockdown condition? Adolescents and young adults forced to stay at home, attend school remotely, and observe physical and social distancing represent a group at risk of experiencing even a greater stressful impact than the rest of the population (Findlay et al., 2020). In particular, some studies have shown that adolescent boys appear to have suffered more from social distancing (Buzzi et al., 2020), while adolescent girls have presented more symptoms attributable to PTSD (Liang et al., 2020b) and a higher risk for depression and anxiety (Chen et al., 2020). In fact, all were exposed to a trauma that could block the capability of planning for and envisioning the future, and some expressed the belief that they were now too far behind with the phase-specific growth tasks of their age (Navarra, 2020). On the contrary, in the face of a collapse of hope, adolescents and young adults have also shown that they know how to reorganize themselves, moving online, to the virtual world, everything they could, from classes to meetings with friends, from work to leisure activities, slipping into a new routine that has helped them to cope with physical distancing also in its social valence (Navarra, 2020). Recent studies have shown that adolescents seem to have a better ability to cope with the adverse living conditions experienced during the COVID-19 pandemic than the adult population (Buzzi et al., 2020).

Other studies have demonstrated that pandemic-related stress levels in these young people appear to be associated with heightened levels of depression and loneliness (Chen et al., 2020; Ellis et al., 2020), also linked to staying home alone during the week. In contrast, time spent with family members, virtual connection with friends, and physical activity appears to be protective factors (Ellis et al., 2020) for mental health, as well as access to psychological support and school rescheduling (Sharma et al., 2020). Indeed, without appropriate psychological interventions, depression and anxiety among adolescents can also become risk factors for mental disorders in adulthood (Danese et al., 2009; Jones, 2013), and it is the promptness of intervention that reduces the prevalence of PTSD (Zhou et al., 2013). In this regard, it is important to emphasize that traumatic events lead those exposed to them to experience feelings of helplessness, hypervigilance, and alarm and experience negative emotions that predispose to negative coping patterns, which are more likely to make psychological distress evolve into full-blown PTSD (Vlahov et al., 2002). Adolescents, who tend to experience emotions with higher intensity due to their specific stage of development (Sahoo et al., 2020), may be at greater risk in this perspective.

Isolation, reduced physical activity, instability of the situation, fear of infection, or the presence of sick relatives in the family may also increase the risk factors for depression, anxiety, post-traumatic disorders, and suicidality, particularly in already vulnerable adolescent populations (Hao et al., 2020; Szlyk et al., 2020) such as those with symptomatic medical histories. Studies confirm the severity of the negative psychological impact of strict lockdown measures on psychiatric patients during the pandemic (Hao et al., 2020).

With the COVID-19 outbreak, the need for evidence-based online PTSD treatments has proved to be urgent. In particular, social distancing measures that have been implemented in many countries to reduce the spread of COVID-19 have forced clinicians to deliver treatment *via* audio/video call, e-mail, or the Internet. Continuing distant-delivered treatment during the pandemic is pivotal because psychiatric patients seem more vulnerable to experience worsening of symptoms after the COVID-19 outbreak compared with people without psychiatric complaints (Hao et al., 2020; Lenferink et al., 2020). Even in our local services for adolescents and young adults, it was essential, during the lockdown, to continue delivering remotely the psychological interventions that were already underway, not only to ensure continuity of care but also to prevent, in the second place, the onset of pandemic-related disorders in the area of mental health (Barney et al., 2020).

The clinical study population was formed by a group of adolescents and young adults aged between 13 and 24 years already assisted by the local primary and specialty care services of the Azienda Socio Sanitaria Territoriale (Asst) of Lecco

(Northern Italy) that presented developmental risk factors related to the exposure to collective traumatic events, such as the pandemic. Therefore, attention was paid to the peri- and post-traumatic symptomatology linked to the experience of the coronavirus during the first lockdown in Italy (February–May 2020), proposing a trauma-focused psychotherapeutic group intervention with eye movement desensitization and reprocessing (EMDR) delivered remotely due to the measures imposed by the COVID-19 pandemic. Post-treatment changes in the levels of traumatic stress and anxiety were measured, and it was assessed whether there had been any personal and interpersonal growth opportunities related to the pandemic context experienced in the first emergency wave. This treatment was proposed before the end of the lockdown (May 2020) in a perspective of prevention, for an adaptive return to life and social relationships in an already vulnerable population of adolescents and young adults.

In summary, the main focus of the study is to detect, in an evolutive and prevention perspective, peri- and post-traumatic symptomatology linked to the experience of the coronavirus during the first lockdown in Italy measured before and after a trauma-focused psychotherapeutic group intervention with EMDR delivered remotely. We expect to discuss the following hypotheses:

- The experience of coronavirus during the first lockdown has had a strong impact on the mental health of adolescents and young adults in terms of post-traumatic stress.
- The EMDR group intervention delivered remotely during the first emergency wave to assist a population of adolescents and young adults, already clinically vulnerable, in the exit from the first lockdown has a positive effect in reducing anxiety and post-traumatic symptoms.
- The pandemic experience could cause personal growth and interpersonal growth that result as the tendency, following a trauma, to report positive changes in three main areas: change in self-perception, interpersonal relationships, and philosophy of life.
- The treatment proposed before the end of the lockdown (May 2020) is a helpful intervention in the perspective of prevention and for an adaptive return to life and social relationships in an already vulnerable population of adolescents and young adults.
- The use of telemedicine in emergencies could be a valuable opportunity.

MATERIALS AND METHODS

Setting

Adolescents and young adults were recruited in two settings of the Asst of Lecco: a psychological service dedicated to young people aged between 15 and 24 years (project #quindiciventiquattro) with common emotional disorders and a local Child and Adolescent Neuropsychiatry service dedicated to adolescents aged between 13 and 18 years.

Participation took place in compliance with the privacy and protection of the sensitive data of those involved, as per company forms. The meetings were held online in compliance with the regulations in force issued by the government during the COVID-19 emergency phase.

Subjects

We recruited 50 adolescents and young adults assisted by the local healthcare services prior to the pandemic who continued to receive psychological care remotely during the lockdown.

Inclusion criteria were as follows: (1) psychological care already initiated, (2) age between 13 and 24 years, and (3) willingness to initiate group treatment focused on COVID-19 trauma. We only involved stabilized clinical cases.

The exclusion criteria were as follows: (1) presence of severe psychopathological conditions (in particular, we excluded subjects with schizophrenia, severe psychosis, delirious disorders, and psychotic onsets, and we also excluded subjects with not yet stabilized clinical frames, for example, patients who have had access to the emergency room or been hospitalized in the past 6 months), (2) suicidal ideation or suicide attempts, and (3) cognitive deficits. For all these patients, a trauma-focused COVID-related group and online treatment were not the clinical priority, and the setting could not be appropriate.

Due to the logistic problems and to avoid overloading the adolescents with excessive tests, the SCL-90 was not administered (see the "Limitations" section of the study). The characteristics of the population are described in **Table 1**.

Assessment

Recruitment of the adolescents and young adults was managed by the therapist who conducted the individual psychological sessions remotely with them during the lockdown. EMDR group treatment focused on the COVID-19-related trauma and the aim of offering support when coming out of lockdown were explained. The use of the TEAMS platform for remote meetings was proposed and shared. Participants were divided into small groups of three or four people. The therapist who facilitated the group was qualified to use EMDR. All EMDR therapists were supervised by an EMDR consultant.

For each subject, a personal data sheet was compiled, which included some COVID-19-related life events such as the presence of family members who had been infected or had died from COVID-19, and the isolation of a sick family member at home due to quarantine.

The following self-report scales were administered before and after the group intervention:

Impact of Event Scale-Revised (IES-R): This scale was used to measure stress levels and symptomatology due to the impact of the traumatic event of the pandemic. The IES-R (Weiss and Marmar, 1997) is a 22-item self-report questionnaire consisting of three subscales (eight items relate to intrusions, eight items evaluate avoidance, and six items assess hyperarousal). The scale assesses the subjective distress caused by traumatic events. Participants were asked to rate each item on a scale from 0 (not at all) to 4 (extremely), based on their experience with the traumatic event in the previous 7 days. An IES-R score $\geq$ 33 represents

TABLE 1 | Demographic variables (n%).

Gender	
F	84%
M	16%
Education	
Elementary school	6%
Bachelor's Degree	4%
Junior high school	82%
High school	8%

Relatives that died from Covid-19	
NO	94%
YES	6%
Domicile during the pandemic	
Isolated in the family (family member in quarantine at home)	14%
Not isolated in the family (nobody quarantined)	86%
Relatives that tested positive for Covid-19	
NO	80%
YES	20%

Diagnosis	
F2	4%
F3	22%
F4	44%
F5	10%
F6	10%
F9	10%

the best cut-off for a probable diagnosis of PTSD. The IES-R was found to be highly internally consistent (Cronbach's alpha, $\alpha = 0.96$; Creamer et al., 2003).

StateTrait Anxiety Inventory (*STAI-Y*): This scale was designed by Spielberger et al. (1983), in the Italian version contained in the CBA 2.0 battery by Cilia and Sica (1998), with the aim of measuring the levels of state anxiety through the STAI-Y1 subscale. The STAI-Y1 (Spielberger et al., 1983) is used to measure the presence and severity of current symptoms of anxiety (state anxiety). The subject rates on a scale of 1 to 4 (with 1 = not at all and 4 = very much) how well various statements fit his or her behavior. Range of scores for each subtest is 20–80, the higher score indicating greater anxiety. A cut point of 39–40 has been suggested to detect clinically significant symptoms for the state anxiety scale. The STAI-Y has shown an adequate to excellent internal reliability (Cronbach's alpha, $\alpha = 0.86$–0.95).

Emotion Thermometer (Mitchell et al., 2010): This is a visual analog self-assessment scale used to measure the level of intensity of emotional activation on a Likert scale from 1 to 10 regarding some main emotional experiences (e.g., stress, depressed mood, anxiety, anger, sleep problems, and need for help) during the previous week.

At the end of the intervention, the following was also administered:

Post-Traumatic Growth Inventory (*PTGI*; Tedeschi and Calhoun, 1996; Prati and Pietrantoni, 2014): This is a self-report questionnaire on post-traumatic growth used to measure any personal and interpersonal changes related to the pandemic event. The scale consists of 21 items with response mode on a Likert scale from 0 (no change) to 5 (very important change) and measures the positive outcomes reported by people that faced negative and adverse experiences (Cormio et al., 2017). The total score ranges from 0 to 105. The PTGI was found to be highly internally consistent (Cronbach's alpha, $\alpha = 0.92$; Prati and Pietrantoni, 2006). Post-traumatic growth is defined as the tendency, following a trauma, to report positive changes in three main areas: change in self-perception, interpersonal relationships, and philosophy of life (Tedeschi et al., 1998). Tedeschi and Calhoun (1996) identified five dimensions on which post-traumatic growth acts and on which the PTGI scale is based: (i) a social dimension, which refers to closeness with others; (ii) a cognitive dimension, which refers to feeling stronger and more capable of solving problems; (iii) an emotional dimension, which includes greater compassion for the suffering of others and better expression of emotions and feelings; (iv) a physical dimension, like assuming a healthier lifestyle; and (v) finally, a spiritual dimension, which refers to changing priorities in life. The underlying construct is the theory that people who have undergone traumatic experiences and struggled with highly demanding and challenging life circumstances can then experience a positive change within themselves, such as developing a new appreciation for life, a newfound sense of personal strength, or a new focus on helping others (Collier, 2016).

Treatment

Eye Movement Desensitization and Reprocessing

The subjects of the study participated in three group meetings of 1 h each, delivered online (in compliance with the rules and authorizations provided by the protocols of telemedicine) according to the *brief EMDR group treatment* protocol created by the re-elaboration of the guidelines for the stabilization-decompression of Critical Incident Stress Management (CISM, Everly et al., 2001; Quinn, 2009) and the specific EMDR protocols for Acute and Recent Traumatic Events (Shapiro and Laub, 2008). For alternating bilateral stimulation, the butterfly hug was used (Maslovaric, 2020).

Eye Movement Desensitization and Reprocessing (EMDR) is a therapeutic approach used for the treatment of trauma and traumatic stress-related issues (Shapiro, 2000) based on the adaptive information processing (AIP) model (Shapiro, 2000). According to the AIP, the traumatic event experienced by the subject is stored in memory together with the disturbing emotions, perceptions, cognitions, and physical sensations that characterized that moment. All the information stored in a dysfunctional way remains "frozen" within the neural networks and cannot connect to other networks with useful data (Fernandez and Giovannozzi, 2012); unable to be processed, it continues to cause discomfort in the subject, up to the onset of diseases such as PTSD and other psychological disorders. The aim of EMDR is to restore the natural way of processing the information in the memory to achieve an adaptive resolution through the creation of new, more functional connections. A distinct characteristic of EMDR therapy is the use of

alternating bilateral stimulation (e.g., eye movements, tactile stimulation, auditory stimulation, and butterfly hug), which appears to produce a physiological effect promoting accelerated reprocessing of dysfunctionally stored information related to the traumatic event (Jeffries and Davis, 2013; Carletto et al., 2017; Pagani et al., 2017). EMDR is considered as one of the elective psychotherapeutic treatments for PTSD, according to several meta-analyses and clinical guidelines, and its neurobiological effects are also supported by neuroimaging findings (Pagani et al., 2012; Carletto et al., 2018, p. 2).

At present, it is recognized as an evidence-based method for the treatment of post-traumatic disorders (Baek et al., 2019; Maddox et al., 2019) approved by the *American Psychological Association* (1998–2002), the *American Psychiatric Association* (2004), the *International Society for Traumatic Stress Studies* (2010), and the *Italian Ministry of Health* in 2003. The WHO in August 2013 recognized EMDR as an effective treatment for trauma and trauma-related disorders.

Statistical Methods

Preliminary Coding

The data relating to the 50 subjects were preliminary coded to facilitate the analysis and interpretation of results. This coding, while keeping invariant the original meaning of the variables, allowed for a less biased statistical treatment. This process involved the following:

1. Generation of an ordinal variable named rankscol corresponding to the educational level of the subjects, thus elementary school = 1, junior high school = 2, high school = 3, and bachelor's degree = 4. The natural ordering of the different school grades allows considering only one rank variable instead of four qualitative ones.
2. Elimination of the variables with null (or almost null) variance in the dataset. As a matter of fact, a variable with all identical results does not carry any relevant information (i.e., this was the case of the variable "tested positive for COVID-19" that has all negative answers).
3. Merging less populated classes. This allows to get a more sensible way to perform chi-square statistics or other nominal variables analyses. This merging kept invariant the content of the relative variable for the lockdown variable that was reduced to two entries no quarantine/quarantine for no relatives isolated and one or more quarantined relatives, respectively.

In order to autoscale both the IES and Emotion Thermometer variables, the respective items (each one computed in the pre- and post-conditions) were expressed in terms of differential values: delta = pre–post. All the subsequent correlation analyses were executed on such delta variables.

Emerging Properties and Chance Correlation Reduction

In order to both reduce the risk of chance correlations and evaluate the presence of emergent collective properties from single items, we collapsed all the test variables into only one integrative index correspondent to the first principal component of IES and thermometer items (deltaf1), represented in delta terms (see Factor procedure in SAS 11.2 software earlier). This was made possible by the very strong mutual correlation among the different original variables and endowed with all positive loadings (correlation coefficients between original variables and component). This made deltaf1 a "size" component (Jolicoeur and Mosimann, 1960) directly registering the coherent entity of change of all the studied parameters. Principal component analysis (PCA) was computed over the correlation matrix of the original variables so giving rise to normalized (Z-scores) component scores having zero mean and unit standard deviation on the entire set of subjects. This means that a subject with a negative component score has a "less than average" amelioration, while a subject with a positive component score has a "greater than average" response.

We adopted the same procedure for PTGI data. In this case, the main variabile (changeglobal) explained 64% of total variance collecting all the items with the only exception of "spiritual change" that generated an independent component of its own (PC2) we named spiritual change accounting for 17% of variance. This component in any case is largely irrelevant given only a minority of subjects scored a different from 0 delta as for spiritual change.

Inferential Statistics

The influence of demographic nominal variables on both deltaf1 and changeglobal was assessed by ANOVA (General Linear Model [GLM] procedure in SAS 11.2 software), while Spearman's correlation coefficient (CORR procedure in SAS 11.2 software) was applied to check the influence of ordinal and quantitative variables on the test variables.

When submitted to paired t-test, almost all the variables showed a statistically significant departure from delta = 0, corresponding to the no-change condition.

RESULTS

First (**Table 2**), we extracted the main principal components from the original 11 variables dataset corresponding to the IES and thermometer items. The five-component solution explained around 82% of total variance with the first component (deltaf1) accounting alone for 40% of the original information. As mentioned in the Methods section, deltaf1 emerges as a global index upon which the effect of covariates is tested.

All single IES-R and thermometer variables showed post-EMDR highly significant changes in delta scores albeit with differences between one and the other (**Table 3**).

As evident from **Table 4**, deltaf1 has no statistically significant correlation with demographic variables, with the exception of the correlation between age and rankscol. The latter is largely trivial, being linked to the progression of students along with the school curriculum.

Table 5 reports the PCA relative to PTGI variables; as anticipated in the Methods section, even here we have a first principal component collecting the major portion of variance

TABLE 2 | PCA on delta variables (IES and Thermometer).

	Deltaf1	Deltaf2	Deltaf3	Deltaf4	Deltaf5
Deltaiesavoidance	**0.59**	−0.45	−0.36	0.07	0.27
Deltaiesintrus	**0.70**	−0.44	0.36	−0.09	−0.05
deltaieshypera	**0.78**	−0.40	−0.03	−0.09	−0.14
Deltaiestotal	**0.84**	−0.53	−0.01	−0.04	0.04
delta stress	**0.62**	0.50	−0.24	−0.32	−0.20
delta anxiety	**0.60**	0.47	0.16	−0.17	−0.22
delta mood	**0.61**	0.51	−0.13	0.32	0.10
delta anger	**0.73**	0.16	−0.28	−0.16	−0.18
delta sleep	0.40	0.02	0.31	**0.77**	−0.31
delta help	0.34	0.22	**0.75**	−0.28	0.27
Deltastaix	**0.58**	0.38	−0.09	0.23	0.53

In bold the variables grouped in the same component.

TABLE 3 | Univariate statistics relative to the delta variables.

Variables	Mean	Standard deviation	*P*<
deltaiesavoidance	2.72	5.05	**0.0005**
Deltaiesintrus	4.04	5.22	**0.0001**
deltaieshypera	3.94	4.37	**0.0001**
Deltaiestotal	10.70	11.90	**0.0001**
delta stress	2.00	2.72	**0.0001**
delta anxiety	2.00	2.71	**0.0001**
delta mood	1.22	2.65	**0.005**
delta anger	0.86	2.90	**0.05**
delta sleep	0.76	2.69	**0.05**
delta help	1.54	2.54	**0.0001**

In bold the statistical significances.

TABLE 4 | Spearman correlation matrix and *p* values between deltaf1 and demographic variables.

	Age	rankscol	n. of live-in members	DELTAF1
Age	100.00	0.69	0.013	−0.02
		< 0.0001	0.93	−0.87
Rankscol	0.69	100.00	0.08	−0.02
	< 0.0001		0.57	0.89
n. of live-in members	0.01	0.08	100.00	0.02
	0.93	0.57		0.87
DELTAF1	−0.02	−0.02	0.02	100.00
	0.87	0.89	0.87	

In bold the statistical significances.

(64%) and practically coincident with the delta between the sum over all items (Pearson's *r* between changeglob and PTGI sum = 0.99).

Table 6 reports the Spearman's correlation between PTGI components and demographic numerical and ordinal variables. Beyond age, there are two weak albeit statistically significant results, pointing to a smaller change for subjects living in big families (Spearman's correlation between changeglob and number of live-in members = −0.33) and a more marked spiritual change in lower degree students ($r = -0.30$).

TABLE 5 | PCA relative to PTGI variables.

	changeglobal	changespirit	PC3
relatingtoothers	**0.85**	−0.19	0.07
newpossibilities	**0.92**	−0.03	0.02
Personalstrength	**0.83**	−0.30	0.35
spiritualchange	0.50	**0.85**	0.15
appreciationoflife	**0.83**	0.01	−0.52

In bold the variables grouped in the same component.

It is worth noting that PTGI and deltaf1 variables are independent of each other, so pointing to a different dimension of change with respect to emotional and psychological parameters registered by PTGI variables (**Table 7**).

The PTGI scored 15.88 ± 7.74 for relating to others, 10.82 ± 6.1 for new possibilities, 9.86 ± 4.93 for personal strength, 0.72 ± 1.26 for spiritual change, and 7.48 ± 3.48 for appreciation of life.

As for STAI-Y, the delta between pre- and post-treatment had a mean of 5.08 ± 10.56 with a significance level of $p < 0.002$.

DISCUSSION

The analysis by principal components revealed a first size component (deltaf1) which, representing 40% of the variance, grouped together the differential values of most of the variables in question. Specifically, there was a significant pre- and post-treatment improvement in the scores of the STAI-Y1, IES-R, and Emotion Thermometer scales. The results point to a post-intervention reduction in anxiety levels and post-traumatic symptomatology in line with previous studies (de Roos et al., 2011; Chen et al., 2014; Wilson et al., 2018; Yunitri et al., 2020). Although the current health emergency is unprecedented, these findings confirm that early intervention with EMDR has positive effects on reducing psychological distress, as it was found in populations exposed to natural disasters such as earthquakes (Saltini et al., 2018).

Regarding the change in the level of psychological distress measured by IES-R, there was a higher reduction of symptoms related to the domains of intrusiveness and hyperarousal. This finding confirms the effectiveness of EMDR in reducing the emotional impact of the stressful event linked to COVID-19 and the lockdown: intrusive thoughts are mitigated, becoming more adaptive from a therapeutic point of view, and emotions and physical sensations are reduced in intensity. The decrease in hyperarousal suggests a higher capacity to manage anxiety, functional to the possibility of more adaptive behaviors when the lockdown ends. In line with these findings, we can also read the reduction of the overall scores on the STAI-Y1: youngsters perceive post-intervention lower levels of anxiety and stronger feelings of calm and safety.

The improvement in the domain of avoidance is statistically significant but to a lesser extent. The data confirm what emerged from other studies (Saltini et al., 2018): the aspects of avoidance persist more over time within the mental functioning of the

TABLE 6 | Spearman correlation matrix and *p* values between PTGI components and demographic numerical and ordinal variables.

	Changeglob	changespirit	age	rankscol	n. of live-in members
Changeglob	100.00	−0.19	−0.15	−0.05	−0.33
		0.18	0.29	0.71	**0.02**
changespirit	−0.19	100.00	−0.20	−0.30	0.02
	0.18		0.17	**0.03**	0.90
Age	−0.15	−0.20	100.00	0.69	0.01
	0.29	0.17		**< 0.0001**	0.93
Rankscol	−0.05	−0.30	0.69	100.00	0.08
	0.70	**0.03**	**< 0.0001**		0.57
n. of live-in members	−0.33	0.02	0.01	0.08	100.00
	0.02	0.90	0.93	0.57	

In bold the statistical significances.

individual. With reference to our population and considering that the COVID-19 pandemic is occurring in several emergency waves, the persistence of aspects related to avoidance could have an adaptive nature, functional to the fact that phase-specific growth tasks like the capacity of planning for and envisioning the future are hindered by the lockdown.

The deltaf1 component does not comprise the measurement of sleep disturbance and the need for help included in the Emotion Thermometer, which remain stable over time. It is presumed that, in the first case, the absence of pre- and post-treatment change is due to the condition of being hyper-connected, amplified by distance learning during the lockdown; and in the second case, to the fact that all subjects were in therapy even before the outbreak of the pandemic.

The overall clinical improvement does not correlate with any of the demographic variables of the sample taken into consideration, from which it appears independent. Nor does it correlate with the level of post-traumatic growth, as shown also in other studies (Jeon et al., 2017).

With respect to post-traumatic growth, the results confirm a perceived global positive change (changeglobal at PTGI). It should be considered the limitation related to the questionnaire, which records only positive changes and not negative ones.

Finally, it can be speculated that the overall clinical improvement and the global post-intervention perceived positive changes indicate the preventive function that early treatment with EMDR may have had on the exit from lockdown as a COVID-19-related life event.

The significant modifications recorded pre- and post-remotely delivered EMDR group treatment are in line with previous studies conducted face to face (Chen et al., 2014; Saltini et al., 2018; Wilson et al., 2018), confirming the importance of telemedicine in emergencies. However, further studies are needed to evaluate the effects of face-to-face vs. online treatments, as well as face-to-face EMDR vs. guided online EMDR (Lenferink et al., 2020).

An interesting prospect will be to be able to monitor changes over time with respect to new waves of emergency by comparing the scores of the sample with the scores of adolescents and young adults assisted by the local healthcare services but not treated with EMDR.

TABLE 7 | Pearson correlation coefficients relative to main principal components of IES, Thermometer and PTGI.

	DELTAF1	changeglob	changespirit
DELTAF1	100.00	−0.14	−0.02
		0.35	0.88
changeglob	−0.14	100.00	0.00
	0.35		10.00
changespirit	−0.022	0.00	100.00
	0.88	10.00	

Limitations

The main limitation is the sample size, especially when compared with the number of items administered with the scales. Being aware of the possible flaw, as for the IES-R (22 items) and PTGI (21 items), we used only four and five cumulative scales, deriving from the summation of specific subsets of items, respectively, and only one cumulative value for the STAI-Y (20 items).

Furthermore, to overcome the above-sketched limitation, we performed the PCA on the delta values of IES-R and thermometer items demonstrating the presence of five components explaining 82% of the variance (40% for the first component only). The emergence of such a global index corroborated the effect of treatment on the single variables. It has to be stressed that all items gave a significant result in terms of pre- and post-treatment of delta variables.

Another limitation Is represented by the absence of a self report scale to detect psychopathological diagnoses of any instrument for general psychopathology; to avoid overloading the adolescents with excessive tests, the SCL-90 was not administered.

Conclusion

The COVID-19 pandemic was and is a traumatic personal and collective event that occurs in multiple emergency waves, imposing repeated lockdowns. The EMDR group intervention delivered remotely during the first emergency wave to assist a population of adolescents and young adults, already clinically vulnerable, in the exit from the first lockdown had a positive effect in reducing anxiety and post-traumatic symptoms and was accompanied by a perception of global positive change. The need imposed by the pandemic to explore new frontiers as therapists,

particularly the use of telemedicine in emergencies, proved to be a valuable opportunity. Therefore, the significant change before and after online group treatment with EMDR as measured through the self-report scales encourages us to continue in this direction, despite all the uncertainties we have experienced in this pandemic, both as professionals and as adults, in order to rewrite the hope in a possible future with the adolescents and young adults assisted by the local healthcare services.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

RI, EF, and GM contributed to conception and design of the study. RI and EF organized the database. MP performed the statistical analysis. EL, RI, and EF wrote the first draft of the manuscript. All authors wrote sections of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

ACKNOWLEDGMENTS

We wish to thank Ambulatorio Adolescenti SC.NPIA (Francesca Macchi, Flavia Passoni, Francesca Rossicone) and Progetto #quindiciventiquattro (Pietro Alfieri, Marta Carenini, Paola Galli, Chiara Lanfranchi) for their contribution in the acquisition of data and Asst Lecco (Enrico Frisone, Vittorio Rigamonti, Ottaviano Martinelli, Carmen Baldi). Special thanks to Valentina Martini, Isabel Fernandez, and EMDR Italy Association for the enthusiasm and the logistic support. We also thank all the adolescents and young adults we have met.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 05 October 2021
doi: 10.3389/fpsyg.2021.748712

OPEN ACCESS

Edited by:
Christopher William Lee, University of Western Australia, Australia

Reviewed by:
Nathaniel James Siebert Ashby, Technion Israel Institute of Technology, Israel
M. Teresa Anguera, University of Barcelona, Spain

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *28 July 2021*
Accepted: *10 September 2021*
Published: *05 October 2021*

Citation:
Mischler C, Hofmann A, Behnke A, Matits L, Lehnung M, Varadarajan S, Rojas R, Kolassa I-T and Tumani V (2021) Therapists' Experiences With the Effectiveness and Feasibility of Videoconference-Based Eye Movement Desensitization and Reprocessing. Front. Psychol. 12:748712. doi: 10.3389/fpsyg.2021.748712

Therapists' Experiences With the Effectiveness and Feasibility of Videoconference-Based Eye Movement Desensitization and Reprocessing

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Research on the effectiveness and applicability of eye movement desensitization and reprocessing (EMDR) *via* videoconference is sparse. Considering the emerging use of internet-based psychotherapy during the COVID-19 pandemic, information on videoconference-based EMDR (eEMDR) would be beneficial for many therapists. In this study, 23 therapists from the EMDR-Institute in Germany provided information about their experiences with eEMDR in a questionnaire-based survey. Information on the effectiveness and the course of 102 eEMDR sessions was recorded. Results showed the potential of eEMDR as an effective and viable method. The decrease in the subjective unit of disturbance (SUD), which is an important indicator of treatment outcome, was found to be at a similar level compared to that of previous EMDR studies that were not administered in eEMDR format. The most important predictor of the SUD decrease was the type of bilateral stimulation used in eEMDR sessions. Eye movements resulted in significantly greater SUD reductions than tapping. Perceived disadvantages and impediments for the implementation of eEMDR were mainly of bureaucratic and technical concerns. In addition, about one-third of the therapists stated that some patients were not willing to engage in eEMDR. In our study, eEMDR proved to be a practically applicable therapy method and therefore, therapists can consider using eEMDR. These findings will hopefully encourage EMDR therapists and their patients to use eEMDR due to its effectiveness and viability as an online treatment approach.

Keywords: eEMDR, videoconference-based EMDR, EMDR-online, therapist experiences, traumatherapy in pandemic, internet-based trauma-therapy, trauma-focused psychotherapy, COVID-19 pandemic

INTRODUCTION

Mental health consequences of the COVID-19 pandemic suggest a high demand for psychological support during this unprecedented situation (e.g., Benke et al., 2020). At the same time, therapists are constrained from conducting face-to-face psychotherapy sessions due to the risk of infection. To resolve this challenge, an increasing number of therapists is adapting to internet-based psychotherapy sessions (Békés and Aafjes-van Doorn, 2020; DPtV, 2020).

Eye movement desensitization and reprocessing (EMDR) as well as trauma-focused Cognitive-behavioral therapy (CBT) are the primary choice for treatment of PTSD (WHO, 2013; NICE, 2018). EMDR is an eight-phase approach for the treatment of PTSD, developed by Dr. Francine Shapiro in 1987 (Shapiro, 1996; Hofmann, 2014). Both EMDR and CBT are efficacious in treating PTSD symptoms in face-to-face settings (Seidler and Wagner, 2006). Moreover, there is ample evidence for the efficacy of internet-based CBT in the treatment of PTSD symptoms (Knaevelsrud and Maercker, 2007; Lewis et al., 2019). Thereby, internet-based therapy includes both synchronous and asynchronous formats. Synchronous formats mostly cover videoconference-based therapy sessions with direct contact with a therapist, whereas asynchronous formats include different interventions and trainings that are intended to be mainly self-directed (Kuhn and Owen, 2020).

A recently published review showed a lack of available evidence on effects of internet-based EMDR (Lenferink et al., 2020). Furthermore, there are doubts whether the implementation of EMDR *via* videoconference is feasible and appropriate (Gibson et al., 2009; DPtV, 2020). As of now, there are only three studies which examined the effectiveness of internet-based EMDR (Todder and Kaplan, 2007; Spence et al., 2013; Tarquinio et al., 2021). In the study of Tarquinio et al. (2021) an adapted EMDR protocol was applied. Healthcare providers suffering from the effects of the sanitary crisis in hospitals due to the COVID-19 pandemic were treated with the adapted protocol (URG-EMDR) *via* videoconference. Their distress, measured as a reduction of the subjective unit of disturbance (SUD; Wolpe, 1969), significantly decreased in one session. In a study of Spence et al. (2013) patients received a six-lesson online intervention with a combined treatment protocol, i.e., trauma-focused CBT (TF-CBT) and EMDR with a web-based EMDR tool. Results showed a decline in PTSD symptoms both directly after the intervention and after 3 months. A single-case report, Todder and Kaplan (2007) described the successful treatment of a patient with a traumatic memory through a single EMDR session conducted *via* videoconference. These promising findings illustrate the potential of videoconference-based EMDR ("eEMDR"); however, they do not provide general conclusions about the effectiveness of eEMDR in an outpatient treatment setting. In times of COVID-19 and beyond, improvements in the provision of eEMDR and information on its effectiveness in treating PTSD especially in routine outpatient care are strongly required.

To address this research gap, we studied the effectiveness of eEMDR on patients with PTSD and other diagnoses within the framework of an explorative approach. For the study purpose, we consulted therapists from the EMDR-Institute in Germany regarding their experiences with eEMDR sessions during the COVID-19 pandemic. Our study focused on obtaining information regarding the effectiveness of eEMDR sessions in a standard outpatient routine treatment, i.e., ratings of the EMDR process and the SUD decrease in patients reported during an eEMDR session. Notably, the SUD decrease can be seen as an important tool for therapists to assess the treatment process (Kim et al., 2008). Potential moderators of these indicators of effectiveness were considered; we particularly examined possible influences of different modes of bilateral stimulation and the therapists' professional experience on the treatment outcome. Previous research on the latter topic showed inconsistent results (Propst et al., 1994; Tschuschke et al., 2015; Goldberg et al., 2016). Furthermore, we collected information on the technical aspects of eEMDR sessions and challenges in implementing eEMDR. In addition, we also collected therapists' qualitative feedback concerning perceived advantages and disadvantages as well as required improvements of eEMDR sessions. Overall, our study aimed to provide explorative information on the feasibility and effectiveness of eEMDR.

MATERIALS AND METHODS

Participants

Therapists

Four hundred EMDR-therapists were addressed *via* email, and 32 (8%) of them responded and returned filled-in questionnaires. Therapists were mainly female (81.3%) and more than half of them (65.6%) were aged between 51 and 65 years. They had a mean professional experience of 19.77 years ($SD = 9.23$, range = 4–35 years) and a mean EMDR experience of 10.72 years ($SD = 6.59$, range = 1–28 years). Therapists were mainly trained in administering CBT (56.3%) and depth psychology (40.6%). Some therapists (12.5%) indicated they have already had experience with online-based psychotherapy before the COVID-19 pandemic.

Patients

Therapists provided session data for a total of 76 different patients. Patients were mainly female (77.6%) and aged between 18 and 68 years ($M = 41$, $SD = 12.09$). On average, patients had received 4.84 eEMDR sessions ($SD = 5.28$, range = 0–30). Regarding their mental health, roughly 50% of the patient cohort fulfilled criteria of one diagnosis, while the other half of the patients had multiple comorbid diagnosis (see **Figure 1**).

Figure 2 shows patients' main diagnoses grouped according to ICD-10 code. The majority of patients were diagnosed with a disorder from cluster F.43 "acute stress reactions." Secondary diagnoses were mainly psychological problems (i.e., depressive, anxiety, dissociative, somatoform, eating and personality disorders), whereas four patients were also diagnosed with somatic diseases (malignant neoplasm of prostate; obesity due to access calories; 2× relapsing-remittent multiple sclerosis).

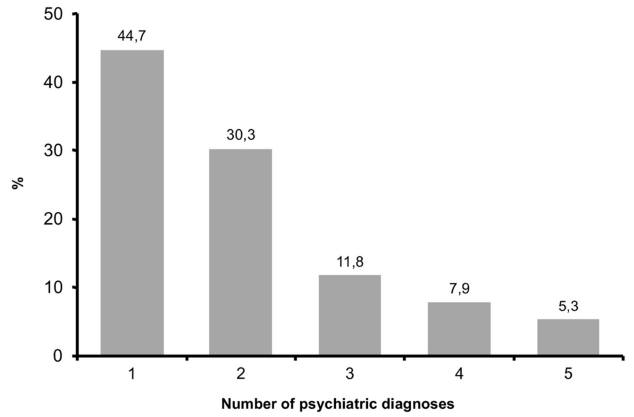

FIGURE 1 | Number of patients' psychiatric diagnoses ($N = 76$).

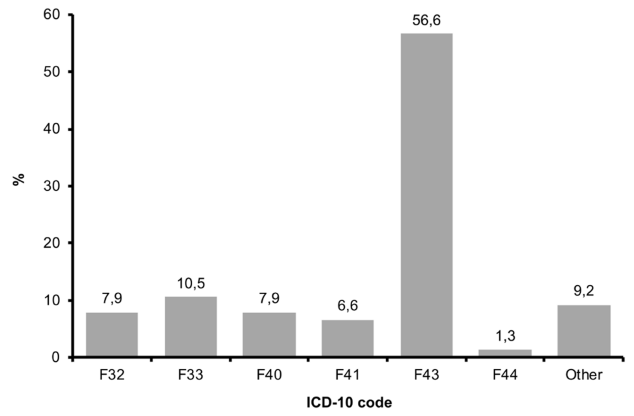

FIGURE 2 | Patients' main diagnosis grouped after ICD-10 code ($N = 76$).

Sessions

Therapists were requested to return eEMDR session protocols of at least three different patients. Nine therapists did not return protocols because they had not yet conducted eEMDR. However, they provided information on generic questions like perceived barriers to online therapy, alternatives to eEMDR in COVID-19 pandemic, and experience with online therapy in general. The remaining 23 therapists on average returned 4.44 eEMDR session protocols ($SD = 4.50$, range = 1–22) and eventually, 102 protocols were available for evaluation. **Figure 3** shows the flow chart of participating therapists and eEMDR session protocols. Mean duration of eEMDR sessions was 61.21 ($SD = 19.75$, range = 30–100) minutes.

Questionnaire

Therapists were sent a survey consisting of two parts, i.e., 21 questions regarding the therapist and 36 questions regarding the eEMDR session, each comprising qualitative and quantitative items

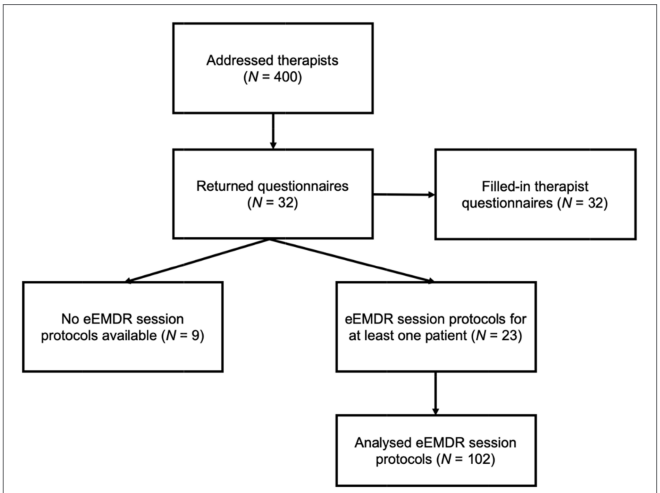

FIGURE 3 | Therapist and session flow chart.

and all answers were provided by therapists. Based on the usual procedure, SUD values at the beginning and end of the session were reported by patients.

Therapist Module

Therapists reported sociodemographic data, information about their professional background (e.g., "*Since when are you practicing EMDR?*"), their experiences with online-based psychotherapy (e.g., "*Do you have experience with video-based psychotherapy/online therapy in general?*") and provided description of the technical as well as organizational measures they implemented to administer eEMDR (e.g., "*Which technical equipment did you use for the eEMDR treatment?*").

Session Module

The session-related questions concerned information about the patients (e.g., age, gender, diagnoses), technical aspects of the eEMDR session (e.g., duration, time, use of different protocols, mode of bilateral stimulation, type of eye movements), and ratings concerning the quality of the eEMDR session (e.g., quality ratings of eEMDR sessions compared to face-to-face EMDR sessions, decrease in SUD ratings from beginning of a session to its end, ratings of process, adherence, confrontation, and grounding). Moreover, on qualitative items, the therapists reported their opinion on advantages and disadvantages of eEMDR as well as adjustments and improvements necessary for the further use of eEMDR.

Procedure

Questionnaires were sent *via* e-mail to therapists from the EMDR network in Germany. The e-mail informed therapists about the purpose and all procedures of the study as well as data protection issues. Most of the questionnaires were returned *via* postal mail; only a few were returned *via* e-mail. All study procedures were approved by the ethics committee of Ulm University.

Statistical Analysis

Data were prepared and analyzed with IBM SPSS statistics (version 26.0.0.0) and R (version 1.3.1093). Our aim was to relate patient and therapist characteristics to quantified session effectiveness. Decrease in SUD ratings was analyzed for associations with potentially influential variables using Spearman's rank correlation coefficients and Pearson's correlation coefficients where applicable. Group comparisons with potential predictors of SUD decrease were computed with Kruskal-Wallis tests. Bonferroni-Holm corrections were conducted to correct the results for multiple testing. A multiple linear regression analysis was computed to examine the combined relevance of various predictors of SUD decrease. Qualitative statements about therapists' attitudes towards eEMDR were collected as free text. The statements were reviewed, and frequency statistics were derived based on superior categories. This classification was crosschecked by one of the other authors (VT).

TABLE 1 | Most frequent combinations of the standard EMDR protocol in eEMDR sessions.

Combination	Frequency (%)
Future perspective	7 (11.1)
Four-fields-technique	3 (4.8)
Flash-technique, grounding, safe place, light stream technique	3 (4.8)
CIPOS, grounding, safe place, light stream technique	3 (4.8)
EMD, EMDr	2 (3.1)
Grounding, safe place	2 (3.1)
Four-fields-technique, grounding, safe place, light stream technique, four-elements-exercise	2 (3.1)

EMDR, Eye Movement Desensitization and Reprocessing; CIPOS, Constant Installation of Positive Orientation and Safety; EMD/EMDr, variations of the EMDR standard protocol (EMD = strictly focused shape of EMDR; EMDr = more focused EMDR in its association). Relative numbers referring to the complete use of the standard EMDR protocol, solely and combined (N = 63).

RESULTS

Technical Aspects of eEMDR

Technical Devices

In most eEMDR sessions, patients used computers or laptops (86.8%) followed by smartphones (18.4%). Likewise, therapists conducted the sessions mainly on computers or laptops (95.7%), followed by smartphones (8.7%), and tablets (8.7%). Some therapists also switched between different technical devices. Occasionally, they used additional equipment, i.e., headsets (30.4%), telephones (17.4%), and additional cameras (8.7%).

Use of Protocols

Eye movement desensitization and reprocessing is a treatment algorithm developed by Shapiro that uses 8 phases and 3 temporal focusing steps to process stressful material. EMD is a modified EMDR protocol that focuses on a single high charge memory. EMDr is another slightly differently modified EMDR protocol that focuses on a single memory and allows only a limited range of associations in the processing phase (Shapiro, 2013). The standard EMDR protocol was conducted in 61.8% of the sessions, EMD in 2.9%, and EMDr in 3.9% of the sessions. Out of the sessions using the standard EMDR protocol, in 73% of sessions, the standard EMDR protocol was exclusively applied, whereas in 27% of sessions, the standard protocol was combined with other protocols (**Table 1** shows the most frequent combinations). When the standard EMDR protocol was used, 53.2% of the sessions ended as complete sessions.

Mode of Bilateral Stimulation

In 52.9% of the sessions, bilateral stimulation was administered *via* eye movements and in 36.3% of the sessions *via* tapping. In 7.8% of the sessions, both modes of bilateral stimulation were combined. When using eye movements for bilateral stimulation, supportive tools (e.g., emdr remote, light bar, eye scan etc.) were often (51.9%) used to evoke eye movements. Less often (31.5%), therapists guided the patients' eyes with their fingers, while acoustical guidance (9.3%) and instructing the patients to switch their gaze between room corners (5.6%) were rarely used.

Stop Signal

In most of the sessions, patient and therapist agreed on raising the hand as a stop signal (43.8%), while in 20.8% of the sessions, patient and therapist agreed on saying "stop," and in 15.6% of the sessions, both signals were used concomitantly. Rarely, other stop gestures (e.g., shaking the head or standing up) were agreed.

Measures of Effectiveness

Ratings of eEMDR Sessions

In roughly 90% of the sessions, the therapists rated the overall impression of eEMDR sessions as very good (i.e., with eight to ten out of ten possible points). Similarly, when asked more specifically about the impression of the eEMDR process, therapists also submitted very good ratings. **Figure 4** depicts the therapists' process rating in more detail. Medians and means of all eEMDR session ratings are shown in **Table 2**. Moreover, when compared to face-to-face EMDR, the therapists rated 91.2% of eEMDR sessions as *good* or *very good* (*Mdn* = 5 *very good*), and no session has been considered *very bad* as compared to face-to-face EMDR.

SUD Ratings

On average, the patient-rated SUD decreased by $M = 73.1\%$ from the beginning to the end of an eEMDR session (see **Table 3** for details). A relative SUD decrease was calculated to take into account the varying SUD ratings at session begin. As some eEMDR sessions ended incompletely, a relative SUD decrease could not be gained from every session protocol.

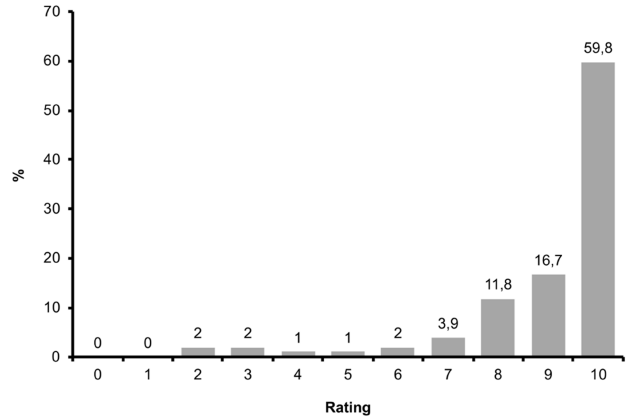

FIGURE 4 | Process ratings in eEMDR sessions ($N = 102$). 0 = very bad, 10 = very good.

TABLE 2 | Descriptive statistics of different eEMDR ratings.

Rating	*Mdn*	*M*	*SD*	Range
Overall	10	9	1.77	2, 10
Process	10	8.99	1.98	0, 10
Adherence	10	9.29	1.22	3, 10
Confrontation	10	9.18	1.46	3, 10
Grounding	10	9.19	1.81	0, 10

TABLE 3 | Descriptive statistics of different subjective unit of disturbance (SUD) ratings.

Rating	*Mdn*	*M*	*SD*	Range
SUD beginning	5	7.98	1.6	4, 10
SUD end	2	2.24	2.28	0, 8
SUD phase 8[a]	1	1.83	2.64	0, 10
Relative SUD decrease[b]	77.8	73.1	26.8	11.1, 100

[a]*Values referring to SUD phase 8 ratings, when sessions were ended as complete sessions; values from incomplete sessions were excluded from this analysis (N = 41).*
[b]*A relative SUD decrease was calculated to take into account varying SUD ratings at session begin.*

Influences on SUD Decrease

Correlational analyses indicated significant associations neither between the therapists' general professional experience and the relative SUD decrease, $r = 0.00$, $p = 0.999$, nor between the therapists' EMDR experience and the relative SUD decrease, $r = -0.02$, $p = 0.865$. The relative SUD decrease was also independent from patients' sex, $r_{pb} = -0.02$, $p = 0.844$, from therapists' sex, $r_{pb} = -0.13$, $p = 0.359$, and from patients' age, $r = -0.10$, $p = 0.404$. Depending on the different therapist age categories, there were no differences in the relative SUD decrease either, $\chi^2(5) = 8.82$, $p = 0.116$. The SUD decrease was lower in sessions with patients who have already had more eEMDR sessions, $r = -0.23$, $p = 0.049$.

The relative SUD decrease differed significantly depending on the mode of bilateral stimulation, $\chi^2(2) = 14.11$, $p < 0.001$. As displayed in **Figure 5**, *post hoc* tests showed, eye movements have been more effective in reducing the SUD ($Mdn = 1$) than tapping ($Mdn = 0.68$).

To test whether the effect of bilateral stimulation still influences the relative SUD decrease when adjusting for the therapists' general work experience and specific EMDR experience, a multiple linear regression was computed, $F(4,71) = 3.93$, $p = 0.006$, $R^2 = 18.1\%$. The analyses corroborated the relevance of the mode of bilateral stimulation as a significant predictor of the relative SUD decrease. However, the therapists' general work experience and EMDR experience were not of relevance (see **Table 4**).

Linear *post hoc* contrasts replicated that eye movements enabled to reduce the SUD significantly stronger than tapping (23.8%, $p_{Holm} < 0.001$), while there was no difference between eye movements and combined eye movements and tapping ($p_{Holm} = 0.166$) and tapping and combined eye movements and tapping ($p_{Holm} = 0.649$).

Therapists' Attitudes Towards eEMDR

Therapists most frequently reported that unstable internet connection either on patient or therapist side to be a barrier to implement eEMDR (37.5%). Several therapists also indicated that their patients refused online-based therapy (31.3%). Some therapists considered lack of personal contact (28.1%) and missing withdrawal options for the patients in their flat (21.9%) as barriers. 6.3% of the therapists considered their own media and technology skills or their patients' cognitive or sensory limitations as barriers. Interestingly, no therapist indicated high impulsivity of patients as a barrier for online therapy.

Furthermore, therapists were asked to report advantages and disadvantages of eEMDR sessions compared to face-to-face EMDR sessions as free text. Qualitative statements about advantages and disadvantages were reviewed and combined to superior categories. Results and frequencies of reported disadvantages can be seen in **Table 5**. Answers to the question concerning therapists' perceived advantages of eEMDR sessions compared to face-to-face EMDR sessions were clustered into five categories as displayed in **Table 6**.

Difficulties with internet connection and dissociating patients were frequent answers concerning perceived disadvantages of eEMDR sessions. We therefore took a closer look at the actual connectivity issues and occurrence of dissociation during eEMDR sessions. Results showed that in 13.7% of the sessions, the connection was interrupted. Nevertheless, a SUD decrease of 68.3% could be accomplished in those sessions, and half of those sessions could be ended completely. Dissociations occurred in patients in 11.8% of the sessions. In those sessions, the mean relative SUD decrease was 53%, and one-third of those sessions could be ended as complete sessions.

TABLE 4 | Multiple regression on the association between SUD decrease and the mode of bilateral stimulation, the therapists' general work experience and their specific EMDR experience.

	F	*df*	*B*	*SE B*	95% CI	*p*	η_p^2
(Constant)	50.50	1, 71	0.72	0.10	(0.51, 0.92)	<0.001	
Mode of bilateral stimulation	7.79	2, 71				<0.001	0.16
Eye movement–Tapping			−0.24	0.06	(−0.36, −0.12)	<0.001	
Eye movement–Eye movement & Tapping			−0.19	0.10	(−0.40, 0.01)	0.066	
Tapping–Eye movement & Tapping			0.05	0.11	(−0.16, 0.26)	0.655	
General work experience	1.37	1, 71	0.01	0.01	(−0.01, 0.02)	0.246	0.02
EMDR experience	0.07	1, 71	0.00	0.01	(−0.02, 0.01)	0.793	0.00

CI, confidence interval. Overall model statistic: $F(4,71) = 3.93$, $p = 0.006$, $R^2 = 18.1\%$.

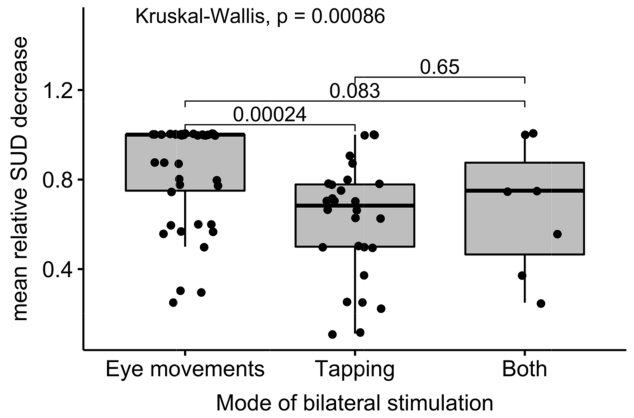

FIGURE 5 | Boxplots for group differences between different modes of stimulation.

TABLE 5 | Frequencies of perceived disadvantages in eEMDR sessions compared to face-to-face EMDR sessions.

	Frequency (%)[a]
Difficulties in detecting facial expression/ gestures/eye movements	8 (34.8)
Difficulties with technology and internet connection	4 (17.4)
Difficulties concerning the EMDR process	4 (17.4)
Missing personal contact	3 (13)
Difficulties with creating therapeutic empathy	3 (13)
Negative implications of domestic surroundings	2 (8.7)

[a]*Relative numbers refer to therapists who returned eEMDR session protocols (N = 23). Qualitative statements were reviewed and combined to superior categories.*

Vast majority (87%) of the therapists stated, they would continue offering eEMDR beyond the COVID-19 pandemic. Conversely, 13% of the therapists considered *not* to offer eEMDR post pandemic. Qualitative statements indicated, the reasons against and in favor of continuing to offer eEMDR coincided with its perceived disadvantages and advantages. Besides, some therapists suggested eEMDR could be inappropriate for certain patients, including patients with dissociation and severe mental disease status. With appropriate patient groups, however, therapists stated they consider continuing to offer eEMDR beyond the COVID-19 pandemic.

In roughly half of the session protocols, the therapists provided information about their ideas and wishes for adjustments and improvements with respect to the future use of eEMDR beyond the COVID-19 pandemic. Answers were clustered into four categories as shown in **Table 7**. Mainly, the therapists emphasized the need of technical improvements in terms of a more reliable internet connection.

DISCUSSION

Responses from therapists and the patients' relative SUD decrease suggest eEMDR sessions can be an efficient and practically applicable alternative for face-to-face EMDR. Throughout eEMDR sessions examined in this study, therapist ratings of adherence, confrontation, grounding, and process were consistently positive, and the quality of more than 90% of the sessions was rated as *good* or *very good*. In this study, the most important indicator of effectiveness was the extent to which eEMDR enabled to reduce the patient-rated SUD from beginning to end of the session. According to Kim et al. (2008) the SUD score is an important and valid number for therapists to evaluate the treatment process. We calculated a relative SUD decrease to take into account the varying SUD ratings at session beginning. In sessions with available SUD ratings, the SUD rating dropped by 73.1% on average. This reduction is comparable to SUD reductions in other studies with clinical samples (Shapiro, 1989; Wilson et al., 1995; Ironson et al., 2002).

Importantly, the SUD decrease was independent from the therapists' professional experience or their EMDR experience. The question whether therapists' experience influences treatment outcome has been debated since the origins of psychotherapy (Goldberg et al., 2016) and findings are inconsistent (Propst et al., 1994; Tschuschke et al., 2015; Goldberg et al., 2016).

TABLE 6 | Frequencies of perceived improvements in eEMDR sessions compared to face-to-face EMDR sessions.

	Frequency (%)[a]
Better patient's focus and engagement in the therapy process	4 (17.4)
Positive implications of domestic surroundings	2 (8.7)
Easier for patients to allow emotions	1 (4.3)
Improvements in detecting facial expression (through the possibility to focus on the screen)	1 (4.3)
Flexibility concerning time and place	1 (4.3)

[a]*Relative numbers refer to therapists who returned eEMDR session protocols (N = 23). Qualitative statements were reviewed and combined to superior categories.*

TABLE 7 | Adjustments and improvements to eEMDR for further use of eEMDR beyond the pandemic.

Adjustment/improvement	Frequency (%)[a]
Reliable and stable internet connection	30 (29.4)
Appropriate framework (permission to work from home, permission from health insurances, technical equipment, surcharge)	12 (11.8)
Quality of platforms/programs (certified, safe, for free)	11 (10.8)
Reduce personal expectations	1 (1)

[a]*Relative numbers refer to all returned eEMDR session protocols (N = 102). Qualitative statements were reviewed and combined to superior categories.*

Our results corroborate previous findings showing that treatment outcomes are widely independent from the therapists' experience (Propst et al., 1994). These results are encouraging especially for newly licensed therapists and newly EMDR-trained therapists. Furthermore, the SUD decrease was independent from the age and sex of both therapists as well as patients. Our results therefore dispel negative expectations based on the preconception that older people might be less tech-savvy and insecure in the use of new media. Importantly, our results clearly emphasize that older therapists and patients should not have any reservations about attempting eEMDR.

In our study, the most relevant predictor of effective SUD reduction was the mode of bilateral stimulation. Administering bilateral stimulation *via* eye movements enabled significantly stronger decrease in the patients' SUD than the use of tapping or a combination of eye movements and tapping. These results were also corroborated in a regression analysis when controlling the therapists' professional and EMDR experience. With regard to the debate on the effectiveness of different modes of bilateral stimulation (Shapiro, 2013), our findings suggest that eye movements are at least more effective in reducing SUD ratings than tapping in eEMDR settings.

Within qualitative therapist statements, the most frequently named disadvantages of eEMDR compared to face-to-face EMDR were difficulties in detecting facial expressions, gestures, and eye movements on the screen. Other frequently referred challenges include difficulties with technology and connectivity issues and difficulties concerning the EMDR process (e.g., necessary adjustments to stabilization and reorientation procedure). However, technology and connectivity issues are concerns that can be resolved through further network expansion throughout the country (especially in rural areas) and also by providing adequate technical equipment. According to the therapists, one of the advantages of eEMDR compared to face-to-face EMDR is that the patients would better focus on and engage in the therapy process. Some therapists also observed positive implications of the patients' domestic surroundings (e.g., patients felt more at ease when they were in their familiar environment). The barriers mentioned by therapists were not of therapeutic concerns, but rather related to the bureaucratic and technical framework of eEMDR. Importantly, more than 80% of the therapists participating in our study indicated they consider offering eEMDR beyond the COVID-19 pandemic, and this underscores the potential of eEMDR.

Limitations

The present study is of explorative nature and it focused on the outcome from a single eEMDR session instead of an entire EMDR therapy. In addition, there was no comparison group to compare the effects of eEMDR to a waitlist-control group, face-to-face EMDR, or other internet-delivered therapy methods. Although this was not the intention of our exploratory study, randomized clinical trials are clearly warranted to ascertain the effectiveness of eEMDR as compared to its face-to-face version and other therapy approaches.

Notably, only 8% of the contacted therapists decided to participate, thus representing a selective and potentially biased subgroup of all therapists. The low response rate may be attributed to the restraint to offer EMDR *via* videoconference but also to a lack of time and capacity considering the strenuous workload for therapists due to the pandemic situation.

The questionnaire asked therapists regarding their attitude and experiences with eEMDR. There could be therapist bias due to social desirability, especially regarding effectiveness measures as they may have chosen not to report on those eEMDR sessions which were assessed as ineffective. However, in the sessions where the standard protocol was applied, nearly half of the sessions ended incompletely, thus dispelling the presumption that therapists selectively returned protocols of only effective sessions. Furthermore, patient-rated SUD values might be also biased by social desirability.

Future research could assess the experiences and compliance of patients participating in eEMDR, as this will provide additional insights for improving effectiveness of eEMDR. Furthermore, studies could investigate which patients benefit most from eEMDR formats and conversely, which diagnoses, or patient characteristics contraindicate the use of eEMDR.

CONCLUSION

This study was one of the first to address the effectiveness of eEMDR by asking EMDR-therapists about their experiences with this treatment format. Our results show eEMDR as

an effective and viable alternative to face-to-face EMDR. Especially the high SUD decrease in eEMDR sessions, an important indicator of treatment outcome was very promising. Thus, the results help to dispel doubts regarding the feasibility and appropriateness of EMDR *via* videoconference (Gibson et al., 2009; DPtV, 2020).

Therapists can consider conducting eEMDR even beyond the COVID-19 pandemic situation, as perceived impediments and disadvantages were mainly related to the bureaucratic and technical framework of eEMDR. However, with certain adjustments to the framework it is feasible to overcome these barriers. Thus, eEMDR has the potential to not only be a temporary solution during the pandemic but to become an integral part of everyday therapy.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/ participants or patients/participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

VT conceptualized the study, obtained ethical approval, and recruited therapists. CM wrote the manuscript under supervision of VT and AB, and performed statisical analysis together with LM under supervision of AB. AH provided expertise and feedback and recruited therapists. ML provided data. SV and RR edited the manuscript. I-TK supervised the study, revised and edited the manuscript. All authors contributed to the article and approved the submitted version.

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frontiers in Psychology

ORIGINAL RESEARCH
published: 23 December 2021
doi: 10.3389/fpsyg.2021.741163

The Effects of the Flash Technique Compared to Those of an Abbreviated Eye Movement Desensitization and Reprocessing Therapy Protocol on the Emotionality and Vividness of Aversive Memories

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OPEN ACCESS

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 14 July 2021
Accepted: 18 November 2021
Published: 23 December 2021

Citation:
Brouwers TC, de Jongh A and Matthijssen SJMA (2021) The Effects of the Flash Technique Compared to Those of an Abbreviated Eye Movement Desensitization and Reprocessing Therapy Protocol on the Emotionality and Vividness of Aversive Memories. Front. Psychol. 12:741163. doi: 10.3389/fpsyg.2021.741163

Introduction: The Flash technique is a novel intervention aimed at rapidly decreasing the subjective disturbance of an aversive memory, thereby serving as a potential way of treating post-traumatic stress disorder (PTSD). The protocol is used to stimulate clients to engage in positive imagery while being discouraged to actively recollect the targeted disturbing memory. Previous research into the Flash technique's efficacy shows promising results, yet controlled studies are lacking.

Objectives: To test the efficacy of the Flash technique, it was compared to an abbreviated eye movement desensitization and reprocessing (EMDR) therapy protocol in a controlled experimental setting. We hypothesized that the Flash technique would lead to a larger decrease in the emotionality and vividness of an aversive autobiographical memory when compared to EMDR therapy. Our second hypothesis was that the procedure of the Flash technique would be evaluated more pleasant by its receiver.

Method: The sample consisted of 60 non-clinical participants (mean age = 25.28 years; 73.33% female) who were able to recall an aversive autobiographical memory. They were randomized to either the Flash technique or the EMDR therapy condition. Measurements consisted of emotionality and vividness-ratings pre and post intervention, and at 1-week follow-up.

Results: Bayesian analyses showed no differences between Flash and EMDR to the extent to which the emotionality and vividness of their memory was reduced. Afterward, the Flash technique was rated more pleasant than EMDR.

Conclusion: The results support the claim that the Flash technique might be used as a brief and efficacious intervention for individuals suffering from disturbing memories. Although the results suggest that its efficacy does not differ from EMDR, the Flash technique seems to yield similar outcomes in a more pleasant way. Further research into its working mechanisms and in a clinical sample is required.

Keywords: PTSD, EMDR, emotional memories, trauma, Flash technique

INTRODUCTION

The treatment of post-traumatic stress disorder (PTSD) is a well-studied topic, having led to the development of global treatment guidelines aiming to maximize the therapeutic effectiveness of individuals suffering from this often debilitating mental health condition (American Psychiatric Association, 2017; International Society for Traumatic Stress Studies, 2018; National Institute for Clinical Excellence, 2018). However, many individuals suffering from PTSD still do not respond to the evidence based treatments from the guidelines or experience only moderate effects, whereas dropout and relapse often occur (Schottenbauer et al., 2008; Imel et al., 2013). Furthermore, treatment costs remain high (Mavranezouli et al., 2020). This situation prompts clinicians and researchers to explore ways to cost-effectively improve the effectiveness of treatments for PTSD. This urge to enhance the (cost-)effectiveness of these treatments brings forth a variety of new techniques and therapeutic interventions. Although the introduction of new therapies stimulates the constant development of a field, these interventions should remain subject of scientific examination before being employed in clinical practice.

One novel trauma-related intervention is called the Flash technique, a brief therapeutic procedure aimed to rapidly alleviate the distress of a disturbing memory (Manfield et al., 2017). A core feature of this technique is the engagement in positive imagery (e.g., an enjoyable activity, a wonderful memory, a dear person, or someone's favorite music), while patients are discouraged from intentionally activating the targeted traumatic memory. More specifically, upon target selection, patients are instructed to only briefly "touch" the memory and rate its disturbance. Subsequently, patients are regularly asked to just lightly check in on the memory and notice any changes without tuning into the memory fully. The positive imagery is combined with recurrent blinking prompted by the therapist. Altogether, the intervention often takes less than 15 min to carry out. The Flash technique was originally developed as a type of "titration technique" preceding eye movement desensitization and reprocessing (EMDR) therapy. It was aimed at increasing the tolerability of recollecting a severely disturbing memory before treating it with EMDR therapy (Manfield et al., 2017). Currently, the Flash technique has evolved to a stand-alone trauma therapy. A detailed description is provided by Manfield et al. (2021).

Regarding the clinical effectiveness and safety of the Flash technique, a few scientific, peer-reviewed studies have been published. One consists of four case-studies in which the technique is being used as a preparation to EMDR therapy (Manfield et al., 2017). In this study, The Flash technique was applied by four different therapists with their own patients who met the diagnostic criteria of PTSD, although it was not specified whether an official clinical interview had been conducted. The application of the technique resulted in a reduction of both disturbance of the targeted aversive memory and avoidance, possibly allowing for subsequent successful EMDR therapy. In one case, it appeared that additional EMDR therapy was no longer needed. Another series of case studies describes the Flash technique applied as group therapy for the treatment of multiple disturbing memories among five addicts in a homeless shelter who suffered from PTSD-related and dissociative symptoms upon recollection of the memory (Wong, 2019). The therapy consisted of eight 50-min group sessions preceded by an individual training session. Although PTSD criteria were not assessed with an official clinical interview, the results showed a large decrease in self-reported PTSD symptoms, subjective distress, and symptoms of depression and dissociation. A more recent uncontrolled study investigated the effects of the Flash technique being applied online. The sample consisted of a large group of healthcare workers (N = 175) who participated in a 1-h webinar to reduce disturbance experienced from a memory of working with COVID-19 patients (Manfield et al., 2021). The webinar consisted of 30 min of psychoeducation, followed by two 15-min group sessions, during which either one memory was treated twice or two different memories were targeted. Emotionality of the memory, as indexed by subjective units of disturbance (SUD), showed a large decrease after undergoing the intervention.

Despite the promising results of previous, uncontrolled studies using the Flash technique, this intervention has not been tested using a controlled design with random allocation. Therefore, the claim made by the authors that "The flash technique (FT) is a low-intensity individual or group intervention that appears to rapidly lessen the distress of disturbing and traumatic memories" (Manfield et al., 2021, p. 1) should be interpreted with caution. This was the reason that we conducted an experimental, lab-analog RCT to provide valid data which may serve as a good starting point for any potential further research into this therapeutic intervention. More specifically, we sought to determine the efficacy of the Flash technique in decreasing the disturbance related to aversive memories. Because the Flash technique is often presented in relation to EMDR therapy, an evidence-based therapy for PTSD (De Jongh et al., 2019; Mavranezouli et al., 2020), and because the Flash technique shows some procedural similarities (in terms of memory recollection alternated with cognitive demanding tasks), we compared the effects of the Flash technique to EMDR therapy using a sample from a non-clinical population. Based upon the previously

described case studies, we hypothesized that the Flash technique would be more effective in reducing the emotionality and vividness of an autobiographical disturbing memory compared to EMDR therapy when used as a brief intervention. Another promising aspect of the Flash technique might be its tolerability as the technique capitalizes on maintaining a positive focus. Accordingly, we hypothesized that the Flash technique would be rated more pleasant upon completion by the participant when compared to EMDR therapy.

MATERIALS AND METHODS

Participants

We recruited participants of 18 years and older with sufficient command of the Dutch language, access to a quiet room, in possession of a computer or laptop with a stable internet connection for using a web-based application for the therapy, and who were able to recall a disturbing memory. They were recruited through social media posts and subsequently screened for participation. Exclusion criteria were the following: a SUD score lower than 6 upon recollection of the disturbing memory, a current diagnosis of a depressive disorder, bipolar disorder, PTSD, psychosis, or autism spectrum disorder, current use of antidepressants, mood stabilizers, benzodiazepines or antipsychotics, current treatment for psychiatric symptoms, prior EMDR therapy for 10 or more sessions and/or less than 3 years ago, visual or auditory impairments, and alcohol or drug use less than 12 h before study participation.

To our invitation responded seventy-nine people of whom 19 were excluded from participation or data analyses for a variety of reasons: seven received EMDR therapy less than 3 years before participation, four were not able to establish a stable video call connection with the researcher, three canceled their appointment after initial application, two gave a SUD rating lower than six upon recollection of their disturbing memory, one showed PTSD symptoms during participation, one used alcohol less than 12 h before participation, and one's data were not stored due to technical issues. Therefore, data were analyzed from a total of 60 participants. They had a mean age of 25.28 years (SD = 4.67), and 73.33% were female. Participants were reimbursed with either course credits or financial compensation independent of study completion.

Although Bayesian statistics do not require an exact a piori power analysis, one was preregistered on OSF[1] to guide recruitment numbers. The analysis suggests a total sample size of $N = 86$. Due to the exclusions and depletion of study resources, this number was not met. Yet, the current sample size of an average of 30 participants per group is deemed sufficient to detect expected statistical differences.

Materials

Emotionality

Participants rated the subjective disturbance upon recollection of the aversive memory using the SUD-scale (Subjective Units of Disturbance; Wolpe, 1969). The scale ranges from 0 (no distress at all) to 10 (maximum distress). It has good psychometric qualities and is considered the standard outcome measurement in EMDR research, as well as EMDR therapy in clinical practice (Kim et al., 2008; Shapiro, 2018). In the current study, SUD-scores were assessed verbally by the researchers pre- and post intervention and at 1-week follow-up.

Vividness

The vividness of the disturbing memory was rated on a 11-point Likert scale ranging from 0 (not vivid at all) to 10 (extremely vivid). This measure is commonly used in experimental EMDR related research (e.g., Van den Hout and Engelhard, 2012). Vividness ratings were assessed orally by the researchers pre- and post intervention and at 1-week follow-up.

Treatment Evaluation

The researchers asked the participants to evaluate the procedure after completion of the experiment: "How pleasant did you find this procedure, estimated on a scale ranging from 0, "not pleasant at all," to 10, "very pleasant"?"

Pleasantness of the Positive Memory

The pleasantness of the positive memory in the Flash condition was measured during the intervention by verbally asking the participant: "How pleasant do you score this memory now on a scale ranging from 0 to 10?"

Procedure

Study procedures were ethically reviewed and approved by the Faculty Ethics Review Board of the Faculty of Social and Behavioral Sciences, Utrecht University (UU; Registration ID: 20-0227). Two graduate students of the Clinical Psychology Master's program of UU conducted the experiment. All study procedures were performed online because face-to-face testing was not possible in the faculty labs due to restrictions regarding the COVID-19 pandemic. Participants applied by sending an email to the researchers, after which they were called to explain study procedures, screened for in- and exclusion criteria and when seemingly eligible, an online appointment was scheduled. Then, they were sent an email containing appointment details, instructions for video calling using the web-based EMDR application "EMDR Platform" (including the possibility for regular one-on-one video conferencing; EMDR Platform, 2020), the information letter, and a link to the online informed consent form. The letter contained detailed study information regarding the procedure, voluntary participation, possible risks and disadvantages, reimbursement, anonymity and confidentiality of the data, and contact information of the researchers.

At the commencement of the online appointment, the researcher checked the quality of the video calling connection and made sure participants sat in a quiet room where they would not be disturbed. They asked whether the participant read the information letter and answered any remaining questions. Participants were then instructed to sign the online informed consent form using the previously sent email link. Next, they

[1] https://osf.io/37zb9

were screened for exclusion criteria. When included, the pre SUD and vividness measurement of the aversive memory was conducted, followed by the randomization into either of the Flash or EMDR protocolized treatment procedures and subsequent post measurement. Participants were allocated randomly in a condition by order of inclusion, using a randomly generated list of participant IDs connected to a condition. The number of tested conditions was counterbalanced between the researchers. All screening and measurement data were collected orally by the researchers and instantly registered in the online, university supported, survey tool Qualtrics (2020). Since the researchers conducted both the intervention and the measurements, they were not blinded to the condition. After completing the post measurement, perceived pleasantness of the treatment was measured and some additional open-ended questions regarding their experience of the procedure were asked. Next, the researcher scheduled a telephonic follow-up appointment and concluded the online appointment. The follow-up appointment consisted of the verbal follow-up measurement of SUD and vividness. After completion, participants were debriefed, reimbursed and thanked for their participation.

Treatment

The interventions were conducted online by two graduate students in clinical psychology, trained and supervised in the procedures by two of the authors (AJ and SM), who were trained in the procedure by attending a workshop and an online training by the originator of the Flash technique. Eight-min protocols were used, either an abbreviated version of the EMDR standard protocol (Ten Broeke et al., 2019), or the Flash technique protocol (De Jongh and Matthijssen, 2020; Manfield et al., 2021). Protocol adherence was ensured by evaluating video recordings of trial sessions. Both interventions were preceded and followed by SUD and vividness measurements of the aversive memory.

Eye Movement Desensitization and Reprocessing

The procedures of EMDR therapy are standardized in an eight-phase protocol (Shapiro, 2018; De Jongh and Ten Broeke, 2019; for a description).[2] In the current study, EMDR therapy was conducted using the web-based EMDR application "EMDR Platform" (EMDR Platform, 2020). The application allows its user to conduct eye movements by controlling the speed of a horizontally moving dot. Meanwhile, the therapist is able to see the participant allowing adherence to the task to be checked. The participant is not able to see the therapist, seeing only the dot on a neutral full-screen background of the application. EMDR therapy started with a practice set of eye movements, adapting the movement frequency to personal maximum speed. Subsequently, most of the assessment phase of the EMDR standard protocol was applied, including selecting and rating the most disturbing image of the aversive memory and focusing on emotions and physical sensations. Next, while stimulated to keep the most disturbing image in mind, the participants performed a set (30 s) of eye movements after which they were asked to report upcoming associations. These sets were repeated until they reported similar or no associations two subsequent times. Consequently, the therapist went back to the most disturbing image to evaluate treatment progress by assessing the SUD, before continuing with a new series of sets. This process was repeated until a SUD score of zero was achieved, or until the maximum session time of 8 min was over.

The Flash Technique

The procedures of the Flash technique are described in the protocol by Manfield et al. (2021). In the present online study, the Flash technique was provided using the video calling function of a web-based EMDR application "EMDR Platform" (EMDR Platform, 2020). The intervention started with the target selection for the positive imagery. Hereby, the participant was instructed to recall the positive memory of an activity, person, animal, vacation, music, or whatever induced an immediate positive emotion and/or laughter. Then, one set of "Flash" was practiced, wherein the researcher prompts the participant by saying the word "Flash" to perform three emphatic and quick blinks, while the participant was also instructed to not think about the disturbing memory. Subsequently, the positive memory was recalled by stimulating vivid recollection, activating sensory details, and rating its pleasantness. Participants were then asked to engage in the positive imagery, while the therapist cued them repeatedly to perform Flash sets for five times. Consequently, the therapist evaluated treatment progress by asking whether or not any change occurred in the memory and to rate its SUD before starting a new round of positive imagery and Flashes. This process was repeated until a SUD score of zero was achieved, or until the maximum intervention time of 8 min was over.

Design

The study used a two (Condition: Flash, EMDR) by three (Time: pre, post, follow-up 1) mixed design. The independent variable Condition was measured between-subjects and was either the Flash Technique or EMDR treatment. The within-subjects variable Time comprised of SUD and vividness measurements prior to treatment (pre), directly following completion (post), and at 1-week follow-up (follow-up 1). Additionally, pleasantness of the procedure was rated as dependent variable.

Data Analysis

Statistical procedures were preregistered on OSF (see text footnote 1). All data were analyzed by Bayesian methods with the statistical software JASP (v0.14.1; JASP Team, 2020). In Bayesian statistics, the Bayes Factor (BF) is computed and used to express the data's relative support for one hypothesis or model vs. one or multiple others. A BF $>$ 1 indicates support for the proposed hypothesis or model, with larger values representing more support. A BF $<$ 1 indicates support for the null hypothesis or alternative model(s), with smaller values representing more support. BF values close to 1 indicate equal support. The advantage of Bayesian statistics compared to Null Hypothesis Significant Testing (NHST) is the absence of a strict cut-off value (e.g., $p < 0.05$) on which the evaluation of the true or falseness of a hypothesis is based. Notwithstanding, a general indication on how to interpret the BF is expedient: BFs of 1–3 are considered

[2]https://www.emdria.org/about-emdr-therapy/experiencing-emdr-therapy/

minor support, BFs of 3–10 indicate moderate support, and BFs > 10 represent major support.

Bayesian repeated measures analyses of variance (ANOVAs) were conducted to analyze overall group differences in treatment efficacy, with condition (Flash, EMDR) as a between-subjects variable and SUD and vividness ratings representing the within-subject variable time (pre, post, follow-up). *Post hoc* analyses of slope differences consisted of Bayesian Independent Samples T-Tests (ISTTs) with condition as the independent variable and SUD and vividness difference scores (pre-post, pre-follow-up, post-follow-up) as dependent variables. For other single measurement analyses such as randomization checks or treatment evaluation, ISTTs were used.

Analyses of variance outcomes are reported using the notation BF_m, which quantifies the support the data shows for one model compared to all other tested models. In this study specifically, these models consist of the main effects for Condition and Time, the interaction effect, as well as the combination between these effects. BF_m is computed by dividing the posterior odds of the tested model by the average posterior odds of the other models. ISTT outcomes are reported using the notation BF_{10}, thereby expressing the relative support of the tested hypothesis vs. the null hypothesis. When the null hypothesis is supported instead, the notation BF_{01} is used. Default priors were used for all analyses (Rouder et al., 2012). JASP automatically corrects for multiple testing by fixing to 0.5 the prior probability that the null hypothesis holds across all comparisons (Westfall et al., 1997).

RESULTS

Descriptive Statistics

Data from 60 participants were included in the analyses. One participant could not be reached for the follow-up measurement, leading to one missing value for both SUD and vividness at this time point. Participants rated their disturbing memory with an average SUD of 7.63 (SD = 0.80) at baseline. The average baseline vividness score of the memory was 8.03 (SD = 1.43). In two cases, a SUD score of 0 was reached before the 8-min session time was over, although the remaining time in both cases was less than 30 s. In the Flash condition the pleasantness of the positive memory was rated with an average of 8.94 (SD = 0.83) at baseline, which did not differ from follow-up (M = 9.44; SD = 2.08) as shown by a Bayesian ISTT (BF_{01} = 2.06).

Randomization Check

There were no differences between the two conditions at baseline for SUD, as shown by Bayesian ISTT (BF_{01} = 3.79). Considering vividness, the model including differences between the conditions was supported marginally (BF_{10} = 1.46), suggesting a higher baseline vividness score in the Flash condition (M = 8.38, SD = 1.39) when compared to the EMDR condition (M = 7.64, SD = 1.39). Successful randomization of age (Bayesian ISTT; BF_{01} = 1.90) and gender (Bayesian contingency table; BF_{01} = 2.04) was supported. Differences in therapeutic effectiveness were analyzed by comparing the differences in SUD and vividness score reductions from pre to post. A Bayesian ISTT showed large support for a difference in SUD decrease between both researchers (BF_{10} = 522.91). Vividness did not reduce differently (BF_{01} = 3.00). However, both experimenters tested an equal number of subjects in both conditions (Bayesian contingency table; BF_{01} = 2.43). Therefore, corrections in the analyses were deemed redundant.

Efficacy

Emotionality

The Bayesian repeated measures ANOVA comparing emotionality between conditions (Flash, EMDR) and over time (pre, post, follow-up) shows the most support for the model including only a main effect of Time (BF_m = 11.78). This main effect is further specified by *post hoc* tests showing major support for a decrease in SUD ratings from pre to post ($BF_{10} = 9.75 \times 10^{11}$; Cohen's d = 1.35), and pre to follow-up ($BF_{10} = 4.13 \times 10^{16}$; Cohen's d = 1.77). No support was found for differences between post and follow-up (BF_{01} = 2.30). The alternative ANOVA model including the main effect for Time and Condition receives no convincing support (BF_m = 1.15). Furthermore, the analysis shows strong evidence against the model including the interaction effect between Time and Condition (BF_m = 0.13). This outcome is further supported by the *post hoc* ISTTs comparing the differences in SUD decreases between conditions, showing support for the null models (pre-post: BF_{01} = 3.63; pre-follow-up: BF_{01} = 2.67). For an overview of the SUD ratings for all time-points, see **Figure 1**.

Vividness

The Bayesian repeated measures ANOVA with Condition (Flash, EMDR) as between-subjects variable and vividness ratings representing the within-subjects variable Time (pre, post, follow-up) shows roughly equal support for the model including a main effect of Time and Condition (BF_m = 3.82), and the model including only a main effect of Time (BF_m = 3.41). *Post hoc* tests further specify this main effect by providing major support for a decrease in vividness ratings from pre to post ($BF_{10} = 8.32 \times 10^6$; Cohen's d = 0.94), pre to follow-up ($BF_{10} = 1.91 \times 10^{13}$; Cohen's d = 1.46), and moderate support for a decrease from post to follow-up (BF_{10} = 4.81; Cohen's d = 0.36). The ANOVA shows strong support against the alternative model including the interaction effect between Time and Condition (BF_m = 0.22). *Post hoc* ISTTs further support this outcome by showing support for the null model including no differences in vividness decreases between conditions (pre-post: BF_{01} = 3.77; pre-follow-up: BF_{01} = 3.78). For an overview of the vividness ratings for all time-points, see **Figure 2**.

Treatment Evaluation

Differences in treatment evaluation between conditions were analyzed using a Bayesian ISTT. The analysis showed moderate support for the model with a difference between conditions (BF_{10} = 7.99). More specifically, participants gave their treatment experience a more pleasant rating in the Flash condition (M = 8.25; SD = 2.60) when compared to the EMDR condition (M = 6.61, SD = 1.57; BF_{10} = 7.99).

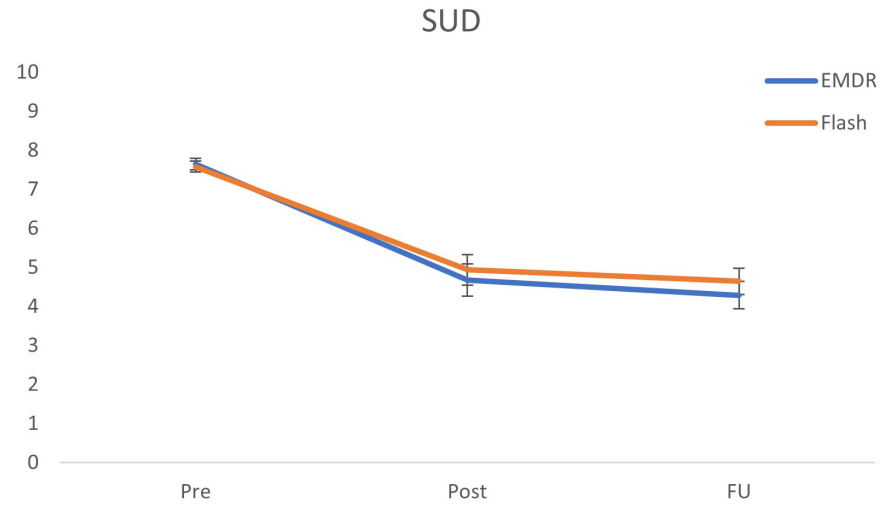

FIGURE 1 | Mean (SE) subjective units of disturbance (SUD) scores for all time points specified per condition. EMDR = eye movement desensitization and reprocessing; SUD = subjective unit of disturbance; and FU = follow-up after 1 week.

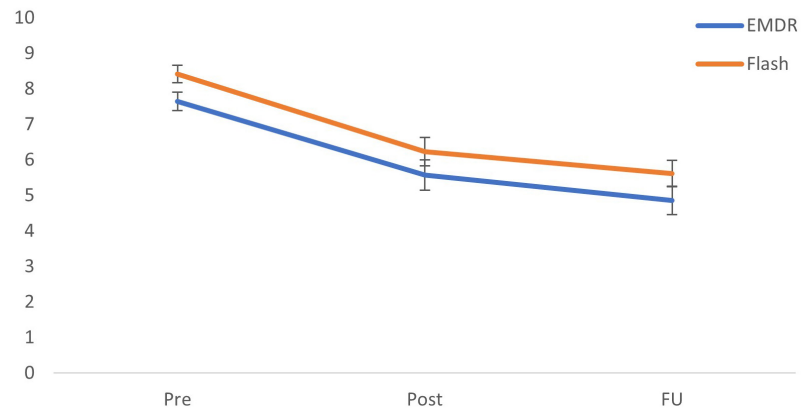

FIGURE 2 | Mean (SE) vividness scores for all time points specified per condition. EMDR = eye movement desensitization and reprocessing; and FU = follow-up after 1 week.

DISCUSSION

The current study had two objectives. The first was to determine the efficacy of the Flash technique in reducing the emotionality and vividness of a disturbing autobiographical memory when compared to an abbreviated EMDR therapy protocol in a non-clinical sample. The hypothesis that the Flash technique would me more efficacious as a brief intervention was not supported by the results. More specifically, we could not detect any differences between the Flash and EMDR condition regarding decreases in either emotionality or vividness from pre- to post-intervention as well as at 1-week follow-up. The second objective was to compare the pleasantness of the procedure between both conditions. The analyses revealed that participants evaluated the Flash technique to be more positive post-treatment, thereby providing support for the second hypothesis.

The results regarding the efficacy of the Flash technique are in accordance with previous studies showing that the Flash technique has a large effect on decreasing the subjective disturbance of an aversive memory (Manfield et al., 2017, 2021; Wong, 2019). Although Manfield et al. (2017) introduced the Flash technique as a preparation to EMDR therapy, the current study shows it might even be efficaciously used as a standalone intervention. It is important to note that most of the earlier support for the claim that the Flash technique shows positive effects on aversive memories is based upon research using a group intervention protocol (Wong, 2019; Manfield et al., 2021). The Flash technique might have the particular advantage over other more trauma-focused interventions in that the participants do not have to share the content of their trauma memories with others, not even with the therapist ("blind to therapist"); in fact, just following process instructions seems

sufficient in this context. Although a group setting might be favorable in terms of cost-effectiveness, in clinical practice the treatment of PTSD will still be applied largely through individual sessions. Nevertheless, future randomized controlled research should further evaluate the Flash technique's applicability and effectiveness as a group therapy.

Regarding our second study aim, the finding that the Flash technique was evaluated more positive post-treatment than EMDR therapy is in line with suggestions made in previous studies, albeit the pleasantness or tolerability of the Flash technique were not explicitly tested in these studies. Given that the Flash technique seems easily applicable to individuals with complex dissociative symptoms (Manfield et al., 2017; Wong, 2019), the current results are of importance. By definition and in essence, trauma-focused therapy is an unpleasant procedure since it involves the active recollection of fearful memories that were previously avoided, and therefore, a less intrusive and even pleasant form of treatment might have a positive effect on dropout rates (Imel et al., 2013). Moreover, a more tolerable treatment for the client could also connote less burden on the therapist, as well as a decrease of other negative side-effects of trauma-focused treatments such as secondary therapist traumatization (Canfield, 2005).

How can the finding that we could not detect any difference between both treatments in reduction of both emotionality and vividness of participants' disturbing memories be explained? Answers might be found when examining potential and supposed working mechanisms of both therapies. First of all, the engagement in positive imagery as applied during the Flash technique could be considered a form of counterconditioning. This mechanism was shown to be effective in decreasing fearful stimuli in lab experiments (e.g., Kang et al., 2018), is proven to be an effective technique in the treatment of anxiety and trauma-related disorders (e.g., Newall et al., 2017; Daneshvar et al., 2021), and is part of several successful treatment protocols for these mental health conditions such as Competitive Memory Training (COMET) and Visual Schema Displacement Therapy (VSDT; Staring et al., 2016; Matthijssen et al., 2019, 2021b). Secondly, one could explain the effects of both EMDR therapy and the Flash technique based upon the working memory theory. To this end, there is mounting quantitative support for this account which predicts that due to its limited capacity, for humans' working memory it is difficult to hold a disturbing memory in mind while simultaneously performing a dual task (e.g., actively conducting rapid eye movements), leading to a reduction in emotionality and vividness of the disturbing memory (Gunter and Bodner, 2008; Van den Hout and Engelhard, 2012; De Jongh et al., 2013). Subsequently, the memory reconsolidates in this altered way (Schwabe et al., 2014). In accordance with the working memory theory, the positive imagery and blinking as part of the Flash technique might also be just another way of dual tasking. From this perspective, boosting the competition between the tasks should increase the effectiveness of the intervention, as is one of the fundamental explanations for proposed improvements to EMDR therapy (i.e., "EMDR 2.0"; Matthijssen et al., 2021a). However, this suggests that activation of the memory is pivotal and should therefore be maximized, speaking against the discouragement of memory activation in the Flash technique. Contrary to the evidence supporting maximum memory activation, neuroscientific research shows that reconsolidation not only occurs in the period directly following recollection of a memory, but appears to continue in the following weeks (Kida, 2019). This suggests that changes in memory not only occur during conscious activation, but may continue unconsciously, and that a brief activation of a memory, as applied in the Flash technique, might be sufficient to subsequently effectuate alteration of its subjective disturbance without further activation. The absence of activation combined with positive imagery in the Flash technique might also be interpreted as a form of fear extinction. Contemporary models of classical conditioning theory predict that extinction occurs when a conditioned stimulus (CS) is presented in the absence of unpleasant consequences; that is, without occurrence of the unconditioned stimulus (US; Craske et al., 2014). During the Flash, after being confronted with an intense positive experience the patient is quickly turned to an aversive, seemingly threatening memory. The patient is still in a positive state and recalling the memory in his or her mind (CS) does not evoke an immediate aversive response (US), so that fear reduction can take place. In line with this, but viewed from another angle, neuroscientific research into subliminal exposure suggests that activation of the amygdala inhibits rapid reprocessing of a memory (Siegel and Weinberger, 2012; Siegel et al., 2020). These findings would advocate maximum deactivation of the amygdala during the treatment of aversive memories. Dual tasking might therefore be seen as just another way of deactivating the amygdala, a notion supported by a recent fMRI study (De Voogd et al., 2018). Taken together, the role of activation and subsequent dual tasking in order to achieve altered memory reconsolidation is an important area of future research.

Several limitations regarding the current study are worth mentioning. Firstly, the sample consisted of non-clinical participants recruited by student researchers. Although a non-clinical sample is commonly employed in a lab-based study into working mechanisms, future research should include a clinical, more heterogeneous, and larger sample to improve generalizability of the findings. Secondly, it was argued that a more positive treatment experience (as was shown in the Flash condition of the current study) might lead to fewer dropouts and thereby increase therapeutic effectiveness. However, the current lab-analog study contained a single 8-min session, rendering us unable to support this argument. Finally, the fixed treatment duration of 8 min in both conditions might have been too short to unveil differences in treatment effectiveness and efficiency. In only two of the 60 participants, a SUD score of zero was reached before treatment time was over, meaning that clinically speaking the treatment was not completed for the other participants. A study including longer sessions might differentiate in the number of SUD scores that reach zero, thereby differentiating in effectiveness (i.e., mean SUD decrease) and efficiency (i.e., mean required session time to reach a SUD score of zero). The major strength of our study is that it is the first randomized controlled trial using a procedurally standardized intervention protocol into the efficaciousness of the

Flash technique. This lays a methodologically sound foundation for future clinical trials and studies into unraveling the Flash technique's working mechanisms.

To conclude, the Flash technique was shown not to differ in efficacy from EMDR in a non-clinical sample, while being evaluated more positive by its recipients. Future research should focus on testing the Flash technique as a standalone treatment compared to a full-length, evidence based trauma-focused therapy in a patient sample diagnosed with PTSD. Such a study might substantiate claims made about the Flash technique being a more rapid and effective form of trauma-related treatment when compared to, for example, EMDR therapy. Furthermore, the absence of repeated memory activation and the use of positive imagery as part of the Flash technique suggest it might be valuable to further study the role of memory activation and positive imagery in the treatment of disturbing memories to the benefit of all PTSD treatments. Taken together, the introduction of the Flash technique might very well be an important next step on a path to more tolerable and thereby effective PTSD treatments.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because of privacy and ethical restrictions. Reasonable requests to access the datasets should be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were conducted according to the guidelines of the Declaration of Helsinki, and reviewed and approved by the Ethics Committee of the Faculty of Social and Behavioral Sciences, Utrecht University (Registration ID: 20-0227; approval date: April 20, 2020). The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

TB, AJ, and SM: conceptualization and methodology. TB: software, investigation, data curation, writing – original draft preparation, visualization, and project administration. SM: resources and funding acquisition. AJ and SM: writing – review and editing. TB and SM: supervision. All authors have read and agreed to the published version of the manuscript.

ACKNOWLEDGMENTS

We want to thank students Anna de Witt and Annemarie Scammahorn for collecting the data.

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Conflict of Interest: AJ receives income from published books on EMDR therapy and for training postdoctoral professionals in this method. AJ and SM received income from a webinar on the Flash technique.

The remaining author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers in Psychology

ORIGINAL RESEARCH
published: 21 January 2022
doi: 10.3389/fpsyg.2021.797901

Implementing an Eye Movement and Desensitization Reprocessing Treatment-Program for Women With Posttraumatic Stress Disorder After Childbirth

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OPEN ACCESS

Edited by:
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Hong Wang Fung,
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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *19 October 2021*
Accepted: *17 December 2021*
Published: *21 January 2022*

Citation:
Kranenburg LW, Bijma HH, Eggink AJ, Knijff EM and Lambregtse-van den Berg MP (2022) Implementing an Eye Movement and Desensitization Reprocessing Treatment-Program for Women With Posttraumatic Stress Disorder After Childbirth. Front. Psychol. 12:797901. doi: 10.3389/fpsyg.2021.797901

Purpose: The purpose of this study is to describe the implementation and outcomes of an Eye Movement and Desensitization Reprocessing (EMDR) treatment-program for women with posttraumatic stress disorder (PTSD) after childbirth.

Methods: A prospective cohort-study with pre- and post-measurements was carried out in the setting of an academic hospital in the Netherland. Included were women who gave birth to a living child at least 4 weeks ago, with a diagnosis of PTSD, or severe symptoms of PTSD combined with another psychiatric diagnosis. All received up to 8 sessions of EMDR-therapy. The posttraumatic stress disorder Checklist for DSM-5 was administered before and after treatment. Trauma history was assessed before treatment with the Life Events Checklist for the DSM-5, the Childhood Trauma Questionnaire and the Childbirth Perception Scale. Descriptive statistics were used.

Results: Forty-four women were referred, 26 met the inclusion criteria. After treatment, none of the women met the criteria for diagnosis of PTSD after on average 5 weekly sessions of EMDR- therapy. These outcomes are promising, as they were achieved in women with relatively high levels of psychiatric comorbidity (64%) and high rates of previous mental health treatment (80%).

Conclusion: Implementing an EMDR-treatment program for women with PTSD after childbirth in the setting of an academic hospital is feasible and effective. Key factors for success include a close collaboration between the relevant hospital departments and a thorough case conceptualization addressing the etiology of the PTSD.

Keywords: EMDR, women mental health, implementation, childbirth, PTSD – posttraumatic stress disorder, treatment program

INTRODUCTION

Posttraumatic stress disorder (PTSD) following childbirth occurs relatively frequent. Prevalence rates range from 3% in community samples and 15% in at risk populations (Grekin and O'Hara, 2014). PTSD after childbirth is most typically related to a traumatic delivery (Ayers et al., 2016) and is characterized by the re-experiencing of the traumatic event, avoidance, negative changes in mood and cognition and hyper arousal (APA, 2014). PTSD after childbirth not only negatively affects the mother's health and the partner-relationship (Ayers et al., 2006), but also child outcomes. Maternal PTSD has a negative impact on the development and sensitivity of the stress-system in the infant, the mother-child bond, the attachment style of the child, and the child's social-emotional and cognitive development (Ammerman et al., 2012; Parfitt et al., 2014; Garthus-Niegel et al., 2017, 2018; Cook et al., 2018). To reduce the mother's disease burden and to prevent transgenerational transmission of mental health problems, treatment is warranted as soon as possible. Moreover, starting a new pregnancy with untreated PTSD has shown to be related to unfavorable fetal development and obstetric outcomes, poor maternal well-being, fear of childbirth, avoidance of pregnancy care and maternal requests for cesarean section, and therefore treatment should be initiated before a subsequent pregnancy (Stramrood et al., 2012; Baas et al., 2017; Nesari et al., 2018). In addition, treating women with severe PTSD symptoms who do not fulfill all diagnostic criteria should also be considered (Ayers et al., 2008; Verreault et al., 2012) because untreated PTSD symptoms after childbirth may lead to a chronic disorder (Baas et al., 2017; Yildiz et al., 2017; Dikmen-Yildiz et al., 2018). A recent review indeed underlined that untreated perinatal PTSD impacts long-term maternal and child health and contributes to health disparities (Small et al., 2020). Altogether, this makes a strong case for early recognition and referral for evidence-based treatment of PTSD in women after giving birth. So far however, data on treatment programs for this group are limited and indeed recent studies emphasize the need for exploration of effective interventions for perinatal PTSD in mothers (de Bruijn et al., 2020; Grekin et al., 2021).

Eye Movement and Desensitization and Reprocessing (EMDR)-therapy is an evidence-based treatment for PTSD and recommended in international guidelines, for example those of the WHO (WHO, 2013; Shapiro, 2014; NICE-guidelines, 2018). EMDR-therapy is effective in treating PTSD, with large effect sizes compared to control conditions, and comparable effects compared to cognitive behavioral therapies (Cuijpers et al., 2020). In a recent review we showed that EMDR- therapy may be a promising intervention for women with PTSD following childbirth (de Bruijn et al., 2020). However, referral for such treatment may be impeded for several reasons (van Dinter-Douma et al., 2020), such as poor recognition, ideas on that the first period after delivery would be too burdensome to start treatment, insecurity about the safety of EMDR-treatment during an already subsequent pregnancy, or lack of a structure for efficient referral for treatment. Therefore, the aim of this study is to investigate the feasibility of an EMDR-therapy program for women with PTSD following child birth and to evaluate the outcomes of such treatment.

MATERIALS AND METHODS

Design

The current study was an observational prospective cohort-study with pre- and post measurements. The study was approved by the medical scientific research Ethical Committee of the Erasmus University Medical Centre and evaluated as exempt (reference number MEC-2018-1234). Study inclusion took place from January 2019 to June 2020. All participants gave written informed consent. No external funding was obtained for this study.

Participants

Women suspected of PTSD following childbirth were recruited at three different departments of the Erasmus MC, a large academic hospital in Rotterdam, the Netherland: the department of Obstetrics and Gynecology, the department of Psychiatry and the department of Child and Adolescent Psychiatry. All physicians from those departments could refer women suspect of PTSD following childbirth for the current study. In case of doubt or questions about referral, physicians could consult the colleagues of the Psychiatry department by email or direct phone line. As our aim was to the study the feasibility of implementing an EMDR-treatment program for women with PTSD following childbirth in clinical practice, we stayed as close as possible to real-life referral practice. Therefore, all new patients referred were enrolled consecutively in this study and as such we made no exceptions. In accordance with this aim, the inclusion criteria were: giving birth to a living baby at least 4 weeks ago; a current PTSD diagnosis, or actual severe PTSD-symptoms combined with another DSM-5 diagnosis; and written informed consent. Exclusion criteria were: insufficient understanding of Dutch/English language, <18 years of age, (other) severe psychopathology that would require immediate treatment first, for example high suicidality risk or active psychosis.

Procedures

Before the start of this study, members of the Psychiatry department (LK, MLvdB, and EK) provided clinical lessons on PTSD following childbirth for the colleagues of the department of Obstetrics and Gynecology. During these meetings, attention was paid to recognizing PTSD symptoms in women who recently gave birth. In addition, clinical training was given on how to discuss these symptoms and the possibilities for treatment. Education was given on how to pose the two most important questions in this respect: "Have you experienced any event during pregnancy, delivery or childbed period that you would describe as extremely stressful?" and 2. "If so, are you still suffering from this? For instance, do you have nightmares about what happened, or do you avoid talking/thinking about what has happened? Are you constantly alert as if something bad is about to happen?" To further enhance the screening process on PTSD after childbirth, screening questions were incorporated

in the standard Patient Related Outcome Measures (PROMs)-assessment of women in the perinatal trajectory as part of value-based healthcare. In case women answered positive on these screening questions, outcomes were discussed during the following consultation with their gynecologists and obstetricians. Healthcare providers of the departments of Psychiatry received no clinical lessons, but were actively informed about this study during regular weekly team meetings in which treatment advice for women presenting with psychiatric complaints was decided upon. Women who seemed eligible for study participation and treatment could then be referred. The department of Child and Adolescent Psychiatry offers a so-called mother-child treatment program, focusing on mother-child interaction and bonding in women with perinatal psychiatric disorders. As one reason for impaired mother-child interaction is PTSD after childbirth in the mother, this department was informed about the study as well. Referred women were invited for an intake at the outpatient clinic of the Psychiatry department. Intakes were performed by a senior health care psychologist (LK) and psychiatrist specialized in the field of perinatal psychiatry (MLvdB). During intake, current psychopathology was evaluated, PTSD was assessed by systematically addressing PTSD symptoms according to the DSM-5 criteria, a DSM-5 classification was established and questionnaires were administered (see below, measures). If women met the inclusion criteria and gave informed consent, EMDR- therapy was offered (see below, intervention).

Measurements

All questionnaires were administered at baseline. The PCL-5 was administered both before and after treatment.

Demographic Data

Age, previous and current psychopathology and obstetric data were collected at the moment of intake or were retrieved from the already present patient hospital records.

Trauma History and Posttraumatic Stress Disorder Symptoms

Posttraumatic Stress Disorder Checklist for the DSM-5 and Life Events Checklist for DSM-5 With Extended a Criterion

The LEC-5 (Weathers et al., 2013; Dutch Version: Boeschoten et al., 2014) is a self-report questionnaire to screen for 17 lifetime potentially traumatic events. Respondents indicate whether they have experienced one or more of sixteen listed events. The last item consists of an additional question, where respondents can indicate whether they have experienced a stressful event, other than the events mentioned in the previous items. Items are scored with regard to the type of exposure: direct experience; witnessing the trauma; learning that a traumatic event has happened to a close family member or friend and; experiencing a traumatic event as a part of the daily job. The PCL-5 is a widely used and well validated 20-item self-report questionnaire assessing the 20 symptoms of PTSD according to DSM-5. Respondents report the level of PTSD symptoms that they have experienced in the past month. Items are scored on a scale from 0 (not at all) to 4 (extremely). Scores range from 0–80, with higher scores representing more PTSD symptoms. The test-retest reliability of the total score of the PCL-5 is good (r = 0.82). Convergent and discriminant validity are strong (*rs* 0.74 to 0.85 and 0.31 to 0.60, respectively) (Blevins et al., 2015). A cut-off score of 31 is often used as indicator for the presence of PTSD (Bovin et al., 2016) and a 10–20 point change on this scale is perceived as clinically significant (Weathers et al., 2013).

Childhood Trauma Questionnaire-Short Form

This widely used self-reported childhood trauma questionnaire of 25 items (Bernstein et al., 2003) is the short version of the original CTQ (70 items). It is used to investigate five types of traumatic experiences of neglect (physical and emotional) and abuse (physical, emotional and sexual) in childhood and adolescence. CTQ-SF items are rated on a 5-point scale, ranging from 1 (never true) to 5 (very often true). Items 2, 5, 7, 12, 17, 23, and 25 are scored in reverse. Scores range from 25–125, with higher scores indicating more trauma experiences. Reliability coefficients (Cronbach's alpha) of the subscales range from 0.61 to 0.95 (Bernstein et al., 2003).

Childbirth Perception Scale

The 12-item CPS (Truijens et al., 2014) consists of two dimensions, namely the perception of delivery and the 1st week after delivery, both measured with six items. Example statements from both categories are: "*My labor was a lot worse than I expected*" and "*I truly enjoyed the first week after delivery*". All items are scored on a 4-point scale from 0 (fully agree) to 3 (completely disagree). Items 1, 2, 5, 6, 7, 8, and 10 are scored in reverse. Scores range from 0 to 36, with higher scores indicating a more adverse perception toward childbirth. The total scale, as well as both subscales, have a good reliability (Cronbach's alphas $>$0.75) (Truijens et al., 2014).

Intervention: Eye Movement and Desensitization Reprocessing Therapy

All women received up to eight weekly 90-min sessions of EMDR-therapy in the context of this study. The first session was allocated for case conceptualization. During this session, LEC-5, PCL-5, CTQ-SF, and CPS outcomes were thoroughly discussed. The reason for this is that previous trauma, be it pregnancy-related or not, can influence the development and persisting of actual PTSD symptoms. Based on this case-conceptualization, the course of treatment was designed. In session 2–7, women received EMDR-therapy following the 2020 version of the Dutch EMDR protocol (De Jongh and Ten Broeke, 2018). During each session, the target images, cognitive domains, the validity of (positive) cognitions (lowest and highest score), the subjective unit of distress (lowest and highest scores) were registered. Targets images refer to specific disturbing memory images of the traumatic event. A cognitive domain refers to the type of cognitions that make that a specific memory image still causes distress in the present, even though the event belongs to the past and even though the event may have had a good ending after all. The cognitive domains as applied in the Dutch EMDR protocol are: control, safety, self-evaluation and guilt.

For instance, a memory image can have high load on the domain "self-evaluation", if negative cognitions about the self are most prominent when a woman is confronted with the disturbing memory image. Session 8 consisted of an evaluation of treatment. If symptoms diminished and there was loss of diagnosis before session 8, treatment ended. If after session 8 symptoms persisted, the treatment plan was adjusted and women were offered appropriate continuation of treatment. Treatment was performed or supervised by a licensed EMDR Europe practitioner.

Data-Analysis

Data were analyzed by means of descriptive statistics (M,SD) in IBM SPSS statistics (version 25). To calculate pre-post differences for PCL-5 outcomes, a dependent samples *t*-test was applied.

RESULTS

Forty-four women were referred. For all women referred, psychiatric treatment was indicated and offered. However, for the results presented below, only data from women who met the inclusion criteria are presented. Main reasons for exclusion were based on psychiatric assessment, in that another psychiatric disorder (than PTSD) was more prominent and/or required treatment first. Twenty-six women were included and 25 completed treatment. We had one drop-out due to severe family circumstances, with unexpected illness and death of a close family member during the first COVID-19 outbreak, which made continuation of EMDR-therapy not possible for her at the time. Respondent characteristics and main outcomes are presented in **Table 1**. Mean age was 32, and women were referred on average 10 months after giving birth. In most cases there was a comorbid psychiatric disorder present, most often depression. Most women had received mental health treatment earlier in life. Almost all women had experienced (other) traumatic events in the past, as is shown by their scores on the LEC-5 and CTQ. There was a statistically significant difference in the PCL-5 score before (M 46.33, SD 14.19) and after treatment (M 14.58, SD 11.97), $t(23) = 9{,}835$, $p = 0.000$.

Table 2 shows the treatment specific characteristics. Average treatment duration was 4.96 (SD 3.67) sessions. All women lost their PTSD diagnosis. Per treatment, on average 3.12 (SD 2.37) "targets" were neutralized. The cognitive domain control was most common for the selected memory images.

TABLE 1 | Respondent characteristics and main outcomes.

	***N* = 25 women**
Age (mean, SD)	32.36 (4.56)
Months since delivery (mean, range)	10 (2–42)
Number of children	
1	13
2	5
3	2
4	1
Pregnant (2nd or 3rd child)	4
Previous mental health problems (%, n)	80% (20/25)
Psychiatric comorbidity (%, n)	64% (16/25)
Depressive disorder (%, n)	52% (13/25)
LEC-5 no. of events (mean, SD)	5.08 (2.41)
CTQ-total score (mean, SD)*	33.61 (10.29)
CTQ-emotional abuse (%,n above cut-off)†	26% (6)
CTQ-physical abuse (%,n above cut-off)	9% (2)
CTQ-sexual abuse (%, n above cut-off)	9% (2)
CTQ-emotional neglect (%,n above cut-off)	39% (9)
CTQ-physical neglect (%,n above cut-off)	17% (4)
CPS-total score (mean, SD)*	24.32 (6.58)
CPS-delivery (mean, SD)	10.73 (4.47)
CPS-1st week postpartum (mean, SD)	13.59 (3.29)
PCL-5 score baseline (mean, SD)	44.84 (15.77)
PCL-5 score after treatment (mean, SD)*	14.58 (11.97)

**Missings were excluded. There were 2 missings for the CTQ, 3 for the CPS and 1 for PCL-score after treatment.*
†The CTQ-cut-off scores for low severity abuse were used (Spinhoven et al., 2014).

TABLE 2 | EMDR-therapy specific characteristics.

	***N* = 24 women**
Number of sessions *(mean, SD)*	4.96 (3.67)
Number of targets during treatment *(mean, SD)*	3.12 (2.37)
Cognitive domain	
Control *(%), [+ flashforwards* (%)]*	59%, (21%)
Self-evaluation *(%)*	15%
Safety *(%)*	1%
Guilt *(%)*	4%

**"Flashforwards" are a special technique associated with the cognitive domain of control. Within the flashforward-technique, it is not the adverse memory that is targeted, but anxious expectations of what may happen in the future, so-called "disaster fantasies".*

DISCUSSION

All women in our study showed a major and clinically relevant decrease in PTSD symptoms after on average 5 weekly sessions of EMDR. The average decrease was 30 points on the PCL-5, whereas a decrease of 10–20 points on this scale is already considered clinically significant (Weathers et al., 2013). All women lost their PTSD diagnosis. These outcomes are extra promising, as they were achieved in women with relatively high levels of psychiatric comorbidity and high rates of previous mental health treatment.

In many women in our sample a comorbid depressive disorder was present. PTSD and depressive disorder often co-exist and interfere, and depression both during pregnancy and after childbirth influence the trauma response (Ayers et al., 2016; King et al., 2017). There is an overlap in symptoms between depression and PTSD (APA, 2014; Grekin et al., 2021), for instance with regard to negative changes in mood and cognition. King et al. (2017) found that negative cognitions about the self in relation to the birth were the strongest cognitive behavioral predictors of PTSD. These findings underscore the

need to explicitly address feelings of shame, self-blame, guilt and responsibility in making an adequate plan for treatment. We indeed found that these types of emotions were common. Still, women may find it hard to acknowledge their distress and initially try to downplay or avoid their problems, until the point that they feel they have no other option than to seek help (Slade et al., 2021).

Another finding of the present study was that the cognitive domain of "control" was by far the most prevalent cognitive domain in explaining why certain memory images were still disturbing. This high prevalence of the cognitive domain "control" is in line with findings on the treatment of non-childbirth related PTSD (De Jongh and Ten Broeke, 2021). So, in this respect, PTSD following childbirth is comparable to "other PTSDs". The high prevalence of the cognitive domain "control" makes sense conceptually, as pregnancy and childbirth are by definition situations where a certain unpredictably and loss of control are rather rule than exception.

Clinical Implications

In our experience it is important to ensure bi-directional low-key options for consultation and advice between Psychiatry and Gynecology and Obstetrics departments, including regular interdisciplinary meetings. Moreover, we noticed that informing women on these lines of collaboration adds to the trust of the women in their treatment. Although women's trust in treatment may increase the chance for successful treatment outcomes in general, trust is especially important in this specific group whose trust, in themselves or others, may have been violated. Further, with regard to the psychiatric treatment, it is recommended to pay close attention to previous trauma, as we did in our study by administering the CTQ and LEC-5-questionnaires. Although PTSD after childbirth can be the direct result of a pregnancy, birth or childbed-related event, pregnancy-related experiences can also trigger the memories of previous trauma, such as adverse sexual experience (Ayers et al., 2016; King et al., 2017). In this study, we started treatment with a thorough case conceptualization in collaboration with the women. In general, women were well able to indicate which symptoms were most burdensome, how these related (or not) to previous traumatic experiences, and consequently which complaints needed treatment first.

Strengths and Limitations

A strength of the study is that it is driven by both current literature and clinical practice. Both perspectives acknowledge the need for adequate referral-and treatment lines for women with PTSD after childbirth. In this respect, our study fits within the current *Zeitgeist* by starting to fill a gap in literature. Our results provide a basis for future research and/or implementation of EMDR treatment programs in other hospitals. To our knowledge, the sample we describe is unique as it is the first in its kind describing EMDR outcomes for women with postpartum PTSD and high levels of psychiatric comorbidity. At the same time, such design holds the limitation of including a heterogeneous sample. Still we believe that these outcomes are valuable, because they resemble clinical practice. As such, these outcomes provide new insights on what to expect when starting hospital-based treatment program for women with PTSD following childbirth. Although the sample size of this study could be described as small, we believe that outcomes are convincing enough to positively answer the research question with regard to feasibility. A limitation of the current study is that a PTSD diagnosis was not made with a formal clinical interview such as the CAPS-5, which is the gold standard for making a clinical diagnosis for research purposes. Furthermore, although the results of this study are promising, the findings need confirmation of studies applying more advanced research design that include a control group. Future studies preferably also include outcome-measures for child outcomes and cost-effectiveness.

CONCLUSION

Implementing an EMDR-therapy treatment program for women with PTSD after childbirth in the context of a large academic hospital is feasible and effective. Treatment led to clinically significant decrease of symptoms and loss of PTSD diagnosis in all cases. Results can be achieved in a short time-span, even in pregnant women and women with comorbid psychiatric disorders and/or a history of previous mental treatment. Key factors for success are a close collaboration between the relevant hospital departments and a thorough case conceptualization addressing the etiology of the PTSD after childbirth.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Medical Scientific Research Ethical Committee of the Erasmus University Medical Centre. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

LK: conceptualization, data curation, formal analysis, investigation, methodology, validation, visualization, and writing – original draft. HB: data curation, investigation, and writing – review and editing. AE: conceptualization, investigation, and writing – review and editing. EK: conceptualization, investigation, and writing – review and

editing. ML-V: conceptualization, data curation, investigation, methodology, and writing – review and editing. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

The authors thank all women who have participated in this study.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers in Psychology

ORIGINAL RESEARCH
published: 24 March 2022
doi: 10.3389/fpsyg.2022.845481

A Randomized-Controlled Trial of EMDR Flash Technique on Traumatic Symptoms, Depression, Anxiety, Stress, and Life of Quality With Individuals Who Have Experienced a Traffic Accident

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OPEN ACCESS

Edited by:
Antonio Onofri, Azienda Sanitaria Locale Roma 1, Italy

Reviewed by:
Sara Carletto, University of Turin, Italy
Martina Cussino, Centro di terapia EMDR, Italy

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *29 December 2021*
Accepted: *22 February 2022*
Published: *24 March 2022*

Citation:
Yaşar AB, Konuk E, Kavakçı Ö, Uygun E, Gündoğmuş İ, Taygar AS and Uludağ E (2022) A Randomized-Controlled Trial of EMDR Flash Technique on Traumatic Symptoms, Depression, Anxiety, Stress, and Life of Quality With Individuals Who Have Experienced a Traffic Accident. Front. Psychol. 13:845481. doi: 10.3389/fpsyg.2022.845481

The Flash Technique of Eye Movement Desensitization and Reprocessing (EMDR) is widely recognized for its effectiveness in reducing the effects of emotional responses associated with traumatic memories. Using a randomized-controlled trial methodology, this study attempts to establish the efficacy of the EMDR Flash Technique. This study's sample includes volunteers who were involved in traffic accidents and were given the randomized EMDR Flash Technique and Improving Mental Health Training for Primary Care Residents (mhGAP) Stress management module. The participants were given a socio-demographic data form, the Depression-Anxiety-Stress 21 scale (DASS-21), the Impact of Event Scale-Revised (IES-R), and the WHOQOL Quality of Life scale. Participants were evaluated using measurements taken before and after the application, as well as a one-month follow-up. The mean age of the participants was 36.20 (11.41) years and 82.1% ($n = 32$) were female. The DASS-21 Anxiety ($\eta^2 = 0.085$), IES-R Intrusion ($\eta^2 = 0.101$), Avoidance ($\eta^2 = 0.124$), Total ($\eta^2 = 0.147$), and WHOQOL-BREF Psychological ($\eta^2 = 0.106$) score improvements of the EMDR Flash Technique group were shown to be statistically significant when compared to the mhGAP group. However, no statistically significant difference in the DASS-21 Depression, Stress, Impact of Event Scale-Revised Hyperarousal WHOQOL-BREF General Health, Physical, Social Relationships, and Environment component scores was reported between the two groups. The present study's findings clearly demonstrate that the EMDR Flash technique, when applied to persons involved in traffic accidents, is successful in improving anxiety, intrusion, avoidance, total traumatic stress, and mental quality of life symptoms for at least 1 month. We believe that these findings will improve the reliability and applicability of the EMDR Flash Technique, which was tested for the first time in a clinical randomized-controlled trial (RCT).

Keywords: EMDR, flash technique, mhGAP, randomized-controlled study, traumatic stress

INTRODUCTION

Traumatic experiences that impact a person emotionally, behaviorally, and physiologically are difficult to live with and make regular living circumstances challenging (Raja et al., 2015). Despite the fact that exposure to traumatic life events varies, a 2019 study indicated that 70% of the population had experienced a traumatic incident at least once in their lives (2019). Various therapeutic intervention approaches for such a prevalent illness have been developed and implemented in clinical practice (Shapiro, 1989; Schouten et al., 2015). Individual interventions, on the other hand, are a key component of these strategies (Schouten et al., 2015). Due to variables such as financial constraints and a lack of qualified and licensed workers, only a small proportion of trauma victims have access to these procedures in this context (Davis and Maul, 2015). As a result, it is obvious that effective procedures that can be applied to more than one person in need are required.

Eye movement desensitization and reprocessing (EMDR) is a psychotherapy method developed by Shapiro (1989) for the treatment of trauma and associated disorders (Shapiro, 1989). According to the EMDR model, faulty and/or insufficient coding or processing of the traumatic experience may result in psychopathology owing to a lack of adaptive integration into memory (Hase et al., 2017). As a result, bilateral eye movements, also known as EMDR bilateral stimulation (BLS), indicate that it is successful in encoding and processing these unpleasant memories and related cognitions *via* distinct procedural stages to review and re-encode memory with auditory or tactile inputs (Hase et al., 2017). A great number of distinctive research have proved the usefulness of EMDR, and over time, approaches that propose its application to more than one individual have been presented (Gonzalez-Vazquez et al., 2018; Oztanriover et al., 2019; Doğan et al., 2021). EMDR Flash Technique is a relatively recent individual and group intervention that allows EMDR to be applied to a technical group at the same time (Manfield). Although the Flash Technique originated in the context of EMDR, there are publications suggesting that it should be considered as an independent trauma-related intervention that can presently be used outside of EMDR therapy (Brouwers et al., 2021; Manfield et al., 2021). Its effectiveness has already been proven in a small number of case studies and case series (Manfield et al., 2017; Yaşar et al., 2021). This limited literature indicates that the EMDR Flash technical intervention reduces trauma-related stress symptoms (Manfield et al., 2021; Yaşar et al., 2021). These reports analyze the EMDR Flash Technique before and after administration; however, there is no comparison with any other intervention strategy (Manfield et al., 2017, 2021; Wong, 2019; Yaşar et al., 2021). A randomized-controlled trial (RCT) of this novel approach is expected to disclose its effectiveness more clearly in clinical group.

Considering all this evidence, the aim of this study was to determine the efficacy of the EMDR Flash Technique in persons who had experienced traumatic events. In addition, utilizing an RCT design, we anticipated that participants in the EMDR Flash Technique group would report substantial improvements in measures of traumatic stress symptoms, anxiety, depression, stress, and quality of life compared to the mhGAP stress management module application group.

MATERIALS AND METHODS

In this randomized-controlled trial, the EMDR Flash Technique and mhGAP were evaluated using pre- and post-administration assessments and a one-month follow-up.

Sample

One hundred and four people who were involved in a traffic accident filled out a Google Form to apply to the study. Due to the pandemic-related circumstances, the volunteers were interviewed by phone, and 13 people who did not fit the requirements to be included in the study, 19 participants who did not want to be included in the study, and 4 persons who were omitted due to technical problems (inability to contact the participant, lack of technical prerequisites for the application, etc.) were excluded. As a consequence, the remaining 68 individuals were randomized using the "research randomizer" tool, and it was determined to use the EMDR Flash Technique on 34 people and the mhGAP on 34 people. The study's flow chart is presented in **Figure 1**.

The inclusion criteria of the study are as: (a) aging between 18 and 65, (b) having had a traffic accident between 6 months and 10 years ago, (c) not having organic mental complaints as a result of the traffic accident, d. having a score of <7 on the Adverse Childhood Experiences Questionnaire (Gunduz et al., 2018), (e) not having a psychiatric illness such as schizophrenia or bipolar disorder, (f) not having severe head traumas, (g) possessing the technological capabilities to implement the application, and (h) volunteering to participate in the study.

Study Design

The study was carried out between February and October 2021 under the supervision of the Behavioral Sciences Institute. To reach people who had been in car accidents, an announcement was posted on social media, the research was detailed, and volunteers were asked to give their contact information using Google Form. The volunteers were interviewed and were thoroughly informed about the study, the inclusion requirements were assessed, and a Google Form information comprising data collecting tools was delivered to the participants who fulfilled the inclusion criteria. Following that, the subjects were randomly assigned to groups and the EMDR Flash Technique and mhGAP were applied to them online. Participants eligible for the applications were randomized to be 20–24 subjects. In other words, randomization was applied to three groups in total for the study. In both groups, the application was made for three consecutive days. Those who were unable to finish their applications at this stage were ruled out of the study. Participants were requested to complete out forms including data collection tools 1 week and 1 month after completing the applications. Participants who did not complete the forms were barred from participating in the study. Following appropriate processing, the obtained data were subjected to statistical analysis.

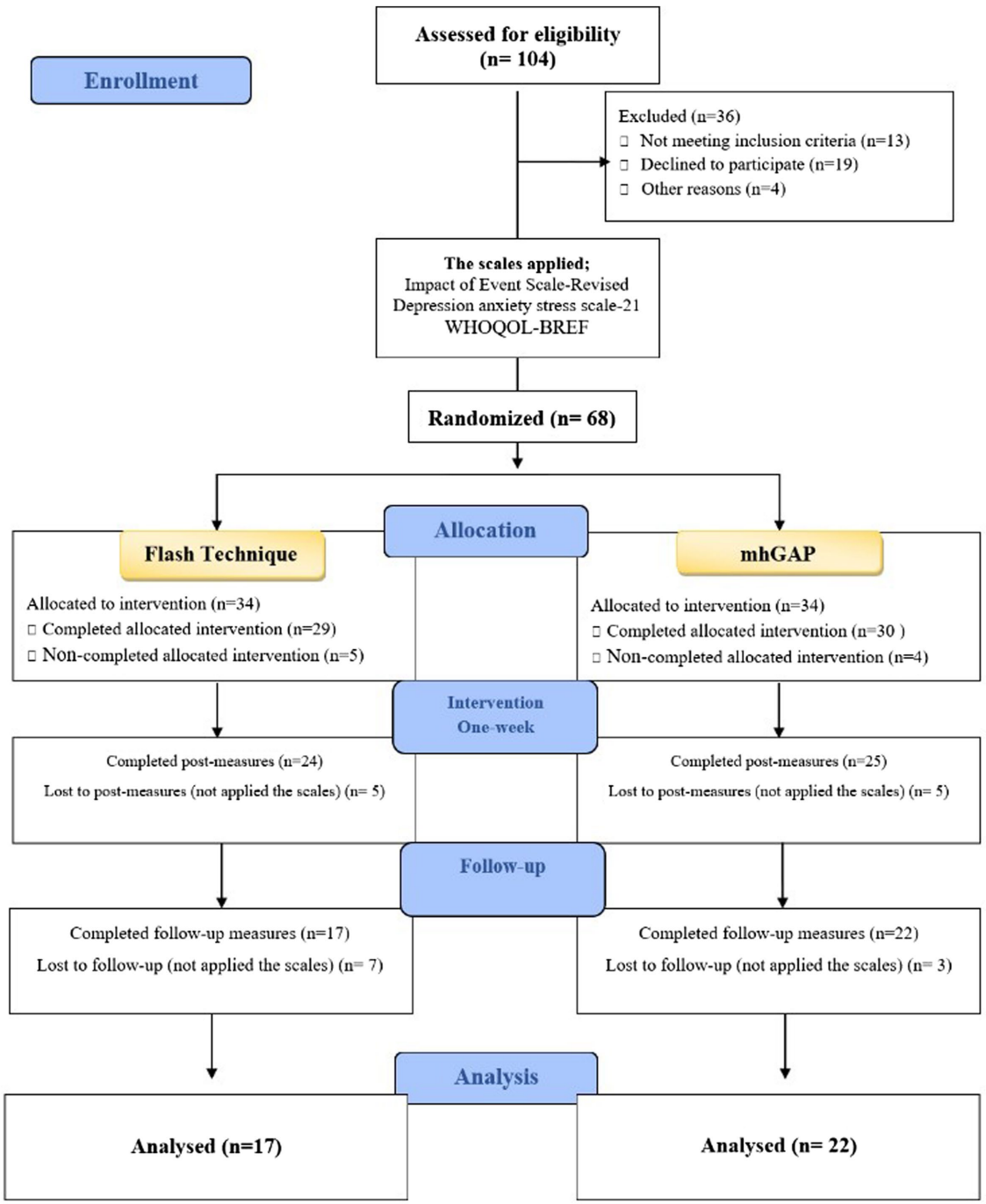

FIGURE 1 | Flowchart of participants through each stage of the study.

Before the study, power analysis was performed and when the α error: 0.05, power: 0.80, and effect size were calculated as 0.4, the sample size was found to be 18 for each group.

Implementation

EMDR Flash Technique

The EMDR Flash Technique Group Protocol was employed in this study, and session lengths ranged from 60 to 75 min. Each group application was completed in three sessions. A 15-min introduction session was conducted at the first group session. At this stage, traumatic incidents were not discussed; instead, the group's togetherness was the focus. The 15-min application was then presented. At this stage, EMDR therapy was presented briefly, and the technical specifics of the Flash Technique are introduced. This section requested the importance of the positive moment, as little contact with the traumatic memory as possible,

the belief that it will be beneficial with some neurocognitive mechanisms, the requirement of being close to the screen to follow the blinks in the online application and taking a sitting position in order to do medicine. The participants were then asked to identify five troubling scenes connected to the traffic accident they witnessed and to rate the subjective units of distress intensity they felt immediately when focusing on each of them on a scale of zero to 10 (SUD score). After that, they were asked to recall a happy moment, dream, or image that brought them comfort when they thought about it. Examples were given to assist them to recall such a memory and a few people who were able to do so were encouraged to briefly share their happy recollections with others until everyone certainly had recalled at least one scene. The instructions were then explained, and repeated attempts were made to guarantee compliance. Flash Technique Desensitization was used from this stage until the last 10 min of the second and third sessions. In the desensitization phase, 5 bilateral stimulation sets and then, a triple blink (FLASH) application was performed six times in a row in accordance with the protocol used by Yaşar et al. (2021) in their study on traumatic stress, and the change in memory was questioned at short intervals, and then, this six-fold application was repeated. Requested to go on to other memories until the final part of the last session continued, when the memory with zero SUD value was over. Those who had all five memories reset were asked to recall another unpleasant aspect of the experience, if possible. If the memory they were working on was not reset, they were just instructed to keep working. The group sessions were concluded with comments in the final 10 min of the Third Group session.

mhGAP Stress Management Module

mhGAP (known as Improving Mental Health Training for Primary Care Residents in Turkey) is a WHO capacity-building, training/implementation program aimed at improving mental health services in primary healthcare settings. Stress management and associated disorders are covered as part of this training program. The mhGAP training program for primary care family physicians in Turkey has been carried out in collaboration with the Ministry of Health and the WHO Turkey office. One of the first-line strategies in the management of stress and related disorders is described as "Psychoeducation for stress and associated disorders" in this module. The aim of this training is to understand the origin of the individual's stress symptoms and to make sense of the symptom cluster that emerges as a result of the stressor event. As a consequence, the tension created by the individual's symptoms is also alleviated. In our study, our researcher, who is also one of the module's trainers, administered recommended psychoeducation in the stress-related disorders module to the control group. The implementation of the mhGAP protocol in this study was applied in session lengths ranging from 55 to 65 min. Each group application was completed in three sessions.

Ethics

All participants who agreed to enroll for the study were informed online and their consent was obtained. The study only included individuals who provided their consent. All stages of the study and data protection were carried out in line with the Helsinki Declaration, and the approval was obtained from the Clinical Research Ethics Committee of Marmara University Faculty of Medicine (26.07.2019/09.2019.707).

Data Collection Tools

The Socio-Demographic Data Form

The socio-demographic data form was developed by the researchers in line with the literature and study objectives. Participant's demographic data such as age, sex, educational level, and profession were inquired.

The Depression-Anxiety-Stress Scale-21

The Depression-Anxiety-Stress Scale-21 (DASS-21) was used in the study to determine the depression, anxiety, and stress symptoms of the participants. The scale has 21 items (Lovibond and Lovibond, 1995). Each question is evaluated on a four-point Likert-type scoring and it has seven items each for depression, anxiety, and stress. The score that can be obtained from the scale for each subdimension changes between 0 and 21. The Turkish validity and reliability study of the scale were conducted by Saricam (2018).

The Impact of Event Scale

The Impact of Event Scale (IES-R) was applied to measure the amount of effect of persons from an event in the study. It was developed by Weis and Marmara in 1997 (Weiss, 2007). It is a self-report five-point Likert-type scale and includes 22 items. It evaluates the level of exposure to events in three different fields as "Intrusion," "Avoidance," and "Hyperarousal." The score that can be obtained from the scale varies between 0 and 88. The Turkish validity and reliability studies of the scale were carried out (Çorapçıoğlu et al., 2006).

The World Health Organization Quality of Life Instrument

The World Health Organization Quality of Life Instrument (WHOQOL-BREF-TR) was created by the WHO to assess the practitioner's quality of life. The Turkish version of the scale has 27 items. The scale assesses the General Health, Physical, Psychological, Social Relationships, and Environment aspects of quality of life. An increase in the scale score depicts an improvement in one's quality of life. The Turkish validity and reliability studies of the scale were conducted by Fidaner et al. (1999).

Adverse Childhood Experience Turkish Form

Adverse Childhood Experience Turkish Form (ACE-TR) was developed by Permanente in 1997 to inquire whether a person's life prior to the age of 18 included domestic emotional violence, physical violence, sexual violence, abuse, emotional and physical neglect, and unpleasant childhood events such as divorce and being interrogated. It is a self-report scale consisting of 10 items. The Turkish validity and reliability studies of the scale were conducted by Gunduz et al. (2018).

Statistical Analysis

SPSS 22 package program was used to perform statistical analyses on study data. Descriptive data were presented with frequency and percentage for categorical variables and mean and standard deviation for continuous variables. The Pearson Chi-square test for categorical variables and parametric assumptions for continuous variables were used to compare the pre-application variables of the two groups, followed by the Student's *T*-test. The repeated measures analysis of variance was used to see whether EMDR Flash Technique and mhGAP procedures alone resulted in significant changes in the dependent variables and if there was a difference in changes between the two groups. In cases where the Mauchly test revealed that the sphericity assumption had been violated, the Greenhouse–Geisser adjustment was used, and the corrected results were reported. The effect size was determined using η^2. A value of $p < 0.05$ was considered statistically significant.

RESULTS

The analysis of the study was carried out with a total of 39 participants, including 17 EMDR Flash Technique and 22 mhGAP who completed the study (**Figure 1**). The participants in the study had a mean age of 36.20 (11.41) years, with 82.1% ($n = 32$) being female. **Table 1** compares socio-demographic and traffic accident-related ratings between the pre-intervention EMDR Flash Technique and mhGAP groups. As a result, there was no significant difference between the two groups when socio-demographic and traffic accident-related ratings were compared ($p > 0.05$).

There was no statistical difference between the two study groups pre-intervention in DASS-21 Anxiety ($p = 0.704$), Depression ($p = 0.717$), Stress ($p = 0.355$) subscale scores, Impact of Event Scale-Revised Intrusion ($p = 0.482$), Avoidance ($p = 0.349$), Hyperarousal ($p = 0.657$), and total ($p = 0.925$) scores, and WHOQOL-BREF General Health ($p = 0.761$), Physical ($p = 0.124$), Psychological ($p = 0.710$), Social Relationships ($p = 0.432$), and Environment ($p = 0.268$) component scores.

Table 2 compares DASS-21 Anxiety, Depression, and Stress subscale scores, Impact of Event Scale-Revised Intrusion, Avoidance, Hyperarousal, and total scores, and WHOQOL-BREF General Health, Physical, Psychological, Social Relationships, and Environment component scores in the EMDR Flash Technique and mhGAP groups before, 1 week, and 1 month after the study, within and between groups. As a result, there was a statistically significant difference in the DASS-21 Depression [$F_{(2-42)} = 4.388$, $p = 0.019$, $\eta^2 = 0.173$], Stress [$F_{(2-42)} = 4.117$, $p = 0.023$, $\eta^2 = 0.164$], Impact of Event Scale-Revised Intrusion [$F_{(2-42)} = 12.621$, $p < 0.001$, $\eta^2 = 0.375$], Avoidance [$F_{(1-25)} = 11.738$, $p < 0.001$, $\eta^2 = 0.359$], Hyperarousal [$F_{(2-42)} = 6.695$, $p = 0.003$, $\eta^2 = 0.242$], Total [$F_{(1-28)} = 15.343$, $p < 0.001$, $\eta^2 = 0.422$], WHOQOL-BREF Physical [$F_{(2-32)} = 5.198$, $p = 0.012$, $\eta^2 = 0.257$] subscale scores in the mhGAP group, while no statistically significant difference was found in the DASS-21 Anxiety [$F_{(2-42)} = 2.228$, $p = 0.120$, $\eta^2 = 0.096$], General Health [$F_{(1-20)} = 2.133$, $p = 156$, $\eta^2 = 0.118$], Psychological [$F_{(2-32)} = 14.641$, $p = 0.807$, $\eta^2 = 0.013$], Social Relationships [$F_{(2-32)} = 1.215$, $p = 0.310$, $\eta^2 = 0.071$], and Environment [$F_{(2-32)} = 0.946$, $p = 0.399$, $\eta^2 = 0.059$] component scores.

TABLE 1 | Baseline characteristics of mhGAP and flash technique participants.

	mhGAP ($n = 22$)	EMDR Flash Technique ($n = 17$)	*p*-value
Age; year, Mean (SD)	34.22 (11.00)	38.76 (11.76)	0.240
Gender (Female); *n* (%)	18 (81.8%)	14 (%82.4)	0.966
Marital Status (Single); *n* (%)	7 (31.8%)	6 (35.3%)	0.819
Education (University); *n* (%)	20 (90.9%)	14 (82.4%)	0.428
Time after the accident; month, Mean (SD)	36.00 (33.77)	29.88 (36.73)	0.592
Death in accident (Yes); *n* (%)	2 (9.1%)	2 (11.8%)	0.785
Physical injury in accident (Yes); *n* (%)	8 (36.4%)	9 (25.9%)	0.301
Hospitalization after the accident (Yes); *n* (%)	6 (27.3%)	6 (35.3%)	0.590
Physical injury to other individuals in the accident (Yes); *n* (%)	4 (18.2%)	4 (23.5%)	0.682
Psychological assistance due to accident (Yes); *n* (%)	4 (18.2%)	4 (23.5%)	0.682
Pre-accident mental assistance (Yes); *n* (%)	3 (13.6%)	3 (17.6%)	0.731
Adverse Childhood Experiences; year, Mean (SD)	1.63 (1.55)	2.64 (2.17)	0.100

mhGAP, Mental Health Gap Action Program; SD, Standard deviation.

There was a statistically significant difference in the DASS-21 Anxiety [$F_{(2-32)} = 39.089$, $p < 0.001$, $\eta^2 = 0.710$], Depression [$F_{(2-32)} = 9.996$, $p < 0.001$, $\eta^2 = 0.385$], Stress [$F_{(2-32)} = 11.381$, $p < 0.001$, $\eta^2 = 0.416$], Impact of Event Scale-Revised Intrusion ($F_{(2-32)} = 65.301$, $p < 0.001$, $\eta^2 = 0.803$), Avoidance [$F_{(2-32)} = 33.685$, $p < 0.001$, $\eta^2 = 0.678$], Hyperarousal [$F_{(1-21)} = 38.808$, $p < 0.001$, $\eta^2 = 0.708$], Total [$F_{(2-32)} = 74.893$, $p < 0.001$, $\eta^2 = 0.824$], WHOQOL-BREF General Health [$F_{(1-16)} = 13.265$, $p = 0.001$, $\eta^2 = 0.487$], Psychological [$F_{(2-28)} = 11.541$, $p < 0.001$, $\eta^2 = 0.495$], and Environment [$F_{(2-28)} = 3.634$, $p = 0.040$, $\eta^2 = 0.206$] subscale scores in the EMDR Flash Technique group, while no statistically significant difference was found in the Physical [$F_{(2-32)} = 0.501$, $p = 0.611$, $\eta^2 = 0.035$] vs. Social relationships [$F_{(2-28)} = 2.015$, $p = 0.152$, $\eta^2 = 0.126$] component scores.

The change in DASS-21 Anxiety [$F_{(2-74)} = 3.421$, $p = 0.038$, $\eta^2 = 0.085$], Impact of Event Scale-Revised Intrusion [$F_{(2-74)} = 4.142$, $p = 0.020$, $\eta^2 = 0.101$], Avoidance [$F_{(2-74)} = 5.220$, $p = 0.008$, $\eta^2 = 0.124$], Total ($F_{(2-74)} = 6.363$, $p = 0.003$, $\eta^2 = 0.147$, **Figure 2**), and WHOQOL-BREF Psychological [$F_{(2-60)} = 3.540$, $p = 0.035$, $\eta^2 = 0.106$] scores of the EMDR Flash Technique group was determined to be statistically significantly different compared to the mhGAP group. However, no statically significant difference was observed in the DASS-21 Depression [$F_{(2-74)} = 3.609$, $p = 0.403$, $\eta^2 = 0.024$], Stress [$F_{(2-74)} = 0.732$, $p = 0.484$, $\eta^2 = 0.019$], Impact of Event Scale-Revised Hyperarousal [$F_{(2-74)} = 2.846$, $p = 0.064$, $\eta^2 = 0.071$], WHOQOL-BREF General Health [$F_{(2-60)} = 1.855$, $p = 0.165$, $\eta^2 = 0.058$], Physical [$F_{(2-58)} = 0.703$, $p = 0.499$, $\eta^2 = 0.024$], Social relationships [$F_{(2-60)} = 0.351$, $p = 705$, $\eta^2 = 0.012$], and Environment [$F_{(2-60)} = 0.198$, $p = 821$, $\eta^2 = 0.007$] component scores between the two groups.

TABLE 2 | Descriptive statistics for outcome variables in the mhGAP and flash technique.

	Methods	Pre-measurement	Post-measurement	Follow-up Measurement	Between Time Effect Size (η^2)	Between Groups Effect Size by the time (η^2)
DASS-21; Mean (SD)						
Anxiety	mhGAP	5.09 (3.58)	3.63 (2.57)	3.77 (2.99)	0.096	0.085*
	Flash Technique	5.47 (2.23)	1.82 (1.38)	2.00 (1.76)	0.710*	
Depression	mhGAP	6.04 (3.82)	4.50 (3.55)	4.50 (3.54)	0.173*	0.024
	Flash Technique	5.58 (3.93)	2.88 (2.52)	3.11 (3.03)	0.385*	
Stress	mhGAP	7.50 (3.29)	6.09 (2.54)	5.72 (3.25)	0.164*	0.019
	Flash Technique	6.58 (2.59)	4.23 (2.99)	3.82 (2.62)	0.416*	
Impact of Events Scale-Revised; Mean (SD)						
Intrusion	mhGAP	12.04 (7.91)	7.77 (6.92)	7.13 (6.37)	0.375*	0.101*
	Flash Technique	10.47 (5.16)	2.52 (2.45)	2.23 (2.94)	0.803*	
Avoidance	mhGAP	10.54 (5.81)	7.31 (4.06)	6.36 (3.69)	0.359*	0.124*
	Flash Technique	12.41 (6.44)	4.88 (2.80)	5.05 (4.03)	0.678*	
Hyperarousal	mhGAP	9.59 (5.75)	6.81 (3.88)	6.13 (4.76)	0.242*	0.071
	Flash Technique	8.82 (4.68)	3.35 (2.84)	2.58 (2.59)	0.708*	
Total	mhGAP	32.18 (16.57)	21.90 (12.32)	19.63 (13.01)	0.422*	0.147*
	Flash Technique	31.70 (14.03)	10.64 (7.16)	9.88 (8.63)	0.824*	
WHOQOL-BREF; Mean (SD)						
General Health	mhGAP	53.67 (19.14)	58.08 (19.23)	62.50 (20.25)	0.118	0.058
	Flash Technique	55.83 (20.52)	70.83 (11.24)	71.66 (12.01)	0.487*	
Physical	mhGAP	48.52 (7.99)	51.74 (8.38)	55.13 (4.11)	0.257*	0.024
	Flash Technique	53.80 (10.83)	55.71 (7.49)	56.66 (8.41)	0.035	
Psychological	mhGAP	56.86 (10.81)	57.10 (7.62)	58.57 (11.73)	0.013	0.106*
	Flash Technique	55.55 (8.57)	64.72 (4.94)	65.27 (6.03)	0.495*	
Social relationships	mhGAP	62.25 (25.53)	63.23 (25.35)	67.15 (21.54)	0.071	0.012
	Flash Technique	56.11 (16.50)	61.11 (13.60)	62.77 (16.32)	0.126	
Environment	mhGAP	63.23 (14.12)	65.63 (13.32)	66.74 (13.45)	0.059	0.007
	Flash Technique	68.33 (10.94)	72.70 (9.55)	73.54 (9.29)	0.206*	

mhGAP: Mental Health Gap Action Program, SD: Standard deviation, DASS-21: Depression-Anxiety-Stress Scale-21, WHOQOL-BREF: World Health Organization Quality of Life Scale Abbreviated Version.
*$p < 0.05$.

DISCUSSION

The present research aims to examine the efficiency of the EMDR Flash Technique application for anxiety, depression, stress, trauma symptoms, and the quality of life in a sample affected by traffic accidents. According to the findings of the research, the EMDR Flash Technique application, which is based on the assumption that a given discomfort may be reduced by effectively reconstructing traumatic stress symptoms using the adaptive information processing model, has been determined to be effective in alleviating traumatic stress symptoms. The current results have explicitly demonstrated that the EMDR Flash technique application in the individuals emotionally affected by traffic injuries is effective in healing the individuals' symptoms including anxiety, intrusion, avoidance, total traumatic stress, and the quality of mental state. The present research is the first clinical randomized control study to compare the effectiveness of the EMDR Flash Technique application with the mhGAP module, a structured application, on the assessment and management of stress-related conditions. We believe that these results will contribute to the reliability and applicability of the EMDR Flash Technique.

The primary result of this study was that traumatic stress symptoms were significantly reduced more in the EMDR Flash Technique group than in the mhGAP group. Depending on the measurements conducted, there were significant differences between the participants' scores for traumatic stress in pre-treatment and post-treatment periods and during a one-month follow-up. These results obtained affirm the results of the articles indicating that the EMDR Flash Technique reduces traumatic stress symptoms (Shebini, 2019; Manfield et al., 2021; Wong, 2021; Yaşar et al., 2021) and feature a superiority regarding the greater effectiveness that it showed in comparing a group having the similar traumatic story of socio-demographic and ACE scores such as marital status with a randomized group. It is possible to state that the findings of this study will contribute to the reliability of the EMDR Flash Technique. Furthermore, this specific application features some particular aspects. First, compared to EMDR Therapy solely, the application of the EMDR Flash Technique protocol way more practical as it does not require questioning and/or thinking about the details related to traumatic cases. Moreover, compared to the standard EMDR Therapy, clients shortly contact to traumatic memories for several times throughout the therapy and thus, the risk of dissociation is reduced for the participants and their level of comfort is elevated. Less contact to traumatic cases and a relatively easier application can be among the advantages

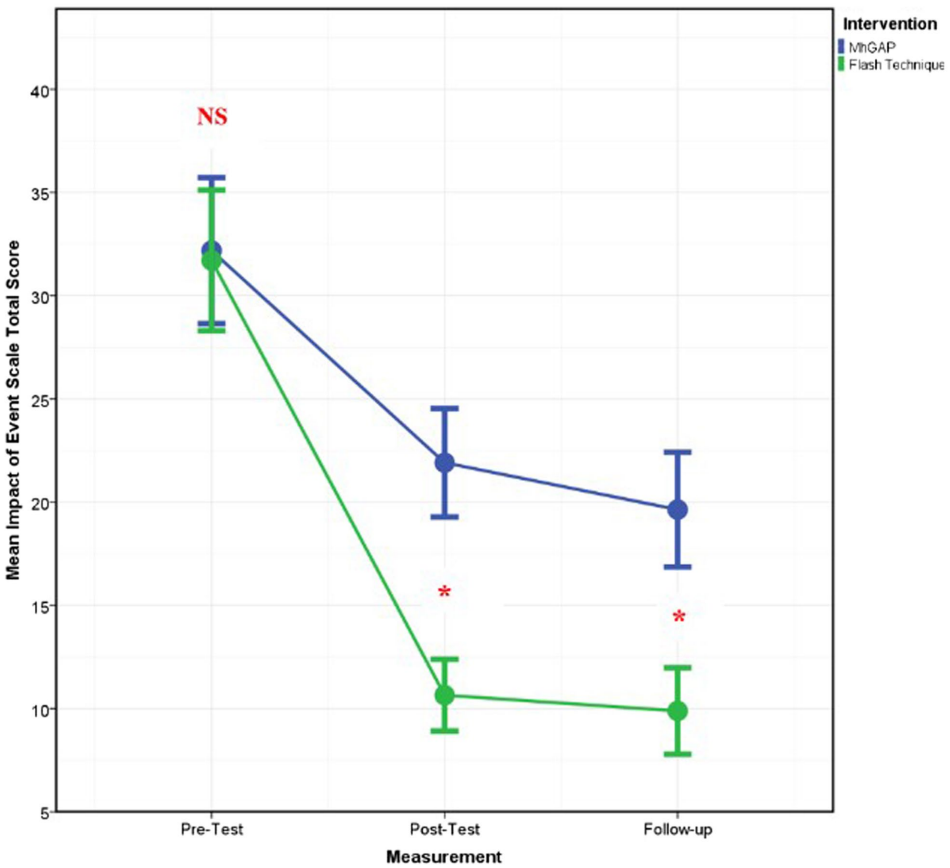

FIGURE 2 | Graph of change of IES-R total score between two applications. *: statistically significant.

of the EMDR Flash Technique for the group therapy format. This allows the method to be applied to a plurality of individuals. Therefore, it can be stated that the present study well proves the reliability and safety of the EMDR Flash Technique.

Another significant finding of the present research is that the EMDR Flash Technique application is more effective in reducing anxiety than the mhGAP group. Furthermore, as an important aspect of the study, no significant difference was observed between the two groups while the levels of depression and stress were decreasing. Given their effectiveness in comparing anxiety levels, the mhGAP application can be said to have an effect on anxiety reduction. When examining these three results in conjunction, it can be seen that the selection of the mhGAP management as the control group preferable to demonstrate the effectiveness of the EMDR Flash Technique. In this context, the effectiveness of the EMDR Flash Technique was underscored again. Furthermore, it was pointed out that the EMDR Flash Technique was more effective in the quality of mental status with the present study. Noting that the present study focuses on the last 1 month to assess the quality of life, it can be concluded that further long-term research is required for more objective results (Fidaner et al., 1999).

Such an outstanding effectiveness of the EMDR Flash Technique can be understood with a variety of mechanisms. Manfield (2021) has suggested that the Technique enables traumas to be processes effectively by firstly being subjected to a traumatic memory for an instant, subsequently preventing the activation of the amygdala by inhibiting conscious thinking over the trauma while activating the prefrontal cortex. Accordingly, during the processing period, the Flash Technique aims to prioritize memory while excluding details and discomfort from conscious awareness (Manfield et al., 2021). Besides the hypotheses on the need for the existence of a contradictory experience to reconsolidate the trauma, it can be seen that the effect mechanism of the EMDR Flash Technique is quite robust considering its ability to process both positive and negative memories simultaneously (Ecker et al., 2012). On the other hand, Adaptive Information Processing is activated during the application of EMDR Flash Technique, which explains the logic of trauma processing in EMDR Therapy (Shapiro and Forrest, 2001). According to this model, a client becomes an observer against the trauma resulting from a negative memory and his prefrontal cortex is activated by being processed during the application, the activation of his traumatic memories is inhibited and thus, the client is enabled to have a more positive perspective against the trauma with a reduced level of affection and emotional memory (Manfield et al., 2021). On the other hand, another

effect mechanism of EMDR Flash Technique can be through Working Memory Theory. Accordingly, while the working memory of the human being performs two tasks at the same time, the discomfort of the traumatic memory decreases and this change is consolidated (de Jongh et al., 2013; Schwabe et al., 2014). In addition, another possible mechanism may be the subliminal exposure theory. Accordingly, it is thought that the activation of the amygdala prevents the processing of the traumatic memory, but the continuation of the processing is ensured by the dual tasking inhibiting the activation of the amygdala (Brouwers et al., 2021; Manfield et al., 2021; Siegel et al., 2022). In conclusion, considering rapid effectiveness of the EMDR Flash Technique, it should be noted that it may have an effect mechanism which is quite novel and has unexplained aspects.

The findings of the present research are required to be interpreted within some limitations. First, it should be noted that the implementations within the study were conducted on the participants using online methods due to the COVID-19 pandemic. This can be interpreted as both a limitation and an indication of the effectiveness of the implementations. As another limitation, the follow-up period was kept short to reduce the rate of drop-out. It is preferable to plan longer periods of follow-up for prospective studies. Another limitation of the study could be the absence of a shortlist control group. Differences in traffic accidents experienced by study participants were attempted to be restricted using various criteria, as shown in **Table 1**; however, proper homogeneity may not be provided. Moreover, it should be noted that the participants are likely to be manipulated as the scales employed in the study are the type of self-reports. Finally, the absence of the pre-registration of the clinical trial protocol can be considered as another limitation.

CONCLUSION

In conclusion, the present study, which is the first clinical randomized control study to examine the EMDR Flash Technique, has indicated that the EMDR Flash Technique is effective and safe in reducing traumatic stress symptoms. Furthermore, it has been found out that the application of EMDR Flash Technique is more effective in alleviating traumatic stress symptoms compared to the mhGAP method. According to these findings, the study urges the application of the EMDR Flash Technique for the groups suffering from negative memories. It will be advantageous if prospective randomized control studies have longer periods of follow-up and focus on possible effect mechanisms.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors upon appropriate request.

ETHICS STATEMENT

All participants who agreed to participate were informed online and their consent was obtained. The study only included individuals who provided their consent. All stages of the study and data protection were carried out in line with the Helsinki Declaration, and the approval was obtained from the Clinical Research Ethics Committee of Marmara University Faculty of Medicine (26.07.2019/09.2019.707).

AUTHOR CONTRIBUTIONS

AY, İG, EK, ÖK, and EU contributed to conception and design of the study and wrote sections of the manuscript. AY, İG, AT, and EU organized the database. İG, EU, and AT performed the statistical analysis. AY wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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frontiers | Frontiers in Psychology

ORIGINAL RESEARCH
published: 25 April 2022
doi: 10.3389/fpsyg.2022.845520

The Effectiveness of Eye Movement Desensitization for Post-traumatic Stress Disorder in Indonesia: A Randomized Controlled Trial

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Reviewed by:
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Dorothée Bentz,
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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: 29 December 2021
Accepted: 25 March 2022
Published: 25 April 2022

Citation:
Susanty E, Sijbrandij M, Srisayekti W, Suparman Y and Huizink AC (2022) The Effectiveness of Eye Movement Desensitization for Post-traumatic Stress Disorder in Indonesia: A Randomized Controlled Trial. Front. Psychol. 13:845520. doi: 10.3389/fpsyg.2022.845520

Objective: Post-traumatic stress disorder (PTSD) may affect individuals exposed to adversity. Eye Movement Desensitization and Reprocessing (EMDR) is an evidence-based trauma-focused psychotherapy for PTSD. There is still some debate whether the eye movements (EMs) are an effective component of EMDR. The primary aim of this study was to investigate the effectiveness of Eye Movement Desensitization (EMD) treatment in reducing PTSD symptoms compared to a retrieval-only active control condition. We also investigated whether PTSD symptom reduction was associated with reductions in depression and anxiety, and improvements in quality of life.

Methodology: Adult PTSD patients (n = 91) were recruited at public psychological services in Jakarta, Bandung and Cimahi, Indonesia. PTSD was diagnosed with the Structured Clinical Interview for DSM-5 disorders (SCID-5). Participants were randomized into: EMD (n = 47) or retrieval-only (n = 44). EMD consisted of clinical history and treatment planning, preparation, assessment, EMs, closure, whereas retrieval-only consisted of the same elements except EMs. Data were collected at baseline (T0), 1-week post-treatment (T1), 1-month follow-up (T2), and 3-months follow-up (T3). Outcome measures included the PTSD Checklist for DSM-5 (PCL-5), Hopkins Symptoms Checklist-25 (HSCL-25), and the World Health Organization Quality of Life–BREF (WHOQoL–BREF). Data were analyzed with linear mixed model analysis in R Statistics.

Results: Although there were main effects of time indicating reductions for both EMD and retrieval-only in PCL-5 and HSCL-25 scores, and improvements in WHOQoL-BREF scores at T1, T2, and T3, no significant differences in PCL-5, HSCL-25, and WHOQoL-BREF total scores between the EMD and retrieval-only groups at T1, T2, and T3 were found (all group x time interaction p's > 0.005).

Conclusion: Within a clinical sample of PTSD patients in Indonesia, both EMD and retrieval-only was associated with reductions in symptoms of PTSD, anxiety and depression, and improvements in quality of life, although EMs did not add to the efficacy of the treatments. Further research to examine the underlying mechanisms of EMDR's effective treatment elements in clinical samples is needed.

Clinical Trial Registration: [www.ClinicalTrials.gov], identifier [ISRCTN55239132].

Keywords: eye movements, eye movement desensitization and reprocessing, post-traumati stress disorder, psychological treatments, anxiety, depression, quality of life

INTRODUCTION

Post-traumatic stress disorder (PTSD) is a common mental disorder that may occur after exposure to a traumatic event, such as a natural disaster, a terrorist attack, a serious accident, or a physical or sexual assault in adult- or childhood. Most people do not experience any PTSD symptoms or experience initial symptoms in the first few days or weeks after the event that reduce naturally. However, some people will continue to experience intrusion symptoms, avoidance, negative alteration in cognition and mood, and alterations in arousal and reactivity, and develop PTSD (American American Psychiatric Association [APA], 2013). PTSD symptoms may significantly impair the ability to function in social and family life, negatively affect quality of life (Fu et al., 2013) and reduce overall psychological and physical health (McFarlane, 2010).

PTSD prevalence rates vary widely, depending on various risk factors, including sociodemographic and background factors, trauma type, social support or the intensity of the acute response to the traumatic event (Neria and Galea, 2008; Farooqui et al., 2017; Marthoenis et al., 2019). A systematic review revealed that the prevalence of PTSD in the first year after exposure among survivors of a natural disaster ranges between 30 and 40%; the prevalence range of PTSD among rescue workers was 10 and 20%, as compared to a PTSD prevalence in the general population ranging between 5 and 10% (Neria and Galea, 2008). In Indonesia, where the current study was conducted, the overall PTSD rate in 3–6 years after major natural disasters in Sumatera and Java was 20.9% (Downs et al., 2017).

Several psychotherapies have been proven to be effective in treating PTSD. Trauma-focused cognitive-behavioral therapy (TF-CBT), cognitive processing therapy (CPT) and Eye Movement Desensitization and Reprocessing (EMDR) have the strongest evidence base (Cusack et al., 2016; Lancaster et al., 2016; Tran and Gregor, 2016), and are the most recommended treatments for adults with PTSD).

EMDR is a form of psychotherapy developed by Shapiro (2002, 2007), that is widely used to treat PTSD patients. A specific aspect of EMDR is bilateral stimulation during retrieval of the traumatic memory. EMDR engages a person in imaginal exposure to trauma, while simultaneously performing saccadic eye movements. As such, patients are required to divide their attention between bilateral stimulation and the retrieval of traumatic memories (Shapiro and Maxfield, 2002).

Several explanations for the working mechanism of eye movements in EMDR have been proposed. For example, it has been suggested that Ems elicit an orienting response (Sack et al., 2008; Schubert et al., 2011). According to this theoretical model, EM activates an "investigatory reflex," in which first an alert response occurs, and next a reflexive pause produces a relaxation sensation that inhibits negative affect related to the traumatic memory (Cusack et al., 2016). Furthermore, it increases alertness and facilitates exploratory behavior, which is assumed to evoke more flexible and efficient cognitive processes (Kuiken et al., 2001). Another theoretical framework is the Adaptive Information Processing (AIP) model, which posits that the primary source of psychopathology is the presence of traumatic memories inadequately processed by the brain (Hase et al., 2017). According to this model, the "re-processing," promotes integration into adaptive memory networks, leading to a resolution of symptoms, and enabling learning (Solomon and Shapiro, 2008; Hase et al., 2017).

Most empirical support was found for the Working Memory explanation for the working mechanism of EMDR, stating that when the two tasks of recalling unpleasant memories and EMs are performed simultaneously, the working memory becomes less efficient as EMs use up processing resources (van den Hout and Engelhard, 2012). This may deteriorate the quality of the trauma image even upon reconsolidation into the episodic memory (Gunter and Bodner, 2008; Maxfield et al., 2008; Engelhard et al., 2011). The role of EMs as part of EMDR is assumed to cause unpleasant memories to become less vivid and less unpleasant and thus lead to overall improvements in terms of PTSD symptoms (Gunter and Bodner, 2008; van den Hout and Engelhard, 2012; Jeffries and Davis, 2013).

Support for the Working Memory (WM) model has been found in several experimental studies in healthy participants. Mertens et al. (2021) conducted a meta-analysis of 45 studies to evaluate the Working Memory model specifically on dual-task intervention studies within the laboratory to attenuate emotional memories and intrusive mental images. The authors concluded that taxing the working memory by performing dual tasks such as EMs or counting reduced vividness and emotionality of intrusive mental image and emotional memories (Mertens et al., 2021). These results are in line with another meta-analysis on the effect of dual-task interventions, which also indicated that EMs yielded a stronger overall vividness reduction than alternative dual tasks (Houben et al., 2020).

In addition, a number of studies in PTSD patients were carried out to investigate the additive benefit of EMs. A small study of Thomaes et al. (2016) in eight patients with PTSD compared recalling the traumatic memory with EMs to a "recalling-only" condition within a cross-over experimental design. The results showed that subjective vividness and emotionality of the traumatic memory did not change significantly over time in both conditions. A study of Sack et al. (2016) in 139 patients with PTSD, compared regular EMDR with either EMDR fixating on the therapist's non-moving hand or with an exposure only condition. It was found that both EMDR conditions led to stronger reductions in PTSD symptoms than exposure only, but there were no differences between following a moving hand vs. a non-moving hand (Sack et al., 2016). A meta-analysis by Lee and Cuijpers (2013) compared the effects of EMDR therapy with eye movements to interventions with a similar procedure but without eye movements (exposure only) in a meta-analysis across 14 studies. They found that EMs in EMDR had a moderate and significant beneficial additive effect. However, the quality of the majority of included studies in this meta-analysis (Lee and Cuijpers, 2013) was low due to, for instance, a lack of adequately handling incomplete data or not describing adequate sequence generation used to randomize the participants in the different conditions. Furthermore, previous clinical studies comparing the effect of EMDR therapy with eye movements to those of EMDR without the eye movement are hampered by small sample sizes (i.e., largest sample size $N = 25$; Devilly et al., 1998), no randomization (Devilly et al., 1998), or lack of therapist training (Renfrey and Richard Spates, 1994). The low quality of research involving EMDR in previous studies has prevented us from building robust conclusions regarding the role of EM in the EMDR procedure when evaluated in patient samples. In a recent meta-analysis, Cuijpers et al. (2020) examined the effect of EMDR on PTSD and other mental health problems. The study found five dismantling studies specific on PTSD, in which full EMDR was compared with EMDR in which one component was removed (e.g., Sack et al., 2016). The results showed that the pooled effect size of full EMDR vs. partial EMDR was non-significant. Three of these studies had a high risk of bias (Cuijpers et al., 2020). Despite some indications showing that EMs may add to EMDR's effectiveness, until now dismantling studies are very scarce, and there is still debate around the working mechanism of EMDR.

Our study aimed to improve the methodology by including a relatively large sample, randomizing the participants, trained therapists, which would potentially increase the fidelity of the intervention, and comparison conditions that allowed us to test for the specific effect of EMs. In the current study, we focus on EMDR, and more specifically, on the first part of this treatment: Eye Movement Desensitization (EMD) and compare it with retrieval-only in terms of its effectiveness in reducing symptoms of PTSD, anxiety, and depression, and improving quality of life in PTSD patients. We did not include the installation phase of the regular EMDR treatment, since it has been suggested that this phase may render a positive image or thought less vivid and positive, which would be counter-productive in improving mental health (van den Hout and Engelhard, 2012). We compared EMD with a retrieval-only comparison group, which received the same treatment as the EMD group participants, except that during desensitization, no eye movements were performed during retrieval of the traumatic memory.

MATERIALS AND METHODS

Study Design

We conducted an RCT to test the effectiveness of EMD vs. a retrieval-only control condition, which consists of the EMD protocol without EMs. The study protocol was approved by the Research Ethics Committee of Universitas Padjadjaran Bandung on 2 July 2018 (Document number: 3 35/UN6.KEP/EC/2018). For a detailed description of the study protocol (see Susanty et al., 2021b). We adhered to the CONSORT statement and referred to the CONSORT checklist (**Supplementary Appendix A**).

Participants

We approached outpatients or inpatients in one of the participating centers in Indonesia: (1) the "Pulih" clinic in Jakarta, (2) the "Unisba psychology service" in Bandung and (3) the "Unjani crisis center" in Cimahi. Inclusion criteria were: (1) increased levels of PTSD as indicated by a PTSD Checklist for DSM-5 (PCL-5) cut-off score of 33 or higher (Bovin et al., 2016); (2) a diagnosis of PTSD as diagnosed with the Structured Clinical Interview for DSM-5 disorders (SCID-5); and (3) age of 18 years or older. Exclusion criteria (determined by chart review of the SCID-5) were: (1) current or previous psychotic disorder; (2) current substance use disorder; (3) acute suicidality; and (4) current organic disorder, i.e., epilepsy, brain damage.

We based the power calculations on expecting a significant difference between the two treatment arms on the primary outcome, which was a stress measure outcome as described in the study protocol (Susanty et al., 2021a). In order to detect a difference with an expected effect size of $d = 0.4$ (see Lee and Cuijpers, 2013), power calculations suggested a minimum sample size of 41 participants per group anticipating 25% drop out at follow-up, 110 participants (55 per group) were aimed for.

Study Procedures

A trained assessor provided information about the purpose of the study, including the study rationale, risks and safety, benefits, and their right to withdraw from the study at any time without consequences. Oral and written informed consent was obtained from all participants. The trained assessor continued the baseline assessment by administering the Hopkins Symptoms Checklist-25 (HSCL-25), and the World Health Organization Quality of Life (WHOQoL-BREF).

After all baseline assessments were completed, participants were allocated on a 1:1 ratio using block randomization using the Castor data management software[1] into one of two conditions: (1) EMD or (2) retrieval-only control. Block sizes of 4, 6, and 8 were applied to allocate the participants. The time span between T0 and the first intervention session was approximately

[1] www.castoredc.com

1 week. Upon randomization, participants received 4–6 EMD or retrieval-only weekly therapy sessions. Participants completed the self-report measures at 1-week post-treatment (T1), at 1 month (T2) and 3 months (T3) after treatment completion. The assessors were blinded to the study conditions.

Treatment Conditions

Both treatment conditions were delivered individually and in-person by experienced psychotherapists with at least 1 year experience in treating PTSD patients. Eight therapists were recruited through colleagues from the Clinical Psychologist Association (IPK) in Indonesia. Therapists received extensive training in EMD and retrieval-only, including case practices with supervision and ongoing weekly supervision by an accredited EMDR supervisor throughout the duration of the study. Sessions were video recorded for supervision purposes. The therapists were responsible for delivering the treatment conditions. A minimum of four to a maximum of six sessions were given in order to minimize heterogeneity. If the participant reached a score of 0 or 1 at the fourth or fifth session, the therapy was ended. At the end of the sixth session, the therapy was always ended. Each EMD session lasted 45–60 min.

Eye Movement Desensitization Treatment Procedure

In this study, the procedures of EMD were carried out in line with the standard EMDR protocol (Shapiro and Maxfield, 2002). Furthermore, we decided to omit the installation phase in both study groups. It has been suggested that the installation phase may be counter-effective since performing eye movements when retrieving a positive cognition or image (as done in the installation phase) may render that positive image less vivid and positive (van den Hout and Engelhard, 2012). In this study, EMD consists of the following steps: (***1) Client history*** **and** ***treatment planning***: obtaining information regarding the clients' clinical condition, including intrusive emotions and physical sensations. (***2) Preparation***: building a therapeutic bond with the client, providing an explanation of the EMDR process and its possible effects. (***3) Assessment***: identification of the target visual image of the traumatic memory and associated negative emotions. The participant then rates the intensity of the negative emotions on the 0–10 SUD scale). (***4) Desensitization***: clients were asked to focus on target traumatic events, while focusing their eyes on the therapist's finger that moves from left to right and back in the participant's visual field. The therapist conducted the EMs bilateral stimulation for 24 cycles several times. Before and after the desensitization phase, the client was asked to rate Subjective Units of Distress (SUD)—a scale ranging from 0 to 10 to measure the subjective distress that the client feels (Shapiro and Forrest, 2004). This phase ended if the SUD scores reached 0 or 1. Next, participants were instructed to scan their body until any sensation of tension disappears. (*5)* ***Closure***: the session ends, and the stabilization techniques and relaxation exercises were reviewed. Sessions 2–4 started with a reevaluation of the patient's progress and SUD scores of the target events to guide the choice of continuing the therapy with the target traumatic event or choosing a new event.

Retrieval-Only Condition (Control)

Control participants received the same treatment as the participants in the EMD group, except that during phase (4) Desensitization, no eye movements were performed during retrieval of the traumatic memory.

Measures

The SCID-5 is a well-established structured clinical interview to diagnose all DSM-5 Axis I disorders, including PTSD (Glasofer et al., 2015). We have used the Bahasa Indonesian version of SCID-5 (Arjadi et al., 2018). We administered three modules of the Indonesian version of the SCID-5 (Arjadi et al., 2018) during screening: the Trauma and Stressor-Related Disorders, Psychotic and Associated Symptoms, and Substance Use Disorders Modules.

The PCL-5 is a 20-item self-report measure that assesses the DSM-5 criteria for PTSD symptoms experienced in the last month. The participants rated their PTSD symptoms on a scale from 0 to 4 ["not at all (0)" to "extremely (4)"]. Items are summed to provide a total severity score and total score range from 0 to 80, with higher scores indicating higher symptoms severity. The PCL-5 showed good psychometric properties (Blevins et al., 2015). The Indonesian version of the PCL-5 has been proven a valid and reliable questionnaire in Indonesia. The internal consistency coefficient (Cronbach's alpha) for the total scale of PCL-5 was 0.93. Cronbach's alpha ranged between 0.75 and 0.85 for different subscales (Asti, 2015).

Other Measures

The HSCL-25 is a 25 item self-report measure that assesses anxiety and depression symptoms. The HSCL-25 consists of two parts: anxiety symptoms (10 items) and depression (15 items). Symptoms are scored on a five-point scale varying from "not at all (0)" to "extremely (4)." Total scores range from 0 to 100, ranging from 0 to 40 for anxiety and 0–60 for depression, with higher scores indicating more symptoms. The HSCL-25 has been translated and culturally adapted for use in Indonesia (Turnip and Hauff, 2007), and has been found to be reliable and valid across a variety of cultural groups, including Indonesia (Larson-stoa et al., 2015).

The WHOQoL-BREF consists of 26 items, two of which measure overall quality of life and general health (World Health Organization [WHO], 1996). The other 24 items are divided into four domains: physical, psychological, social relationships and environmental domains during the past 4 weeks (Purba et al., 2018). Domain scores are scaled in a positive direction (1 = not at all, 2 = not much, 3 = moderately, 4 = a great deal, 5 = completely). The scores are transformed into a linear scale between 0 and 100, with lower scores indicating lower levels of quality of life. The Indonesian WHOQoL-BREF has shown adequate psychometric properties (Purba et al., 2018). Cronbach's alpha ranged between 0.41 and 0.77 for the different subscales. The lowest Cronbach's

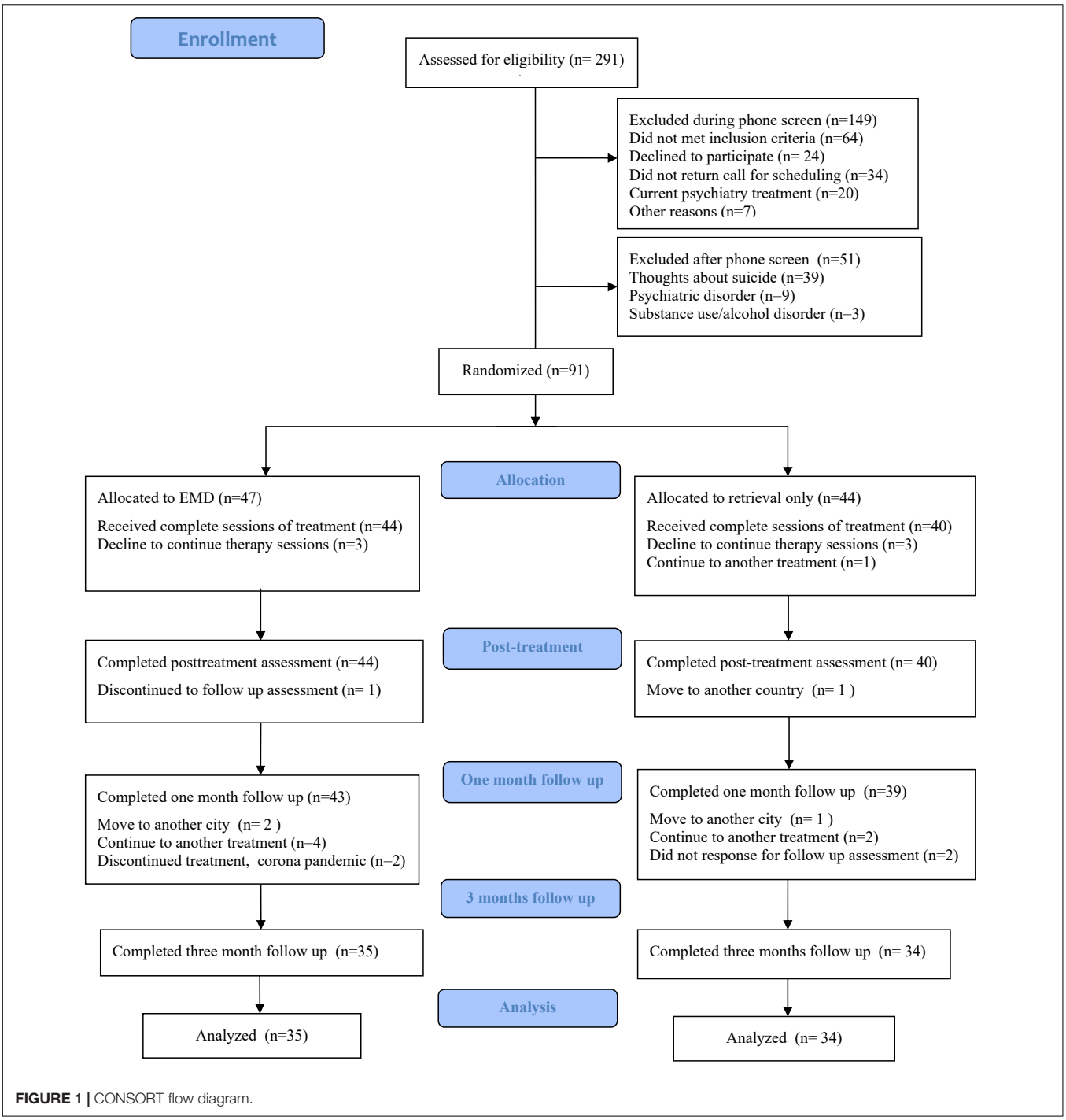

FIGURE 1 | CONSORT flow diagram.

alpha was found for the social relationships domain (<0.5) (Salim et al., 2007).

Data Analysis

Baseline sociodemographic data and outcomes of interest were first compared between treatment conditions using chi-square tests and independent-samples *t*-test in SPSS version 26. We also compared baseline demographic and clinical characteristics between patients who dropped out vs. those who did not drop out at T1, T2, and T3. We used logistic regression analysis to evaluate dropout at T1, T2, and T3, based on the characteristics and treatments given in the experiment or treatments outside the experiment.

We analyzed the effects of EMD vs. retrieval only on symptoms of PTSD, anxiety, and depression, and quality of life using linear mixed models in R versions 3.6.1 using the "nlme" package (Linear and Non-linear Mixed Effects Models. R package version 3.1-152), with a random effects model. We

included time, condition (EMD vs. retrieval only), and time by condition. All outcomes were reported as unstandardized regression coefficients. In all analyses, a treatment x time interaction term represented the effect of EMD and retrieval-only interventions on the outcome variables over time. In our trial (see Susanty et al., 2021a) we planned 11 tests in total to examine our primary and secondary outcomes as were discussed in our protocol paper (Susanty et al., 2021a). These outcomes included the measures as described in this paper (PTSD Checklist for DSM-5 (PCL-5), Hopkins Symptoms Checklist-25 (HSCL-25), and the brief version of World Health Organization Quality of Life (WHOQoL BREF) and other measures, related to stress (e.g., Heart Rate Variability, Heart Rate, cortisol) and cognitive outcomes such as Digit Span (WAIS-IV), California Verbal Learning Test (CVLT) and Trail Making Test (TMT). To correct for multiple testing within our trial, we used *post-hoc* test by applying Bonferroni correction considering 11 planned tests (alpha level was 0.05/11 = 0.005). Intention to treat (ITT) analysis was conducted using the data of all randomized participants, with missing data imputed using the regression method for participants who did not complete the T2 and/or the T3. Second, the per-protocol analyses were conducted using only the data of participants who completed the treatment (at least 4 sessions).

RESULTS

Participants

The enrolment and flow of participants throughout the study is summarized in **Figure 1**. Of the 291 participants approached, 91 (31.3%) agreed to participate in the study. We excluded 149 candidates after the first round of screening, due to the following reasons: 64 did not meet the inclusion criteria, 24 declined to participate, 34 did not return the call for scheduling, 20 had current psychiatric comorbidities and 7 had other reasons. Then, 51 candidates were excluded after the second round of screening, with the following reasons: 39 had thoughts about suicide, three had substance use/alcohol disorder, and nine had another psychiatric disorder, of whom two had bipolar disorder, two had paranoid personality disorder, and five had hallucination symptoms. We refer the individuals who had thought about suicide to another psychological crisis center for further help. Further, seven participants, who were randomly assigned to the intervention (EMD group) or control (retrieval only group), withdrew after randomization and baseline assessment; five of these seven participants declined to continue the therapy sessions, one participant failed to be contacted, and one participant switched to another treatment.

Ninety-one participants were assigned to EMD (n = 47) or retrieval-only (n = 44). At T1, 93.6% (44/47) of the EMD group and 90.9% (40/44) of the retrieval-only group completed their 1-week follow-up after treatment. At T2, 91.5% (43/47) of the EMD group and 88.6% (39/44) of the retrieval-only group completed the 1-month assessment after treatment. At T3, 74.5% (35/47) of the EMD group and 77.3% (34/44) of the retrieval-only group completed the 3-months follow-up assessment. Additionally, at T1 and T2, the patients who dropped out did not differ significantly from the patients who completed the assessments in terms of medical history and sociodemographic background. At T3, participants who received previous treatment for PTSD were more likely to dropout at T3 than those who did not (OR 19.4; 95% CI 1.11–338.26). Meanwhile, subjects without prior or concurrent medical histories were more likely to drop out (OR 4.1, 95% CI 1.10–15.38).

Descriptive statistics for baseline variables and sociodemographic characteristics by group are displayed in **Table 1**. There were no significant differences between the EMD and retrieval-only groups in demographics, symptom measures and quality of life at baseline (see **Table 1**). Most of the participants were females: 89.4% (42/47) of the EMD and 93.2% (41/44) of the retrieval-only group, and more than half of participants had experienced domestic violence: 57.4% (27/47) of the EMD, and 56.8% (25/44) of the retrieval-only group.

Treatment Effects

Post-traumatic Stress Disorder Symptoms

ITT analysis of the estimates for the effect of group, time, and group-time interactions for PCL-5, HSCL-25, and WHOQoL-BREF are presented in **Supplementary Appendix B**. There was main effect of time for PCL-5 total scores. Results indicated a significant reduction in PCL-5 total scores from baseline to T3 for both groups ($p < 0.001$). *Post-hoc* tests showed PCL-5 total scores were lower at T1, T2, and T3 than T0 in both groups (Bonferroni-adjusted $p < 0.005$). For both groups, PCL-5 total scores dropped by a clinically significant 23.10 points at 3-months after treatment (T3; $p < 0.001$). We found that there was no effect of group ($p = 0.92$) nor of group-time interactions ($p = 0.25$) on the PCL-5 scores. Thus, no significant differences between the EMD and retrieval-only group were found from baseline to T3 on PCL-5 total scores. Furthermore, there was no significant difference between retrieval-only and EMD groups on any of the PCL-5 subscales. Per-protocol analysis of estimates for the effect of group, time, and group-time interaction for PCL-5 indicated similar results (**Supplementary Appendix C**).

Linear mixed models (LMM) in the intention to-treat sample for the PCL-5 total score showed no significant difference between retrieval-only and EMD groups at T1 [M (SE) 29.20 (5.20) vs. 26.60 (5.12), 95% Cl −5.73 to 10.92, $p = 0.54$] or at T2 [M (SE) 28.30 (5.20) vs. 25.70 (5.12), 95% CI −5.69 to 10.97, $p = 0.53$] or at T3 [M (SE) 38.30 (5.20) vs. 33.90 (5.12), 95% CI −3.95 to 12.7, $p = 0.30$] (**Table 2**). Per-protocol analyses for PCL-5 indicated similar results (**Supplementary Appendix D**).

Depression and Anxiety Symptoms

There was a main effect of time for HSCL-25 total scores. The results indicate a significant reduction in HSCL-25 total scores from baseline to T3 for both groups ($p < 0.001$). *Post-hoc* tests showed HSCL-25 total scores were lower at T1, T2, and T3 than T0 in both groups (Bonferroni-adjusted $p < 0.005$). HSCL-25 total scores dropped by a clinically significant average of 42.30 points at 3 months after treatment (T3; $p < 0.001$). There was no effect of group ($p = 0.72$) nor of group-time interactions ($p = 0.66$) on HSCL-25 scores. No significant differences between the EMD and retrieval-only groups were found from baseline

TABLE 1 | Baseline characteristics of participants.

Variable	Total *N* = 91	Retrieval only (*n* = 44)	EMD (*n* = 47)	χ^2 or *t*	*p*-value*
Age, mean (*SD*)		24.66 (5.51)	26.15 (6.81)	−1.14	0.26
Sex, *n* (%)				0.41	0.52
Male	8 (8.8)	3 (6.8)	5 (10.6)		
Female	83 (91.2)	41 (93.2)	42 (89.4)		
Education, *n* (%)				3.98	0.26
High school	33 (36.6)	18 (40.9)	15 (31.9)		
College	5 (5.5)	4 (9.1)	1 (2.1)		
Bachelor	49 (53.8)	21 (47.7)	28 (59.6)		
Master	4 (4.4)	1 (2.3)	3 (6.4)		
Work, *n* (%)				0.53	0.77
Unemployed	47 (51.6)	21 (47.7)	26 (55.3)		
Public sector	2 (2.2)	1 (2.3)	1 (2.1)		
Private sector	42 (46.2)	22 (50.0)	20 (42.6)		
Marital status, *n* (%)				0.41	0.38
Unmarried	69 (75.8)	33 (75)	36 (76.6)		
Married	21 (23.1)	10 (22.7)	11 (23.4)		
Divorced	1 (1.1)	1 (2.3)	0 (0)		
Trauma type, *n* (%)				1.29	0.53
Domestic violence	52 (57.1)	25 (56.8)	27 (57.4)		
Sexual abuse	13 (14.3)	8 (18.2)	5 (10.6)		
Other	26 (28.6)	11 (25)	15 (31.9)		
Previous mental health treatment				0.82	0.05
No previous treatment	59 (64.8)	28 (63.6)	31 (66)		
Previous treatment	32 (35.2)	16 (36.4)	16 (34)		
Medical history				0.41	0.69
No previous disease	56 (61.5)	29 (66)	27 (57.4)		
Previous disease hospitalization	35 (38.5)	15 (34)	20 (42.6)		
PCL-5, mean (*SD*)					
PCL-5 total	58.41 (9.36)	57.93 (9.07)	58.85 (9.68)	−0.47	0.64
Intrusive	15.46 (2.93)	15.48 (3.05)	14.45 (2.85)	−0.05	0.96
Avoidance	6.09 (1.62)	5.86 (1.73)	6.30 (1.49)	−1.28	0.20
Thinking and mood	20.11 (4.59)	19.77 (4.69)	20.43 (4.52)	−0.67	0.50
Arousal and reactivity	16.75 (3.52)	16.82 (3.16)	16.68 (3.87)	−0.19	0.85
HSCL-25, mean (*SD*)					
HSCL-25 total	69.25 (17.46)	67.68 (17.17)	70.78 (17.80)	−0.84	0.41
Anxiety	27.83 (7.68)	27.09 (7.56)	28.56 (7.82)	−0.90	0.37
Depression	41.47 (11.61)	40.59 (11.78)	42.33 (11.50)	−0.71	0.48
WHOQoL, mean (*SD*)					
WHOQoL total	35.25 (5.83)	35.00 (6.13)	35.49 (5.58)	−0.94	0.50
Physical health	6.80 (1.52)	6.91 (1.44)	6.69 (1.59	0.68	0.61
Psychological health	7.40 (1.58)	7.32 (1.47)	7.49 (1.69)	−0.51	0.41
Social relationship	14.29 (3.83)	13.95 (3.92)	14.62 (3.76)	−0.82	0.72
Environment	6.75 (1.67)	6.82 (1.69)	6.69 (1.68)	0.36	0.69

**Significance, $p < 0.05$.*
Chi-square test for nominal variables and independent samples t-tests for continuous variables.
Previous treatment; participants who had counseling, psychotherapy, hypnotherapy.
Previous disease hospitalization; participants who had dengue fever, typhoid, bronchitis, mammae tumor, ovarium tumor, gastritis, thalassemia, appendicitis, HIV.
EMD, Eye Movement Desensitization; HSCL-25, the Hopkins Symptom Checklist- 25; PCL-5, PTSD Checklist for DSM-5; WHOQoL-BREF, World Health Organization Quality of Life Scale; SD, Standard Deviation.

to T3 on HSCL-25 total scores. Furthermore, there was no significant difference between retrieval-only and EMD groups on all subscales of HSCL-25 score (**Supplementary Appendix B**). Per-protocol analysis of estimates for the effect of group, time, and group-time interaction for HSCL-25 indicated similar results (**Supplementary Appendix C**).

LMM in the intention to-treat sample for the HSCL-25 total score showed no significant differences between retrieval-only

TABLE 2 | Summary statistics and results from mixed-model analysis for symptoms of PTSD, anxiety, depression s and quality of life (Intention-to-Treat sample, *N* = 91).

Outcomes	Measurement time	Mean (SD)				Mean difference (95% confidence interval)	*p*-value*
		Retrieval only		EMD			
PCL-5 total	T1	29.20	5.20	26.60	5.12	2.6 (– 5.73 *to* 10.92)	0.54
	T2	28.30	5.20	25.70	5.12	2.64 (– 5.69 *to* 10.97)	0.53
	T3	38.30	5.20	33.90	5.12	4.38 (– 3.95 *to* 12.7)	0.30
PCL-5 intrusion	T1	7.08	1.10	6.55	1.09	0.53 (– 1.24 *to* 2.31)	0.55
	T2	6.85	1.10	5.82	1.09	1.03 (– 0.74 *to* 2.81)	0.25
	T3	5.78	1.10	5.42	1.09	0.37 (– 1.41 *to* 2.14)	0.68
PCL-5 avoidance	T1	2.71	0.56	2.70	0.55	0.01 (– 0.91 *to* 0.94)	0.98
	T2	2.64	0.56	2.18	0.55	0.45 (– 0.47 *to* 1.38)	0.33
	T3	2.66	0.56	2.27	0.55	0.39 (– 0.53 *to* 1.32)	0.40
PCL-5 cognitive and mood	T1	8.35	1.55	8.68	1.53	−0.33 (– 2.83 *to* 2.18)	0.80
	T2	8.39	1.55	8.48	1.53	−0.09 (– 2.6 *to* 2.41)	0.94
	T3	6.95	1.55	6.47	1.53	0.48 (– 2.02 *to* 2.99)	0.70
PCL-5 arousal and reactivity	T1	8.51	1.27	8.80	1.26	−0.29 (– 2.41 *to* 1.84)	0.79
	T2	8.80	1.27	8.21	1.26	0.59 (– 1.54 *to* 2.72)	0.58
	T3	6.93	1.27	6.24	1.26	0.7 (– 1.43 *to* 2.82)	0.52
HSCL-25 total	T1	31.20	5.54	30.90	5.46	0.29 (– 8.74 *to* 9.31)	0.95
	T2	30.30	5.54	28.40	5.46	1.88 (– 7.14 *to* 10.91)	0.68
	T3	26.20	5.54	25.80	5.46	0.4 (– 8.63 *to* 9.42)	0.93
HSCL-25 anxiety	T1	14.40	2.31	13.40	2.28	0.93 (– 2.85 *to* 4.7)	0.63
	T2	14.70	2.31	13.40	2.28	1.32 (– 2.46 *to* 5.09)	0.49
	T3	12.50	2.31	11.00	2.28	1.52 (– 2.26 *to* 5.3)	0.43
HSCL-25 depression	T1	16.70	3.42	15.50	3.38	−0.49 (– 6.09 *to* 5.12)	0.86
	T2	16.50	3.42	15.50	3.38	0.98 (– 4.63 *to* 6.58)	0.73
	T3	13.60	3.42	15.60	3.38	−1.97 (– 7.58 *to* 3.64)	0.49
WHOQOL_total	T1	40.50	1.49	41.40	1.47	−0.87 (– 3.34 *to* 1.59)	0.48
	T2	41.90	1.49	40.80	1.47	1.15 (– 1.32 *to* 3.62)	0.36
	T3	42.50	1.49	42.30	1.47	0.22 (– 2.25 *to* 2.69)	0.86

**Bonferroni correction-significant, p < 0.005.*
PCL-5; PTSD Checklist for DSM-5, HSCL-25; the Hopkins Symptom Checklist-25, WHOQoL BREF; the Brief version World Health Organization Quality of Life, SD, Standard Deviation.

and EMD groups at T1 [*M* (*SE*) 31.20 (5.54) vs. 30.90 (5.46), 95% CI −8.74 to 9.31, $p = 0.95$], at T2 [*M* (*SE*) 30.30 (5.54) vs. 28.40 (5.46), 95% CI −7.14 to 10.91, $p = 0.68$], or at T3 [*M* (*SE*) 26.20 (5.54) vs. 25.80 (5.46), 95% CI −8.63 to 9.42, $p = 0.93$] (**Table 2**). Per-protocol analyses for HSCL-25 indicated similar results (**Supplementary Appendix D**).

Quality of Life

There was a main effect of time for WHOQoL-BREF total scores. The results showed a significant increase on WHOQoL-BREF total scores from baseline to T3 for both groups ($p < 0.001$). *Post-hoc* tests showed WHOQoL-BREF total scores were higher at T1, T2, and T3 than T0 in both groups (Bonferroni-adjusted $p < 0.005$). WHOQoL-BREF total scores increased by a clinically significant average of 6.40 points at 3-months after treatment (T3; $p < 0.001$). We found that there was no effect of group ($p = 0.57$) nor of group-time interaction ($p = 0.48$) on WHOQoL-BREF scores. No significant differences between the EMD and retrieval-only groups were found from baseline to T3 on WHOQoL-BREF scores. Similarly, none of the WHOQoL-BREF dimensions was significantly different between retrieval-only and EMD groups at T1, T2, and T3 (**Supplementary Appendix B**). Per-protocol analysis of estimates for the effect of group, time, and group-time interaction for WHOQoL-BREF indicated similar results (**Supplementary Appendix C**).

The LMM analysis showed no significant differences in WHOQoL total scores between retrieval-only and EMD groups at T1 [*M* (*SE*) 40.50 (1.49) vs. 41.40 (1.47), 95% CI −3.34 to 1.59, $p = 0.48$], at T2 [*M* (*SE*) 41.90 (1.49) vs. 40.80 (1.47), 95% CI −1.32 to 3.62, $p = 0.36$], or T3 [*M* (*SE*) 42.50 (1.49) vs. 42.30 (1.47), 95% CI −2.25 to 2.69, $p = 0.86$] (**Table 2**). Per-protocol analyses [n (T1) = 84, n (T2) = 82, n (T3) = 69] indicated similar results (**Supplementary Appendix D**).

DISCUSSION

The primary aim of the current study was to evaluate the effectiveness of EMD in reducing PTSD symptoms compared to a retrieval-only control condition among

Indonesian adults diagnosed with PTSD. As a secondary aim, it was also examined whether EMD compared to retrieval-only was related to reductions in depression or anxiety symptoms, and improvement of quality of life scores. This study showed that both EMD and retrieval-only reduced PTSD, depression or anxiety, and improved quality of life after treatment and over the course of follow-up of 3-months, but no significant differences between the EMD and retrieval-only conditions were found. Thus, our hypothesis that EMs would be associated with stronger reductions in symptoms of PTSD, anxiety or depression and improvements in quality of life than retrieval only was not supported.

Our results are not in line with a previous dismantling study on EMDR (Sack et al., 2016). The study of Sack et al. (2016) found that EM as a dual-task had no additional treatment effects compared to visually fixating a non-moving hand. When compared to the current study, there are some clear differences with the study design of Sack et al. (2016). According to Sack et al. (2016), fixation on a non-moving hand of the therapist as a dual task generates a dual focus of attention that might help reduce associated PTSD symptoms. In our study, we used a retrieval-only condition and not another dual task condition, to compare with the eye moment element of EMDR. Despite these differences in comparison conditions, both Sack et al. (2016) and the current study reported no additional effects of EM on reduction of PTSD symptoms.

The results of current study are also in contrast with findings from studies described in the meta-analysis (Lee and Cuijpers, 2013), showing an overall moderate effect for additive EM across EMDR studies. The fact that we did not find a difference between EMD and the retrieval-only control condition, is perhaps due to the usage of an active control condition instead of a non-active control condition. Furthermore, Lee and Cuijpers (2013) reported that only six of the fourteen included treatment studies investigated the effects of EM with participants who had a DSM diagnosis of PTSD, while the other eight studies focused on students who had distressing memory or anxiety. Indeed, these six included studies showed that EMDR was superior to control, but four out of these studies found no significant difference between an EMDR and a control condition with a similar procedure but without eye movements (exposure only) in reducing PTSD symptoms or SUD scale (Sanderson and Carpenter, 1992; Renfrey and Richard Spates, 1994; Devilly et al., 1998; Devilly, 2002). These methodological issues regarding the usage of control conditions in the studies reviews by Lee and Cuijpers (2013) may explain why the findings reported in the meta-analysis indicated a significant difference between EM and control conditions, in contrast to the results of our study. It should also be noted that the quality of the included studies in this meta-analysis (Lee and Cuijpers, 2013) was low, which may have distorted the outcome. Our results are also in contrast with the results of experimental studies, which have provided strong evidence of the effects of EM in reducing vividness of intrusive images and emotionality (van den Hout and Engelhard, 2012; Landin-Romero et al., 2018; Houben et al., 2020; Mertens et al., 2021). It appears challenging to translate the results of experimental studies supporting the Working Memory model using healthy participants to estimate effects in clinical studies using clinical patients with standard EMDR procedures. The experimental studies usually examined emotionality and vividness of an autobiographical memory, which is clearly different from the broader picture of PTSD symptoms after real-life traumatic events (van Veen et al., 2019; Houben et al., 2020).

Although our study did not support the effect of EM element in EMD in reducing anxiety and depression, the current study confirmed that both EMD treatment and retrieval-on significantly reduced depression and anxiety symptoms after 3 months follow-up. The results of our study also add to the evidence that both EMD and retrieval-only therapy improve the quality of life of patients after treatment to 3 months follow-up. The current study, therefore, is in line with previous research that found EMDR to be an effective treatment for depressive or, trauma symptoms and improve the quality of life in depression patients with exposure to trauma (Cusack et al., 2016; Gauhar, 2016; Cuijpers et al., 2020).

On a final note, it should be considered that despite the sometimes convincing evidence supporting EMDR's effectiveness for reducing PTSD symptoms (World Health Organization [WHO], 2013; Chen et al., 2014; Cusack et al., 2016; ISTSS, 2018; Wilson et al., 2018), some heterogeneity in methodology still exists (i.e., intervention, control condition, outcome measure, and follow-up procedures). The current study is different from other studies in control condition and the dose-response relationship (i.e., number of times treated and treatment duration) that may yield different results (Acarturk et al., 2016; Carletto et al., 2016; de Bont et al., 2016; Wilson et al., 2018).

Strengths and Limitations of the Current Study

Strengths of the current study include the dismantling RCT design in which we compared single element of a multicomponent EMDR treatment. Further, despite challenges imposed by the COVID-19 pandemic, we were still able to include 90% of the original sample in our follow-up assessment.

Although efforts to lower biases were carried out, several limitations of this study should also be taken into account. We reached the determined sample size of $N = 84$ at posttreatment, since the attrition was lower than expected, but still the current study's sample size can be considered relatively small for a study comparing two active treatments. In addition, not all instruments of the Bahasa Indonesian versions were validated for psychometric properties which may have compromised measurement validity (i.e., SCID-5). Furthermore, we cannot generalize the results to a population with a more equal gender distribution, because we included mostly female participants (91.2%). Finally, fidelity ratings should be included to assess protocol adherence.

Clinical Implications

We have evaluated the effect of EM in EMD and retrieval-only groups in reducing PTSD symptoms. The results showed that both EMD and retrieval-only significantly reduced PTSD symptoms up to 3-months follow-up. In clinical practice, we may suggest that both EMDR and other retrieval-based PTSD treatments should be part of trauma professionals 'toolkits. Unfortunately, there is a large gap between the number of people in need of effective treatments for mental health problems such as PTSD, and people who are receiving them. This is especially true in a low and middle income country such as Indonesia (World Health Organization, 2012). In consideration that Indonesia is a country strongly calling for efficient and effective treatment methods that can be easily and widely disseminated, EMDR is an important tool in meeting this surging clinical demand.

Research Implications

First, future studies are advised to include larger clinical samples. Further, measurements can be complemented by other tools such as eye-tracking software, which functions to identify and monitor a person's visual attention in terms of location, objects, and duration. Thus, this software may provide input on which form of EM is occurring and whether have an effect on the treatment's effectiveness. It may also be worthwhile to examine potential underlying neurocognitive and psychobiological mechanisms (Susanty et al., 2021b) that may be involved in the effects of retrieval-based therapies, including EMDR, on PTSD symptoms reduction.

CONCLUSION

Our study did not support the idea that the EM component in EMDR has a significant effect over retrieval-only in reducing PTSD symptoms. Therefore, we conclude that both EMDR and retrieval only can be used to reduce PTSD symptoms. These findings not only conflict with the considerable body of literature that has demonstrated the efficacy of the EM component, but also did not provide further support for the working memory theory stating that dual tasks are more effective that retrieval only in reducing emotionality and vividness of traumatic memories. Further research to identify the exact mechanisms of EMDR's effective treatment elements in clinical samples is needed.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Research Ethics Committee of Universitas Padjadjaran Bandung on 2 July 2018 (Document number: 3 35/UN6.KEP/EC/2018). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

ES, MS, and AH worked on the original idea of this study and developed the design. ES prepared the manuscript. MS and AH provided detailed feedback and input on all aspects of the manuscript. WS gave input on methodology and ethical issues. YS conducted the quantitative analysis. All authors contributed to this trial study and approved of the final version of the manuscript.

FUNDING

This study was funded by Indonesian Endowment Fund for Education (Lembaga Pengelola Dana Pendidikan), Ministry of Finance, Republic of Indonesia. Ministry of Research Technology and Higher Education (Kementrian Riset dan Teknologi Pendidikan Tinggi) cooperate with Ministry of Finance, Republic of Indonesia through the Scholarship for Indonesia Lecturer or Beasiswa Untuk Dosen Indonesia (BUDI LN) which provided a Ph.D. scholarship and research funding for first author (Document reference: S2747/LPDP.3/2016).

ACKNOWLEDGMENTS

We want to thank all participants and psychological service centers involved in this study for their participation and cooperation. We thank all of those who helped implement the intervention and data collection. We acknowledge the hard work and dedication of the coordinators and team in each area of psychological services. We thank Retha Arjadi for assisting as an instructor in using the SCID-5 measure, and Jackie Viemilawati, for assisting and sharing as a trainer for the EMDR procedure.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.845520/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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PERSPECTIVE
published: 31 May 2022
doi: 10.3389/fpsyg.2022.835470

The Therapeutic Relationship in EMDR Therapy

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The history of EMDR Therapy goes back to 1987, when it was introduced as EMD, a novel treatment for PTSD by Francine Shapiro. Over the course of time EMD developed into the comprehensive therapy approach named EMDR Therapy. The development of the "Adaptive Information Processing (AIP) Model", the model of pathogenesis and change of EMDR Therapy, was a milestone in this development from technique to psychotherapy approach. Up to date EMDR Therapy offers not only a model of pathogenesis and change, but also a variety of treatment plans and techniques to treat patients of various diagnosis far beyond PTSD. What seems to be missing is a specific description of the therapeutic relationship in EMDR Therapy. The therapeutic relationship should be described as a core element of EMDR Therapy, and seems be related to the structure of EMDR Therapy. As attachment theory offers a view on the development of interpersonal relationships in general, an attachment theory based perspective of the therapeutic relationship seems advisable. A description of the therapeutic relationship in EMDR Therapy is necessary at this point of the development of EMDR Therapy to a psychotherapeutic approach and therefore we try to describe the therapeutic relationship in this article and point out parallels between the therapeutic relationship and the development and core features of an attachment based relationship. We propose to describe EMDR Therapy as a sensitive psychotherapy. Implications for treatment, training and research will be discussed.

Keywords: EMDR therapy, adaptive information processing, therapeutic relationship, attachment theory, consultation, training, research

OPEN ACCESS

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *14 December 2021*
Accepted: *02 May 2022*
Published: *31 May 2022*

Citation:
Hase M and Brisch KH (2022) The Therapeutic Relationship in EMDR Therapy. Front. Psychol. 13:835470. doi: 10.3389/fpsyg.2022.835470

INTRODUCTION

Eye Movement Desensitization and Reprocessing Therapy (EMDR) consists of a structured set of treatment plans and procedures based on the Adaptive Information Processing (AIP) model (Shapiro and Laliotis, 2011). EMDR was introduced as EMD in 1987 (Shapiro, 1989) as a treatment for PTSD and was developed into the comprehensive therapy approach named EMDR Therapy over the following years. Shapiro intended EMDR Therapy to be compatible with all major orientations of psychotherapy.

Even if treatment plans, named protocols in EMDR Therapy, for very different disorders are available today and different techniques for modification of memory storage are available (Hase, 2021b) the processing of inadequately processed and maladaptively stored memories remains the core of EMDR Therapy. Valiente-Gómez et al. (2017) gave an overview on the application of EMDR

Therapy beyond PTSD. Some reflections on the AIP model and theory of pathogenic memories contribute to the theoretical foundation for the evolution of EMDR Therapy (Hase et al., 2017). An overview on the research on working mechanism in EMDR Therapy was recently provided by Landin-Romero et al. (2018). The neurophysiology behind bilateral stimulation has been researched to great extent (Pagani et al., 2017).

The theory currently used to explain EMDR Therapy treatment effects is called the Adaptive Information Processing (AIP) model. The AIP model was developed to explain the rapid change toward positive resolution that can be seen in the EMDR memory reprocessing (Shapiro, 2001). The AIP model assumes "an inherent system in all of us that is physiologically geared to process information to a state of mental health" (Shapiro, 2002). The term information as used in EMDR Therapy refers to affect, cognition, sensory, somatosensory or other internal or external input as perceived at the time of the event leading to memory formation. In EMDR Therapy it is presumed, that the activity of the adaptive information processing system leads to the integration of dysfunctionally encoded information toward functional encoding and adaptive state of memory, in consequence contributing to reduction in distress and/or negative emotions. The AIP system may be hindered or blocked by trauma, other severe stress, or other like the influence of psychoactive drugs in consequence leading to formation of the maldaptively stored memory, which is assumed to be foundational for psychopathology.

In contrast to a common, but nevertheless limited perception of EMDR Therapy, the AIP Model is not just a model of the unprocessed memories, but also of positive, adaptive information, often addressed as "resource". Shapiro (2001) stressed the fact, that the client would need sufficient resource memory networks, which are present and accessible, for successful memory reprocessing. Shapiro explicitly refers to neglect and abuse in childhood, developmental windows, which might have closed before important infrastructures were set in place, as well object constancy as prerequisites for memory reprocessing. Shapiro states "Once such positive interactions are forged within the therapeutic relationship, they too become stored in memory and can be enhanced through the EMDR procedures." (Shapiro, 2001, p. 5). In the 3rd edition Shapiro (2018) again addresses these issues, but a bit differently in a case example of a rape victim: "Clinicians must understand how to prepare clients appropriately and stay attuned to to their individual needs while keeping the information processing system activated so learning can take place. Clinicians must take a comprehensive history to identify the appropriate targets for processing and the developmental deficits to be addressed" (Shapiro, 2018, p. 3). Shapiro was even more precise in the 2017 edition of the EMDR Institute Basic Training Manual regarding the necessity of present and accessible adaptive memory networks and referred to the therapeutic relationship as a part of the adaptive memory network: "Adaptive memory networks need to be present and accessible for reprocessing to occur. Therapeutic relationship is part of an adaptive memory network." (Shapiro and Laliotis, 2017, p. 13).

Interestingly Shapiro mentioned the therapeutic relationship in her textbook, even more explicitly in the EMDR Basic Training Manual, and advised on therapist behavior to be "optimally interactive" (Shapiro, 2007, p. 76), but refrained from describing the therapeutic relationship in EMDR Therapy or on how to establish a secure therapeutic relationship prior to memory reprocessing in detail. As the therapeutic relationship is of great importance regarding the outcome in psychotherapy (Orlinsky et al., 1994) this issue needs to be addressed. The therapeutic relationship is in our view a core component of EMDR Therapy, as EMDR Therapy is definitely psychotherapy. But the therapeutic relationship in EMDR Therapy seems to differ from the therapeutic relationship in other psychotherapeutic approaches.

Dworkin (2005) introduced the relational perspective. Together with Errebo Dworkin brought up important aspects on the issue of the therapeutic process in EMDR Therapy. Dworkin and Errebo (2010), referring to Wachtel (2002), advocate to teach and practice EMDR Therapy as a two-person therapy. This in in our view absolutely necessary as EMDR Therapy is a psychotherapy and the dynamic interplay between therapist and patient is the space, where psychotherapeutic change takes place. In so far a view on other concepts in psychotherapy suggest itself. Piedfort-Marin (2018) relates to the concepts of transference and countertransference, recent considerations on attachment theory for patients with disorganized attachment and how to integrate them in the Adaptive Information Processing (AIP) model. In this extremely valuable article Piedfort-Marin focuses on how the client's and the therapist's conscious and unconscious processes are intertwined and how they may affect the efficacy of EMDR therapy. The integration of the concept of transference and countertransference in the AIP Model is in our view an important contribution. Piedfort-Marin, relating to Dworkin (2005) proposes a definition of transference and countertransference close to the AIP terminology. He describes transference as the activation of dysfunctionally stored (mainly trauma or problematic attachment) memories of the client in relation to the therapy, the clinician, or the relation to the clinician. According to Piedfort-Marin countertransference should be defined as the activation of dysfunctionally stored (mainly trauma or problematic attachment) memories of the therapist by the client, his history, his material, and his relation to the clinician, consciously or unconsciously. We are inline with his emphasis on the importance of the subsystems of social engagement, exploration and cooperation in EMDR Therapy and the importance of an attachment related view in EMDR Therapy. Of course this could lead to bringing up interweaves following a certain train of thought, e.g., transference/countertranference based (Piedfort-Marin, 2018) or relational based (Dworkin, 2005).

Dworkin and Errebo (2010) refer to the relational theory and Stern (2004) ideas of the now moment and the concept of rupture and return. Though is certainly interesting and may have potential for EMDR Therapy sessions, it seems not necessary to leave the AIP Model of EMDR Therapy. On can assume that in EMDR Therapy sessions the AIP System of patient and therapist alike need to be activated and there will be a

dynamic interplay, or in other words a reciprocal activation of nodes in therapist and patients memory-networks, leading to patterns of perception and behavior, with positive or negative effects on the course of treatment. This would include also a definition of transference and countertransference in relation to the AIP Model, but is more open or broader as the proposal brought forward by Piedfort-Marin (2018). Such AIP based understanding of clinical phenomena could also integrate the concept of action systems and subsystems (Van der Hart et al., 2006). Dworkin and Errebo (2010) assume, that the risk of potential for relationship rupture in EMDR treatment is very high, referring to the structured approach in EMDR Therapy and the unpredictability of the associative properties of memory reprocessing. In our view we would not overestimate such a risk. The structure of EMDR Therapy safeguards against a high risk of relationship rupture and the attachment perspective may be helpful to understand the properties in EMDR Therapy to develop a strong enough therapeutic relationship as the basis for a profound therapeutic process.

Dworkin and Piedfort-Mari contributed greatly to theory and practice in EMDR Therapy. But a description of the special therapeutic relationship in EMDR Therapy is still missing in the literature. This will be the main objective of this article.

THE THERAPEUTIC RELATIONSHIP IN PSYCHOTHERAPY

Weisz (1998) uses the terms therapeutic relationship and working alliance equally: "the therapeutic relationship, or working alliance", whereas otherwise authors distinguish between therapeutic relationship and working alliance. An extensive discussion would be beyond the scope of this article. We consider the therapeutic relationship as basis of the working alliance. There is a broad agreement on the importance of the therapeutic relationship and being considered an integral part of psychotherapy. However, due to very diverging theoretical foundations the definition of the therapeutic relationship differs between the major psychotherapeutic approaches. There have been some efforts to define common elements. One view is that the therapeutic relationship consist of two interrelated parts (Weisz, 1998): the client's positive emotional connection to the therapist, and a shared conceptualization between the client and therapist of the tasks and goals of therapy (Bordin, 1979). Referring to the literature dealing with treatments of adult patients, the development of a positive therapeutic relationship has emerged as a particularly significant process correlated to positive outcome in several studies (Horowitz et al., 1984; Luborsky et al., 1988; Orlinsky et al., 1994). Shirk and Saiz (1992) have argued that this process variable may be an even more significant contributor to outcome for children due to the non-verbal nature of many forms of client-centered and play therapy for children. This seems to be of interest regarding the non-verbal properties of EMDR Therapy. Even if the general importance of the therapeutic relationship in psychotherapy is hardly questioned, it seems quite understandable, that the focus on the psychotherapeutic relationship differs between distinct psychotherapeutic approaches relating to their different theoretical underpinnings. Looking into EMDR Therapy we will certainly recognize strong similarities between EMDR Phase 1 and 2 and "a shared conceptualization between the client and therapist of the tasks and goals of therapy". One would acknowledge, that a "client's positive emotional connection to the therapist" is of advantage, and vice versa.

Another important topic could be the "idea of man" in EMDR Therapy. The AIP Model implies, that the human being has the innate property of processing information toward an adaptive resolution including appropriate encoding of the memory, leading to symptom reduction as well as personal growth. The "idea of man" in EMDR Therapy is in general the idea of our clients as resourced beings, able to process, to cope with life. Shapiro regards the information processing system as "innate". Even if we consider this system genetically based we would assume that sensitive interaction between caretaker and baby in the early phases of life are crucial for the development of the adaptive information processing system to full working condition. In addition we have to keep in mind, even if the information processing system is established and active, the capacity for processing would also depend on present and accessible adaptive memories (Shapiro and Laliotis, 2017; Hase, 2021a). The lack of adaptive memories in the early traumatized and neglected clients would not only explain their vulnerability, but also the difficulty in memory reprocessing within therapy.

In general, the pathologic condition refers to blockage of the adaptive information processing system. The therapist acts to facilitate the restart of the adaptive information processing system, keeping it dynamic, in order for reprocessing. In a way the therapist in EMDR Therapy is an expert regarding the structure of the therapeutic process and the felt emotional security in the therapeutic relationship during the memory processing, but not regarding the content of memory reprocessing. This gives the client freedom for the content, enabling the client to engage and stay in his very individual process. These reflections on the "idea of man" in EMDR Therapy seem important, as they determine the supportive stance of the therapist, who will refrain from injecting information into the reprocessing if this is not absolutely necessary. Of course, with the severly traumatized client with attachment deficits or disorders the therapist needs to co-regulate more actively and the formation of a secure bonding within the therapeutic relationship is fundamental. But we still feel the need to describe the therapeutic relationship in EMDR Therapy in greater detail.

SOMETHING TO BE LEARNED FROM RESEARCH AND PRACTICE?

Data on the efficacy of EMDR Therapy or on working mechanism in EMDR Therapy are numerous, but in contrast, papers on the therapeutic relationship are rare. The method of qualitative analysis could be helpful in an effort to understand the nature of the therapeutic relationship. Marich published a study on the experience of EMDR Therapy with addicted clients (Marich, 2010) in addiction continuing care. Ten women

in an extended-care treatment facility participated in semi-standardized interviews to share their experiences with active addiction, treatment, EMDR therapy, and recovery. Using a descriptive phenomenological psychological method for analysis, four major thematic areas emerged from the interview data: the existence of safety as an essential crucible of the EMDR experience, the importance of accessing the emotional core as vital to the recovery experience, the role of perspective shift in lifestyle change, and the use of a combination of factors for successful treatment. All 10 women, to some degree, credited EMDR treatment as a crucial component of their addiction continuing-care processes, especially in helping with emotional core access and perspective shift. It is to highlight, that these clients felt safe in the EMDR processes even if getting in contact with their emotional core. An unpublished thesis adds to Marichs conclusions (Günther-Soest, 2002). The author used semi-standardized interviews on six traumatized clients which received EMDR Therapy. The clients, five female, one male, had been treated in an in-patient treatment program at a psychiatric hospital in the north of Germany. The semi-standardized interviews were transcribed and analyzed using a descriptive phenomenological psychological method (Langer, 2000). The data revealed that the clients experienced the therapeutic relationship as respectful, paying attention to theirs needs, which determined the direction of their healing process. The clients experienced the therapist respectful stance regarding them as an individual, paying attention to their strength and acknowledging their self-determination as extremely important. They also reported the eye movements being extremely important for the healing process. They reported that the therapeutic relationship had been extremely important, especially in the early phases of their therapy.

Reports from EMDR trained therapist in clinical supervision give the impression, that the therapeutic relationship in EMDR Therapy develops quite fast and seems to be robust with a variety of clients with different backgrounds, from infant to the elderly client, and also with the intellectually disabled client. This seems to be the case even if we take into account the therapist's primary therapeutic approach, before being educated in EMDR Therapy. It seems to be more important that the therapist can bring up an AIP guided understanding of the clients problems and develop an AIP guided treatment plan. Clients reports seem to indicate, that an AIP guided approach in history taking gives the client the impression of a therapist being interested to understand connections between current problems and the biographical background, in a way going for the roots of the clients problems. A significant factor seeming to explain difficulties in the development of the therapeutic relationship and a straightforward or more slow, complicated approach in the course of an EMDR Therapy seems to be the attachment history and attachment status of the client. As promising data on the properties of EMDR Therapy to change the adult attachment status have been provided by Civilotti et al. (2019) and the therapeutic relationship in general is on attachment between client and therapist, a look into attachment theory might lead to some insights.

ATTACHMENT THEORY

Attachment Theory refers to Bowlbys foundational observations on small children separated from their primary caretakers from 1958 onwards (Bowlby, 1960) and was published in the trilogy "Attachment and Loss". Ainsworth developed a theory of a number of attachment patterns or "styles" in infants (Ainsworth et al., 1978). But peer-relationship in all ages and responses to the care needs of adults may be viewed as including some components of attachment behavior (Brisch, 2002; Bowlby, 2005).

According to Brisch (2002) the development of attachment between the infant and caregiver is related to the sensitivity of the caregiver, thus positioning the concept of sensitivity at a pivotal point. As sensitivity facilitates the development of attachment it could play an important role also in the development of a therapeutic relationship (Brisch, 2002). One could assume, that sensitivity could be an important part in describing the therapeutic relationship in EMDR Therapy and we will discuss this in more detail.

THE THERAPEUTIC RELATIONSHIP IN EMDR THERAPY AND ATTACHMENT THEORY

As said before Shapiro explicitly mentioned the therapeutic relationship in her textbook, articles and even more explicitly in the 2017 edition of the EMDR Basic Training Manual, but refrained from describing the therapeutic relationship in EMDR Therapy in more detail. Dworkin (2005) published a textbook on the "relational imperative" trying to describe the therapeutic relationship in EMDR treatment. The textbook gives an example how a psychodynamic orientation can be adapted to EMDR Therapy and enrich the therapeutic process. Dworkins statement to view EMDR therapy through the relational lens puts the focus on an important aspect, but is somehow limited. Of course the therapeutic relationship is an important part of EMDR Therapy as it is psychotherapy, but it differs from the therapeutic relationship in other psychotherapeutic approaches to great extent. The genuine AIP, respectively, EMDR Therapy aspect is important.

An important distinction could be, that the therapist in EMDR Therapy should consider himself an expert for the structure of the therapy, but not for the content. An important enough aspect, as structure contributes to a feeling of safety, for therapist and client alike. The idea of the therapist being the expert for the structure, but not the content, is reflected in Shapiros conception of the clients own intrinsic information processing system as being able to process information. The therapist is responsible for activating the system and keeping it a dynamic form. Shapiro repeatedly advises the therapist to refrain from injecting anything in the process, ask open questions and in general "stay out of the way", just adding bilateral stimulation as long as the information is reprocessing. But many videos of EMDR Therapy memory reprocessing sessions show the therapist being active facilitating the reprocessing, to a great extent non-verbally or with very

short comments, the so called verbal support in between sets, e.g. "yes", "continue", "I am with you here", "oh yes, that is hard", comparable to a mother co-regulating a baby coping with a strong affect.

During other phases in EMDR Therapy, e.g., phase 1, phase 2 or 7, the therapist is of course more active. The diagnostic procedures in phase 1, the therapists interest in the origins of the clients problems, seem to contribute to the developing therapeutic relationship. Of course the ability to attune himself to the client and titrate history taking according to the clients affect tolerance is fundamentally important regarding the development of the therapeutic relationship, as a fine-tuned co-regulation of affect by the caregiver to the infant fosters the development of the attachment. In EMDR Therapy the therapist has a very unique option: to use the developing therapeutic relationship as a resource and apply EMDR resource installation on this resource. Such an approach, like the "Instant Resource Installation" procedure, (Hase, 2021a) facilitates the development of the therapeutic relationship.

The appropriate dosage, speed and rhythm of bilateral stimulation within resource installation and memory reprocessing is of great importance. If the therapist is able to monitor the clients process and adjust the BLS to the clients needs, this contributes to the safe environment and the special therapeutic relationship in EMDR Therapy. This could also contribute to the formation and representation of new memories of experiences of empathy by fine attuned co-regulation of affective arousal within the therapeutic relationship, and is related to the interpersonal experience, the dance between client and therapist, in EMDR Therapy. This can be described to certain extent, but has to be experienced. Offering this experience is a core component in the training of the EMDR therapist as well as in preparation of the client.

As in psychotherapy the attachment system is often activated and therapeutic relationship in general is related to attachment, some reflections on attachment could be added. Flores highlighted, that the need for attachment is a lifelong issue and not limited to childhood (Flores, 2013). The infant has to learn to survive in a world he cannot understand. By repeated experiences in relation to the attachment figure the child learns, what to expect from, e.g., mother. These learning establishes implicit rules relating to the issue "how I have to be or what can I do on my part, to stay in contact with you". Predictability of the attachment figure is a good basis for the development of the infant. One could assume, that the predictability of therapist behavior in the manualized procedures of EMDR Therapy could contribute to the development of the therapeutic relationship in EMDR Therapy.

According to Brisch (2002) the development of attachment between the infant and caregiver is related to the sensitivity of the caregiver. The caregiver with the most sensitive properties will become the primary attachment figure of the infant. Sensitivity facilitates the development of attachment. How could one define sensitivity? Brisch (2002) outlined that sensitivity shows in speech, rhythm, eye contact and touch. Most important the caregiver has to be able to perceive the infants signals while not misinterpreting them, and react immediately and appropriately.

TABLE 1 | Sensitivity and EMDR Therapy.

Sensitive behavior	EMDR Therapy
Speech	Help to elicit cognition; verbal support during set
Rhythm	Bilateral stimulation; timing of sets and breaks
Eye contact	Aware of facial expression; eye movements
Touch	Tactile stimulation
Perception of client	Awareness during BLS
Not misinterpreting	Refraining from comments; stay out of the way‘
Prompt and appropriate	Keep client in stimulation and react promptly to affective stress of client

This is only possible if the caregiver is emotionally available for the needs, affects and signals of the infant. In EMDR Therapy as therapists we offer speech, but even more important, rhythm. We keep eye contact, while being not intrusive. Sometimes we offer touch. But most important, we perceive our clients signal, be aware not to intrude, while reacting promptly and appropriately, which will certainly facilitate the development of a secure therapeutic relationship. This shows up in the above mentioned ideas and rules, in procedures and protocols within EMDR Therapy. In our opinion EMDR can be described as a "sensitive" psychotherapy approach. It could explain partly the specific therapeutic relationship in EMDR Therapy, which seems to develop rapidly and offer a safe environment, which allows our clients to reprocess, to grow and to get past the past. **Table 1** relates principles of sensitive behavior therapeutic to action in EMDR Therapy.

IMPLICATIONS FOR TRAINING, CONSULTATION, AND RESEARCH

The development of EMDR Therapy from the trauma-resolution technique toward the conception of the AIP model as a model of the unprocessed information, the nodes behind the symptoms, as well the model of the adaptive information, the resources, was not driven by a distinct theory, but was a dynamic process were chance observation, therapeutic experience and theoretical consideration merged. Meanwhile EMDR Therapy offers the AIP Model as the leading model of pathogenesis and change, a broad range of treatment plans for various disorders and a range of procedures for memory reprocessing or modification. But the development from a technique to a psychotherapy approach calls for description of a structure in EMDR Therapy (Hase, 2021b). Describing a structure in EMDR Therapy referring to six levels with a hierarchy, the AIP Model constituting the uppermost level guiding case conceptualization as well as action in EMDR therapy, down to the level of interventions in processing, could contribute to more clarity in teaching as well as research on applying EMDR Therapy, protocols as well as procedures. In addition the current development of EMDR Therapy calls for a description of the therapeutic relationship in EMDR Therapy.

The development from procedure to psychotherapy approach does somehow reflect in the widely used training structure. Still

focussing heavily on the core procedure of memory reprocessing, the phases 4 to 6, often leads the novice in difficulties especially with the complex client with attachment deficits or disorders due to early experiences of neglect and violence experienced within the early relationships. This could be avoided if the training would focus in the beginning to a greater extent on establishing the therapeutic relationship and on enhancing resources, if necessary. This would be in line with Shapiro's above mentioned ideas and reflect the widespread use of resource enhancement procedures (Leeds, 2009). In addition the training should integrate basic knowledge on attachment theory, attachment-oriented self-experience and practice in respect to sensitivity training. The ideas proposed by Dworkin and Errebo (2010) and Piedfort-Marin (2018) to enhance the EMDR Therapy basic training by elements on keeping the patient within the window of tolerance and pay attention to rupture and repair are of great worth and could be integrated in an addition to EMDR basic training.

Such a change in EMDR basic training would also reduce a divergence between the practice of clinical EMDR consultation and training, as many consultants often feel the need to stress these aspects in their work. Reflections on the specific nature of the therapeutic relationship in EMDR Therapy should give reason as the trainee needs to experience this quality and probably needs to be trained to develop this sensitivity. This is common practice in attachment based therapy and could be realized in special workshops.

Research on EMDR Therapy outcome has been very important to give proof of the efficacy of EMDR Therapy and establishing it as an evidence based treatment. The evidence in the treatment of PTSD in adults is very clear. But in the treatment of PTSD in children, in acute presentations, in combat related PTSD, in unipolar depression and in pain evidence is grade I or II relating to Sackett (1989) (Matthijssen et al., 2020). Of course we need more data to reach evidence grade 1, e.g., with unipolar depression. And there are other groups of clients to be treated and efficacy to be shown in new areas. The data on the working mechanism in EMDR Therapy, on the component of bilateral stimulation, are numerous and the insight into the brain of mice (Baek et al., 2019) and men (Pagani et al., 2017) are fascinating. Of course there are still questions open and research must continue. Regarding the therapeutic relationship in EMDR Therapy research is needed. The focus of research could be on the experience of client and therapist alike. The development of a questionaire reflecting on the relational experience of the client in EMDR Therapy could be a step forward. In addition research on the therapist's attachment status in relation to his or her biography and to the therapist's enactment of his or her attachment representation during the therapeutic process would be interesting.

We do hope this article may spark off interest, probably leading to research in more systematic way. Nevertheless, we found it necessary to share these thoughts at this point of the development of EMDR Therapy.

SUMMARY

The dynamic evolution of EMDR Therapy offers many chances to reach out to clients suffering from various symptoms and problems. The AIP Model seems to be ideal to gain understanding of pathogenesis in a non pathologising way and reach out to the suffering human being, offering an approach, which can be tailored to the individual needs. The AIP model is a model of dysfunctionally stored and affectively highly loaded memories, the nodes behind the symptoms, as well as the model of the adaptive information needed for reprocessing, which should be highlighted more in training and consultation. A description of the therapeutic relationship in EMDR Therapy is necessary at this point of the development of EMDR Therapy to a psychotherapeutic approach and therefore we try to describe the therapeutic relationship in this article and point out parallels between the therapeutic relationship and the development and core features of an attachment based relationship. We propose to describe EMDR Therapy as a sensitive psychotherapy. Relating these ideas onto the therapeutic relationship, in our opinion a core element of EMDR Therapy, and integrating important aspects of attachment theory for a deeper understanding of the therapeutic process, the development of the therapeutic relationship in EMDR Therapy might provide ideas for training, case consultation and will hopefully initiate research.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

MH contributed on EMDR Therapy. KB contributed on attachment theory and practice. All authors contributed to the article and approved the submitted version.

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Conflict of Interest: MH is offering education in EMDR Therapy. KB is offering education in attachment-based psychotherapy.

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ORIGINAL RESEARCH
published: 06 July 2022
doi: 10.3389/fpsyg.2022.901855

A Stage 1 Pilot Cohort Exploring the Use of EMDR Therapy as a Videoconference Psychotherapy During COVID-19 With Frontline Mental Health Workers: A Proof of Concept Study Utilising a Virtual Blind 2 Therapist Protocol

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OPEN ACCESS

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *22 March 2022*
Accepted: *19 April 2022*
Published: *06 July 2022*

Citation:
Farrell D, Fadeeva A, Zat Z, Knibbs L, Miller P, Barron I, Matthess H, Matthess C, Gazit N and Kiernan MD (2022) A Stage 1 Pilot Cohort Exploring the Use of EMDR Therapy as a Videoconference Psychotherapy During COVID-19 With Frontline Mental Health Workers: A Proof of Concept Study Utilising a Virtual Blind 2 Therapist Protocol. Front. Psychol. 13:901855. doi: 10.3389/fpsyg.2022.901855

Objective: The COVID-19 pandemic has had a major impact on the delivery of psychological treatment. Due to social distancing requirements, the provision moved to videoconferencing psychotherapy (VCP). There is a paucity of empirical data supporting the efficacy of EMDR therapy as a VCP. This stage 1 pilot study tested an EMDR therapy scripted protocol, such as Virtual Blind 2 Therapist (VB2Tr), on frontline mental health workers as a VCP regarding fitness for purpose, distinctiveness, relevance, and efficiency.

Methods: A total of 24 participants were recruited for the study. The design included a one-session treatment intervention with pre, post, 1-month, and 6-month follow-up (FU) measurements. This treatment session used a "Blind 2 Therapist" EMDR therapy scripted protocol as videoconference psychotherapy that involves non-disclosure of traumatic memory. The research explored the treatment effect on the core characteristics of trauma memory, including subjective disturbance, belief systems, memory intensity (MI), vividness, and levels of emotionality. Additionally, the research explored participants' experiences of adverse and benevolent childhood experiences (ACEs/BCEs) during their childhood.

Results: Regarding the four tests, namely, fitness for purpose, distinctiveness, relevance, and efficiency, results are favourably suggesting potential clinical benefits of using EMDR as videoconference psychotherapy. Although this is a proof-of-concept study showing positive results, no clinical population or control group was used. The purpose of the study is to explore the potential for scalability toward a larger clinical trial. The treatment intervention was achieved irrespective of either ACEs/BCEs during childhood.

Conclusion: The research tentatively supports the case for EMDR therapy as a credible treatment when used as video conference psychotherapy and in using the Blind 2 Therapist protocol. However, more research is needed to scale toward a clinical trial.

Clinical Trial Registration: https://www.isrctn.com/ISRCTN12099530, identifier ISRCTN12099530.

Keywords: EMDR therapy, pathogenic memory, adverse and benevolent childhood experiences, videoconference psychotherapy, Blind 2 Therapist

INTRODUCTION

In an attempt to reduce the risk of infections from COVID-19, many mental healthcare providers are closing their doors to patients requiring face-to-face therapy and instead of creating videoconferencing psychotherapy (VCP), remote access technology, e-health tools, and Internet interventions (Turgoose et al., 2018; Wind et al., 2020a). Several comprehensive reviews highlight the effectiveness of videoconferencing psychotherapy (VCP) and therapist-guided interventions for conditions such as anxiety, major depressive disorders, and trauma (Anderson et al., 2003; Ruskin et al., 2004; Christopher Frueh et al., 2007; Germain et al., 2010; Osenbach et al., 2013; Rousmaniere et al., 2014; Berryhill et al., 2018, 2019; Karyotaki et al., 2018a,b; Tuerk et al., 2018; Turgoose et al., 2018; Watts et al., 2020; Weinberg, 2020a; Wind et al., 2020b). Contemporary research supports VCP as "feasible" and "acceptable" as a mode of psychological treatment delivery, providing high satisfaction and effectiveness (Simpson and Reid, 2014; Dores et al., 2020; Viswanathan et al., 2020; Weinberg, 2020b; Wells et al., 2020; Wind et al., 2020b; Wright and Caudill, 2020; Aafjes-van Doorn et al., 2021; Hoffman, 2021). Furthermore, VCP provides a viable alternative to providing continuity of care in times of social, economic, and health upheaval (Crowe et al., 2020).

There are several distinct barriers toward the equitable provision and access to evidence-based, face-to-face/in-person psychological treatments, with a paucity of suitably qualified mental health workers to sufficiently address the global burden of mental illness and psychological trauma (Farrell et al., 2020). With relatively few providers trained in the therapies underpinned by a solid empirical evidence base, those who live in rural or remote communities are further restricted. The barriers to care are compounded further by disability, poverty, and stigma (Myers et al., 2008; Morland et al., 2011; Tuerk et al., 2018). VCP provides alternative flexibility and equity of access than in-person therapy, with potential for financial efficiencies and cost savings, enhanced reach, flexible implementation, improved cultural adaptability and sensitivity, and improved equity when compared with in-person therapy (Barak et al., 2008; Morland et al., 2011; Backhaus et al., 2012; Bolton et al., 2014; Wild et al., 2016; Baños et al., 2017).

Despite potential benefits, VCP does require critical consideration. One factor is the impact that VCP has on the therapeutic alliance when assuming the "In person," traditional model, which is the gold standard for psychotherapy. Recent studies (Germain et al., 2010; Simpson and Reid, 2014; Berger, 2017) acknowledge that an effective therapeutic alliance is essential in underlying successful therapy. **Table 1** outlines the advantages and disadvantages of using V and how they can be adapted to promote greater effectiveness (Dores et al., 2020; Viswanathan et al., 2020; Weinberg, 2020b; Wells et al., 2020; Wind et al., 2020b; Wright and Caudill, 2020; Aafjes-van Doorn et al., 2021; Hoffman, 2021).

The reality of the COVID-19 pandemic ostensibly has removed choice for a great many individuals, with the options being VCP intervention, no intervention, or an extensive and uncertain period of waiting. The current advances in VCP technology enable it to offer an innovative solution as a viable alternative to in-person therapies.

The World Health Organisation (2020) has expressed concern over the psychological impact of the pandemic and social distancing on the mental health of a broad sector of society. The psychosocial consequences include increases in loneliness, anxiety, depression, gender-based violence, insomnia, substance misuse, self-injurious activity, and suicidal behaviour (Cullen et al., 2020; Ghebreyesus, 2020; Kavoor, 2020; Khan et al., 2020; Kumar and Nayar, 2020; Talevi et al., 2020; Usher et al., 2020). However, COVID-19 is not "ground zero" when considering the mental well-being of a population. Those clients with pre-existing mental health issues before the pandemic started risk further minimisation of their lived experience, and potential to fall out' of existing service provision. It is essential to acknowledge that events that pre-date COVID-19 may still influence an individual's response. Two considerations are exposure to adverse childhood experiences (ACEs) and benevolent childhood experiences (BCEs). Exposure to ACEs is the single most potent global public health issue when considering social inequality, lifelong impact on health and behaviour, and social deprivation. Arguably the COVID-19 pandemic further compounds antecedent ACEs. Social inequalities such as these create significant barriers when accessing services, either in person or via VCP (Felitti et al., 1998; Brown et al., 2009; Kim et al., 2010; Burke et al., 2011; Bellis et al., 2014a,b, 2015, 2017, 2019; Islam et al., 2021).

Videoconferencing psychotherapy interventions have primarily focussed on prolonged exposure (Strachan et al., 2012; Hernandez-Tejada et al., 2014; Yuen, 2015; Acierno et al., 2016; Clapp et al., 2016; Acierno, 2017; Tuerk et al., 2018), behavioural activation (Luxton et al., 2015; Acierno et al., 2016; Acierno, 2017), cognitive processing therapy (Morland et al., 2011; Fortney et al., 2015; Grubbs et al., 2015; Maieritsch et al., 2016), and CBT (Olthuis et al., 2016a,b). Currently, limited research publications support EMDR therapy, which uses VCP to treat post-traumatic stress disorder (PTSD) (Todder et al., 2007; Todder and Kapln,

TABLE 1 | Advantages, disadvantages, and adaption factors in VCPs.

Advantages	Disadvantages	Adaptation factors to promote greater effectiveness
∘ Greater flexibility Cultural adaptability ∘ Enhanced reach ∘ Better use of scarce resources ∘ Cost efficiencies ∘ Increased accessibility ∘ No geographical restrictions ∘ Environmentally – reduces carbon footprint ∘ Responds to the need for rural services for veterans ∘ Convenience and affordability for disabled people	∘ Technology knowledge, application, functioning, and reliability, including challenges ∘ Poor internet connections, particularly in low socioeconomic areas ∘ Body language restricted to head and face ∘ Privacy into the home environment ∘ Creating safe space, time, and relationships ∘ Cultural considerations and norms ∘ Risk management & triage ∘ Geographical factors, legislation, professional indemnity, logistics ∘ Insurance cover and liability	∘ Adjusting for more restricted access to non-verbal communication ∘ More regular "checking in" with clients ∘ Requesting more information and clarification on specific points ∘ More focus on facial expressions and bodily gestures ∘ More frequent emotion checking ∘ Enhanced preparation before sessions ∘ More control of the space ∘ The therapists assuming a greater sense of ownership and responsibility for the therapeutic alliance within the therapy work ∘ Client centredness – the Therapist "tailoring" their approach more to the client individual and specific needs

2007; Lightstone et al., 2015). However, a recent study (Bongaerts et al., 2021) has used home-based psychotherapy, delivered by telehealth, as a treatment intervention for complex PTSD. The intervention was delivered in an intensive format, offering both prolonged exposure and eye movement desensitisation and reprocessing [EMDR therapy]. Six participants took part in the study, with two-thirds losing their PTSD or complex-PTSD diagnostic status, demonstrating that the telehealth intervention was both safe and effective (Bongaerts et al., 2021). However, the sample size in their study was small, with just six participants, and only four of the six losing their diagnosis. The safety and effectiveness determinants of the EMDR therapy intervention indicate more extensive and more representative sample sizes.

Eye movement desensitisation and reprocessing therapy, an empirically supported intervention for PTSD and complex PTSD (Christopher Frueh et al., 2007; American Psychological Society, 2017; ISTSS, 2018; Bisson et al., 2019; de Jongh et al., 2019b; Karatzias et al., 2019, 2020), was developed in the late 1980s by an American psychologist, Francine Shapiro. Its primary foci are on the treatment of pathogenic memories and their associated stress symptoms using the model of pathogenesis and change known as adaptative information processing (Hase et al., 2017; Valiente-Gómez et al., 2017). Shapiro (2018) considered trauma memories in a range of mental health disorders and not just PTSD and complex PTSD. Within the AIP theoretical framework, a meta-theory unique to EMDR therapy, the model assumes that the human brain can usually process memories of adverse life events to complete integration. The essence of EMDR therapy involves four distinct aspects, namely, preparation, access, stimulation, and integration [PACI]. What gives EMDR therapy a specific distinctness relates to bifocal physical stimulation, a working memory taxation device that enables the client to attend to internal and external stimuli (de Jongh et al., 2019a,b, 2020). The hypothesised working mechanism of EMDR therapy is still under investigation (Matthijssen et al., 2021). However, most evidence supports the working memory account. Working memory has a limited capacity. Therefore, dual taxation sets up a competing situation. Consequently, the emotional intensity of the pathogenic memory, with all its subjective levels of disturbance, is gradually lost and eventually reconsolidated into a less disturbing and reduced emotional form. Within the EMDR therapy literature, the dominant empirical evidence supports physical eye movements; however, other forms of bifocal physical stimulation can include acoustic, somatic, or multiple forms such as is used within EMDR 2.0 (de Jongh et al., 2020).

The core characteristics of the EMDR B2T protocol are to access and activate a pathogenic memory. However, the primary distinction between this protocol and the standard protocol is that the client does not reveal details about the memory itself, other than its emotional and somatic content and an indication of their subjective unit of distress (SUD). Clients are not under pressure to disclose any of the trauma content during trauma processing using B2T. **Table 2** highlights the core components of the EMDR therapy B2T, its context regarding the eight phases of therapy, and the assessment phase (Phase 3 of the standard protocol of EMDR therapy).

Many empirically supported treatments for PTSD contain various elements and degrees of exposure. These rely upon the client's ability and willingness to disclose the memory of the adverse life event causing a stress response. When pathogenic memories involve shame, guilt, disgust, fear of retribution, lack of language, and non-disclosure self-protection/preservation factors, disclosure may not even be a viable option for a client. A study published from research carried out in Northern Iraq tested the "Blind 2 Therapist" (B2T) protocol, an adaption of EMDR therapy. This study demonstrated the safety, effectiveness, efficiency, and relevance as a treatment intervention for both "shame-based" and "fear of retribution" trauma (Farrell et al., 2020). However, an evaluation of EMDR B2T as a VCP method of delivery has not occurred to date. Therefore, this study aimed to test the virtual version of B2T (referred to as VB2Tr), delivered as a VCP, as a suitable clinical intervention in the desensitisation and reprocessing of a pathogenic memory.

As indicated earlier, within the existing EMDR therapy literature, there is a paucity of research regarding the use of VCP EMDR (Bongaerts et al., 2021). In addressing this aspect, any potential study would have to address two significant aims:

TABLE 2 | EMDR Blind 2 Therapist protocol in context, adapted from Wolpe and Lazarus (1966), Shapiro (2018, 1995, 2001), and Farrell et al. (2020).

EMDR therapy: 8 phases	EMDR therapy Phase 3 Standard Protocol – Assessment Structure	EMDR therapy Phase 3 Assessment Blind 2 Therapist structure and VB2Tr version
Phase 1: history taking	Target Memory	Target memory – cue word
Phase 2: preparation	Worst Image	Emotions
Phase 3: assessment	Negative Cognition	Subjective Unit of disturbance (SUD 0–10)
Phase 4: desensitisation	Positive Cognition	Location of body sensation
Phase 5: installation	Validity of Cognition (1–7)	
Phase 6: body scan	Emotion	
Phase 7: closure	Subjective Unit of Disturbance (0–10)	
Phase 8: re-evaluation	Location of body sensation	

1. What adaptations, if any, would be required to use EMDR therapy as a VCP?
2. Do we critically consider the potential advantages/disadvantages of EMDR therapy as a VCP?

Therefore, the purpose of this study was to determine whether the application of VCP EMDR therapy would be associated with (1) fitness for purpose – safe and effective, (2) distinctiveness – alterations in the core components of a pathogenic memory regarding intensity, vividness, and emotionality, (3) relevance, and (4) efficiency.

A directional hypothesis predicts a positive or negative change between two variables in a specific population. These changes were measured at pre, post, 1-month, and 6-month FUs. The research study hypotheses were as follows:

> Hypothesis 1: Fitness for purpose – Virtual Blind 2 Therapist EMDR (VB2Tr), when delivered as VCP, will have no impact on the SUD and the validity of cognition (VOC) regarding a pathogenic memory when measured at post-treatment, 1-month, and 6-month in comparison to a pre-measure.
>
> Hypothesis 2: Distinctiveness – VB2Tr, as a VCP, will have no impact on reducing MI, memory emotionality (ME), and memory vividness (MV) of a pathogenic memory following intervention when measured at post-treatment, 1-month, and 6-month in comparison to a pre-measure.
>
> Hypothesis 3: Relevance – when using VB2Tr, ACEs or BCEs will influence the processing of a pathogenic memory.
>
> Hypothesis 4: Efficiency – as VB2Tr takes longer in time than the 60–90 min recommended by www.emdria.org, it would be more expensive as a clinical intervention.

METHODOLOGY: RESEARCH DESIGN

Ethical approval for the study was granted by the University of Worcester (United Kingdom) [CBPS1920031-R2]. Consequently, all the methods used for the study were carried out in strict adherence to the ethical approval granted and in accordance with relevant guidelines and regulations. Informed consent was obtained from all subjects. Additionally, the study was registered as a clinical trial ID ICSRCTN12099530 [30/06/2021]. This stage 1 pilot study used a pre-test/post-test design for taking measures before and after a one-session treatment using the EMDR VB2Tr protocol, including 1-month and 6-month FUs to determine the impact of the treatment intervention on the pilot cohort. The rationale for an experimental design as a stage 1 research project was to determine proof of concept before proceeding to stage 2, involving a quasi-experimental design utilising a distinct control group. The longer-term strategy is for phases 1 and 2 to support a more significant funding application, utilising a randomised control design incorporating a delayed treatment paradigm.

Participants

As this was a "proof of concept" study, and consistent with the COVID-19 focus, the research study participants were frontline, mental health workers engaged in active clinical practice during the first period of lock down in the United Kingdom. The design of the study incorporated a self-selecting (volunteer) sampling approach, with participants recruited via advertising on psychotherapy Internet forums. Inclusion criteria were as follows:

- Clinically active using online treatment platforms – remote working.
- Encountered an adverse life event that generated a presently held, subjective level of disturbance (SUD+).
- Willingness to be a client for a one-session intervention using the EMDR therapy Blind 2 Therapists protocol (VB2Tr) as a VCP, using the remotEMDR platform.
- No expectation to disclose anything about the target adverse memory.

A sample size of 17 was deemed sufficient to compare findings from the original study, which used the EMDR Blind 2 Therapist protocol with participants from Northern Iraq (Bennett-Levy and Lee, 2014; Chigwedere et al., 2020; Collard and Clarke, 2020; Farrell et al., 2020; Scott et al., 2021). A total of $N = 24$ was recruited for the study.

Measures Used for the Study

The pre-test/post-test design utilised the following measures:

- Subjective unit of disturbance (SUD) is a 0–10 scale for measuring subjective levels of distress or disturbance currently experienced by an individual (Wolpe and Lazarus, 1966).

- The validity of the cognition scale (VOC) provides a rapid assessment of cognitive structure on an emotional/somatic level rather than an intellectual level (Shapiro, 2018, 1995, 2001). Both the SUD and VOC have documented validity, reliability, and correlations with several physiological indices of distress.
- Memory vividness (MV) and emotionality (ME) – a subjective unit of measurement (0–10) of the vividness of the target memory, either positive or negative (Andrade et al., 1997; Gunter and Bodner, 2008; Maxfield et al., 2008; Engelhard et al., 2010; Schubert et al., 2011, 2016; van den Hout et al., 2011; Leer and Engelhard, 2020).
- Memory intensity (MI) is a subjective unit of measurement (0–10) of the intensity of the target memory, either positive or negative (van der Kolk, 2003, 2007, 2015).
- Adverse childhood experience scale (ACE) collects crucial information based upon the prevalence of adversity during childhood in ten categories before the age of 18: emotional abuse (recurrent), physical abuse (recurrent), sexual abuse (contact), physical neglect, emotional neglect, substance misuse in the household, mental illness in the household, mother treated violently, divorce or parental separation, and criminal behaviour in the household (Felitti et al., 1998; Burke et al., 2011). With each category counting as one point, with ten categories, the highest possible ACE score is 10 (Felitti et al., 1998; Brown et al., 2009; Felitti, 2010; Narayan et al., 2017; Afifi et al., 2020; Aronson et al., 2020; Finkelhor, 2020; Struck et al., 2021). An additional component of the ACEs was to test the study participant groups for comparability with the original CDC-Kaiser Permanente Study (Felitti et al., 1998). A further comparison was integrated using ACEs replication data carried out within the United Kingdom by Bellis et al. (2015).
- The BCEs scale is a new instrument designed to assess positive early life experiences in adults with a history of childhood adverse experiences. Ostensibly, BCEs are a counterpart to the ACE questionnaire. The BCEs (Narayan et al., 2018) are multiculturally sensitive and applicable, regardless of socioeconomic position, urban-rural background, or immigration status. The BCEs items utilise a developmental psychology framework, integrated with ecological systems theory (Narayan et al., 2017; Crandall, 2019, Crandall, 2020; Merrick et al., 2019; Karatzias et al., 2020; Malti, 2020; Merrick and Narayan, 2020; Starbird and Story, 2020; Doom et al., 2021).
- Each treatment session was timed (minutes) using the metric period recommended by EMDRIA sessions; 60–90 minutes, measuring from commencement of Phase 3 – assessment, to the completion of Phase 7 – closure (including debrief).
- The cost per session (£s/€s) was calculated at £56.49 (€66.36) using economic modelling from the University of Worcester.

After 1 month of each VB2Tr session, another research team member carried out Phase 8 – re-evaluation, conducted a qualitative interview, and obtained 1-month FU data – additional psychometric data were also collected at 6 months.

Treatment

The research utilised a 1-treatment session intervention (EMDR VB2Tr as a VCP), which was a partial replication of a previous study (Farrell et al., 2020). This study used a beta-tested software programme called remotEMDR[1], a technology that enabled the delivery of EMDR as a VCP. The remotEMDR is a synchronous programme that offers various visual and acoustic forms of bifocal physical stimulation and includes an integrative video platform, giving EMDR therapists complete control within the session.

The EMDR therapy VB2Tr protocol, adapted for VCP usage, originated from the original B2T (Farrell and Reid, 2020), including pathogenic MV, intensity, and emotionality metrics.

An EMDR Europe Accredited Senior Trainer and Consultant carried out each of the VB2Tr treatment sessions, and each was digitally recorded and made available for treatment fidelity checking. EMDR Europe Consultants and Co-researchers carried out these fidelity checks for the project. The EMDR Foundation Fidelity Rating Scale (EFRS) – version 2 was developed initially by van der Kolk (2007), subsequently revised and updated by Maxfield et al. (2018).

VB2Tr sessions incorporated multiple consent points, including initial recruitment, the commencement of the VB2Tr session, permission to record digitally, and permission to utilise the research participants' data at the end of the VB2Tr session.

Statistical Analysis

Statistical analysis utilised the Statistical Package for Social Sciences (SPSS version 26.0; Chicago, IL, United States) to include means and standard deviations calculated for SUD, VOC, MV, ME, and MI before treatment, post-treatment, and at 1-month and 6-month FUs (**Table 3**). Skewness and kurtosis were estimated in the data sets to evaluate the normality of the outcome measures, and frequencies of total and individual scores for ACEs and BCEs. This detailed examination and alpha testing included generalised estimating equations (GEE) to compare before/after the intervention and FU changes in SUD, VOC, MV, ME, and MI. ACEs and BCEs were added as the covariates in the modelling exercise. The GEE model accounts for time variations and correlations among repeated measurements and does not require the dependent variable to be normally distributed (Locascio and Atri, 2011). Gamma with log link was selected as the outcome variables were skewed. The presence of negative values for SUD, MV, ME, and MI measures was handled by adding a constant value to the data before the analysis. As for descriptive statistics, we used mean ± standard deviation (±SD) for numerical variables and percentage (%) for categoric variables. The p-values of <0.05 were considered significant. The overall effect size was calculated using Hedges' g.

[1] www.remotEMDR.com

TABLE 3 | Descriptives – subjective unit of disturbance (SUD) and validity of cognition (VOC): pre, post, 1-month, and 6-month FUs (N = 24).

	Pre SUD	Post SUD	SUD-1-mth FU	SUD-6mth FU	Retro VOC Pre	VOC Post	VOC 1-mth FU	VOC 6-mth FU
Mean	7.75	0.17	0.55	0.35	2	6.96	6.86	6.89
Median	8	0	0	0	2	7	7	7
STD	1.39	0.48	0.74	0.59	0.78	0.2	0.35	0.32

TABLE 4 | Descriptives – memory vividness (MV), memory emotionality (ME), and memory intensity (MI): pre, post, 1-month, and 6-month FUs (N = 24).

	Memory vividness				Memory emotionality				Memory intensity			
	Pre	Post	1-mth FU	6-mth FU	Pre	Post	1-mth FU	6-mth FU	Pre	Post	1-mth FU	6-mth FU
Mean	8.04	1.42	0.227	0.579	8.33	0.417	0.0909	0.211	8.46	0.0417	0.409	0.474
Median	8	0	0	0	8	0	0	0	8	0	0	0
Standard deviation	1.78	2.41	1.82	1.46	1.43	0.717	2.2	1.23	1.41	0.999	1.99	1.68
Minimum	5	0	−7	−3	6	0	−8	−4	6	−4	−6	−6
Maximum	10	8	2	2	10	2	3	1	10	2	1	1

RESULTS

Of the N = 24 research participants who took part in the study, all completed the VB2Tr treatment session and post-treatment, 1-month, and 6-month FU measures. There were no dropouts from the study. **Tables 3**, **4** highlight the descriptive data regarding various measures, namely, SUD, VOC, MV, ME, and MI, and pre, post, 1-month, and 6-month FUs.

Hypothesis 1. **Figure 1** shows the decrease in SUD and the increase in the VOC at the post, 1-month, and 6-month FUs.

Additionally, **Table 5** highlights the mean, standard deviation, skewness, kurtosis, baseline, and p values for the SUD and VOC at pre, post, 1-month, and 6-month FUs and the maintenance of the VB2Tr treatment effect in more detail.

There was a substantial reduction in SUD after receiving EMDR in comparison with the baseline assessment (B = −1.02, SE = 0.03, $p < 0.001$). The decrease in SUD was maintained in the FU assessments at 1 month (B = -0.94, SE = 0.05, $p < 0.001$) and 6 months (B = -0.99, SE = 0.04, $p < 0.001$) in comparison with the baseline. Simultaneously, there was an increase in VOC after receiving EMDR in comparison with the baseline assessment (B = 1.22, SE = 0.07, $p < 0.001$). The increase was maintained after 1-month (B = 1.21, SE = 0.08, $p < 0.001$) and 6-month (B = 1.22, SE = 0.08, $p < 0.001$) post intervention.

The results of this study indicate that VB2Tr decreased the SUD and increased the VOC in the treatment of a pathogenic memory tested at pre, post, 1-month, and 6-month FUs, suggesting that using VB2Tr as a VCP demonstrated a treatment effect on the pathogenic memory when measured by the SUD and VOC. Furthermore, there was a statistically significant difference between pre-treatment (M = 7.75, SD = 1.39) and 6-month FU (M = 0.35, SD = 0.59), with a Hedges' g effect size value (g = 6.71) suggesting high practical significance. Therefore, we rejected the directional hypothesis that there is no difference in the SUD or VOC when using the VB2Tr EMDR intervention as a VCP.

Hypothesis 2. **Figure 2** shows a reduction in the nature and characteristics of the pathogenic memory, including MV, emotionality, and intensity. For some research participants, alterations in memory characteristics indicated positive change rather than disturbance (negative), and therefore positive change is presented as a minus score.

As **Figure 2** demonstrates, the VB2Tr intervention clearly impacted on the three areas of pathogenic distinctiveness, namely, MV, emotionality, and intensity, with results maintained at both 1-month and 6-month FU. There were significant decreases in MV (B = -0.42, SE = 0.05, $p < 0.001$), ME (B = -0.61, SE = 0.03, $p < 0.001$), and MI (B = -0.77, SE = 0.04, $p < 0.001$) following the intervention. These effects were maintained in the first month FU for ME (B = -0.65, SE = 0.06, $p < 0.001$), MI (B = -0.79, SE = 0.03, $p < 0.001$), MV (B = -0.60, SE = 0.07, $p < 0.001$) and sustained after 6 months for MV (B = -0.58, SE = 0.03, $p < 0.001$), ME (B = -0.62, SE = 0.03, $p < 0.001$), MI (B = -0.79, SE = 0.04, $p < 0.001$). Overall, these results indicate changes that were consistently, statistically significant at $p < 0.001$. Additionally, the results demonstrate a favourable dose effect, with potential evidence in support of resilience and post-traumatic growth, as indicated by the treatment effect emphasis

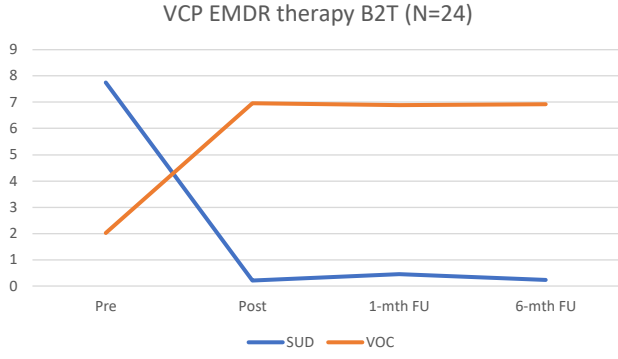

FIGURE 1 | Alterations in SUD and VOC scores at pre, post, 1-month, and 6-month FUs.

TABLE 5 | Means, SD, skewness, and kurtosis for SUD and VOC at pre, post, 1-month, and 6-month FUs.

	Mean (SD)	Skewness (SE)	Kurtosis (SE)	B (SE)	*p* value
Pre-SUD	7.75 (1.39)	−0.15 (0.47)	−0.95 (0.92)	0	
Post-SUD	0.21 (0.49)	2.72 (0.47)	7.73 (0.92)	−1.02 (0.03)	<0.001*
1 m FU SUD	0.64 (0.79)	0.78 (0.49)	−0.89 (0.95)	−0.94 (0.05)	<0.001*
6mFU SUD	0.23 (0.95)	−1.74 (0.51)	6.99 (0.99)	−0.99 (0.01)	<0.001*
Pre-VOC	2.02 (0.79)	−0.08 (0.47)	−1.36 (0.92)	0	
Post-VOC	6.96 (0.20)	−4.90 (0.47)	24.00 (0.92)	1.22 (0.07)	<0.001*
1 m FU VOC	6.87 (0.31)	−2.60 (0.49)	5.63 (0.95)	1.21 (0.08)	<0.001*
6 m FU VOC	6.92 (0.25)	−3.34 (0.52)	11.19 (1.01)	1.22 (0.08)	<0.001*

**Statistically significant.*

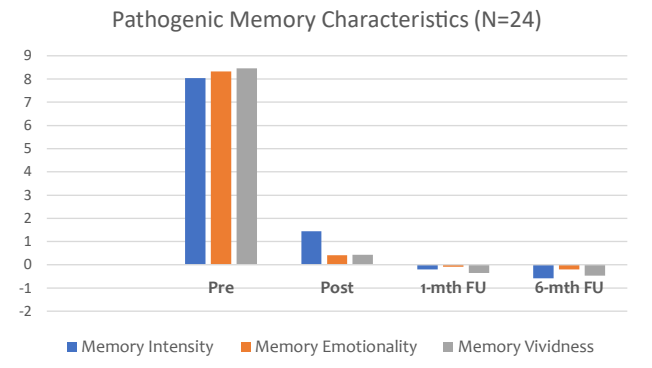

FIGURE 2 | Changes in pathogenic memory subjective characteristics.

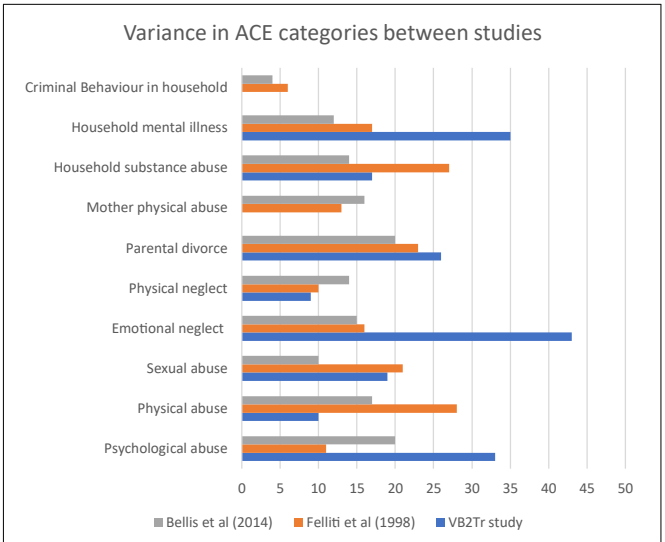

FIGURE 3 | ACE by category between studies.

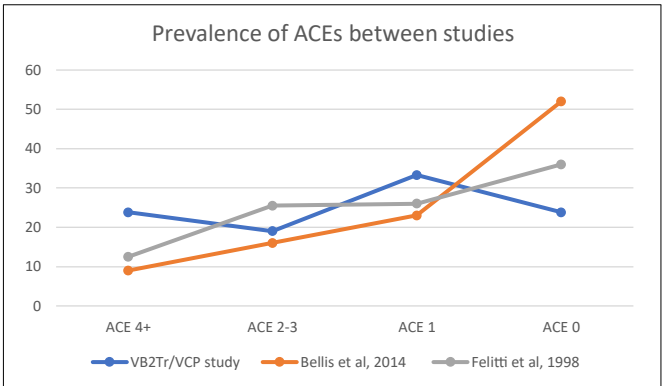

FIGURE 4 | Prevalence of ACE scores between the three groups: VB2Tr.

between pre and 6-month FU. This represents a significant finding from this study.

Therefore, it would be reasonable to assume that when VB2Tr is delivered as a VCP, it has the potential to instigate distinct changes to core components of the pathogenic memory, suggesting evidence of memory reconsolidation. Regarding hypothesis 2, distinctiveness – VB2Tr, as a VCP, will have no impact in reducing MI, ME, and MV of a pathogenic memory following intervention when measured at post-treatment, 1-month, and 6-month in comparison with a pre-measure. Therefore, the directional hypothesis is not supported.

Hypothesis 3. **Figures 3**, **4** demonstrate that exposure to ACEs or BCEs did not influence the processing of the pathogenic memory or the intervention outcome following the utilisation of VB2Tr.

As explained previously, testing the relevance hypothesis compared the study participant group with the original primary studies (Felitti et al., 1998; Bellis et al., 2014a,b, 2015, 2017, 2019). A single factor ANOVA explored the between-group variances. This one-way analysis of variance is a technique used to compare two or more samples when utilising numerical or categorical data.

Figure 4 highlights the prevalence of ACEs between studies (Felitti et al., 1998; Bellis et al., 2014b). A descriptive review of the results suggests higher exposure to 4 + ACEs within the VB2Tr participant group; however, results yielded an $F(3,4) = 8.45$, p-value < 0.03*, suggesting that there were, in fact, differences between the three groups in terms of the prevalence of ACEs, therefore, the directional hypothesis is not supported.

Table 6 provides more descriptive data about the VB2Tr participant group relating to specific exposure to ACEs. The results focussed on exposure to physical abuse, physical neglect, mother physical abuse, and criminal behaviour in the household.

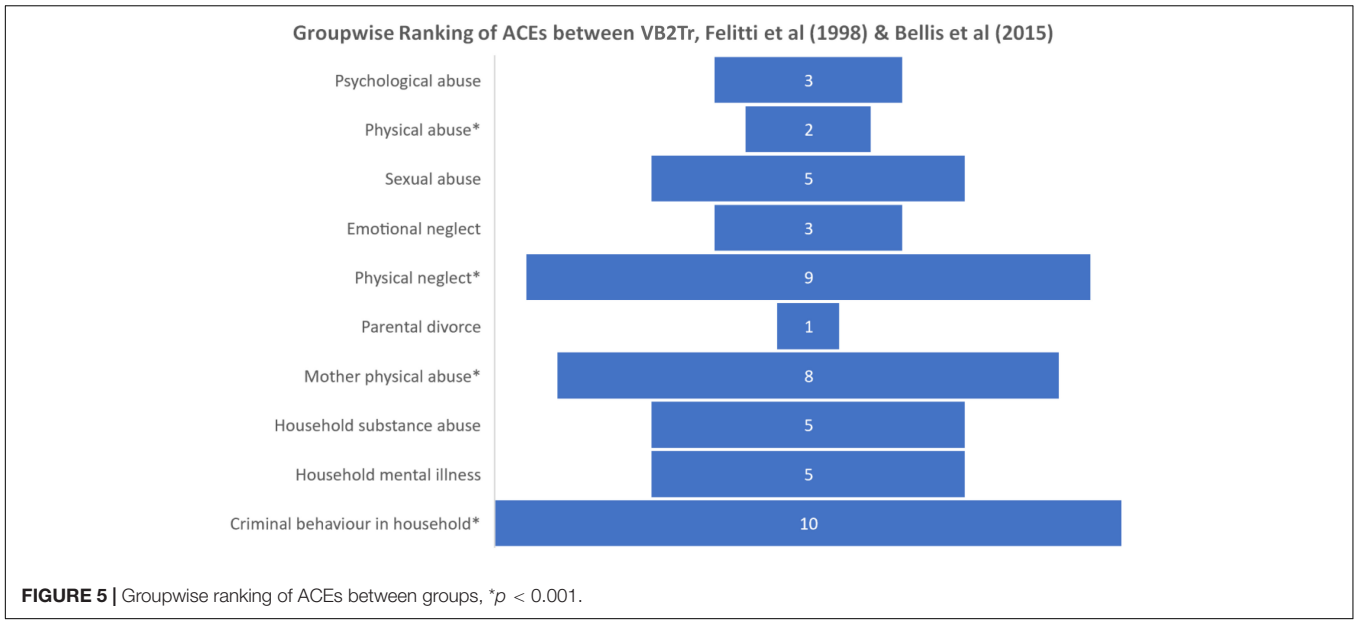

FIGURE 5 | Groupwise ranking of ACEs between groups, $^{*}p < 0.001$.

TABLE 6 | Types of adverse childhood experiences (ACE).

ACEs	Incidence	Sig. (2-test)
Psychological abuse	7 (33%)	0.189
Physical abuse	2 (10%)	<0.001*
Sexual abuse	4 (19%)	0.007
Emotional neglect	9 (43%)	0.664
Physical neglect	2 (9%)	<0.001*
Parental divorce	6 (26%)	0.035
Mother physical abuse	0 (0%)	<0.001*
Household substance abuse	4 (17%)	0.003
Household mental illness	8 (35%)	0.210
Criminal behaviour in household	0 (0%)	<0.001*

*$p < 0.001$.

Although an ANOVA revealed a distinction between the three groups, it is essential to highlight the elevated incidence of exposure to psychological abuse, emotional neglect, household mental illness, absence of exposure to mother physical abuse, and criminal behaviour in the household VB2Tr research participant group. **Figure 5** ranks the scores of the ten questions of the original ACEs questionnaire from most prevalent (1) to least (10).

Figure 6 compares the frequency of both ACEs and BCEs from the VB2Tr research population. The mean ACE was 1.8 (SD 1.68) and the BCE was 7.6 (SD 2.06). The correlation between ACEs and BCEs is $r(22) = -0.48$.

For the BCEs, the mean for the sample was 7.6 ($SD = 2.06$), and the median was 8. As shown in **Table 7**, most participants reported having eight (17.4%), nine (21.7%), and ten (21.7%) benevolent experiences in their childhood. All participants reported at least four BCEs. **Table 5** displays the frequency of each type of BCEs in the current sample. Results suggest that having "At least one good friend" (96%) and "Opportunities to have a good time" (91%) were the most frequent benevolent experiences.

In exploring further into hypothesis 3, relevance – first, results seem to indicate that neither ACEs nor BCEs scores did not influence the outcome of the intervention. Second, although 75% of the research participants admitted their motivation for participation was based firmly on "non-disclosure," results indicated 87.5% did disclose their target memory to the treating clinician. Of these 87.5%, **Table 8** highlights the categories of target memories disclosed.

As indicated earlier, using VB2Tr demonstrates a distinct treatment effect with **Table 8**, highlighting clinical applicability. In addition, desensitisation and reprocessing of these trauma memories occurred irrespective of either ACEs or BCEs. These results were consistent at 1-month and 6-month FU. Consequently, this data set supports the assertion of hypothesis 3, therefore, the directional hypothesis is not supported in relation to ACEs and BCEs.

In testing hypothesis 4, efficiency – the administration of VB2Tr was tested against the period recommended by EMDRIA sessions; 60–90 min. Results for this study used a time metric (minutes) from the commencement of Phase 3, assessment, to the completion of Phase 7, closure (including debrief). Of the $N = 24$ research participants, the average VB2Tr session was 57 min and 27 s, with an SD of 17 min 27 s. Results highlight that the treatment sessions were below the 60 min threshold.

Testing the costing element of hypothesis 4 required economic modelling using University of Worcester financial algorithms. The UW costing model used for each VB2Tr treatment session was calculated at £56.49 (€66.36). Of the 24 clinical sessions of VB2Tr carried out, the mean cost per session was £54.02 (€63.45). This represented potential modest savings of £2.47 (€2.91) per session. However, **Figure 7** indicates the variation in treatment costs for each individual session. One of the distinct advantages of remote intervention is the reduction in client-related costs such as travel time, transportation, and parking.

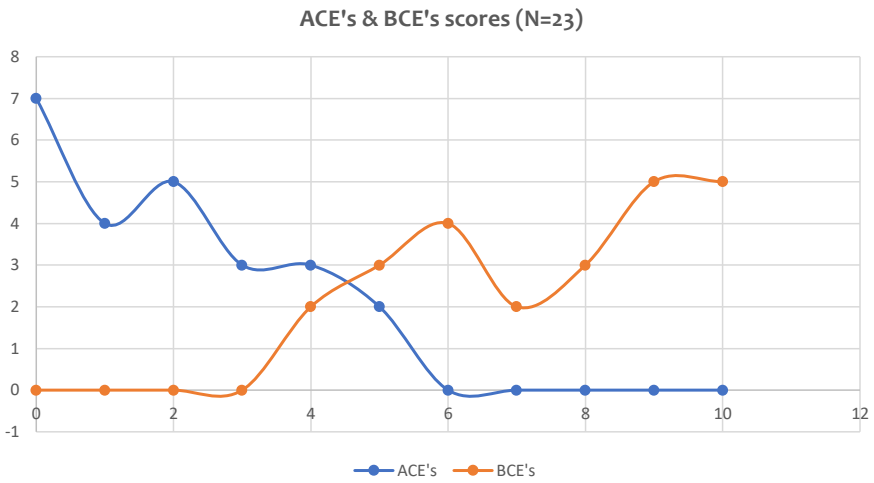

FIGURE 6 | Frequency of ACE and BCE scores of the research participants.

Results indicate savings in terms of time and efficiency, with additional health economic benefits. The results of hypothesis 4 results suggest the rejection of the directional hypothesis.

DISCUSSION

The rationale for this study was to ascertain how EMDR therapy could be used as a VCP considering the current COVID-19 pandemic, where social distancing is a vital strategy in reducing infection rates. However, more specifically, this research wanted to explore the potential use of the EMDR therapy VB2Tr protocol virtual version as a VCP, in order to determine its fitness for purpose, distinctiveness, relevance, and efficiency.

The memory targets identified in **Table 8** suggest that the research participants worked on distressing pathogenic memories of major adverse life events and that the intervention (VB2Tr) suggests a treatment effect. Despite a large effect size (Hedges' g = 6.71), this should be regarded with caution to not overgeneralise. As the primacy of this research was to demonstrate "proof of concept," the evidence from this study suggests potential considerations for both scalability and progression to a clinical population with a distinct diagnosis such as PTSD or complex PTSD. For this reason, future research should utilise both an experimental design and a clinical population, both of which would potentially deliver a more realistic treatment effect size.

To the best of our knowledge, this is the first EMDR therapy study that has examined both ACEs and BCEs. The most significant ACEs were emotional neglect, exposure to household mental illness, and psychological abuse up to 18 years of age. However, exposure to physical abuse by the mother and criminal behaviour in the household, with exposure to physical abuse and physical neglect, presented as the more prevalent ACEs in this research population.

The BCEs highlighted positive early life experiences in adults who built resilience and provided a counterbalance to ACEs.

TABLE 8 | Disclosed target memory themes and frequencies chosen by research participants for VB2Tr as a VCP.

- Sexual assault (3)
- Child abuse (4)
- Parental neglect (1)
- Fatal road traffic collision (1)
- Occupational bullying (4)
- Complicated grief (2)
- Episodes involving shame and humiliation (6)

These positive childhood experiences include effective caregiving, quality parenting, close relationships with other significant adults, effective schooling, and community. Higher BCEs are associated with more favourable long-term development (Masten, 2014). Within the participant group, the most decisive factors included having at least one good friend, at least one teacher who cared, opportunities to have a good time, and a predictable home routine. Although the data set indicates high levels of BCEs, caution is required as the study participants were highly trained mental health professionals and are not a clinical population. Other interesting observable aspects from the dataset highlight a dichotomy between having an adult (other than a caregiver) who could support and advice and liking or feeling comfortable with oneself. More research is needed to understand further the impact that ACEs and BCEs have on and explore further if and how BCEs act as a potential resilience to counteract the impact of ACEs. However, the results of this study highlight that trauma processing occurred using VB2Tr irrespective of the research participants' ACE or BCE scores.

Regarding testing hypotheses 1 through 4, the results from the study indicate a treatment effect from using the remotEMDR software to carry out VB2Tr as a VCP. Although the alterations in SUD and VOC are highly consistent with the more comprehensive empirical support for EMDR therapy, the data highlighting personal changes to the characteristics of the

TABLE 7 | Types of BCEs.

BCEs	Incidence	Sig. (2-test)
At least one caregiver with whom you felt safe	18 (78%)	0.011
At least one good friend	22 (96%)	<0.001*
Beliefs that gave you comfort	16 (70%)	0.093
Enjoyment at school	18 (78%)	0.011
At least one teacher that cared	20 (87%)	<0.001*
Good neighbours	17 (74%)	0.035
An adult (not a parent/caregiver or the person from *11) who could provide you with support or advice	12 (52%)	1.000
Opportunities to have a good time	21 (91%)	<0.001*
Like yourself or feel comfortable with yourself	12 (52%)	1.000
Predictable home routine, like regular meals and a regular bedtime	20 (87%)	<0.001*

Statistically significant.

pathogenic memory targeted from processing is undoubtedly intriguing. Again, caution is necessary as the sample size is relatively small and would need further testing with a clear clinical population with a more formal medico-legal diagnosis.

In testing hypothesis 3, relevance, the results for disclosure (90%) appear consistent with the previous B2T study in Northern Iraq (Farrell et al., 2020), highlighting a clear clinical benefit in using both B2T and VB2Tr EMDR therapy protocols. This VB2Tr study adds to the literature demonstrating equal effectiveness and suggests a potential correlation between non-disclosure and the level of SUD. Desensitisation and reprocessing of the pathogenic memory increase the probability of disclosure with results of 87.5% for this VB2Tr study. The clinical advantages of this make this an effective tool for use as a trauma treatment intervention, highlighting a distinct benefit of using EMDR therapy for undisclosed trauma memories compared to other trauma-focussed interventions. Again, caution is required as further research is needed to investigate this aspect.

The use of three additional subjective measures, namely, MI, MV, and ME, within this study suggests an argument for including these within the EMDR therapy B2T and the VB2Tr protocol, but also within the standard protocol. These measures appear particularly useful in understanding the subjective experience of the trauma memory targeted for processing. Further research and investigation are needed to pursue this argument further.

Although this was only a 1-treatment session study, the data set reveals an interesting health economic argument, with an average session cost of £56.49 (€66.36). Although the study yielded modest economic savings of £2.47 (€2.91) per session, the cumulative implications of this, in addition to the clinical benefits, suggest a particularly compelling argument.

As indicated earlier, there are two major flaws in this study. First, the research participant group, although frontline mental health workers working under extraordinary circumstances, is not a non-clinical population. However, in mitigation, this is a "proof of concept" study. Second, relating to methodology, this was a straightforward pre-test–post-test research design. A future study would need to utilise a more robust experimental framework. However, results from this study suggest a more empirical foundation upon which future studies can build. As the study involved non-disclosure of trauma memory, randomisation was not possible for both ethical and moral reasons. Scaling up to a full randomised control study would not be possible; however, a quasi-experimental design would be a viable alternative.

To summarise, the research results suggest VB2Tr EMDR therapy to be an effective, fit-for-purpose, safe-to-use trauma treatment intervention. Additionally, the results highlight its clinical relevance and applicability as a trauma intervention. Furthermore, the remotEMDR software provided a highly effective platform for delivering EMDR therapy as a VCP.

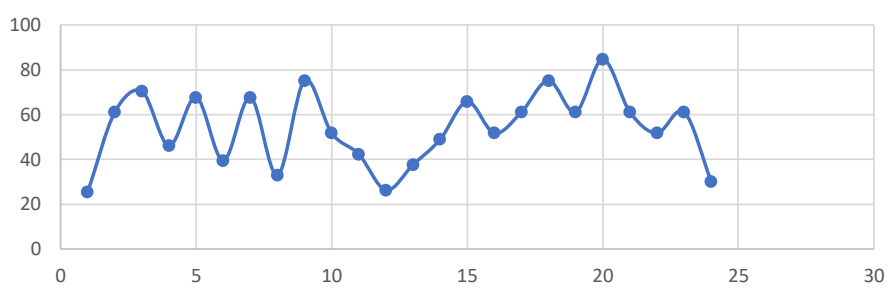

FIGURE 7 | Variance in cost of VB2Tr treatment sessions carried out as a VCP.

Although the researchers acknowledge that other platforms exist, results from this study are based entirely on remotEMDR.

CONCLUSION

This research study demonstrated encouraging evidence in support of EMDR therapy as VCP in treating a pathogenic (trauma) memory. In addition, the study explored specific factors influenced by the treatment intervention. The results of this study highlight the potential of using EMDR therapy, in this case using the B2T protocol as a VCP. Furthermore, results suggest the intervention has clinical applicability. Caution does need to be exercised regarding both the lack of a clinical population and the need for a more experimental design. However, results from this study demonstrate "proof of concept."

However, to have an intervention that appears effective with either shame-based or fear-based trauma memories suggests great potential regarding clinical applicability. To have such an intervention that works on trauma memories that clients are unwilling to disclose due to fear, blame, or prejudice suggests distinct advantages for EMDR therapy in the repertoire of empirically supported trauma treatment interventions. Furthermore, to have such an intervention that appears safe and effective adds more temerity to this assertion. This study highlights how the VB2Tr EMDR therapy scripted protocol alters core characteristics of the pathogenic memory itself, including memory disturbance, emotionality, intensity, and vividness. The results also demonstrate that these changes occur irrespective of either ACEs or BCEs. Another critical finding relates to resilience and post-traumatic growth factors more powerful when considering a stark choice for clients, such as disclosure of the memory or no treatment, they choose no treatment. Providing a credible alternative in this critical decision-making juncture suggests distinct clinical benefits and applicability. Potential health efficiency arguments highlighted by this research are tentative yet worthy of further investigation and critical consideration.

It does need to be acknowledged that psychological treatment through the medium of videoconferencing may not suit some people. These reasons may be technological, safety factors, security, and/or individual choice. Understandably, this must be respected and accommodated. This study highlights that when individuals are given a choice between "disclosure" or "no treatment," the research participants in this study chose the latter and not the former. This raises an interesting ethical question: is it better to do something, than nothing? Being able to offer clients greater choice is essential. In a world of increasing uncertainty and insecurity, the need for having suitable, evidence-based alternatives to "in-person" is paramount.

In summary, these results demonstrate proof of concept and put forward the case for further research and investigation. The stage 2 aspect of the study will further test the EMDR intervention as a VCP with a defined, clinical control group. The research supports the case for EMDR therapy as a credible treatment when used as a VCP.

The COVID-19 pandemic has challenged existing mental health and psychology services enormously. As the global burden of psychological trauma continues unabated, and we remain in an environment of scarcity in resources, any intervention that provides distinct choice and effectiveness in treating shame- or fear-based memories is a compelling argument, and much-needed treatment approach. The EMDR therapy "Blind 2 Therapist" appears to be a distinctly helpful psychotherapeutic tool in this endeavour. The fact that such an intervention has the potential health efficiency benefits strengthens this argument further. Any intervention, virtual or not, which improves accessibility and reach must be welcomed.

DATA AVAILABILITY STATEMENT

The EMDR therapy Virtual Blind 2 therapist (VB2Tr) protocol used for the study is available at: https://trnireland.ie/. Additional original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the University of Worcester, Worcester, United Kingdom. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DF conceived the study, carried out the VB2Tr treatment sessions, and was the chief investigator for the project. LK, PM, and ZZ were part of the research team, acquired the FU date, and conducted the qualitative interviews. AF, DF, and MK carried out the data analysis. The primary author was the principal investigator. All authors contributed to the overall article and approved the submitted version for publication.

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Conflict of Interest: NG is the co-founder and CEO of remotEMDR.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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frontiers | Frontiers in Psychology

ORIGINAL RESEARCH
published: 13 July 2022
doi: 10.3389/fpsyg.2022.944838

A Biologically Inspired Neural Network Model to Gain Insight Into the Mechanisms of Post-Traumatic Stress Disorder and Eye Movement Desensitization and Reprocessing Therapy

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OPEN ACCESS

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Specialty section:
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

Received: *15 May 2022*
Accepted: *06 June 2022*
Published: *13 July 2022*

Citation:
Mattera A, Cavallo A, Granato G, Baldassarre G and Pagani M (2022) A Biologically Inspired Neural Network Model to Gain Insight Into the Mechanisms of Post-Traumatic Stress Disorder and Eye Movement Desensitization and Reprocessing Therapy. Front. Psychol. 13:944838. doi: 10.3389/fpsyg.2022.944838

Eye movement desensitization and reprocessing (EMDR) therapy is a well-established therapeutic method to treat post-traumatic stress disorder (PTSD). However, how EMDR exerts its therapeutic action has been studied in many types of research but still needs to be completely understood. This is in part due to limited knowledge of the neurobiological mechanisms underlying EMDR, and in part to our incomplete understanding of PTSD. In order to model PTSD, we used a biologically inspired computational model based on firing rate units, encompassing the cortex, hippocampus, and amygdala. Through the modulation of its parameters, we fitted real data from patients treated with EMDR or classical exposure therapy. This allowed us to gain insights into PTSD mechanisms and to investigate how EMDR achieves trauma remission.

Keywords: post-traumatic stress disorder, eye movement desensitization and reprocessing therapy, prolonged exposure, computational modeling, amygdala

1. INTRODUCTION

Post-traumatic stress disorder (PTSD) is a maladaptive reaction to traumatic events characterized by American Psychiatric Association (2013): (a) intrusiveness of distressing memories of the traumatic event, that occur in response to reminder cues of the trauma; (b) avoidance of the trauma-associated cues; (c) negative alterations in cognitions and mood; (d) hyperarousal. Many studies found that the activation of the amygdala during the exposure to trauma reminders or fearful stimuli is significantly correlated with the severity of PTSD symptoms (Rauch et al., 2000; Pissiota et al., 2002; Fredrikson and Furmark, 2003; Shin et al., 2004; Protopopescu et al., 2005; Ganzel et al., 2007; Brohawn et al., 2010; Jacques et al., 2011; McLaughlin et al., 2014; Neumeister et al., 2017; Stevens et al., 2017). Also, the reduction of the amygdala activation after the treatment correlates with the success of psychotherapy in attenuating the symptoms (Peres et al., 2011; Thomaes et al., 2014; King et al., 2016). Moreover, patients suffering from PTSD show reduced recruitment of the brain areas involved in emotion regulation, such as the ventromedial prefrontal cortex (vmPFC) and the dorsolateral prefrontal cortex (dlPFC), when facing cues associated with trauma (Rauch et al., 2006; Liberzon and Sripada, 2007; Kasai et al., 2008; Milad et al., 2009; Shin and Liberzon, 2010).

Post-traumatic stress disorder does not occur in all individuals that experience trauma, suggesting that specific susceptibility factors determine if the disorder will develop or not (Alisic et al., 2014; Musazzi et al., 2018). For instance, during the extinction of Pavlovian fear conditioning, patients with PTSD reveal hypoactivation of the vmPFC, compared to healthy controls (Milad et al., 2009; Rougemont-Bücking et al., 2011), although it is not known whether this alteration has to be considered a cause or a consequence of the trauma (Yehuda, 1999; Kasai et al., 2008; Sun et al., 2013; Miller et al., 2017; Alexander et al., 2020).

Prolonged exposure (PE) to threatening stimuli and eye movement desensitization and reprocessing (EMDR) are first line therapeutic strategies for PTSD (World Health Organization, 2013; Schnyder et al., 2015; Cusack et al., 2016; Gainer et al., 2020). PE consists of several sessions of exposure to the trauma-related stimuli in a safe context. The exposure can also be imaginal. In the latter case, the therapist asks the patient to relive the traumatic experience as it was happening at that precise moment (Foa and Rothbaum, 2001). When the distress arising from physical or imaginal exposure is too high, PE can be paired with anxiety reduction techniques, such as slow breathing or mindfulness (Brewer, 2001; Frye and Spates, 2012).

It has been suggested that vmPFC activation during exposure and the resulting downregulation of the amygdala are key factors of PE therapy (Stojek et al., 2018). It is worth noting that patients with PTSD in whom the vmPFC is more active during emotional conflict tasks benefit from a greater symptoms reduction after PE (Fonzo et al., 2017). This is in agreement with the proposed role of the vmPFC in discriminating safety signals and inhibiting the amygdala during fear extinction (Phelps et al., 2004; Schiller et al., 2008; Feng et al., 2016; Fullana et al., 2016; Via et al., 2018; Tashjian et al., 2021). Murine studies and simulations confirm this picture. Indeed, the homologous brain region in mice—the infralimbic cortex—is progressively recruited during the exposure to no longer threatening conditioned stimuli and promotes synaptic plasticity and fear extinction in the amygdala through long range projections (Garcia et al., 1999; Milad and Quirk, 2002; Cho et al., 2013; Moustafa et al., 2013; Senn et al., 2014; Do-Monte et al., 2015a; Mattera et al., 2020). Even though the vmPFC is believed to fire in response to safe stimuli and context in an automatic way (Gyurak et al., 2011), it has been shown that it can also be recruited endogenously and actively, for example through exercises of mindfulness (Zeidan et al., 2014).

The mechanisms of action of EMDR have been widely debated (Lohr et al., 1998; Herbert et al., 2000; Rogers and Silver, 2002; Lee et al., 2006; Pagani et al., 2017; de Voogd et al., 2018; Landin-Romero et al., 2018; Baek et al., 2019; Holmes, 2019). During EMDR sessions, the patient is instructed to keep the most disturbing image, the negative feelings, beliefs, emotions, and the body sensations associated with the trauma in mind, while following an alternating bilateral stimulation (e.g., right-left hand movements, bilateral fingers tapping, or bilateral auditory stimuli) from the therapist (Gainer et al., 2020). An important characteristic of this therapy is that patients show a faster symptom improvement, usually in 6–8 sessions (Power et al., 2002; Shapiro, 2014; Proudlock and Peris, 2020), compared to the PE recovery that lasts on average 12 sessions (Foa and Rothbaum, 2001; Banducci, 2021).

The neurobiological correlates of EMDR have been investigated in real time, with millisecond resolution, through electroencephalography (EEG) recorded during the whole session. Notably, the bilateral stimulation induces an immediate synchronization of all cortical areas in the delta band (1–4 Hz; Harper et al., 2009; Pagani et al., 2011, 2012). On the basis of these results, it has been proposed that slow waves arising during EMDR enact a sleep-like mechanism of memory consolidation (Pagani et al., 2017). Indeed, during sleep, recent memory traces are reactivated simultaneously in the hippocampus and the slowly oscillating sensory and prefrontal cortices (Sirota et al., 2003; Ji and Wilson, 2007; Peyrache et al., 2009; Helfrich et al., 2019). It is thought that this process is the basis of a hippocampus-to-cortex transfer, where episodic memories can be integrated into the existing cognitive schemes (Sirota et al., 2003; Mölle and Born, 2009; Diekelmann and Born, 2010). Experimental disruption of memory reactivation or impairment of slow waves impinges memory consolidation (Miyamoto et al., 2016, 2017). On the other hand, a stimulation mimicking slow waves induces long term potentiation in neocortical neurons (Chauvette et al., 2012; Sandler et al., 2016) and enhances memory retention (Miyamoto et al., 2016). Theoretical investigations indicate that slow oscillations boost synaptic plasticity and associative learning between cortical areas (Wei et al., 2016; Capone et al., 2019; Golosio et al., 2021).

The adaptive information processing (AIP) model of Shapiro proposes that traumatic memories are not integrated into the existing memory networks and remain stored in a maladaptive form (Solomon and Shapiro, 2008). The slow waves-promoting effect of EMDR suggests that therapy would promote the transfer of memories from the hippocampus-amygdala complex to the cortex, where they can be integrated into the associative cortical networks; this would allow to process the traumatic memory in an adaptive form, leaving the cognitive aspects of the memory intact, while erasing the associated emotional trace (Stickgold, 2002; Pagani et al., 2017). As in Shapiro's AIP model, the cortical transfer would help to make sense of the trauma by connecting the memory with the previously acquired cognitive schemes (Solomon and Shapiro, 2008).

Besides slow oscillations, another important insight into the mechanisms of EMDR comes from the *Working Memory Hypothesis* (de Voogd et al., 2018; Landin-Romero et al., 2018). This hypothesis suggests that tasks engaging in working memory reduce traumatic memory intrusion and downregulate the amygdala (Holmes et al., 2009; Qin et al., 2009; Schweizer et al., 2013; James et al., 2015; Iyadurai et al., 2018). It has been observed that bilateral eye movements during the presentation of conditioned stimuli previously associated with an electric shock activate the dlPFC and inhibit the amygdala, similarly to a working memory task. Moreover, it has been shown that, contrary to PE therapy, the vmPFC is deactivated by bilateral eye movement during the processing of traumatic memories (de Voogd et al., 2018). This evidence suggests that PE and EMDR exert their therapeutic action through the recruitment

of different subsets of the PFC areas possibly having different efficacy in fear inhibition.

As many brain areas are involved, the integration of the phenomena involved in PTSD and its therapies in a whole coherent framework posits a challenge. Moreover, we still lack models of PTSD able to account for the whole complexity of the disease. On one hand, imaging research in patients often has substantial problems with resolution and reliability (Nord et al., 2017; Kredlow et al., 2022), and does not allow insight into the actual computations exerted by the investigated brain area (Logothetis, 2008). On the other hand, murine models permit a finer resolution and manipulation of the circuits and neuronal populations, but often fail to recapitulate the actual characteristics of the disorder. In particular, while Pavlovian fear conditioning—the most used PTSD-mimicking protocol in mice—reproduces some aspects of PTSD (Mahan and Ressler, 2012; Verbitsky et al., 2020), the continuous exposure to the conditioned stimulus no longer associated with the noxious stimulus causes the extinction of conditioned fear after some trials (Mattera et al., 2020), while PTSD symptoms are particularly resistant to extinction and can last decades (Morgan et al., 2003; Chapman et al., 2012; Careaga et al., 2016). Moreover, although humans can extinguish Pavlovian fear with exposure (Kalisch et al., 2006), in the case of PTSD the exposure to trauma reminders outside a therapeutic context can worsen the symptoms (Eysenck, 1982; Hassija and Gray, 2007).

Computational models can be a tool to face the outlined complex problem through the integration of disparate experimental information in the same theoretical framework (Eliasmith and Trujillo, 2014; Nair et al., 2016). Models are constrained by experimental data to gain biological plausibility and, at the same time, can incorporate new hypotheses to be tested. The emergent properties of the model produce insights into the mechanisms possibly underlying the studied phenomena, and allow predictions that are testable in future experiments, grounded on the hypotheses incorporated in the model and the data used to constraint it (Shen and McNaughton, 1996; Nair et al., 2016). Here, we used a biologically inspired neural network to model PTSD, and the effects of PE and EMDR, to verify the computational plausibility and coherence of the proposed mechanisms of action. In particular, to reproduce the overall effect of EMDR, we adjusted two parameters representing the inhibitory activity of PFC on the amygdala and the enhanced cortical learning rate induced by the slow waves. Moreover, the simulations allowed us to reproduce experimental data and gain insights into their neurobiological implications.

The article is organized as follows. First, we describe the PTSD model and its biological underpinnings (Section 2). Then, we test its robustness through the reproduction of different PTSD related phenomena (Sections 3.1, 3.2). Next, we reproduce the proposed mechanisms underlying PE and EMDR to simulate data from patients (Nijdam et al., 2012) and derive information regarding the different time courses of the two therapies (Sections 3.3, 3.4). Finally, we discuss the results of the simulations and their contribution to the understanding of PTSD (Section 4.1) and EMDR (Section 4.2).

2. MATERIALS AND METHODS

2.1. Neural Units

The neural units forming the model are *leaky units* (Dayan and Abbott, 2001), each representing the activity of a population of neurons with the same electrophysiological properties (Moustafa et al., 2013; Carrere and Alexandre, 2015; Mannella et al., 2016; Mattera et al., 2020). These units are characterized by membrane potential and a firing rate. In leaky units the change of the unit potential in time, $\dot{V}_{post}$, is represented with the following differential equation, approximated with the Euler method:

$$\tau \cdot \dot{V}_{post} = -V_{post} + I + \sum_{pre}(w_{post,pres} \cdot F_{pre}) \quad (1)$$

where τ is the time constant, I is the external input to the unit (representing the activation of the sensory cortices, the recalling signal to the hippocampus, the safety signal to the vmPFC in PE or the eye movement in EMDR, the trauma to the amygdala; refer to **Figure 1**), $w_{post,pre}$ is the weight of the connection between the pre- and post-synaptic unit, F_{pre} is the firing rate of the presynaptic units. The firing rate of the unit, F_{post}, was calculated with the hyperbolic tangent function $tanh(x)$:

$$F(V_{post}) = [tanh(V_{post} - \theta)]^{+} \quad (2)$$

where θ is the firing threshold and $[x]^{+}$ the positive function ($[x]^{+} = x$ if $x \geq 0$, and $[x]^{+} = 0$ if $x < 0$). The connection weights at the beginning of the simulation, as well as the firing thresholds of the neurons, are listed in the **Supplementary Table 1**.

2.2. Model Connectomics and Its Biological Underpinnings

The model involves four areas (**Figure 1**), representing the sensory cortices, the hippocampus, the amygdala, and the PFC. The hippocampal-amygdala network is organized as a bidirectional associative network, inspired by Alvarez and Squire (1994). It has been theorized (Tryon, 1998), but never shown with simulations (Radell et al., 2017) that this kind of neural network would recapitulate the symptoms of PTSD. Associative networks are indeed capable of pattern completion, i.e., the ability to reconstruct a whole pattern from a single cue (Alvarez and Squire, 1994; Tryon, 1998), and this is a characteristic of the intrusive memory flashbacks that follow a trauma-reminder cue (Brewin, 2015; Ehlers, 2015).

The hippocampus receives input from unimodal and multimodal sensory cortices, that can converge in the same hippocampal population (Fried et al., 1997; Quiroga et al., 2009). Lateral inhibition and sparse connectivity at the dentate gyrus level ensure the separation of information, thus strongly segregated patterns of contextual input from sensory cortices activate non-overlapping hippocampal populations (Norman and O'Reilly, 2003; Rolls, 2013; Espinoza et al., 2018). In the model, these characteristics are captured by a winner-take-all architecture (Alvarez and Squire, 1994). The initial weights from the neuronal units in the sensory cortices to the

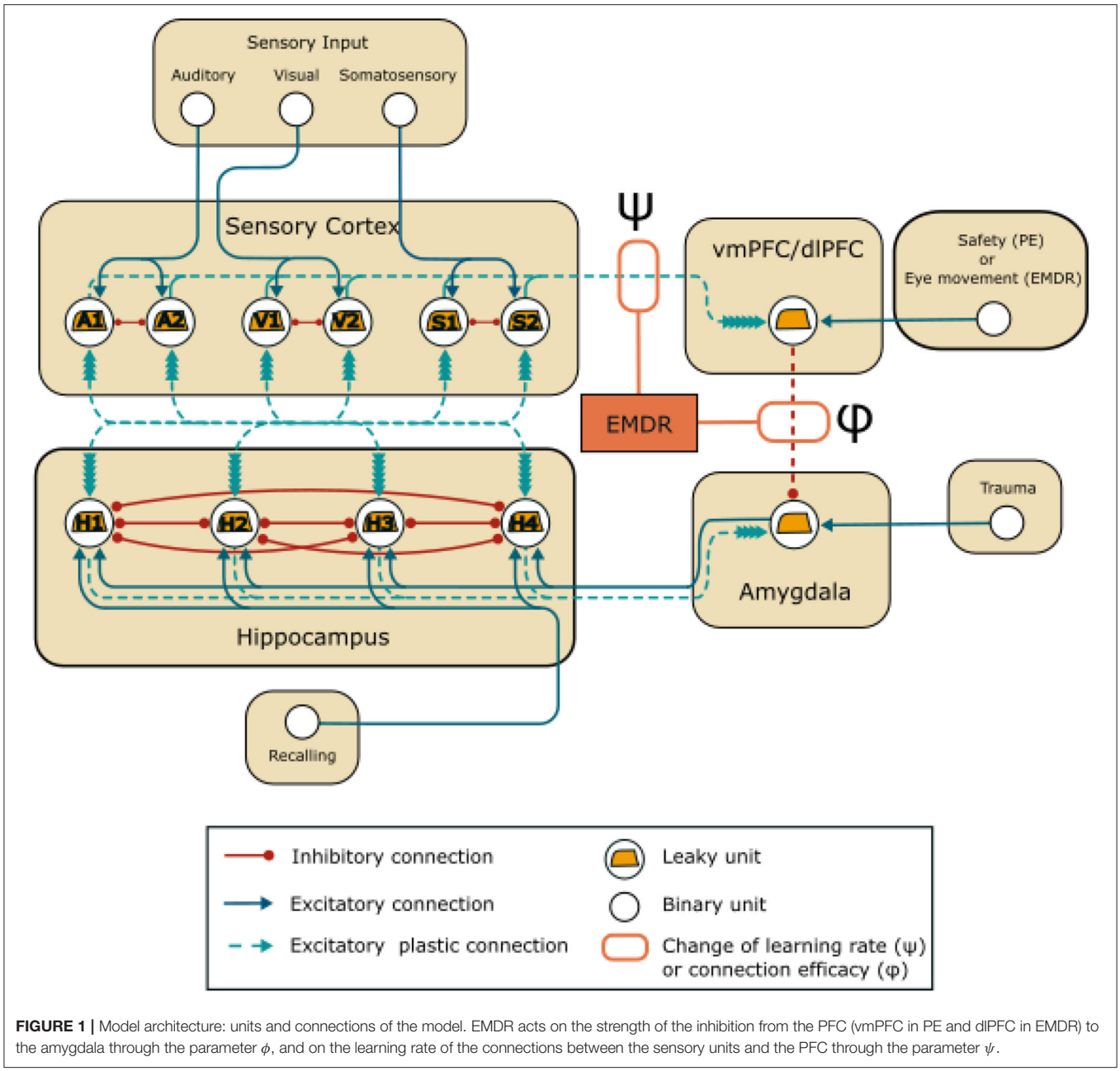

FIGURE 1 | Model architecture: units and connections of the model. EMDR acts on the strength of the inhibition from the PFC (vmPFC in PE and dlPFC in EMDR) to the amygdala through the parameter ϕ, and on the learning rate of the connections between the sensory units and the PFC through the parameter ψ.

hippocampal units and from the hippocampus to the sensory cortices are extracted randomly from a uniform distribution (**Supplementary Table 1**). This allows a different activation of the hippocampal units for each possible input pattern. A strong lateral inhibition between the hippocampal units ensures that only one hippocampal unit wins the competition and fires persistently in response to a sensory pattern. On the other hand, each sensory modality is represented by two mutually inhibiting units (units A1 and A2 represent the auditory cortex, S1 and S2 the somatosensory cortex, and V1 and V2 the visual cortex). Importantly, the sensory cortices in **Figure 1** represent both primary cortices and also higher level unimodal cortices. Differently from Alvarez and Squire (1994), which used simplified firing rate neurons, we did not implement lateral excitatory connections between the sensory cortices. This has been done to avoid a perpetual activation induced by an excessive recurrent excitation due to the more realistic dynamic nature of the leaky neurons used here. This implies that, in our model implementation, the memory trace is not transferred form the hippocampus to the cortex, as in Alvarez and Squire (1994). Since obtaining this feature with the more realistic neurons used here would have been overly complicated, we decided to not consider this aspect as it goes beyond the scope of the research objective pursued here.

It has been shown that recalling a particular experience reactivates the same hippocampal population that fired at the moment of the actual experience (Rolls and Xiang, 2006; Gelbard-Sagiv et al., 2008). Moreover, this internally generated hippocampal reactivation is capable of reinstating the original cortical representations (Wheeler et al., 2000; Tanaka et al., 2014). Our model reproduces this property through an associative learning process taking place at the level of the reciprocals connections between the sensory cortices and the hippocampus (Alvarez and Squire, 1994; Rolls, 2007; Schwindel and McNaughton, 2011). This learning process is driven by the Bienenstock-Cooper-Munro (BCM) learning rule (refer to Section 2.3).

Hippocampus and amygdala are reciprocally connected (**Figure 1**), as shown by anatomical investigation (Pitkänen et al., 2000). In murine, hippocampal projections directly target amygdala fear neurons, i.e., the neuronal population that becomes active after the establishment of fear conditioning (Herry et al., 2008). In particular, the hippocampus conveys contextual information to the amygdala (Phillips and LeDoux, 1992; Kim and Cho, 2017) through synaptic projections that are potentiated by fear learning (Kim and Cho, 2020). In humans, after contextual fear conditioning, the context associated with an electric shock evokes a coupled activation in both hippocampus and amygdala, as revealed by imaging studies (Alvarez et al., 2008; Marschner et al., 2008; Lang et al., 2009; Baeuchl et al., 2015).

Finally, the amygdala is under the inhibitory control of the PFC. vmPFC and dlPFC are respectively engaged in PE (Phelps et al., 2004; Schiller et al., 2008; Feng et al., 2016; Fullana et al., 2016; Via et al., 2018; Tashjian et al., 2021) and in EMDR therapy (de Voogd et al., 2018). In the model (**Figure 1**), the PFC unit represents vmPFC or dlPFC, depending on the therapy that is being simulated and receives plastic inputs from the unimodal sensory cortices. These should not be intended to represent direct anatomical projection, but functional indirect connections that are modulated by learning (Bhanji et al., 2019; Ginty et al., 2019). In **Figure 1**, and throughout the article, the weight of the connection between the PFC and amygdala is indicated by ϕ. The initial value of ϕ (Sections 3.1, 3.2, 3.3) was set to -1 (**Supplementary Table 1**). Subsequently (Section 3.4), it was modified according to the results of the grid search algorithm that was used to tune the parameters: this was done to reflect a possible difference in the amygdala inhibition efficacy of vmPFC and dlPFC. Indeed, we reasoned that if EMDR recruits different PFC areas compared to PE, this would be reflected in a different total efficacy of amygdala inhibition (the parameter ϕ) by the whole vmPFC/dlPFC compound.

2.3. Plasticity Equations and Their Biological Underpinnings

The weights of the plastic connections (refer to **Figure 1**) are updated according to a simplified BCM learning rule (Bienenstock et al., 1982):

$$\Delta W_{post,pre} = \alpha \cdot (F_{post} - \rho) \cdot F_{pre} \quad (3)$$

where α is the learning rate, ρ is the plasticity threshold (**Supplementary Table 1**), F_{post} and F_{pre} are the post- and pre-synaptic firing rates. Following this rule, a connection undergoes long-term potentiation (LTP) or long-term depression (LTD) if the firing of the post-synaptic unit is respectively above or below the threshold ρ. The weights are clipped within a ($Wmax$, $Wmin$) range (**Supplementary Table 1**).

An influential paradigm states that the cortex is a slow learner, while the subcortical structures are fast learners. This would allow the gradual integration of episodic memories with previous knowledge through slow consolidation, and favor the integration rather than interference between old and newly acquired memories (McClelland et al., 1995; Frankland and Bontempi, 2005). This theory is supported by experimental findings concerning the temporal dynamics of memory transfer from subcortical to neocortical zones (Zola-Morgan and Squire, 1990; Kim and Fanselow, 1992; Quinn et al., 2008; Do-Monte et al., 2015b), by the well-known difficulty of producing synaptic plasticity in neocortical slices compared to hippocampal ones (Bear et al., 1992; Bear and Kirkwood, 1993), and by computational models (Alvarez and Squire, 1994; Hattori, 2014). Even though some cases of remarkably fast cortical engram formation have been found (Kitamura et al., 2017; Brodt et al., 2018), it has been shown that rapid cortical learning requires that the new information is consistent with previously acquired cognitive schemes (Tse et al., 2007, 2011; Squire et al., 2015; Kumaran et al., 2016).

We incorporated slow cortical learning into the equation driving synaptic plasticity in our model. In particular, the learning rate of the connections between the sensory cortex and the dlPFC/vmPFC is 10 times slower. We choose this value accordingly to Alvarez and Squire (1994), where an order of magnitude of difference in cortico-cortical learning rate compared to the hippocampal learning rate allowed the reproduction of the gradual hippocampus-cortex information transfer found in experiments. The model also reproduces the plasticity-promoting effect of slow waves induced by bilateral stimulation in EMDR (Chauvette et al., 2012; Sandler et al., 2016; refer to Section 1). In particular, we simulated this effect by modifying the strength of the plasticity acting on the cortical connections through the parameter ψ (refer to **Figure 1**):

$$\Delta W_{cortex} = \alpha \cdot \psi \cdot (F_{post} - \rho) \cdot F_{pre} \quad (4)$$

2.4. Simulation Protocols

Input units to the model (**Figure 1**) are binary units that can be in two different states, "off" and "on". Only in the "on" state do they send an input equal to 1 to the postsynaptic unit.

The sensory cortex units are organized in mutually inhibiting couples: A1- A2, S1-S2, V1-V2, representing neuronal populations in the auditory cortices, somatosensory cortices, and visual cortices. Among the 8 possible patterns of stimulation, we have chosen A1-S1-V1 to be associated with the trauma (Pattern 1) and A2-S2-V2 as a control (Pattern 2). The model receives other three inputs: the trauma unit, which is connected to the amygdala, the recalling unit, which is connected

to the hippocampus, and the safety/eye movement unit, which represents the input to the PFC during the PE or EMDR therapy.

To model trauma establishment and the subsequent PTSD, we used a protocol consisting of 35 trials (Section 3.1). First, the baseline activation of the hippocampus and amygdala were measured with a single trial of stimulation (Trial 1; one trial lasted 104 time steps; an interval of 104 time steps separated the trials). In trial 1, we activated the input to V1 or the input to V2 without the other elements of the patterns. During the PTSD establishment (Trial 2, corresponding to $3 \cdot 104$ timesteps), we activated the whole Pattern 1 together with the trauma binary unit, or Pattern 2 without the trauma input. For the remaining trials (each lasting 104 timesteps) we stimulated V1 or V2 to observe if a single cue was able to activate (a) the amygdala (PTSD establishment), and (b) the hippocampus and the other units of the pattern (memory acquisition).

The simulation of the increased vmPFC excitability in Section 3.2 was obtained by halving the firing threshold θ of the unit. The experience of an event with mild emotional activation was simulated in Section 3.2 by reducing the activation of the unit Trauma (refer to **Figure 1**) from 1 to 0.3.

To model PE or EMDR therapy (Sections 3.3, 3.4), we first established PTSD as aforementioned. Then we activated the recalling unit projecting to the hippocampal unit associated with the memory trace from trial 11. At the same time, we activated the PFC unit to represent a safety signal delivered to the vmPFC in case of PE, or the eye movement-induced activation of dlPFC in case of EMDR. This protocol corresponds to the reactivation of the traumatic memories during the therapy (imaginal exposure or recalling), associated with the recruitment of the respective cortical areas recruited by the PE and the EMDR (refer to Section 1). After each therapy trial, we delivered a test trial, with only the V1 activation while stopping learning, to measure the PE or EMDR trial-by-trial effect on the cue-induced traumatic memory reactivation. Note that in the figures in Sections 3.3, 3.4, we only show the test trials (V1 activation) after each therapy trial (hippocampus plus PFC activation).

We fitted the data from Nijdam et al. (2012) through a grid search of the parameters ϕ and ψ (Section 2.4). The test reported in Nijdam et al. (2012) compared the timing of symptoms decline in PTSD patients treated with brief eclectic psychotherapy (consisting of session 1 of psychoeducation, sessions from 2 to 6 of imaginal exposure, and the following sessions of cognitive therapy) with that of patients treated with EMDR. Through the measurement of the "Impact of Events Scale - Revised" score (IES-R), they showed a session-by-session decline of symptoms in the two groups of patients. We took the average group data from sessions 2 to 6, where imaginal exposure was administrated to the patients under brief eclectic psychotherapy, and compared them to the corresponding sessions in the EMDR group. The IES-R was normalized to the maximum value and the values were re-scaled, subtracting the IES-R baseline reached after the whole therapy. In order to reproduce the patients' curves of symptom remission after PE and EMDR in Nijdam et al. (2012) we leveraged the fact that the activation of the amygdala is significantly correlated with PTSD symptoms severity (Rauch et al., 2000; Pissiota et al., 2002; Fredrikson and Furmark, 2003; Shin et al., 2004; Protopopescu et al., 2005; Ganzel et al., 2007; Brohawn et al., 2010; Jacques et al., 2011; Peres et al., 2011; McLaughlin et al., 2014; Thomaes et al., 2014; King et al., 2016; Neumeister et al., 2017; Stevens et al., 2017) to reproduce, with the activation of the amygdala unit in our model, the curves of symptom remission after the PE and EMDR in Nijdam et al. (2012) patients. The parameters ϕ and ψ were allowed to vary respectively in steps of 0.05 and 0.5 and ranges of 0.5–2.0 and 0.5–8.5. We measured the distance of the simulations from the real data with the root-mean-squared error (RMSE; Granato and Baldassarre, 2021).

3. RESULTS

3.1. Trauma Establishment

During the first trial of the protocol, we activated the input unit to V1 or V2 only, representing two different visual cues to the visual cortex. In both cases, we observed no activity in the hippocampus or the amygdala (trial 1 in **Figures 2A,B**). In the second trial, the whole pattern 1 (traumatic pattern: A1-S1-V1 + trauma) or the whole pattern 2 (control pathway: A2-S2-V2) was activated. In this case, the hippocampus firing is induced for both patterns, whereas the amygdala firing is caused only by pattern 1, as a consequence of the activation of the trauma input unit (trial 2 in **Figures 2A,B**). Note that we observed hippocampal activity only in one unit per pattern, as we show below. During the following trials (trials 3 to 35, **Figures 2A,B**), we activated only the sensory units V1 or V2.

Because of the winner-take-all architecture described in Materials and methods, the patterns 1 and 2 activate different units in the hippocampus (**Figures 3A,C**). While V2 induces an hippocampal activation that slowly fades away during subsequent trials (**Figure 2A**, white dots: compare trial 3 with trial 35), V1 induces a robust and persistent firing in both hippocampus and amygdala (**Figures 2A,B**, black dots). This indicates that the initially neutral cue V1 became associated with a threat, causing a persistent amygdala activation.

One of the principal features of PTSD is the emotional flashbacks induced by a trauma reminder. We observed that the presentation of V1 after trauma establishment drives the activation of the hippocampus and also of the other sensory cortices, reinstating the whole pattern 1 (traumatic flashback; **Figure 3A**). This reinstatement effect is persistent even after several trials (**Figure 3B**). Instead, the presentation of V2 weakly activates another hippocampal unit (corresponding to a different hippocampal engram) and transiently reinstates the memory trace in the cortex (pattern completion, with the activation of S2 and A2; **Figure 3C**). However, the memory retrieval induced by V2 is not emotionally loaded (there is no amygdala activation, **Figure 2A**) and is lost after some trials (**Figure 3D**).

3.2. Differences Between PTSD, Pavlovian Fear, and Emotional Memory

It has been hypothesized that reduced recruitment of vmPFC is a risk factor for developing PTSD while its higher activation might protect from it (refer to Section 1; Milad et al., 2009; Rougemont-Bücking et al., 2011). We, thus, investigated whether

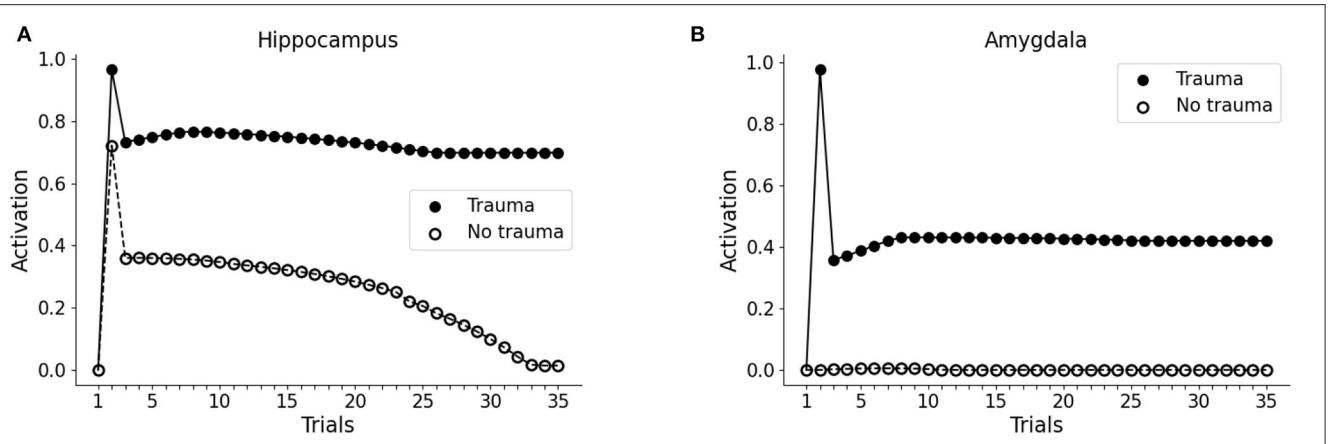

FIGURE 2 | Effect of trauma establishment in hippocampus and amygdala, compared to the control. In the first trial, the baseline activity of the hippocampus **(A)** and amygdala **(B)** were measured during the stimulation of the V1 or the V2 sensory units. In trial 2, pattern 1 (A1-S1-V1) was coactivated with the trauma unit; as a control, pattern 2 (A2-S2-V2) was activated with the trauma unit turned off. During trial 3 and succeeding trials, V1 and V2 were repeatedly activated to investigate the dynamics of the hippocampus and amygdala response. After memory establishment in trial 2, V2 stimulation induces the activation of the hippocampus (**A**, white dots, trials 3–30), but not of the amygdala (**B**, white dots, trials 3-35). On the other hand, the trauma-associated stimulus V1 induces both hippocampus (**A**, black dots, trials 3–35) and amygdala (**B**, black dots, trials 3–35). Over time, the non-traumatic memory trace is lost (**A**, white dots, trial 35), while traumatic associated stimulus V1 is persistently capable to activate the hippocampus (**A**, black dots, trial 35) and amygdala (**B**, black dots, trial 35).

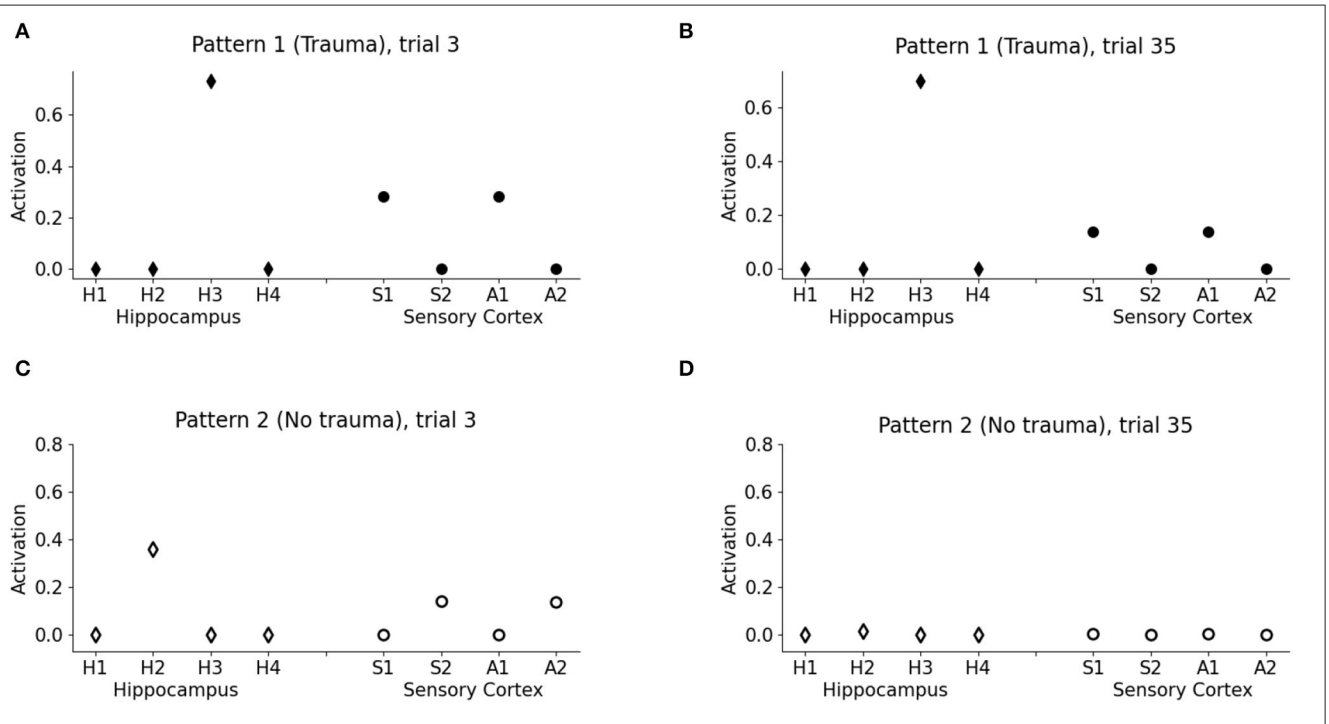

FIGURE 3 | Model memory formation in PTSD and control conditions. **(A)** The graph corresponds to trial 3 of **Figure 2** in the condition with the trauma. V1 activates the hippocampal unit H3 and the cortical units S1 and A1 encoding the other elements of pattern 1. **(B)** The graph corresponds to trial 35 of **Figure 2** in the trauma condition. The memory trace continues to be activated by V1 even after many trials. **(C)** The graph corresponds to trial 3 of **Figure 2** in the control condition with no trauma. V2 activates H2, a different unit of the hippocampus with respect to V1, and also the other cortical elements of the pattern, S2 and A2, although to a lesser extent with respect to PTSD [note the different scales in **(A,C)**]. **(D)** The graph corresponds to trial 35 of **Figure 2** in the control condition. After 35 trials, the memory trace is lost and V1 does not elicit activations (the memory has been transferred to the cortex).

an increase in the excitability of vmPFC would protect the model from developing a persistent activation of the amygdala after the exposure to a traumatic event. We observed that, with a more excitable vmPFC induced by halving its activation threshold (refer to Sections 2, 2.4, for details), the V1 cue still induces amygdala unit activation (trial 3). However, similar to a fear

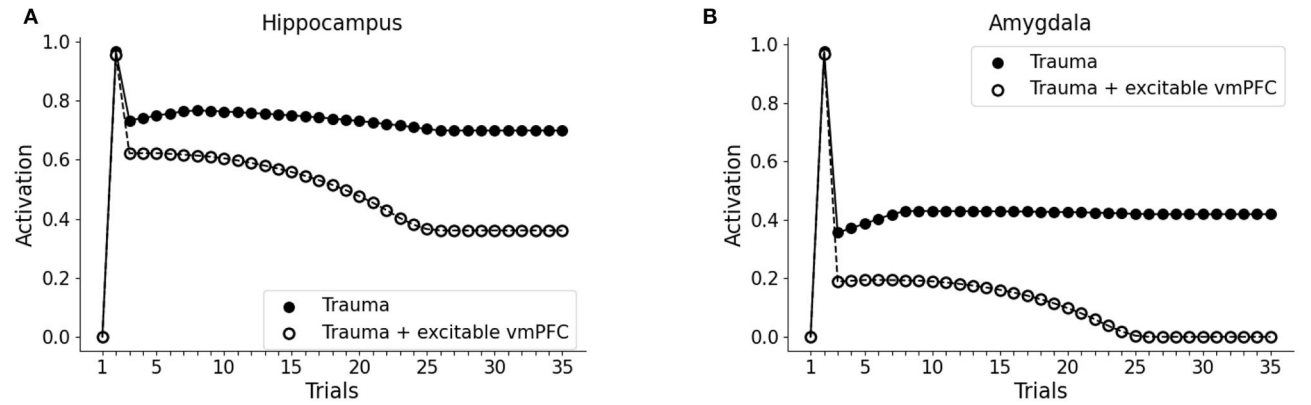

FIGURE 4 | Effect of the high excitability of vmPFC on the triggering of post-traumatic stress disorder (PTSD). Hippocampus **(A)** and amygdala **(B)** activity before (trial 1: V1 input), during (trial 2: V1-A1-S1-Trauma input) and after (trial 3–35: V1 input) trauma, in a model where the vmPFC firing threshold is halved (white dots) compared to the model shown in **Figure 2** acquiring the PTSD (black dots).

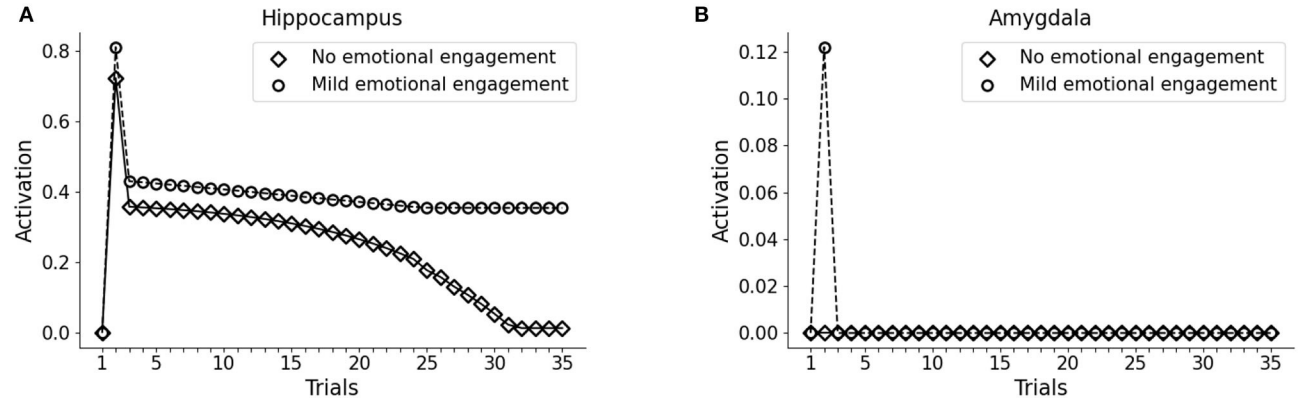

FIGURE 5 | Effect a mild emotional engagement on memory retention. Hippocampus **(A)** and amygdala **(B)** activity with an activation protocol as in **Figure 2**, except that the vmPFC firing threshold is halved (model robust with respect to PTSD) and that during the second trial the emotional (Trauma) unit is weakly activated (1/10 of activation) to represent a mild (non-traumatic) emotional engagement of the amygdala.

extinction protocol (Mattera et al., 2020), after some trials of exposure to V1 the amygdala unit ceases to activate while the hippocampus remains active even at trial 35 (**Figures 4A,B**). Thus, the model where the vmPFC is less excitable is predisposed to develop PTSD after a traumatic experience while the model where the vmPFC is more easily recruited is resilient to PTSD and shows a spontaneous fear extinction with exposure to stimuli associated with the trauma.

As observed in **Figures 2A**, **3D** (Section 3.1), the model does not establish a long term memory of the elements of the pattern if the emotional (Trauma) unit is not activated. In humans and mice, the longevity of memory traces depends on the emotional charge associated with experiences to be encoded (Hamann et al., 1999; Akirav and Richter-Levin, 2002; Kilpatrick and Cahill, 2003; Huff and Rudy, 2004; Phelps et al., 2004; Huff et al., 2006; Roozendaal et al., 2009; Murty et al., 2011; Hansen, 2017). We, thus, reasoned that in the model a weak amygdala activation during the experience of a sensory pattern (V1-A1-S1) would induce a subsequent enhancement of memory retention. This might correspond to a mild emotional engagement accompanying an experience. To test this, during trial 2 of the protocol we exposed the version of the model seen above, non-predisposed to develop PTSD (high vmPFC excitability), to the pattern V1-A1-S1, together with an activation of 0.1 (instead of 1) of the emotional (Trauma) unit. In this condition, we observed that the hippocampal unit activation persisted throughout all the subsequent trials of V1 presentation, while a pattern that was not associated with the mild amygdala unit activity progressively faded away (**Figures 5A,B**).

3.3. The PE Therapy

Next, we investigated whether the PTSD model is capable of trauma symptoms remission through different trials of hippocampal reactivation (mimicking imaginal exposure) coupled with vmPFC activation (mimicking safety signals from the therapy setting). As shown in **Figures 6A,B**, after the first 10

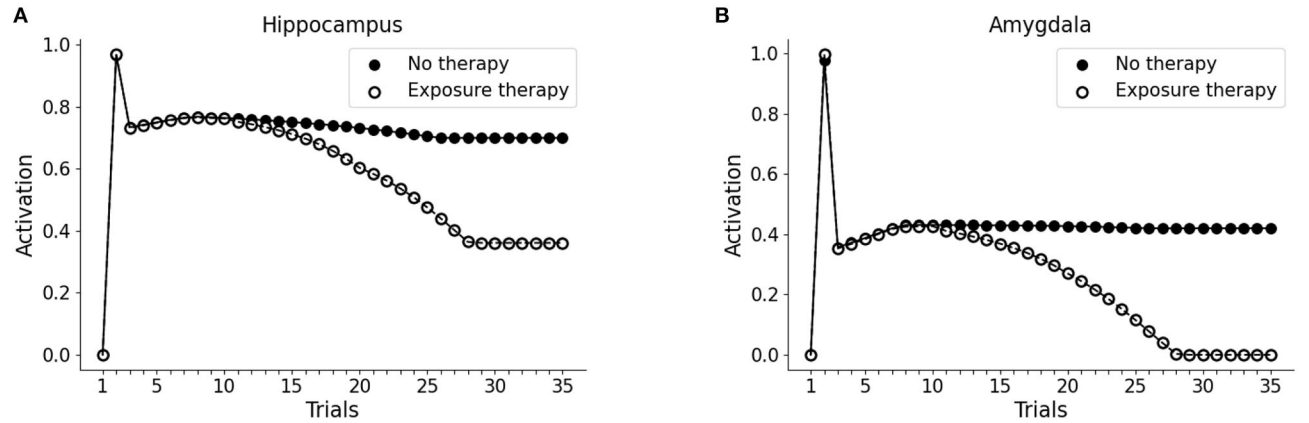

FIGURE 6 | Effect of PE on hippocampus **(A)** and amygdala **(B)**. The first 10 trials were as in **Figure 1**: trial 1 was the baseline V1 activation of hippocampus and amygdala; trial 2 marked the trauma experience (A1-S1-V1-Trauma); trials 3–10 involved the re-experience of V1 to observe the effect of the trauma. After trial 10, however, we administered PE for 20 sessions (20 trials in the model). PE consisted in the activation of the hippocampal memory trace (unit H3 from the **Figures 3A** and **B**), coupled with the activation of vmPFC. Each time point in trials 11–30 corresponds to a V1-activation test after a PE session (trial). After the 20 trials of therapy, hippocampal activation is reduced to a plateau **(A)** and amygdala activation becomes zero **(B)**: the memory has been freed from the negative emotional load.

trials (baseline: trial 1; trauma: trial 2; after-trauma: trials 3–10), we delivered PE therapy for 20 trials (trials 11–30). For each trial of therapy (not shown in figures), we did a subsequent test trial of V1 exposure, to observe the effect of PE on hippocampus and amygdala activation (dots in the figure). PE progressively reduces V1-induced recruitment of the hippocampus (**Figure 6A**) and amygdala (**Figure 6B**).

3.4. Differences Between the PE and the EMDR Therapies

Finally, we investigated whether the fast symptom improvement that follows EMDR could be explained by an increase in the cortical learning rate, induced by slow waves, or by a more powerful amygdala inhibition from dlPFC, compared to vmPFC. For this purpose, we modulated the cortical learning rate ψ and the weight ϕ of the inhibitory connection from the PFC to the amygdala to find the best fit of the data from Nijdam et al. (2012). The results of this test show that the set of ϕ and ψ parameters that provide the most accurate fitting of the PE data and EMDR data are well-segregated from other values producing a worse fitting (**Figures 7A,B**, **8A,B**).

In particular, the best combination for PE ($\psi = 1.5$, $\phi = 1$; MSE = 0.039; **Figure 8A**) and the best combination for EMDR ($\psi = 5$, $\phi = 1.3$; MSE = 0.075; **Figure 8B**) imply that the cortical learning rate is more than tripled during EMDR with respect to PE, and dlPFC has a 30% higher capacity to inhibit amygdala compared to vmPFC in PE. This results in a faster amygdala deactivation (**Figure 8C**) and a higher PFC recruitment (**Figure 8D**) over the course of the therapy sessions.

To investigate the mechanisms of trauma establishment and extinction in PE and EMDR, we analyzed the modifications of the connection weights after trauma and PE or EMDR therapy (**Figures 8A,B**). After trauma, the connection from the hippocampus to the amygdala is potentiated (**Figure 8B**), while the sensory connections to the vmPFC and dlPFC are almost unchanged (**Figure 8A**). Both therapies cause LTP onto the sensory-prefrontal connections (**Figure 8A**) and LTD onto the hippocampus-amygdala connections (**Figure 8B**). However, compared to PE, EMDR induces a stronger cortical connection strengthening, and this results in a higher PFC activation (**Figure 9A**) and a faster amygdala inhibition (**Figure 9B**).

4. DISCUSSION

4.1. Contribution of the Model to PTSD Understanding

This study has presented a model capable of recapitulating a core symptom of PTSD, namely the emotional flashbacks enacted by a trauma-reminding cue and the consequent amygdala hyperactivation. An initial neutral cue can be associated with other neutral cues through the sensory-cortex-to-hippocampus and hippocampus-to-sensory-cortex plastic connections. Then, the representation of one of the cues can reactivate the other cortices through the hippocampal hub (**Figures 2A**, **3C**), similarly to the associative cortex-hippocampus network in Alvarez and Squire (1994).

Following previous theoretical predictions (Tryon, 1998; Radell et al., 2017), we showed in **Figures 3A,B** how a bidirectional associative neural network can indeed be used to model the traumatic flashback in PTSD. Indeed, after a pattern of cues has been temporally coupled with the amygdala activation, a reminding cue reinstates not only different associated elements encoded in other cortices, but also activates the amygdala (**Figure 2B**). This is in line with data reporting amygdala activation in patients with PTSD exposed to trauma-related stimuli (Liberzon et al., 1999; Pissiota et al., 2002; Shin et al., 2004; Protopopescu et al., 2005).

On the other hand, a pattern of stimuli non-associated with the emotional activation of the amygdala is not retained for long in the hippocampus (**Figures 2A**, **3C,D**). This is coherent

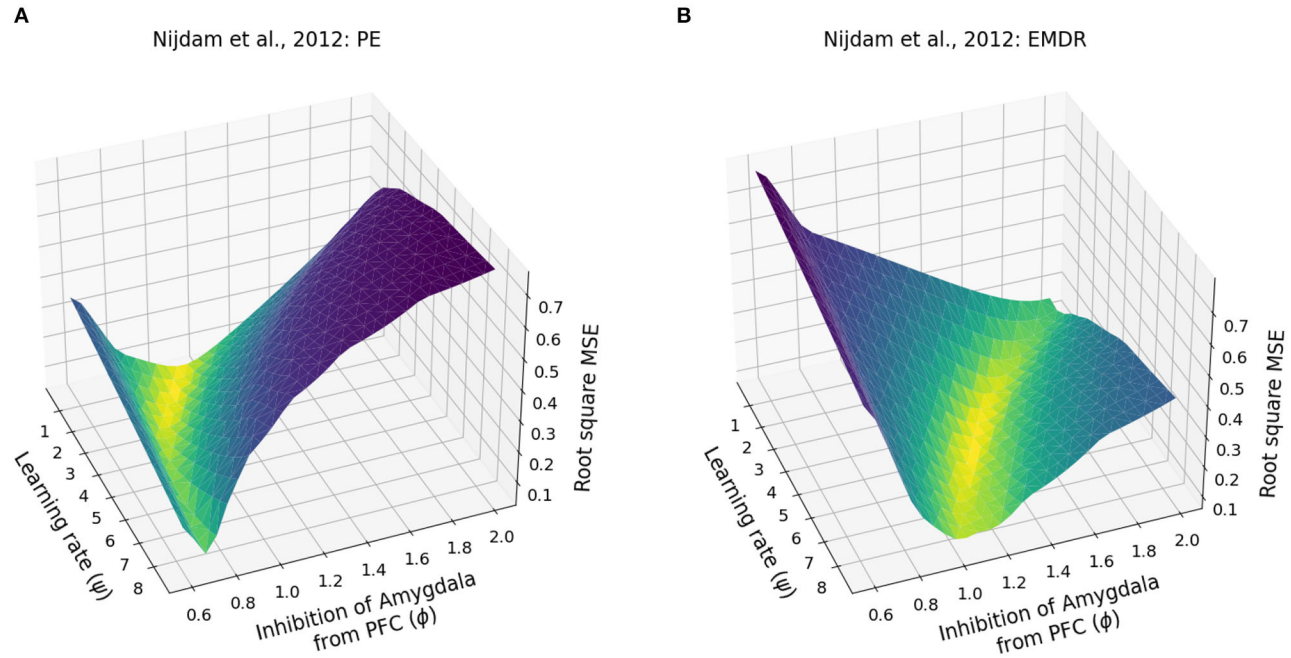

FIGURE 7 | Patients data fitting. **(A)** Root square MSE for the fitting of the PE data from Nijdam et al. (2012). **(B)** Root square MSE for the fitting of the EMDR data from Nijdam et al. (2012).

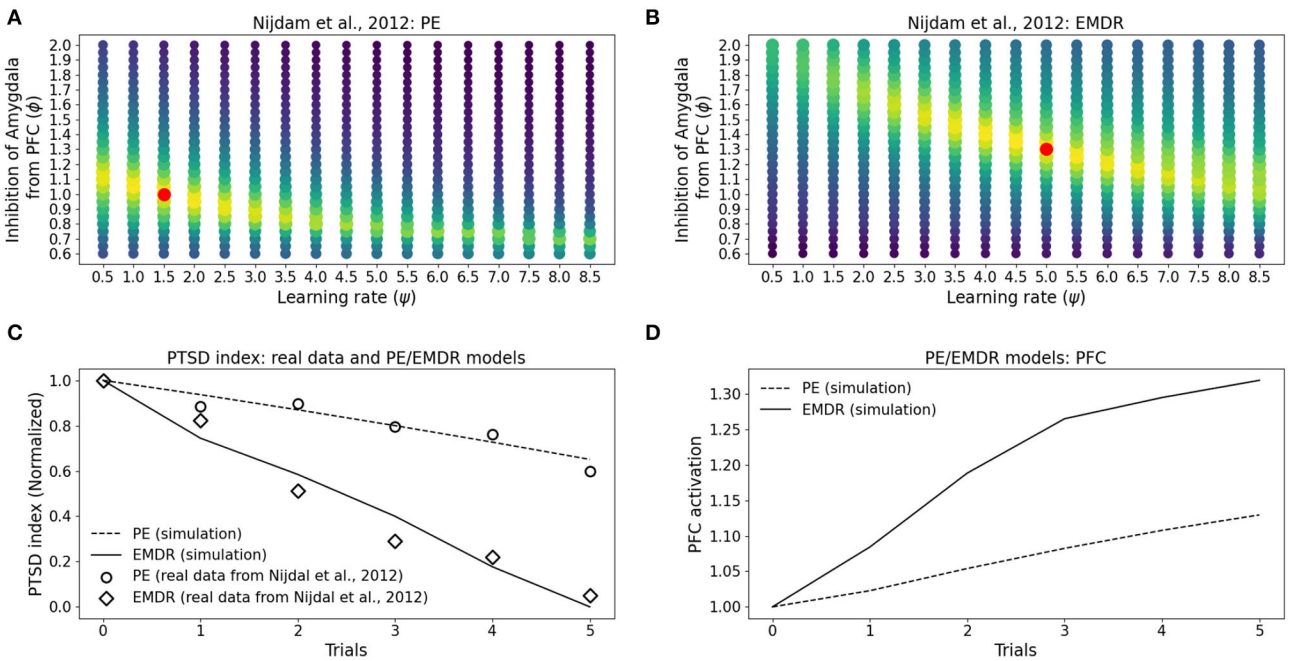

FIGURE 8 | Eye movement desensitization and reprocessing therapy is compared to PE therapy. Each dot in **(A,B)** represents a simulation to fit the data of PE **(A)** and EMDR **(B)** in Nijdam et al. (2012). The size and the color (from blue to yellow) of the dots are proportional to the root square MSE: the best fitting model is marked by a red dot. **(C)** Comparison between the symptoms remission curves obtained with the model, using the parameter combinations indicated by the red dots in graphs **(A)** PE and **(B)** EMDR, and the actual experimental data from Nijdam et al. (2012). For the real data, the PTSD index is represented by the normalized IES-R score (Nijdam et al., 2012; refer to Section 3.4); in the model, the PTSD index represents the normalized amygdala unit activation following the presentation of the reminder cue. **(D)** PFC activation in correspondence to the simulation trials in **(C)**.

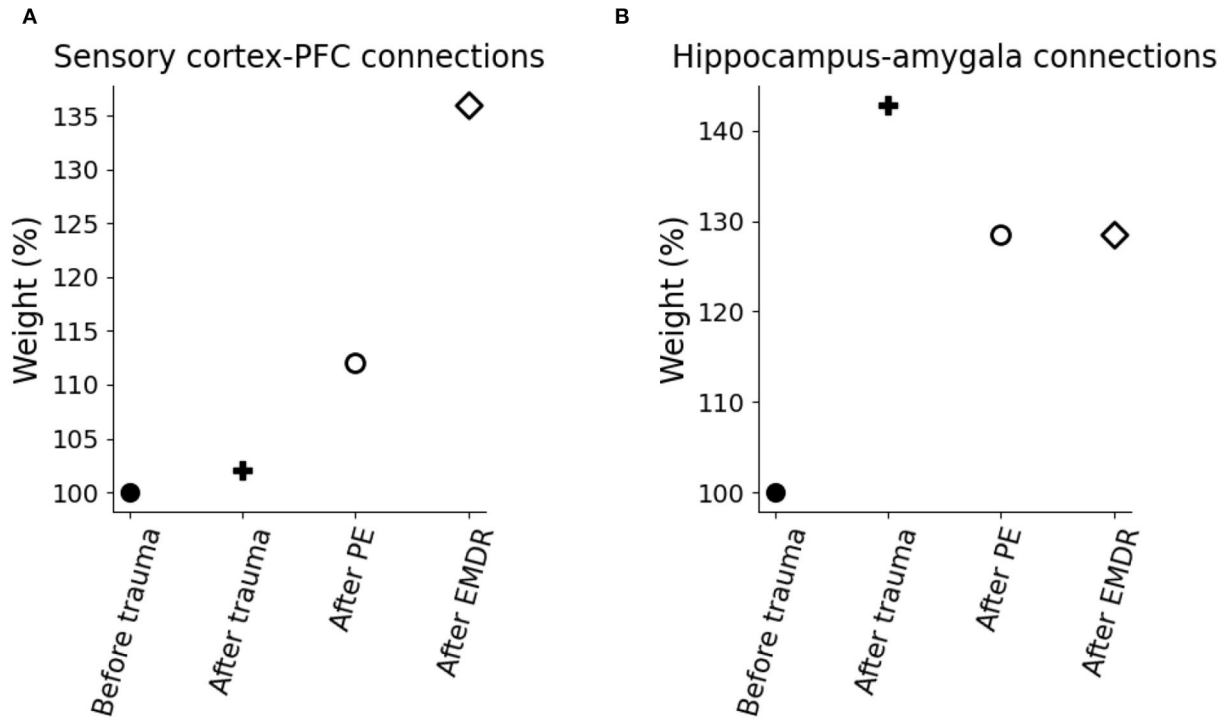

FIGURE 9 | Model weight modification due to trauma and therapy. **(A)** Connection weights linking the sensory cortices to the PFC. **(B)** Connection weights linking the hippocampus to the amygdala.

with the well-known role of the amygdala in the modulation of synaptic plasticity and memory formation in the hippocampus, both in rodents and in humans (Hamann et al., 1999; Akirav and Richter-Levin, 2002; Kilpatrick and Cahill, 2003; Huff and Rudy, 2004; Phelps et al., 2004; Huff et al., 2006; Roozendaal et al., 2009; Murty et al., 2011). Interestingly, it has been shown that, besides fear neurons, the murine amygdala contains reward neurons activated by positive experiences (Kim et al., 2016; Zhang and Li, 2018; Lutas et al., 2019). These neurons send projections to the hippocampus and potentiate spatial memory consolidation (Yang et al., 2016; Yang and Wang, 2017). Together, these observations contribute to the idea that the amygdala, as well as other brain areas associated with a positive or negative emotional content (e.g., locus coeruleus; Hansen, 2017) signal salient memories to be retained in the hippocampus, as also shown in our simulations (**Figures 5A,B**). The mechanism of amygdala-induced memory consolidation described above, however, can become maladaptive and lead to PTSD. In our model, the ability of PFC to recruit the amygdala inhibiting areas determines if a traumatic memory will be spontaneously extinguished by the exposure to a trauma-reminding cue or not (**Figures 4A,B**). In particular, when PFC is not sufficiently intrinsically excitable for a spontaneous trauma remission, the exposure must be paired with an external activation of the PFC, represented in our model by a "safety" input (**Figure 1**) and in real patients by the therapeutic setting. Indeed, feeling safe during the imaginal reliving of traumatic memories is an important component of the therapy, and it has been suggested that patients gradually learn to incorporate safety information into the traumatic memories (Rothbaum and Schwartz, 2002). Coherently with this view, over the course of the PE sessions, our model learns to autonomously recruit the PFC when the trauma-reminding cue is presented (refer to PE simulation in **Figure 8D**). This relies on an increase in the strength of the connections between the sensory areas and the PFC (**Figure 9A**).

While a high percentage of the population is exposed to traumatic events, PTSD only occurs in a subgroup (Alisic et al., 2014; Musazzi et al., 2018) of people for which the symptoms can last even 40 years (Orr et al., 1993). Three main hypotheses, each supported by some experimental findings, have been proposed to explain the susceptibility to the trauma and its long term persistence (Careaga et al., 2016). One hypothesis suggests that some individuals are predisposed to PTSD because of a higher conditionability, meaning that the association between the conditioned stimulus and the unconditioned stimulus is acquired more strongly than in the healthy population (Orr et al., 2000; Blechert et al., 2007; but refer to Milad et al., 2008). A second hypothesis proposes that, in patients with PTSD, the distressing conditioned responses acquire themselves the role of unconditioned stimuli, resulting in a self-strengthening cycle. This predicts a fear incubation effect (Eysenck, 1982), where the conditioned fear responses would become greater over time with the repeated presentation of the trauma-reminding cues, instead of being extinguished (Sandin and Chorot, 2002; but see Nicholaichuk et al., 1982). A third hypothesis postulates a defective extinction (Davis et al., 2000), supported by the

fact that patients with PTSD, compared to healthy controls, show deficits in extinction learning and recall in Pavlovian fear paradigms (Blechert et al., 2007; Milad et al., 2008).

In our model, the PFC excitability determines the susceptibility to the trauma. We did not find any difference in the conditionability when the models with hypo- and hyper-excitable PFC were confronted (**Figures 4A,B**), thus supporting the experimental findings of Milad et al. (2008) rather than those of Orr et al. (2000). Instead, the model shows that reduced PFC recruitment results in defective extinction (**Figures 4A,B**). Coherently with these results, it has been observed that extinction retention in a protocol of Pavlovian fear and the vmPFC activation are correlated and that patients with PTSD are defective in both (Milad et al., 2009).

Finally, we found a fear incubation effect in the model (refer to trials 3–8 in **Figure 2B**), where the presentation of the trauma-related cue V1, without the trauma unit activation, induces further conditioning. This occurs because, in the model, the association between the memory trace and the trauma resides in the strength of the connection between the hippocampus and the amygdala (**Figure 9B**), as suggested by research in murine (contextual fear conditioning; Kim and Cho, 2020) and humans (correlation between hippocampus-amygdala functional connectivity and IES-R scores; Li et al., 2017). In the absence of sufficient inhibition from the PFC, as in the simulation of **Figure 2**, the loop between the hippocampus and amygdala (**Figure 1**) enacts the self-strengthening cycle between the conditioned stimulus and the conditioned response hypothesized by the fear incubation paradigm (Eysenck, 1982).

4.2. Contribution of the Model to EMDR Understanding

Despite initial skepticism, due to the discussion about underlying neurobiological mechanisms (Lohr et al., 1998; Herbert et al., 2000), several meta-analyses and international guidelines show that EMDR is an effective treatment for PTSD (INSERM Collective Expertise Centre, 2004; Ursano et al., 2004; Bisson et al., 2007, 2019; World Health Organization, 2013; de Roos et al., 2017; Khan et al., 2018; Lewey et al., 2018; Navarro et al., 2018; Wilson et al., 2018; Karatzias et al., 2019; Bastien et al., 2020; Mavranezouli et al., 2020). Our model allowed us to analyze patients' data in search of the most suitable parameter set that explains the experimental findings. Coherently with the positive correlation found between IES-R measurement of PTSD symptoms and amygdala activation (McLaughlin et al., 2014), we could reproduce the IES-R curves from Nijdam et al. (2012) using the activity of the amygdala as a proxy. The parameters found by the grid search analysis suggest that PE and EMDR make use of different mechanisms to exert their therapeutic effect (**Figures 7**, **8**). While cognitive and exposure therapies are centered on the activities focusing on the traumatic memories, during an EMDR session, the patient is invited to notice the trauma with a distant attitude ("Imagine you are on the train and the scenery is passing by. Just notice the scenery without trying to grab hold of it or make it significant."; from Shapiro, 1995). It is known that distancing and distraction activate the prefrontal, cingulate, and parietal cortices (among which are the dlPFC) and are very effective in emotion regulation, in particular in amygdala downregulation (McRae et al., 2010; Kanske et al., 2011; Dörfel et al., 2014). Moreover, de Voogd et al. (2018) observed that the dlPFC is activated following bilateral eye stimulation. The parameter ϕ of the model, which in EMDR resulted to be 30% higher than in PE (**Figures 8A,B**), indicates that: (1) the regions recruited by EMDR are different from the regions recruited by PE; (2) EMDR-recruited regions have a higher capacity to inhibit amygdala compared to the regions activated during PE. The parameter ψ, which is 3.3 times higher in EMDR than PE (**Figures 8A,B**), indicates an enhanced cortical learning rate during the bilateral stimulation, as suggested by the slow waves recorded during the therapy in patients (Harper et al., 2009; Pagani et al., 2011, 2012). The physiological alternation during sleep between slow waves and rapid eye movement periods promotes memorization and facilitates the elaboration and contextualization of traumatic memories (Carletto et al., 2017). The evidence that EMDR therapy induces the appearance of slow waves concurrently with bilateral stimulation speaks in favor of faster synaptic and neuronal plasticity and hence faster processing of traumatic memories as compared to other psychotherapies (Pagani et al., 2012, 2017).

4.3. Limitations

The model reproduces simplified connectomics between sensory cortical areas and the PFC, where direct connections reach the vmPFC and dlPFC from unimodal sensory areas. Indeed, secondary sensory cortices have a role in storing and retrieval of fear memory content (Sacco and Sacchetti, 2010) and PFC receives direct inputs from the whole cortex in murine, primates, and humans (Öngür and Price, 2000; Ährlund-Richter et al., 2019). However, relevant evidence suggests the presence, for fear-related input, of at least a relay station (the anterior cingulate cortex) between secondary cortices and PFC (van Heukelum et al., 2020; Kredlow et al., 2022). Another area not considered in the model, that has been suggested to be involved in PTSD (Yoshii, 2021) and, at least in murine, is the effect of alternating bilateral sensory stimulation (Baek et al., 2019), is the thalamus. The level of detail and the number of brain regions included in the model are a trade-off between biological plausibility and computational complexity, in order to test a large scale hypothesis of the PTSD network and the PE and EMDR mechanisms while maintaining the number of parameters reasonably low (Eliasmith and Trujillo, 2014). This allowed us to avoid a large number of model degrees of freedom as well as to perform a grid search with hundreds of simulations. Future study could include more brain areas in this model in order to investigate their potential role in trauma and therapy.

Two limitations concern the data fitting. First, we did not fit data from the single patients, but only from the average curve reported in the literature (Nijdam et al., 2012). This provided a proof of concept of the putative PE and EMDR mechanisms, but a more robust analysis will be performed in the future on the single patients if the data will be obtainable. This would test the robustness of the conclusions drawn from the present study on a dataset containing individual participant data. Moreover, it would allow the use of the model as a tool to investigate

the individual differences in trauma remission, response to the therapy, and PTSD susceptibility factors. Second, we used the amygdala activation as a proxy of patient symptoms, measured in the original work with the IES-R. Although several experiments have found a linear correlation between the symptoms severity and the amygdala recruitment (refer to Section 1; in particular, for the IES-R refer to McLaughlin et al., 2014), the best solution would be to use the amygdala activation in the model to fit fMRI data from patients. This would require fMRI measurements of the amygdala activation during the exposition to trauma reminders, taken between different therapeutic sessions of EMDR or PE. To our knowledge, these datasets are currently not available in the literature. Despite the technical limitations of the procedure, this would furnish a novel and powerful link between the time course of amygdala deactivation, the time course of symptoms remission during therapy, and the computational modeling of the underlying mechanisms.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

AM, MP, and GB conceived the model and wrote this article. AM and AC conducted the simulation. AM, AC, GG, MP, and GB analyzed the results. All authors reviewed the article and approved the submitted version.

FUNDING

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 713010 (GOAL-Robots—Goal-based Open-ended Autonomous Learning Robots) and a dedicated Grant from EMDR Italy Association.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.944838/full#supplementary-material

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 08 August 2022
DOI 10.3389/fpsyg.2022.964407

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 08 June 2022
ACCEPTED 11 July 2022
PUBLISHED 08 August 2022

CITATION
Faretta E, Garau MI, Gallina E, Pagani M and Fernandez I (2022) Supporting healthcare workers in times of COVID-19 with eye movement desensitization and reprocessing online: A pilot study. *Front. Psychol.* 13:964407. doi: 10.3389/fpsyg.2022.964407

Supporting healthcare workers in times of COVID-19 with eye movement desensitization and reprocessing online: A pilot study

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We report the results of a pilot study regarding the adaptation of the group eye movement desensitization and reprocessing (EMDR) protocol for the treatment online, for the management of trauma associated with the COVID-19 Pandemic in Italy. The target group were healthcare workers in a nursing home (Residenza sanitaria assistita, RSA) who decided to live and stay on site during the most acute phase of the Pandemic in order to protect the residents of the home. Scores for perceived post traumatic stress disorder (PTSD) symptoms and quality of emotional experience improved significantly following participation in the therapy programme. These preliminary results confirm the innovative potential of the EMDR protocol when used online on early intervention, to prevent the development of later psychological disturbances.

KEYWORDS

healthcare workers, EMDR, PTSD, COVID-19, online

Introduction

The COVID-19 Pandemic undoubtedly qualifies as a mass disaster, with significant negative effects on the social, cognitive and emotional functioning of everyone involved. One group that has been at the frontline throughout are health workers, who have had to deal with the emergency in hospitals and emergency services, in prevention and epidemiology services and in nursing homes (Residenza sanitaria assistita, RSA). These workers have been in a constant state of high physical and psychological alert (Johnson et al., 2020): emergencies produce a state of activation that enables rapid rescue attempts. Unsurprisingly, then, therapy experiences with this category of workers have evidenced emotional reactions that include fear, anxiety, and anger, aggravated and complicated by objective, subjective and organizational risk factors. While this is true in general of health field workers, it is a particularly acute problem for health workers operating in nursing homes (RSA). The residents are elderly, weak or vulnerable and need help and support with physical, emotional, relational, and medical/health needs,

and it was in these structures that the sudden explosion of the epidemic was most overwhelming. The elderly were the population most affected by the pandemic as well as healthcare workers. Along with hospitals, nursing homes were identified by the health authorities as the main locus of spread of the COVID-19 Pandemic, making them the epicenter of this silent slaughter. As soon as the pandemic hit, nursing home workers were exposed to continuous cumulative traumatic experiences that resulted in repeated activation of extreme stress reactions. Each new activation further sensitized this population, increasing their risk of developing post traumatic stress disorder (PTSD) and other comorbid disturbances.

Of the therapeutic options available for the treatment of PTSD, eye movement desensitization and reprocessing (EMDR) is one of those that has been demonstrated to be highly effective (Greenberg et al., 2015). It is based on the adaptive information processing (AIP) model, according to which many psychological disorders are the manifestation of unresolved traumatic or stressful memories (Shapiro, 1995, 2001). One of the most important aspects of this therapy is the identification of the life events that have been particularly traumatic for the person (Poon, 2012).

The current emergency leads to the use of a group EMDR protocol, as has already been done in many countries worldwide following mass disasters. Group EMDR has been used both on adults and on children and has been adapted in many cases to suit specific contexts and circumstances (Wilson et al., 2000; Korkmazlar-Oral and Pamuk, 2002; Fernandez, 2007; Gelbach and Davis, 2007; Zaghrout-Hodali et al., 2008). The group protocol (EMDR-IGTP) combines standard 8-phase EMDR therapy with a group therapy model (Jarero et al., 1999; Artigas et al., 2000) and uses of a form of bilateral stimulation called the Butterfly Hug (Artigas and Jarero, 2014; Jarero, 2020) along with drawing tasks (Maxfield, 2008). Given the benefits of group therapy and the proven effectiveness of EMDR Integrative Group Treatment Protocol (EMDR-IGTP), we tested an online adaptation of the group EMDR protocol intended to respond to the needs generated by the current emergency, as also reported in recent literature (Luber, 2020; Pérez et al., 2020; Tarquinio et al., 2020; Fisher, 2021).

The study was conducted in a nursing home for the elderly where the healthcare staff had decided to live inside the facility in order to protect the residents from infection of COVID-19. Not only were the healthcare staff exposed to the risk of infection and to exhausting shifts, hard physical work and a reduction in personnel resulting in an emotional overload, but they had to bear these burdens without the support and presence of their families. Other complexities arose due to the measures necessary to prevent the spread of the virus, which lead to changes in the nursing home routines and restricted contact between residents and their families and between healthcare workers and their families.

The goals were to further test the feasibility of online group EMDR treatment and to qualitatively and quantitively assess its effects on the emotional and psychological health of participants. The expected outcomes, in line with these goals, pertained to two main areas: prevention of the chronicization of psychological disturbances; and strengthening of protective psychological resources.

Materials and methods

Research context

Participants were healthcare workers employed at a nursing home in Capoterra (CA). They had chosen to isolate themselves within the facility for 30 days in April, 2020 in order to avoid outside contact and the potential consequent infection of residents with COVID-19: it was well-established by then that therapeutic communities were among the hardest hit by the COVID-19 emergency. The owning company provided live-in accommodation to staff and the manager of the facility contacted the Italian EMDR association to request an intervention to support the operative team over this period.

The intervention was implemented online, and two groups were held by trained EMDR therapists whose job was both to evaluate stress levels and to help reprocess the disturbing experiences and promote self-protective resources.

Participants

There were 11 participants: 7 women and 4 men with an average age of 46, divided into two groups therapy of 6 and 5 participants, respectively. All of them had chosen to isolate within the nursing home for the 30-day period from April 1 to April 30, 2020.

Procedure

Two programmes of group therapy were carried out. Each consisted of five meetings: an initial pre-test and psychoeducational meeting, followed by three EMDR group therapy meetings, and a final post-test and debriefing meeting.

The interventions were conducted by therapists trained in EMDR, at a Consultant level (certified by EMDR Europe Association). All the meetings were carried out on a virtual conference platform to preserve social distancing. The aim of the project was to provide support to the care team to help them bear the emotional burden of isolation, to reduce stress and to contain anxiety and anger. This was done by offering a space where they could "describe" their most stressful experience, their negative feelings and process them through EMDR, in order to reduce their risk of developing post-traumatic stress.

The first meeting (meeting 1) in each intervention was dedicated to introducing the participants, presenting the project and conducing an initial pre-test of emotion and post-traumatic stress levels (IES-R scale and emotion thermometer) and a

Critical Incident Stress Orientation (CISO, Maslovaric, 2020). Patients were informed about the confidentiality agreement.

Since the goal of the intervention was to improve participants' psychological wellbeing, initial screening of their symptoms in the acute phase was carried out.

The CISO has the following features:

- It provides a symptom grid showing Normal and Common reactions to post-traumatic stress. This allows participants to identify their own symptoms as common, albeit disturbing. It also provides explanations and descriptions of what is meant by a traumatic event, the psychological reactions that can arise following one, and vulnerability factors (in this case level of absurdity and level of involvement);
- It provides indications for emotional self-protection to support coping strategies and resilience;
- It provides explanations of the EMDR approach, and in particular on the short group protocol (EMDR-IGTP).

Accordingly, the CISO phase of meeting 1 started with normalization of participants' emotional reactions using the symptom grid, followed by introduction of techniques to prevent distress due to acute reactions to stress and to post-traumatic stress disorder. It was then explained that the EMDR support programme was intended to prevent and/or treat symptoms arising from participants' experience of isolation and to allow them to maintain and develop their coping resources. The intervention was expected to be useful to cope not only with the quarantine period inside the nursing home, but also with the separation from their families, with a view to facilitating a smooth reunion and return to normality following the separation period.

Defusing, a standardized method used in rapid treatments and emergencies, was employed to give relevant information on post-traumatic stress reactions and to enhance individual coping resources. The butterfly hug was taught to develop participants' awareness of their own emotional reactions. This technique (Artigas and Jarero, 2014; Jarero, 2020), generally used in the EMDR-IGTP protocol, involves patients using self-administering bilateral stimulation and it is used in stabilization, reinforcement of resources and safe place as well as for processing traumatic episodes.

One of the most recent publications on the Cost-effectiveness of psychological treatments for post-traumatic stress disorder in adults, Mavranezouli et al. (2020), report that EMDR is one of the most effective intervention for adults with PTSD and the most cost-effective, due to the brief duration. That is why EMDR was chosen and supported for this intervention with the healthcare workers in the middle of the COVID-19 Pandemic.

The three following meetings (meetings 2, 3, and 4) focused on the distress and the needs of the team and group EMDR (EMDR-IGTP) treatment protocol was carried out. Participants reported feelings of helplessness, being unable to see their loved ones and at the loss of their normal pre-COVID routines, feelings of absurdity but especially for the residents about missing Easter festivities and contact with their families due to isolation. They also reported a wide variety of traumatic memories. Some of the worst memories treated included seeing their elderly patients struggling to breathe, watching them die without being able to touch them, having to rush continually from room to room, the lack of space in the morgue for dead bodies and others that show the dramatic situation the healthcare workers experienced. In addition, somatic symptoms like difficulty sleeping, anxiety and worry and irritability and restlessness were also reported.

Sessions can range from 1 h to 1 h and 30 min. The participants were guided through a safe/secure place exercise or breathing exercises. The EMDR-IGTP leader asked them to think about the worst part of the event (the current crisis) and then to draw that image on the paper provided. They were then asked for the related Subjective Units of Disturbance (SUD) rating and told to write the corresponding number on their picture. After that they were asked to look at their picture and to provide their own alternating bilateral stimulation with the Butterfly Hug. The participants were then instructed to draw another picture of their own choice related to the event and rate it according to its level of distress. Processing continued with the adults looking at the second picture and using the Butterfly Hug. The process was repeated twice more so that each participant drew four pictures, and provided a SUD rating for each. The final level of distress associated with the current crisis was then assessed by asking to focus on the drawing that was most disturbing and to identify the current SUD level. This number was then written on the back of the paper and was the 5th SUD rating for the session. The participants then drew a final picture that represented their future vision of themselves, along with a word or a phrase that described that picture. No SUD rating was provided for this picture. The drawing and the phrase were then paired with the Butterfly Hug. The clients were instructed to close their eyes, scan their body, and do the Butterfly Hug or grounding techniques for the stabilization.

The last meeting (meeting 5) was conducted using the same procedure as the previous three, but some time was dedicated to post-test administration of the IES-R scale and the emotion thermometer and to allowing participants with EMDR to share their impressions of the experience. The intervention ended with concluding comments and a wrap up.

Measurements

Pre- and post-intervention measurements were carried out in meetings 1 and 5, respectively, to verify results. A follow up measurement was carried out 9 months after the intervention.

The following questionnaires were administered to participants.

1. Impact of Event Scale-Revised (IES-R) in accordance with the criteria of the DSM IV-TR (Weiss and Marmar, 1997) validated and translated into Italian (Pietrantonio et al., 2003). This psychometric test consists of 22 items. It includes three subscales measuring the following dimensions: intrusion, avoidance, and hyperactivation. Participants were asked to rate their level of post-traumatic symptoms using a 5-point Likert scale ranging from 0 (= "not at all") to 4 (= "a lot") referring to the previous 7 days. The total score between 0 and 88. The cut-off of 33 highlights a high risk of PTSD; in line with the literature, there are no specific cut-offs for scale interpretations.
2. The emotion thermometer, a non-standardized instrument, used to measure on a scale of 1–10 participants' subjective experience of six emotions and their consequences: stress, anxiety, depressed mood, anger, difficulty sleeping, and need for help.

Results

Qualitative results

The following is the coordinator's summary of feedbacks given by the healthcare team.

The first topic is the most difficult moment the team had to face, i.e., "*We had to close the gates to visitors. It was the toughest moment for two reasons: the first was because we were gradually but surely realizing how serious the situation was; the second was the feeling that one of the cornerstones of our service, a "safe haven" was being removed: the constant presence of our residents' family members. In our value, family members are an essential element: there have never been limits to visiting times or the duration of visits, and their presence is an important resource, that we are loosing with the Pandemic and that we have to cope without.*"

Regarding the EMDR intervention, the coordinator describes its efficacy as follows: "*EMDR interventions helped immensely to process the critical moments and to connect with each other. It enabled all of us to acknowledge our tiredness, our longing for our families, and the desire to get out of the nursing home. . .without making us feel less important, less efficient or less worthy!! It allowed us all to express our fragilities and transform them into resources! One of our colleagues compared the EMDR meetings to weaving silk: any of the single threads would break under the pressure of the loom and personal dynamics. EMDR brought all the threads together to make one strong, tenacious, resistant one.*"

Descriptive statistics

The graphs in **Figures 1**, **2** show the symptoms scores obtained with the IES-R for each participant at meeting 1 and 5, before and after the EMDR programme. They show that all participants' scores improved after the programme.

Table 1 shows average scores for the IES-R. It can be seen that pre-test scores were high for intrusiveness M = 16,18 (SD = 6,65), avoidance M = 10,18 (SD = 8,96), and hyperarousal M = 11,18 (SD = 6,11). All the average post-test scores are lower: avoidance M = 1,18 (SD = 1,25); intrusiveness M = 1,91 (SD = 1,64); hyperarousal M = 1,09 (SD = 1,04).

The difference between pre-and post-treatment average scores is statistically significant.

With regards to the results obtained with the emotion thermometer, shows that all participants reported a

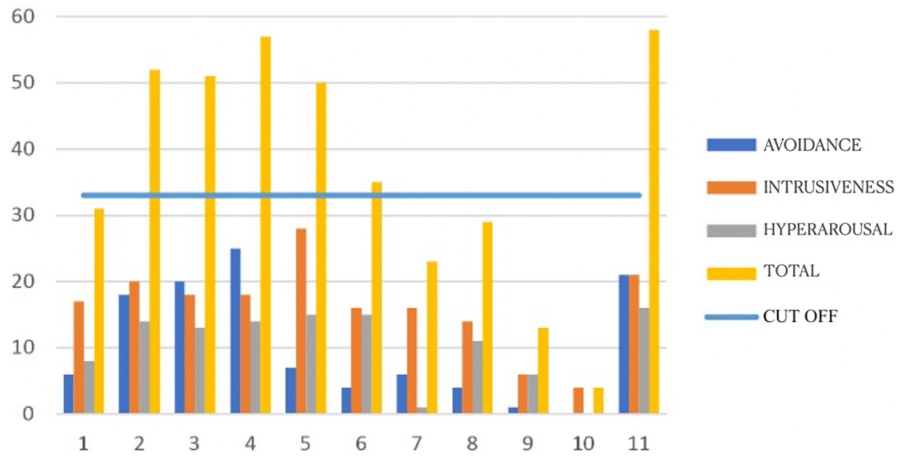

FIGURE 1
Impact of Event Scale-Revised (IES-R) pre-intervention scores for each participant.

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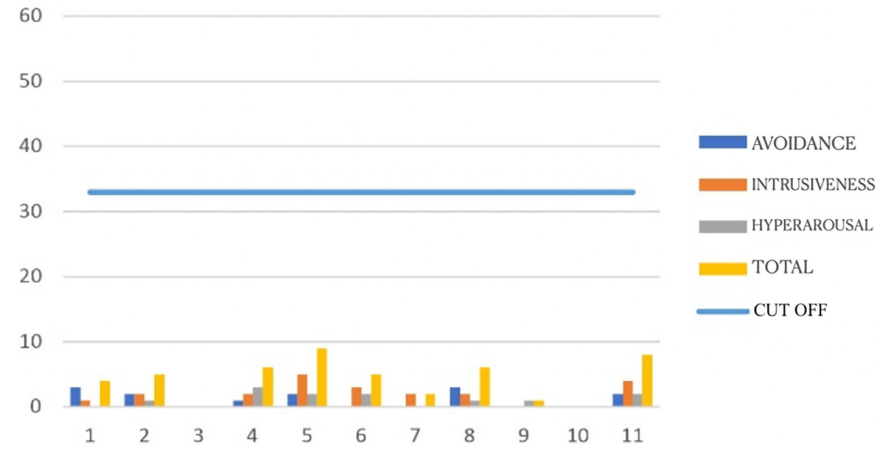

FIGURE 2
Post-intervention Impact of Event Scale-Revised (IES-R) scores for each participant.

substantial improvement in all the dimensions following the EMDR treatment.

Overall, as Table 2 shows, participants scored high on the emotion thermometer subscales measuring psychosomatic disturbances, like stress (M = 7,36; SD = 2,73), anxiety (M = 6,73; SD = 3,52), sleeping problems (M = 7,91; SD = 2,51). The high average need for help score shows that the EMDR intervention would indeed potentially be very helpful.

TABLE 1 Average scores, standard deviations, and significance level Impact of Event Scale-Revised (IES-R) (Weiss and Marmar, 1997).

	Avoidance	Intrusiveness	Hyperarousal	Total
PRE				
Mean	10.18	16.18	11.18	37.55
SD	1.18	1.91	1.09	4.18
POST				
Mean	8.96	6.65	6.11	18.36
SD	1.25	1.64	1.04	3.09
$p<$	0.005*	0.0000*	0.0001*	0.0000*

*Significance $p < 0.05$.

TABLE 2 Emotion thermometer: Average scores, standard deviations, and significance level.

	Stress	Anxiety	Mood	Anger	Sleep	Help
PRE						
Mean	7.36	6.73	4.09	5.36	7.91	7.09
SD	2.73	3.52	3.62	4.30	2.43	2.51
POST						
Mean	3.64	3.64	2.27	2.09	3.91	3.36
SD	3.29	3.61	3.29	2.39	3.48	3.64
$p<$	0.0000*	0.0003*	0.005*	0.001*	0.0000*	0.001*

*Significance $p < 0.05$.

Average scores for the same dimensions were lower following the intervention. The difference between pre- and post-intervention scores is statistically significant.

The IES-R questionnaire was administered to participants again at follow up, 9 months after the end of the intervention. The numbers obtained show a slight increase on all subscales: intrusiveness (M = 7,5; SD = 6,48), avoidance (M = 7,2; SD = 7,33), and hyperarousal (M = 7,1; SD = 7,01). This total increase (M = 21,8; SD = 19,83) may be attributable to the prolonged psychophysical stress caused by the continuing COVID emergency situation, and by the effect of the second wave of COVID-19 arrived in Italy in that time, as it reported in Figure 3.

Discussion

Our results confirm that the isolation, that was a fundamental strategy during the COVID-19 pandemic was a disturbing event that had a strong emotional impact on the nursing home healthcare workers; and that EMDR was effective in contrasting this impact. However, due to the lack of a control group, it is not possible to exclude that any other type of intervention, interrupting the social isolation, would have been effective in reducing the effects of stress-induced PTSD.

Participants' post-intervention IES-R scores were significantly lower on the intrusiveness, avoidance, and arousal subscales. Post-intervention scores on the emotion subscales also showed significant decreases in levels of stress, anxiety, depressed mood, anger, sleep problems, and perceived need for help. Although preliminary, these results are statistically significant and show that the EMDR programme we conducted was effective in reducing the effects of stress-induced PTSD as a result of isolation during the COVID-19 pandemic. The

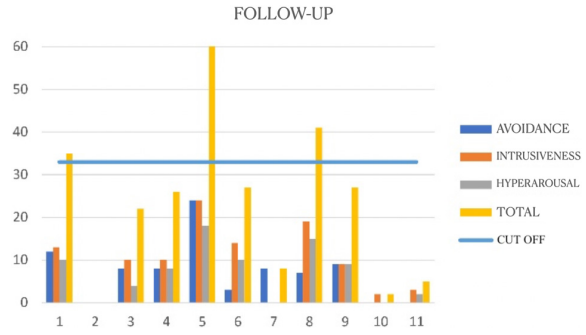

FIGURE 3
Follow-up Impact of Event Scale-Revised (IES-R) (Weiss and Marmar, 1997).

outcome was an improvement in the psychological wellbeing of participants, also confirmed in participant feedback. In addition to reducing the negative emotional charge of the event and the PTSD symptoms, it also improved the general emotional climate within our group.

Our results thus confirm that EMDR treatment can be applied in the short term and/or in emergency situations. The protocols and techniques can be used on their own or integrated into broader programmes with a wide variety of applications in individual or group settings.

Group EMDR seems to be a useful instrument for both prevention and treatment. It is of economic value because it lowers the cost of downstream management of mental health problems (de Bont et al., 2019). Our results are in line with those of other studies in showing that the standard EMDR protocol can be successfully adapted for use online to conduct EMDR therapy online (e.g., Fisher, 2021), including on workers involved in healthcare during the COVID-19 emergency (Pérez et al., 2020; Tarquinio et al., 2020). Still, they cannot be considered conclusive due to the small size of our treatment groups and the lack of a control group. Nevertheless, our aim was to report the outcome of a programme intended to prevent medium- and long-term disturbances, and to provide treatment for acute and chronic symptoms caused by the stress associated with the COVID-19 emergency situation in which the participants were currently immersed. In conclusion, future research involving larger samples and control groups is necessary to properly assess the effectiveness of group psychotherapy conducted online. Additionally, we recorded an increase in PTSD symptoms at the 9 month follow up, considering the different waves and the long duration of the Pandemic, even if not significant, suggesting that support spread over a wider period of time might be more effective in these circumstances.

Nevertheless, online administration of the EMDR protocol opens new possibilities in terms of timely intervention and prevention of long-term psychological disturbances as a result of acute stress.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

EF, MG, EG, IF, and MP contributed to conception and design of the study and wrote first draft of the manuscript. EF and MG organized the database. MP performed the statistical analysis. All authors wrote sections of the manuscript and contributed to manuscript revision, read, and approved the submitted version.

Acknowledgments

We wish to thank nursing home in Capoterra (CA) for their contribution in the acquisition of data. Special thanks to EMDR Italy Association for the enthusiasm and the logistic support. We also thank all the healthcare workers we have met.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 10 August 2022
DOI 10.3389/fpsyg.2022.937204

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 05 May 2022
ACCEPTED 27 June 2022
PUBLISHED 10 August 2022

CITATION
Altmeyer S, Wollersheim L, Kilian-Hütten N, Behnke A, Hofmann A and Tumani V (2022) Effectiveness of treating depression with eye movement desensitization and reprocessing among inpatients–A follow-up study over 12 months. *Front. Psychol.* 13:937204. doi: 10.3389/fpsyg.2022.937204

Effectiveness of treating depression with eye movement desensitization and reprocessing among inpatients–A follow-up study over 12 months

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Increasing prevalence of depression poses a huge challenge to the healthcare systems, and the success rates of current standard therapies are limited. While 30% of treated patients do not experience a full remission after treatment, more than 75% of patients suffer from recurrent depressive episodes. Eye Movement Desensitization and Reprocessing (EMDR) therapy represents an emerging treatment option of depression, and preliminary studies show promising effects with a probably higher remission rate when compared to control-therapies such as cognitive behavioral therapy. In the present study, 49 patients with severe depression were treated with an integrated systemic treatment approach including EMDR therapy that followed a specific protocol with a treatment algorithm for depression in a naturalistic hospital setting. Following their discharge from the hospital, the patients were followed up by a structured telephone interview after 3 and 12 months. 27 of the 49 (55%) patients fulfilled the Beck's depression criteria of a full remission when they were discharged. At the follow-up interview, 12 months after discharge, 7 of the 27 patients (26%) reported a relapse, while the remaining 20 patients (74%) had stayed relapse-free. The findings of our observational study confirm reports of earlier studies in patients with depression, showing that EMDR therapy leads to a high rate of remission, and is associated with a decreased number of relapses. Patients with depression receiving EMDR treatment may be more resilient to stressors.

KEYWORDS

depression, EMDR, EMDR DeprEnd protocol, psychotherapy, follow up

Introduction

Eye Movement Desensitization and Reprocessing (EMDR) therapy was introduced in 1987 by Francine Shapiro as a treatment for post-traumatic stress disorder (PTSD). EMDR therapy has the goal to integrate maladaptive information into a functional memory network by focusing on stressful memory content and simultaneous bilateral stimulation (Shapiro, 2018). EMDR Therapy consists of a structured set of protocols and procedures based on the Adaptive Information Processing (AIP) Model. The AIP model postulates that traumatic experiences are stored in a dysfunctional and frozen state which enhances the possibility of suffering a mental disorder (Shapiro, 2018). A recent study of Baek et al. (2019) could demonstrate the plausible biological main mechanism of EMDR treatment by showing that a fear response learned through classical conditioning is unlearned more quickly if the mouse's gaze or attention is directed back and forth with the aid of a moving LED light. Meanwhile, a large number of scientific studies are available that not only demonstrate the effect of EMDR in PTSD (Chen et al., 2014), but also that EMDR leads to symptom reductions in depressive disorders, anxiety disorders, and other medical conditions (Shapiro, 2018; Wilson et al., 2018).

Depression is one of the most common mental illnesses that pose major challenges to the healthcare system worldwide (suicides, work disability, inpatient treatment, and early retirement). With a lifetime prevalence of up to 20% (Ebmeier et al., 2006; Kessler and Bromet, 2013), depression is considered one of the most common mental disorders, affecting more than 350 million people worldwide (Depression, 2017). Current statistics also show that depression has become more prevalent due to the COVID-19 pandemic (Hawes et al., 2021). Depressive illness has been treated to date with behavioral therapy, psychodynamic psychotherapy and, in severe cases, additional medication (DGPPN, 2015). In severe forms of depression, patients must also be provided with inpatient treatment. However, the major problem is that many patients get readmitted as inpatients due to the high recurrence rate, i.e., after treatment, 30% of treated patients do not achieve a complete remission (cure) and more than 75% of patients suffer from recurrent depressive episodes (Maj et al., 1992; de Jong-Meyer et al., 2007; Fostick et al., 2010). Although psychotherapy and medication can improve remission rates, the success rates of currently available treatments are limited. Even after a successful treatment with full remission of symptoms, 40–50% of patients experience a relapse within the first year after completing treatment (Hollon et al., 1992; Hautzinger et al., 1996; de Jong-Meyer et al., 2007).

Stressful traumatic life events and stressful experiences (e.g., separation, loss, humiliation, embarrassment, serious illness, excessive demands, childhood abuse and maltreatment, neglect and other negative childhood stresses etc.) play a crucial role in the development of depression (Kendler et al., 2003; Teicher et al., 2006; Hase et al., 2018). Besides increasing the risk to develop depression, it also plays a crucial role concerning symptom severity and the course of depression (Karabatsiakis and Schönfeldt-Lecuona, 2020).

Eye Movement Desensitization and Reprocessing is an effective trauma focused approach to treat depression, and in clinical practice, since many years therapists use EMDR therapy to work with stressful and traumatic memories in depressed patients (Hofmann, 2020). Moreover, a recent systematic review and metanalysis by Carletto et al. (2021) and Yan et al. (2021) reported efficacy of EMDR therapy in the treatment of depression in 9 controlled studies. Most of these 9 studies show a higher rate of remission at the end of therapy compared to the control therapies (including cognitive behavioral therapy; Yan et al., 2021). Usually patients with full remissions of their depression have a significantly lower risk to relapse again (Paykel et al., 1995; Nierenberg et al., 2003). So far, no study has investigated long-term stability of EMDR therapy in treating depressive symptoms (Carletto et al., 2021). To advance the existing evidences, in our present study, the aim was to evaluate the efficiency and stability of treatment results with "EMDR therapy," for depressive inpatients in the Gezeiten Haus, Hospital Schloss Eichholz.

Materials and methods

The study aimed to show whether the intervention with EMDR leads to an improvement of symptoms in depressive patients and if the stability of the remission rates in patients treated with EMDR therapy are different from those mentioned in the previously reported literature. The protocol and implementation of the study was carried out according to the ethics committee Ärztekammer Nordrhein. The patients were selected according to their date of admission if they met the inclusion criteria.

Our study consisted of 49 inpatients who were treated in the Gezeiten Haus, hospital Schloss Eichholz (see **Table 1** and **Figure 1**). The Gezeiten Haus hospital, Schloss Eichholz is a private hospital for psychotraumatology, EMDR, psychosomatics and traditional Chinese medicine. The focus of the specialist hospital is on integrative acute treatment of psychological and psychosomatic disorders, especially trauma related disorders and depression. The patients are usually referred to the hospital by psychiatrists and psychotherapists as well as other psychiatric units who recommend the clinic for a specialized intensive EMDR treatment because they don't respond to guideline oriented treatment any more. The EMDR therapy followed the EMDR DeprEnd protocol and the eight-phase approach by Shapiro, 2018). The EMDR DeprEnd protocol is an EMDR treatment algorithm for depression that focuses on stressful or traumatic episode triggers of depressive

episodes, negative belief systems, depressive or suicidal states (Hofmann et al., 2018).

The current study included all patients between 18 and 70 years of age with the diagnoses of depression (ICD 10 F32.XX, F33.XX) potentially with a combination of PTBS (ICD 10 F43.1). Exclusion criteria were acute suicidal tendencies, acute psychoses, manic episodes, severe dissociation, severe self-harm or addiction due to the additional complexity that these disorders add to the treatment time. Most patients (75.5%) were admitted with a prescribed medication. During hospitalization, the main focus is not on medication change, so patients are usually discharged with similar medications. If medications were administered, they had to be stable for 2–4 weeks for the patient to be enrolled in the study.

Study design and procedure

As part of quality assurance, a series of diagnostic tests is routinely administered to all inpatients admitted to the Hospital Gezeiten Haus with written informed consent. This test package is given both at the beginning of the hospital stay and shortly before discharge.

The questionnaires cover the following topics: Symptomatic Distress in various domains [Symptom-Checklist (SCL-90-R)]; depressive symptoms [Beck Depression Inventory (BDI-II)]; Self-esteem [Rosenberg Self-esteem Scale (RSE)]; Dissociative phenomena [Dissociative Experiences Scale (DES)]; Trauma related disorder, intrusion, avoidance and hyperarousal [Impact of Events Scale (IES-R)]; childhood traumatic experiences [Childhood Trauma Questionnaire (CTQ)]; complex PTSD [Screening of complex post-traumatic stress disorder (Sk-PTBS)].

After the diagnostic phase, psychotherapeutic treatment is provided in an overall treatment plan, which includes psycho- and sociotherapeutic as well as psychoeducational and supportive measures in addition to medication. After a potential remission, BDI-II score under 12 (as per the BDI-II recommendation), of depressive symptoms and individual discharge preparations, patients were discharged. In order to examine the further course, especially after leaving the hospital, as follow-up, two telephone interviews were conducted both after 3 and 12 months. In the short telephone interview, experienced psychological staff asked the patients about their further therapeutic treatment after discharge, their current work situation, and whether they have had a relapse in the last 3 or 12 months. At the end of the telephone interviews, the former patients were asked to answer the three questionnaires. If they agreed, they were sent an e-mail with information and link for completion and submission of the questionnaires.

TABLE 1 Sociodemographic characteristics of the study cohort (n = 49).

Gender (f/m)	**32 (65.31%)/17 (34.69%)**
Age (M (SD) (years)	46 (11.1)
Marital status	
In a relationship	9 (18.37%)
Married	24 (48.98%)
Divorced/separated	10 (20.41%)
Single	3 (6.12%)
No information	3 (6.12%)

Statistical analysis

All data were saved and analyzed in anonymized form using IBM SPSS Statistics (version 26.0.0) and R (version 4.1.3). Four-field tables on remission and relapse after therapy provided a descriptive overview of the success of treatment. Further analyses on the success of the treatment were performed using two-tailed paired t-tests for pre-post comparisons of symptom severity measures. Repeated measures ANOVAs with BDI-II and IES-R scores and overall symptom burden as dependent variable, measurement time (pre, post) as independent variable and the CTQ score as a potential covariate, as well as the interaction of time × CTQ score were conducted to determine a possible influence of childhood maltreatment on symptom reduction.

Results

Evaluation of treatment changes

A total of 49 of the patients who met the search criteria were analyzed. The average follow-up time at the end of the inpatient treatment was 13 and a half months (MDN = 11.5 months). Table 2 and Figure 2 display an overview of the distribution of remission and relapse from depressive symptoms in our study cohort. 27 (55.0%) of patients achieved a remission after therapy, 22 (44.9%) did not. If remission was achieved during therapy, 74.07% (20 out of 27) of cases remained stable during follow-up phase; 25.93% (7 out of 27) relapsed. If no remission was achieved during therapy, 59.09% (13 out of 22) relapsed and 40.91% (9 out of 22) achieved a remission during follow-up phase.

TABLE 2 Therapy-related characteristics of the study cohort (n = 49).

Number of EMDR sessions M (SD)	**12.88 (6.02)**
Remission (yes/no)	27 (55, 1%)/22 (44, 9%)
Relapse (yes/no)	20 (40, 82%)/29 (59, 18%)
Working (yes/no)	30 (63, 83%)/17 (36, 17%)

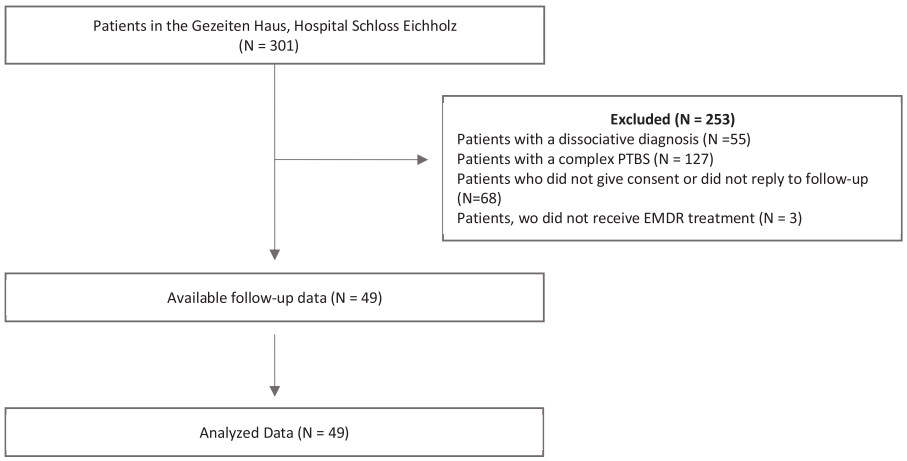

FIGURE 1
Overview of the data collection process.

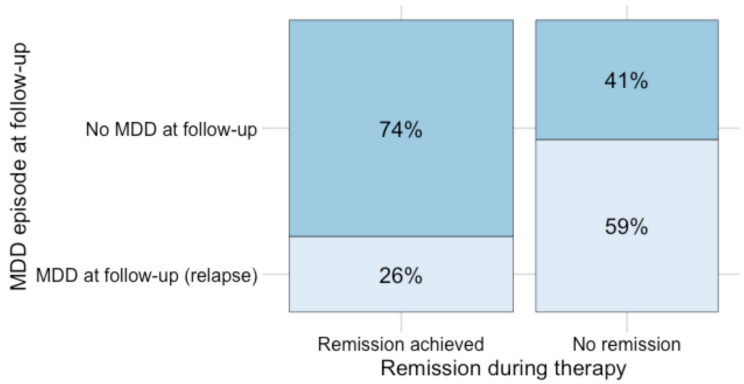

FIGURE 2
Distribution of relapse and remission in the study cohort.

A total of 15 of the patients suffered from primary depression without PTSD comorbidity. Eleven of them suffered from recurrent depression, four suffered from a first episode of depression. In the follow-up (*MDN* = 12 months after discharge; *M* = 15 months after discharge) nine (60%) of these patients reported a remission from their depressive symptoms at the end of their inpatient therapy. After the 3-month follow-up one patient reported a relapse that occurred 3 months after being discharged from hospital. The others reported that they had not had a relapse at follow up (on average *M* = 12 months after discharge).

In comparison, in the group of patients with depression and comorbid PTSD, 18 (52.9%) patients had remissions at the end of treatment in the hospital and 12 of these patients also did not report relapse in the follow-up interview (*MDN* = 11 months after discharge; *M* = 13 months after discharge).

Paired *t*-tests were used to examine all pre- and post-treatment changes. Results revealed a statistically significant decline in depressive symptoms ($p < 0.001$; Figure 3B) and subjective distress caused by traumatic events ($p < 0.001$; Figure 3C) after treatment with EMDR. Similarly, overall symptom burden, as assessed by sum of depressive and distress symptoms, significantly decreased over time ($p < 0.001$; Figure 3A). All changes were considered very robust in effect ($g > 1.0$). Details of all pre-post comparisons can be seen in Figure 3.

A repeated measures ANOVA, $F_{(3,60.4)} = 24.6$, $p < 0.001$, $R^2 = 0.289$ (0.652), indicated that the reduction of overall symptom burden during therapy differed depending on the patients' experience of child maltreatment (CM), Time × CM: $F_{(1,45)} = 3.14$, $p = 0.08$, $\eta^2_p = 0.07$. Explorative *post-hoc* tests showed that before therapy, the patients' symptom burden did not correlate with their CM experiences, $d = -0.03$, $p = 0.9$. Through therapy, symptoms were reduced more in patients with more CM experiences (e.g., at CTQ score = 58: Cohen's $d = -1.94$, $p < 0.001$) whereas symptom reduction was lower in patients with less CM experiences (e.g., at CTQ score = 32: Cohen's $d = -1.4$, $p < 0.001$). Consequently, patients reporting

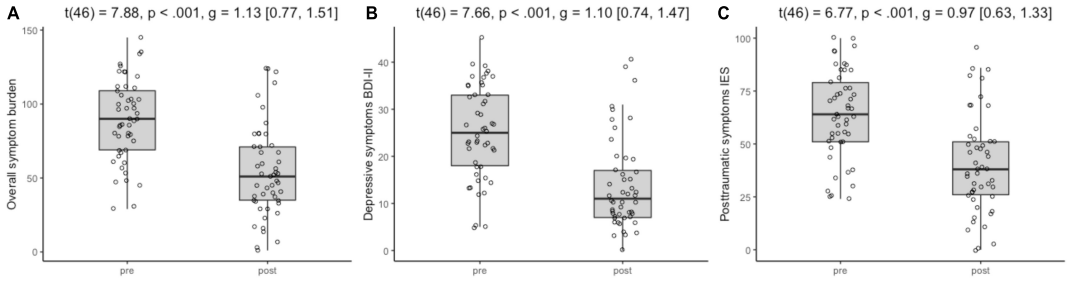

FIGURE 3
Symptom change from pre- to post Eye Movement Desensitization and Reprocessing (EMDR) treatment. **(A)** Overall symptom burden, **(B)** depressive symptoms BDI-II, **(C)** posttraumatic symptoms IES.

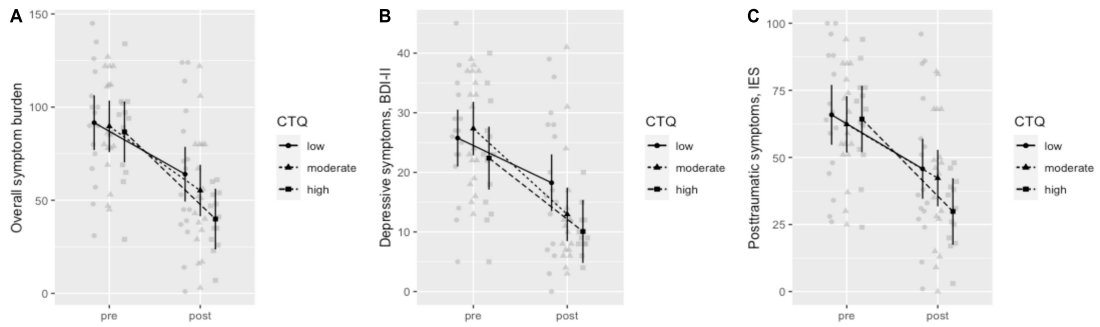

FIGURE 4
Influence of childhood maltreatment on therapy outcome. **(A)** Overall symptom burden, **(B)** depressive symptoms BDI-II, **(C)** posttraumatic symptoms IES.

more CM showed less symptom burden at post therapy, $d = -0.46$, $p = 0.06$. Results are visualized in **Figure 4A** (for statistical details, see **Supplementary Tables 1a–c**). Similar effect patterns could also be shown for the independent consideration of depressive symptoms (**Figure 4B** and **Supplementary Tables 2a–c**) and subjective distress caused by traumatic events (**Figure 4C** and **Supplementary Tables 3a–c**).

In this context, it was also investigated whether patients with depression as primary diagnoses differed from patients with depression and comorbid PTSD regarding their CM experiences. An independent t-test showed no significant difference, $t(45) = 0.411$, $p = 0.683$.

Discussion

In a naturalistic setting, the present study investigated, whether EMDR intervention leads to a symptomatic improvement in depressed patients, and whether remission rates in EMDR-treated patients are stable at the follow-up (Hase et al., 2018; Ostacoli et al., 2018).

Randomized clinical trials have already shown that EMDR is an effective method for treating patients with depressive symptoms (Yan et al., 2021). In the present study comparable results could be obtained under naturalistic conditions. Ostacoli et al. (2018) reported a 71% remission rate in the EMDR group right after treatment and 54.8% stable remissions after 6 months follow-up. Hase et al. (2018) reported a 50% remission rate in patients with depression after being treated with EMDR therapy in an inpatient setting. Accordingly, in our study, we showed a comparable overall remission rate, although there was a difference in the remission rate between patients with depression as primary diagnosis and patients with a comorbid PTSD. Patients without PTSD had better remission rates after completion of EMDR therapy, which remained stable after an average of 1 year of follow-up in almost all cases. Here, it should be mentioned that in some previously listed studies, remission was considered to be a BDI-II value below 9. In our study, we defined remission as a BDI-II value below 12.

The results in our study population show fewer relapses (26% **Figure 2**) in depressed patients after successful treatment compared to relapse rates reported in previous literature (Hollon et al., 1992; Hautzinger et al., 1996; de Jong-Meyer et al., 2007). This finding is comparable to the follow-up results reported by Ostacoli et al. (2018), who reported 54.8% relapse free patients at 6 months follow-up in the group of depressed patients treated with EMDR.

Therefore, these results are consistent with recent EMDR studies reporting that EMDR therapy possibly leads not only to

a higher rate of remissions in depressive patients, but also may decrease the number of relapses after treatment when compared to treatment as usual (Hase et al., 2018).

Childhood trauma is a major risk factor for developing depression (Edwards et al., 2003; Chapman et al., 2004; Humphreys et al., 2020). Adversities during childhood are not only associated with the severity (Rhebergen et al., 2012) and the chronicity (Nanni et al., 2012; Klein and Kotov, 2016) of the course of depression, but also with a longer time to remission (Fuller-Thomson et al., 2014). Heim et al. (2008) showed in their study that adverse childhood experiences and childhood trauma are associated with altered HPA axis potential as well as persistent sensitization of the stress response, which are also related to depressive symptoms. Studies show that neurobiological differences exist in depressed patients depending on whether trauma occurred in childhood or adolescence (Heim et al., 2004, 2008).

Heim et al. (2008) hypothesize that different therapeutic methods are required depending on whether childhood traumatization is present in depressed patients, with the aim to integrate the components of a neural network that have been altered by trauma, with the goal of normalizing neuroendocrine responsiveness and behavior. Notably, the present study also found that patients with more childhood trauma seem to have achieved better improvement during the hospital stay. In the light of the AIP model and regarding the results of the present study, this could mean that EMDR is particularly effective in patients belonging to the subgroup with childhood traumatization with corresponding biological changes.

Since a large number of studies show that emotional abuse and maltreatment are significantly more associated with depression compared to physical abuse (Mandelli et al., 2015; Humphreys et al., 2020), it would be relevant to investigate in future studies the effect of EMDR treatment in depressed patients, distinguished by the type of childhood maltreatment.

Limitations

The present study has limitations that should be considered when interpreting the results. This is a naturalistic observational study, in which less factors could be controlled for. For example, medication change and additional treatments might have influenced the course of symptoms after discharge. Importantly in this regard, 91% of patients received an outpatient therapy after their hospital stay, and 25% of the patients were in the hospital during the COVID-19 pandemic which meant potential stress exposure within the hospital setting and after discharge. Another limitation of the present study is that the number of subjects (N = 49) was small. Further limitations include lack of randomization, and, more importantly, lack of a control group to compare the efficiency of EMDR with other depression-focused interventions. The reliability of the follow-up assessments may be lower due to use of telephone-based self-reporting instruments.

Conclusion

In our study EMDR therapy leads to a high rate of remission and is associated with a decreased number of relapses in patients with depression. The results of the present observational study confirm data from previous research that EMDR is a promising method for treating depression as well as depressive symptoms in patients with history of childhood trauma. In the light of these results, future studies could further examine the effectiveness of EMDR treatment in patients with depressive disorders.

Data availability statement

The original contributions presented in this study are included in the article/**Supplementary material**, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by the protocol and implementation of the study was carried out according to the ethics committee Ärztekammer Nordrhein. The patients/participants provided their written informed consent to participate in this study.

Author contributions

AH and SA developed the study concept. LW and NK-H introduced and established the methodology. LW conducted the study setup, coordinated the study, and collected the psychological data. AB performed the statistical data analyses. VT supervised and coordinated the study. SA and LW drafted the manuscript under the supervision of AH and VT. All authors contributed to data interpretation, critically revised the manuscript, and approved its final version for submission.

Conflict of interest

A possible conflict of interest worth mentioning could be that the first author SA was also the chief physician of the hospital where the data were collected. Furthermore, the co-author AH was the founder of the German EMDR Institute.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.937204/full#supplementary-material

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 08 September 2022
DOI 10.3389/fpsyg.2022.964334

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 08 June 2022
ACCEPTED 19 August 2022
PUBLISHED 08 September 2022

CITATION
Fernandez I, Pagani M and Gallina E (2022) Post-traumatic stress disorder among healthcare workers during the COVID-19 pandemic in Italy: Effectiveness of an eye movement desensitization and reprocessing intervention protocol.
Front. Psychol. 13:964334.
doi: 10.3389/fpsyg.2022.964334

Post-traumatic stress disorder among healthcare workers during the COVID-19 pandemic in Italy: Effectiveness of an eye movement desensitization and reprocessing intervention protocol

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Aim: The Coronavirus 2019 (COVID-19) pandemic represents one of the most catastrophic events of recent times. Due to the hospitals' emergency situation, the population of healthcare workers was the most affected. Healthcare workers who were exposed to COVID-19 patients are most likely to develop psychological distress and post-traumatic stress disorder (PTSD). The present study aimed at investigating PTSD in a sample of Italian healthcare workers during this outbreak and to evaluate the effectiveness of the Eye Movement Desensitization and Reprocessing (EMDR) Therapy with this population.

Methods: A total of 744 healthcare workers were included. 587 healthcare workers were treated with EMDR, while the other 157 were not treated. Participants were asked to provide sociodemographic information; the post-traumatic symptomatology was evaluated through Impact of Event Scale-Revised (IES-R) and to investigate the level of intensity of emotional activation was used The Emotion Thermometer (THERMO) at two time points (pre-post treatment).

Results: The results obtained between EMDR treatment and non-EMDR treatment were evaluated on only 2 hospitals. Treatment group n = 68 vs. waitlist non-treatment group n = 15**7.** All scores pre- and post-EMDR decreased significantly ($p < 0.001$) showing an evident effect of EMDR. The differences between pre- and post-treatment of the IES-R scores of subjects in which EMDR was performed as compared to the scores pre- and post-12 weeks of waiting list subjects in which it was not performed were significantly different ($p < 0.001$).

Limitation: The emergency situation did not provide an opportunity to explore further aspects that would have been important for research. One limitation

is the use and analysis of only two standardized tests. In addition, other psychopathologies were not investigated as outcome measures. A limitation is the comparison of subjects treated online and *de visu*. Although the protocol used was the same, the mode of intervention may have influenced the results. In addition, the effectiveness of EMDR treatment was only evaluated at two time points (pre-post) with no possibility of follow-up and the lack of a control group.

Discussion/conclusion: The findings of the present study suggest that healthcare workers were at high risk of developing PTSD when confronted with COVID-19 outbreak and suggest the importance of psychological support during this humanitarian emergency.

KEYWORDS

healthcare workers, EMDR, PTSD, COVID-19, humanitarian emergency

Introduction

In December 2019, a series of atypical cases of pneumonia were reported in Wuhan, China. Subsequently, the World Health Organization (WHO) defined these cases as Coronavirus 2019 (COVID-19) (Anand et al., 2020). The WHO then officially declared the outbreak as a global pandemic on February 11, 2020.

The virus has rapidly spread throughout China and elsewhere, becoming a global health emergency (World Health Organization, 2020). The rapidly evolving situation drastically altered people's lives, with multiple consequences on the global economy, both public and private (Xiong et al., 2020). The crisis has affected different areas: tourism, transport, agriculture, industry and finance. In fact, due to the outbreak of COVID-19, governments have imposed heavy restrictions nationally and internationally (Xiong et al., 2020).

Since the first months, some phenomena related to mental health have been highlighted in healthcare workers: depressive symptoms, anxiety symptoms, associated risk factors and PTSD (Xiong et al., 2020). Taking into account studies conducted during previous viral epidemics (Chong M. Y. et al., 2004; Chong P. Y. et al., 2004; Wu et al., 2009), it is the mental health of medical and nursing staff that seems to be most at risk. So, the emergency had a negative impact on the psychological wellbeing not only of the general population but also and especially of the medical population, presenting, for the latter, multiple risk factors for the development of posttraumatic reactions (World Health Organization, 2020). These factors may have impacted medical and nursing staff in Wuhan and around the world, leading to serious and persistent mental health problems.

Specifically, in China, healthcare workers have been found to have extremely high rates of post-traumatic stress disorder (PTSD), more than 50% of healthcare workers providers in all studies exceeded the cut-off (Kang et al., 2020; Lai et al., 2020; Li et al., 2020; Liang et al., 2020; Lu et al., 2020; Mo et al., 2020; Shi et al., 2020; Wu et al., 2020).

Also in Italy, early studies found a high incidence of PTSD in 38% of healthcare workers (Di Tella et al., 2020).

Pappa et al. (2020) published data on MDs in the United Kingdom and Greece, where significant mood and sleep problems were found, demonstrating that healthcare workers employed in COVID-19 emergency are at high risk of stress, burnout and PTSD (Chirico et al., 2020).

Many studies further confirmed these findings on nurses, doctors, and general practitioners who required psychological treatments aimed at relieving stress and preventing the onset of psychological disorders (Cao et al., 2020). Given the significance of the prevalence of PTSD in the healthcare population, it is imperative to investigate the effectiveness of programs through the validation of protocols in specific emergency situations. During the COVID-19 emergency, many departments around the world ensured psychological support for healthcare workers: some interventions were based on existing disaster protocols, others created online platforms, apps and websites to help them during their difficult daily lives and others set up *defusing* sites within hospitals (Castelnuovo et al., 2020; Buselli et al., 2021).

The aim of the present research is to investigate the efficacy and the acceptability of Eye Movement Desensitization and Reprocessing (EMDR) treatment to address the immediate stress and traumatic symptoms and prevent its long-term consequences, in healthcare workers during the COVID-19 pandemic.

To assess its impact, we will compare the level of traumatization in groups of health care professionals undergoing or not EMDR. We will also compare the effects of the online-based treatment to face to face sessions of EMDR,

both at individual or group level taking into account potential confounding factor as age, gender, profession etc.

The study will contribute to shed light on the correct procedures and treatments to be carried out to improve the prevention of psychological disorders in healthcare workers.

Materials and methods

Partners

This study was conducted by EMDR Italy Association.

The Italian EMDR Association, in fact, has provided several group and individual interventions in emergency situations with the aim of promoting wellbeing and recovery from trauma in children, adolescents and adults. In 2020, in the context of the COVID-19 emergency, the Italian EMDR Association has developed collaborations with many Italian institutions such as the Ministry of Health, the Ministry of Education and various Municipalities to carry out psychoeducation, awareness and psychology support activities focused both on the general population, HCWs, hospitals and NHS.

Participants

Health care facilities informed all healthcare personnel of the possibility of EMDR intervention to manage the psychological distress caused by the emergency. Freely, facility health workers decided whether or not to take part in the study.

The participants are part of a convenience sample made up of 744 health professionals (medical doctors, nurses, administrative staff, intensive care support staff, psychologists). from 18 different hospitals and nursing homes involved in the COVID-19 emergency. The sample was collected throughout the pandemic emergency period starting from November 2020 until March 2021.

Participants, who were not treated with EMDR, still had a debriefing space with other psychologists. For this reason, the comparison between treated and non-treated was done only in two hospitals (ASST Rhodense), where the 157 non-treated with EMDR were compared with the 68 treated in the same hospitals. Non-treated sample cannot be defined as a control group because for ethical reasons related to the emergency situation that did not allow the absence of psychological support even for the non-EMDR-treated group.

Intervention

The intervention protocol was designed for online and *de visu* groups of about 4–6 participants and online through EMDR-IGTP (Eye Movement Desensitization and Reprocessiong- Intergrative Group Treatment Protocol) (Jarero et al., 2006). Sessions can range from 1 to 1 h and 30 min The participants were guided through a safe/secure place exercise or breathing exercises. The EMDR-IGTP leader asked them to think about the worst part of the event (the current crisis) and then to draw that image on the paper provided. They were then asked for the related Subjective Units of Disturbance (SUD) rating and told to write the corresponding number on their picture. After that they were asked to look at their picture and to provide their own alternating bilateral stimulation with the Butterfly Hug. The participants were then instructed to draw another picture of their own choice related to the event and rate it according to its level of distress. Processing continued with the adults looking at the second picture and using the Butterfly Hug. The process was repeated twice more so that each participant drew four pictures, and provided a SUD rating for each. The final level of distress associated with the current crisis was then assessed by asking to focus on the drawing that was most disturbing and to identify the current SUD level. This number was then written on the back of the paper and was the 5th SUD rating for the session. The participants then drew a final picture that represented their future vision of themselves, along with a word or a phrase that described that picture. No SUD rating was provided for this picture. The drawing and the phrase were then paired with the Butterfly Hug. The clients were instructed to close their eyes, scan their body, and do the Butterfly Hug or grounding techniques for the stabilization. And *de visu* individual session through EMDR standard protocol (Shapiro, 2018). All type of interventions were based on EMDR therapy. Each intervention lasted 3 meetings of about 2 h each carried out over a month, about once a week.

Interventions were managed by one psychotherapist (for session) specialized in EMDR therapy with the aim to reduce the PTSD symptoms.

Procedure

Given the mode of operation of the health care providers and the humanitarian aim of the intervention, it was not possible to implement a randomized, delayed treatment condition. Here it is necessary to focus attention on the importance of a prompt intervention vs. a rigorous and well-planned research design.

The study has a two-point pre-post design in that the questionnaires were administered before (T0) and at the end of the intervention (T1). The first assessment took place for all participants at the beginning of the first meeting while the second at the end of the intervention.

Clinicians were responsible for pre-post assessments but data were collected and analyzed anonymously by other researchers who were doing the data analysis, in this way outcome assessor was masked.

Each participant has read and signed the informed consent and the privacy policy. Once treatment was allowed, subjects had the freedom to leave the study and psychological support at any time. Data were collected anonymously.

Tools

The assessment protocol was based on 2 self-report questionnaires.

The characteristics of the sample were studied through *ad hoc* questions: (1) socio-demographic (age, sex, number of children, number of cohabitants); (2) job-related information (e.g., workplace and occupation). The post-traumatic symptomatology was evaluated through Impact of Event Scale-Revised (IES-R) in accordance with the criteria of the DSM IV-TR (Weiss and Marmar, 1997) validated and translated into Italian (Pietrantonio et al., 2003). The latest PCL-5 (American Psychiatric Association, 2013) was not used, as it is free (in Italian version) as of May 2019. We considered it late and for the reasons of homogeneity we always did the IES-R. This psychometric test consists of 22 items. It includes 3 subscales measuring the following dimensions: intrusion, avoidance and hyperactivation. Participants were asked to rate their level of post-traumatic symptoms using a 5-point Likert scale ranging from 0 (= "not at all") to 4 (= "a lot") referring to the previous 7 days. The total score between 0 and 88. The cut-off of 33 highlights a high risk of PTSD; in line with the literature, there are no specific cut-offs for scale interpretations. The Italian translation of IES-R has shown satisfactory internal validity in studies on different populations at risk, as reported by Craparo et al. (2013) (Intrusion, $\alpha = 0.78$; Avoidance, $\alpha = 0.72$; Hyperarousal, $\alpha = 0.83$) and Converso and Viotti (2014) (Intrusion, $\alpha = 0.91$; Avoidance, $\alpha = 0, 81$; Hyperarousal, $\alpha = 0.87$). Although the IES-R has not been validated in the general Italian population, it has been used to evaluate the symptomatology of PTSD in many Italian samples, which confirmed its adequate reliability (Gambetti et al., 2011; Priebe et al., 2011; Maslovaric et al., 2017).

The Emotion Thermometer (THERMO, Mitchell et al., 2010), a visual analog self-assessment scale to collect the level of intensity of emotional activation on a Likert scale from 1 to 10 regarding some main emotional experiences (stress, depressed mood, anxiety, anger, sleep problems, need for help) during the previous week was also submitted to the investigated subjects.

Statistical analysis

All the original variables were described in terms of their basic location and variability indexes. The binary variables (sex, treatment) were coded as: 0 = female, 1 = male; and 0 = non-treated, 1 = EMDR treated, respectively, implying that the mean of binary variables corresponds to the relative proportion of males and EMDR treated, respectively. The same descriptive indexes were applied to derived variables, namely the "delta" variables, corresponding to the difference between pre and post treatment scores for IES and THERMO.

Inferential statistics on the delta variables testing the null hypothesis of delta = 0, equivalent to a paired test paradigm, was computed by means of two non-parametric (Sign and Signed-Rank) and one parametric (t-test) approach. The very high number of subjects allows to consider both parametric and non-parametric procedures as apt to the evaluation of statistical significance (Edgell and Noon, 1984), on the other hand, the high number of subjects generates a very high statistical power with a consequent possible burden of statistically significant results correspondent to clinically not-relevant differences (Kraemer et al., 2003).

In the case of the two centers in which both treated and non-treated groups were present, the statistical significance between the two groups as for delta variables (entity of the pre-post differences) was estimated by a non-parametric approach based on Wilcoxon scores evaluated by a chi-square Kruskal-Wallis test (Iman and Davenport, 1976).

Principal Component Analysis (PCA) as applied to delta values for both IES and THERMO variables generated two synthetic indexes (PC1DELTAIES and PC1DELTATHERMO) explaining the coherent part of the two test paradigms and thus allowing for a global estimation of treatment effect (Giuliani, 2017).

The between variables correlation was estimated by means of Spearman correlation coefficient, while the modulatory effects of sex, living condition (domicilio), Treatment Center (Ospedale) and Kind of Therapy were estimated by means of an Analysis of Variance (ANOVA) approach.

Results

Despite the large unbalance between females and males there were no difference in response to EMDR between the two genders.

Of the total sample of 744 health professionals 587 were treated with EMDR (433 females and 154 males, mean age 45.5 ± 9.9 years) and 157 were not treated (125 females and 27 males, mean age 44.8 ± 10.6 years).

Overall, 744 subjects completed the IES-R before undergoing EMDR and 706 post-EMDR. The differential attrition in this study was less than 15%.

The results of the scores of the three constructs and the total scores of the test are reported in **Table 1**.

All Deltas between the scores pre- and post-EMDR decreased significantly ($p < 0.001$) showing an evident effect of EMDR. It is worth noting that 68% of the investigated subjects had a pathological pre EMDR IES-R score (>33).

TABLE 1 EMDR treatment.

N = 706	(M/SD) pre	(M/SD) post	Delta *p* <
Tot IES-R	39.13/17.62	21.63/17.605	0.001
Avoidance	12.41/6.318	7.89/6.623	0.001
Intrusiveness	15.35/7.272	8.06/6.879	0.001
Hyperarousal	11.34/5.985	5.74/5.361	0.001

TABLE 2 THERMO.

N = 442	Stress	Anxiety	Mood	Angry	Sleep	Help
PRE						
Mean	5.27	4.42	3.51	4.04	4.36	3.79
SD	2.594	2.825	2.780	3.103	3.205	2.695
N = 338						
POST						
Mean	3.22	2.47	1.95	2.43	2.49	2.33
SD	2.265	2.126	2.079	2.323	2.689	2.247
Delta p <	0.001	0.001	0.001	0.001	0.001	0.001

TABLE 3 IES.

	Avoidance	Intrusiveness	Hyperarousal	Tot
Δ Not treat				
N = 157				
Mean	5.1	6.4	4.9	16.4
SD	8.3	8.2	6.4	21.5
Δ Treat				
N = 68				
Mean	8.9	12.1	8.9	29.8
SD	7.0	7.9	5.7	18.5
Difference delta P <	0.001	0.001	0.001	0.001

Likewise, 442 subjects completed the Emotions Thermometer pre-EMDR and 338 post-EMDR with highly significant Deltas between the scores of all dimensions (**Table 2**).

Summing up, all variables showed a significant improvement after EMDR demonstrating a clear effect of treatment.

In order to properly compare treated and non-treated subjects, we analyzed only the data from the two structures in which both populations were present, with the statistical benefit of keeping under control all possible confounding variables. The Deltas between pre- and post-treatment of the IES-R scores and THERMO of subjects in which EMDR was performed (treated, n = 68) as compared to the scores pre- and post-12 weeks of waiting list subjects in which it was not performed (non-treated, n = 157) was significantly different (**Tables 3**, **4**), speaking in favor of a much stronger effect of treatment vs. mere passage of time.

Furthermore, 31 out of 157 non-treated subjects (about 20% of the total) showed a worsening after 12 weeks but only 2 of the 68 treated (about 3%) did it.

Discussion

The present study aimed to investigate the efficacy and the acceptability of EMDR treatment to address the immediate stress and traumatic symptoms and prevent its long-term consequences, in healthcare workers during the COVID-19 pandemic.

Regarding the efficacy of EMDR intervention, the present study showed that there was a significant difference in IES-R and THERMO scores between pre- and post-intervention. In fact, all Deltas between the scores pre- and post-EMDR decreased significantly ($p < 0.001$) showing an evident effect of EMDR. It is worth noting that 68% of the investigated subjects had a pathological pre EMDR IES-R score (>33).

Our results are supported by the scores of the study by Lai et al. (2020) in which more than 50% of the sample had scores above the threshold at the IES-R. The study showed that 71.5% among physicians and nurses had symptoms of traumatic stress and the level was moderate/severe in 35% of them. Specifically, 33% of physicians and 36.2% of nurses had clinically relevant symptoms (Lai et al., 2020).

The assessment was specifically assessed through the Impact of Event Scale-Revised (IES-R) instrument.

This tool was also used by other studies that investigated the psychological impact of COVID-19 related trauma in healthcare workers (Chew et al., 2020; Kang et al., 2020; Lai et al., 2020; Tan et al., 2020; Zhang et al., 2020). These studies showed the following percentages of PTSD: 7.5% in the study by Chew et al. (2020), 60% in Kang et al. (2020), 7.7% in Tan et al. (2020), and 73.4% in Zhang et al. (2020). The differences in percentages can be attributed to sample differences as explained below. In contrast to this research which adhered to the traditional scoring of presence or non-presence of post-traumatic symptoms, these studies, done in China, interpreted the IES-R scores as follows: normal/sub-clinical (0–8), mild (9–25), moderate (26–43) and severe distress (44–88), with cut-off of 26 (Kang et al., 2020; Lai et al., 2020; Zhang et al., 2020). While studies conducted in Singapore and India assessed IES-R scores as follows: normal (0–23), mild (23–32), moderate (33–36) and severe (>37), with cut-off of 24 indicating possible PTSD (Chew et al., 2020; Tan et al., 2020).

HCWs had therefore found themselves facing critical situations that increase the risk of suffering psychologically, deriving from facing various dangerous conditions, with consequences that could extend from psychological distress to mental health symptoms like stress, depressed mood, anxiety, anger, sleep problems and need for help. These areas were evaluated with THERMO and all Deltas between the

TABLE 4 THERMO.

	Stress	Anxiety	Mood	Angry	Sleep	Help
Δ Not treat						
$N = 157$						
Mean	1.7	1.7	1.5	1.5	1.7	1.2
SD	2.6	2.7	2.3	3.2	2.7	2.2
Δ Treat						
$N = 68$						
Mean	2.8	2.5	2.8	2.3	2.8	2.0
SD	2.4	2.2	2.3	2.3	2.8	2.8
Difference delta $P <$	0.005	NS	0.001	NS	NS	0.05

scores pre- and post-EMDR decreased significantly ($p < 0.001$) showing an evident effect of EMDR for these symptoms.

According to literature In China, HCWs have been found to have extremely high rates of depression, generalized anxiety disorder (GAD), insomnia, stress-related symptoms and PTSD (Cao et al., 2020; Kang et al., 2020; Lai et al., 2020; Li et al., 2020; Liang et al., 2020; Lu et al., 2020; Mo et al., 2020; Shi et al., 2020; Wu et al., 2020).

In Germany, doctors (MDs) have found high levels of anxious and depressive symptoms (Bohlken et al., 2020).

As part of this pandemic, Pappa et al. (2020) published data on MDs in the United Kingdom and Greece, where significant mood and sleep problems were found, demonstrating that healthcare workers employed in the COVID-19 emergency are at high risk of stress, burn-out and disturbance from post-traumatic stress (Chirico et al., 2020).

Also in Italy, the first studies found important psychological illnesses such as depressive symptoms and post-traumatic stress symptoms on health workers (Di Tella et al., 2020).

Then, in order to properly compare treated and non-treated subjects, the Deltas between pre- and post-treatment of the IES-R and THERMO scores of subjects in which EMDR was performed as compared to the scores pre- and post-12 weeks of waiting list subjects in which it was not performed was significantly different ($p < 0.001$), speaking in favor of a much stronger effect of treatment vs. mere passage of time.

As far as the literature is concerned, the intervention on healthcare personnel exposed to the COVID-19 pandemic has not yet been investigated in depth, although studies have already been collected on the protocols implemented during this global crisis (Buselli et al., 2021). Specific interventions on healthcare workers with EMDR treatment during COVID-19 are still absent.

The results of the present study could contribute to shed light on the correct procedures and treatments to be carried out to improve the prevention of psychological disorders in healthcare workers and demonstrate how healthcare workers and how psychological support, through EMDR treatment, improve the prevention of psychological disorders is effective (Shapiro, 2001; Maslovaric and Fernandez, 2016). EMDR therapy is a brief intervention and in this study we have observed how in only three group meetings of 2 h each the level of symptomatology decreased significantly. This is in line with the study of Mavranezouli et al. (2020), where EMDR was found to be the most cost-effective treatment for PTSD (less sessions and high level of effectiveness).

In conclusion, this study allows both to hypothesize the effectiveness of EMDR intervention on healthcare workers but also to hypothesize that other psychological support helps in the reduction of traumatic symptomatology and symptoms such as stress, depressed mood, anxiety, anger, sleep problems, need for help. This is a helpful intervention since these health care workers will continue to be exposed to triggers that can reactivate and remind the most traumatic images they experienced during the Pandemic. To have an effective intervention in the acute phase can give immediate relief, prevent chronization and enhance resources and resilience for future situations. The high level of traumatization in the personnel after the Pandemic found in this study would have been a strong risk factor in general for the mental health and functioning in the workplace. To offer an intervention such as EMDR in the acute phase can also prevent costs in terms of the organization, personnel and at a subjective and family level (Shapiro, 2012).

However, especially in the field of emergencies, which are characterized by a series of challenges due to the implicit characteristics of the event, such as unpredictability and ethical implications that force a sudden intervention, there is an important difficulty in monitoring the outcomes of the intervention and scientific research. For this reason, in the following section, the limitations present in the present research have been exposed.

Potentials and limitations

This study has the potentiality of having been carried out in a moment of difficulty due to the Italian situation during

the pandemic. In fact, the opportunity to have drawn up a pre-post study during a period of crisis allows us to observe a partial psychological situation of a given population, in a given historical period. The emergency situation did not give the possibility to deepen further aspects that would have been important for the research, however it was possible to have a not treatment group, in order to understand the effectiveness of the EMDR protocol on a specific population.

Although the results of the present study are encouraging several limitations are present.

A limitation is represented by the use and analysis of only two standardized tests. In addition, other psychopathologies were not investigated as an outcome measure. The administration of other psychometric tests for the assessment of other psychopathologies may be functional for future research.

Although functional and dysfunctional coping strategies adopted by practitioners during the Pandemic have not been evaluated, this could be a good starting point for a future study.

One bias is definitely the gender distribution in the sample, with a large female prevalence.

One limitation is the comparison of subjects treated online and *de visu*. Although the protocol used is the same, the mode of intervention may have affected the outcomes.

Moreover, the efficacy of EMDR treatment was evaluated in only two times (pre-post) without a possibility of *follow up* and, therefore, the absence of a longitudinal control aimed at following the reduction of PTSD symptoms over time.

A further limitation is related to the no treat group, as it was selected from only two hospitals.

Certainly, these limitations reduce the generalization of the results and may have affected the study.

Conclusion

COVID-19 had a significant impact on the wellbeing of healthcare workers that need for mental health protection, support, and treatment. This study demonstrated that interventions with EMDR for this population had a positive effect to significantly decrease symptoms such as stress, depressed mood, anxiety, anger, sleep problems and need for help.

This confirms that working with EMDR in emergency situations provokes immediate relief, prevents chronization.

Also, the study confirmed that EMDR protocol in all its modalities, both online and *de visu*, can protect health care workers from the consequences of acute stress.

In conclusion, the possibility in the future of collecting further data may improve the statistical strength of the study and observe the resilience of a specific population as time goes on, in order to understand if an early intervention with EMDR, during a critical event, can help the growth of this evolutionary skill.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

IF, EG, and MP contributed to conception and design of the study and wrote the first draft of the manuscript. EG organized the database. MP performed the statistical analysis. All authors wrote sections of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

Acknowledgments

We thank ASST Rhodense (Rho and Garbagnate Milanese) and their equipe (Davide Livio, Francesca Mariani, Stefania Villa, Antonio Pignatto, and Marco Toscano), ASST Lecco, Ospedale Bassi, ASST Pavia, ASST Bergamo, ATS Milano, ASST Sette Laghi, and all RSA in Lombardia (Italy) for their contribution in the acquisition of data. We thank the EMDR Italy Association for the enthusiasm and the logistic support. We also thank all the healthcare workers we have met.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychology

TYPE Clinical Trial
PUBLISHED 29 September 2022
DOI 10.3389/fpsyg.2022.935782

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 04 May 2022
ACCEPTED 13 September 2022
PUBLISHED 29 September 2022

CITATION
Yurtsever A, Bakalim O, Karaman Ş, Kaya S and Konuk E (2022) The effect of the online eye movement desensitization and reprocessing early intervention protocol (EMDR R-TEP) for the risk groups with post-traumatic stress symptoms during the COVID-19 pandemic. *Front. Psychol.* 13:935782. doi: 10.3389/fpsyg.2022.935782

The effect of the online eye movement desensitization and reprocessing early intervention protocol (EMDR R-TEP) for the risk groups with post-traumatic stress symptoms during the COVID-19 pandemic

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The aim of the research is to investigate the effect of eye movement desensitization and reprocessing (EMDR) therapy on post-traumatic stress disorder (PTSD) levels of individuals who can be defined as high-risk groups during the pandemic. Therefore, the online EMDR R-TEP Protocol was applied to a total of 154 individuals working with coronavirus patients, frontline professionals (Doctors, Nurses, Paramedics, Polices, Red Crescent), relatives of coronavirus patients, coronavirus patients, and relatives of someone who died from coronavirus and the PTSD symptom level before, after, and 1month after therapy was measured and examined. A personal information form and impact of events scale were used to collect data. Analyses showed that EMDR therapy was effective in reducing the PTSD level in all groups. The PTSD levels of frontline professionals continued to decrease until the follow-up test but remained the same in the other groups.

KEYWORDS

EMDR, early interventions, R-TEP, PTSD, Covid-19, frontline professionals

Introduction

A pandemic is defined as a large-scale epidemic disease that can affect many countries or the whole world in a period (World Health Organization, 2010). AIDS, SARS, and H1N1 are among the epidemic diseases that have affected large numbers of people in many countries in the past (Bilge and Bilge, 2020). The recent new type of coronavirus (COVID-19), which appeared in China for the first time in December 2019, has spread around the

world since its outbreak, and the World Health Organization (WHO) declared a pandemic on March 11, 2020. According to November 2021 data, during the COVID-19 pandemic, which is still ongoing, the virus has infected approximately 247 million people globally and 5 million cases resulted in death (World Health Organization, 2020). In Turkey, about 8 million people were infected with the virus as of the same date, and about 70,000 people died because of this (Republic of Turkey Ministry of Health, 2020). This situation is a challenge to the psychological health of individuals and societies in addition to their physical health (Holmes et al., 2020). The pandemic's adverse effects on individuals' psychological health have been supported by some research findings (Goodwin et al., 2009; Liu et al., 2020; Zandifar and Badrfam, 2020). Pandemics include psychosocial stressors such as the threat to one's own and loved ones' health, disruption of routines, separation from loved ones, and social isolation, as well as other stressors such as the inability to bury the deceased naturally (Taylor, 2019). Additionally, the ensuing uncertainty, the necessity of isolation, the risk of transmission of the disease, causing different symptoms in different individuals, and the anxiety of infecting relatives can result in a perception of intense stress as well as feelings such as anxiety and fear (Rubin et al., 2010; Shultz et al., 2015; Van Bortel et al., 2016; Bao et al., 2020; Shevlin et al., 2020; Zhang et al., 2020). Wang et al. (2020) noted in their study with 1,210 participants who were in quarantine during the COVID-19 pandemic that 8.1% of these individuals' stress levels increased from moderate to high severity within 2 months. According to Huremovic (2019), being sick and seeing loved ones suffer and die, added to the isolation, and when combined with fear, is likely to cause post-traumatic stress disorder (PTSD) in the long run. Especially for individuals whose relatives are hospitalized in intensive care units, not being able to visit them and the fear of not seeing them again are highly stressful experiences (Luttik et al., 2020).

During the COVID-19 pandemic, the group with the highest risk of getting and transmitting the disease has been frontline professionals (Doctors, Nurses, Paramedics, Polices, Red Crescent). In addition to facing risk constantly, the long working hours, excessive fatigue, and lack of systematic training programs on the pandemic due to lack of time, stigma, etc. also affect healthcare professions mental health significantly (Pala and Metintas, 2020; Sakaoğlu et al., 2020). Some recent studies showed that healthcare professions are in the first-degree risk group for having PTSD (Carmassi et al., 2020; Johnson et al., 2020). Feelings of uncertainty and fear of infecting their relatives and coworkers were stated as other contributing variables (Carmassi et al., 2020). Blekas et al. (2020) determined that negative emotions, physical tension, and insomnia were significant predictors of PTSD in healthcare professions.

The risk of PTSD was found to be higher in individuals experiencing more threats and loss of resources during periods such as pandemics (Kaseda and Levine, 2020) This being the case, providing appropriate and effective psychological support to people who develop chronic symptoms such as PTSD in response to traumatic stress is necessary (Rosen et al., 2020). One approach that can provide this psychological support is Eye Movement Desensitization and Reprocessing (EMDR) Therapy, a psychotherapy school based on the Adaptive Information Processing Model (Shapiro, 2017). EMDR therapy has been proven to be effective for PTSD symptoms (Marcus et al., 1997; Van Etten and Taylor, 1998; Maxfield and Hyer, 2002; Konuk et al., 2006; Acarturk et al., 2016; Wilson et al., 2018; Yurtsever et al., 2018), medically unexplained (somatic) symptoms (van Rood and de Roos, 2009), depression, anxiety (Shapiro, 1999; Capezzani et al., 2013), and many other psychological disorders. In fact, in the meta-analysis study by Mavranezouli et al. (2020), it was found that the two most effective interventions for PTSD were Trauma-focused Cognitive Behavioral Therapy and EMDR.

Early EMDR interventions are used to prevent PTSD or ongoing stress in those with traumatic stress symptoms and acute stress disorder, and those at risk for PTSD or other disorders (Shapiro, 2012). Many protocols were developed as the part of early EMDR interventions. Studies were conducted in which these protocols were applied immediately after traumatic social events like natural disasters such as earthquakes and floods (Adúriz et al., 2009; Saltini et al., 2017; Trentini et al., 2018), wars, terrorist attacks, finding evidence of massacres, and military traumas (Zaghrout-Hodali et al., 2008; Wesson and Gould, 2009; Jarero and Uribe, 2011, 2012; Brennstuhl et al., 2019), and the interventions were found to be effective.

In the early EMDR interventions context, the EMDR R-TEP Protocol, which was designed and developed with an inclusive perspective, is an appropriate method for dealing with recent traumas (Shapiro and Laub, 2009). From this point of view, EMDR R-TEP aims to focus on the traumatic episode in recent traumas and to ensure that the whole traumatic process and the memories in this process are perceived and integrated as a consolidated whole and thus adaptively processed. Thus, the traumatic event is called a traumatic episode, which includes the moment that traumatic event has happened till the present moment. All the disturbing pictures, thoughts, feelings, and body sensations are assessed with bilateral stimulation. It aims to help the brain process traumatic events in the acute phase and prevent PTSD in the long term. Various studies have recommended this method to reduce PTSD symptoms after recent trauma (Shapiro and Laub, 2015; Saltini et al., 2017; Shapiro et al., 2018). Accordingly, the circumstances in which EMDR therapy is effective are parallel with the psychological symptoms that arise or may arise during the current COVID-19 pandemic.

The objective of the present study is to investigate the effect of EMDR therapy on PTSD levels of individuals who could be defined as high-risk groups during the pandemic. Therefore, the online EMDR R-TEP Protocol was applied to individuals working with coronavirus patients, frontline professionals, relatives of coronavirus patients, coronavirus patients, and relatives of someone who died from coronavirus, and the PTSD symptom level before, after, and 1 month after therapy was measured and examined.

10.3389/fpsyg.2022.935782

Materials and methods

Research model

The aim of this study was to examine the effect of five sessions of EMDR R-TEP intervention on the PTSD levels of individuals affected by the COVID-19 pandemic. A single group pre-test-post-test-follow-up (1 × 3) design was used. In this design, the first factor shows the independent process groups (experiment) and the second factor shows the repeated measurements of the dependent variable (pre-test, post-test, and follow-up) under different conditions (Büyüköztürk et al., 2013). The study's independent variable is the EMDR R-TEP intervention and the dependent variable is the PTSD levels of individuals affected by the coronavirus.

Participants

Coronavirus patients, relatives of coronavirus patients, relatives of someone who died from coronavirus, professions working with coronavirus patients, and frontline professionals, who can be defined as high-risk groups during the coronavirus pandemic, participated in the study. The EMDR R-TEP intervention was applied to 745 people who met these criteria. Only 154 of them completed the pre-test, post-test, and follow-up test and included as the participants of this research. They were reminded to fill in, but due to voluntariness, late participants who filled in whenever they wanted could not be included. In addition, the forms of the clients who could not use the internet well, although they filled it in at the right time, the forms reached us late and could not be included.

Process

Before the research started, research permission was obtained from the Social and Human Sciences Scientific Research and Publication Ethics Committee of Izmir Democracy University (Protocol No: 2020/50; Acceptance Date: 07.08.2020; Decision Number and No: 2020/10–06). In order to carry out the trauma recovery group coronavirus study, a unique organization was made specifically for the coronavirus study. Therapists who had at least first-level EMDR Europe accredited EMDR training and voluntarily applied to the trauma recovery group were included in this study. These therapists were given online EMDR training and EMDR R-TEP training. 450 EMDR therapist applied and they were divided into two groups that will perform EMDR therapy and as support teams. The groups that will do EMDR therapy are divided into sub-teams of 20 people. At the head of each team, one person (team leader) provides communication with the main organization and also leads his own team. Support teams are; social media team, WhatsApp team, mail team, project team, morale team (the team that provides psychological support to the volunteer therapists who were psychologically affected for any reason during the project process) and the management coordination team. After establishing the teams, the project was announced to the public *via* social media accounts for five and a half months, from March 16, 2020, when the study on the coronavirus epidemic began, until September 01, 2020, when it was completed, and the project received coverage in the visual and written media. Those who were aware of this project were asked to send a message to the relevant WhatsApp number or email account in order to apply the project. Then a standard consent form and client information form were sent to the applicants. After filling out this form, our inclusion criteria were belonging to one of the four groups we studied and not having a psychiatric diagnosis. If this was not specified on the form, we informed those candidates directly that we would not be able to give service The clients who are matching the criteria were directed to the most appropriate team leader by the team member in the management. The team leader primarily directs the referred client to the most experienced EMDR therapist in his team. Thus, less experienced therapists have the chance to follow the supervision of previous cases. While assigning the client, the information including the personal information form, consent form, and impact of events scale were sent to the therapist. The therapist made an appointment by calling the assigned client. The therapist was asked to plan the therapy for five sessions, in accordance with the EMDR Trauma Recovery Group rules and to get supervision in this regard. The therapist sent the Impact of Events Scale to the client 1 week and 1 month after the five sessions intervention were completed. In the first session the therapist checks if the clients need any psychiatric support and they referred the client to the Psychiatric Advisory Board within the EMDR Trauma Recovery Group. S/he also recorded the entire therapy process on the Therapist Information Entry form. Finally, each client had the five session of EMDR therapy in this project. Below the flowchart of participants through each stage of the study is shown in Figure 1.

Training and supervision of therapists

Between March 2020 and September 2020, 450 volunteer EMDR therapists conducted online EMDR and psychological support work for those affected by COVID-19 pandemic and those who applied upon the invitation from the Turkey EMDR Trauma Recovery Group (Karaman et al., 2020). Only persons who have received accredited EMDR therapy training and are registered with the EMDR Association can participate in EMDR Trauma Recovery Group studies and projects. After the volunteer therapists were accepted for the project, they had in-service training related to the field they would work in, Information on the training and supervision periods of the therapists is given in Table 1.

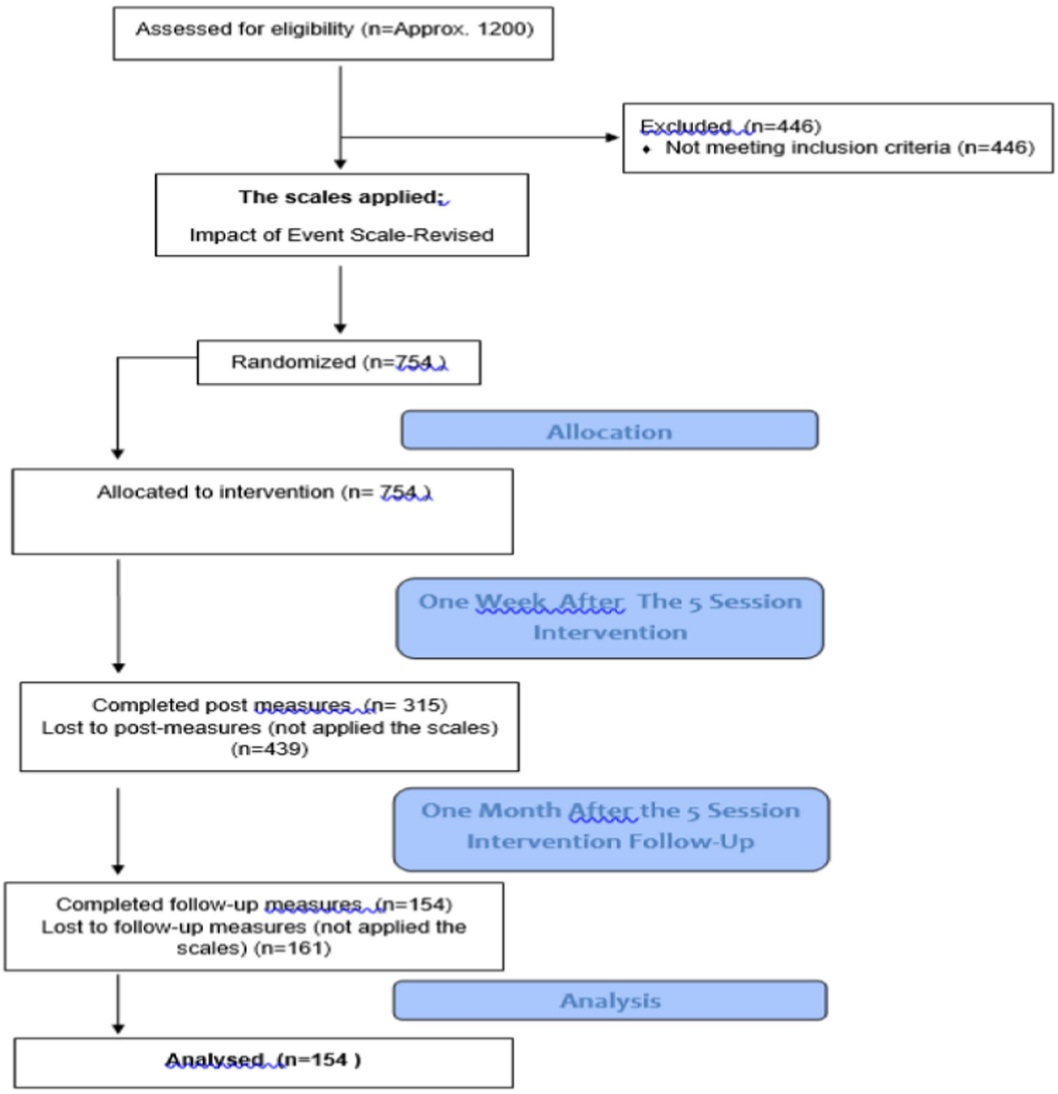

FIGURE 1
Flowchart of participants through each stage of the study.

Data collection tools

Personal information form

This is the form the researchers created to determine the sex, age, education level, and reason for applying for therapy of the participants in the study group.

Impact of events scale (IES-R)

Weiss and Marmar (1997) developed the impact of events scale to evaluate the severity of PTSD symptoms in individuals. The scale, which is a self-reported measurement tool, consists of 22 items. It is a five-point Likert-type scale (0 = never, 4 = extreme). Since each item varies between 0 and 4, the highest score that can be obtained from the scale is 88 and the lowest score is 6. A high score on the scale indicates a high severity of PTSD symptoms. The scale consists of three sub-dimensions. The subscales comprise re-experiencing, avoidance, and hyperarousal. The test–retest correlation coefficients of the original scale ranges from 0.57 to 0.94 for intrusion, from 0.51 to 0.89 for avoidance, and from 0.59 to 0.92 for hyperarousal. The scale was adapted into Turkish by Çorapçıoğlu et al. (2006). The IES-R has high internal consistency and the Cronbach's alpha internal consistency coefficient of the scale was calculated as 0.94. In the present study, the Cronbach's alpha internal consistency coefficient of the scale was 0.84 and all analyses were conducted on the total score.

Intervention

The EMDR R-TEP Protocol, which was designed and developed in the context of early EMDR interventions, was carried out online in this process. The EMDR R-TEP covers all eight phases of EMDR therapy as a method used for recent

TABLE 1 Baseline characteristics of participants.

Variables	Total *N*: 154
Age, mean	36,32
Sex, *n* (%)	
Male	23(%14,9)
Female	131(%85,1)
Education, *n* (%)	
Primary school graduates	8
Secondary school graduates	6
High school graduates	11
University graduates	65
Higher education	29
Blank	35

traumas: History, preparation, assessment, desensitization, installation, body scan, closure, and reassessment. It involves stabilization, containment, and creating a sense of security since the traumatic experience has happened relatively recently or is still ongoing. Due to the nature of recent trauma, it is recommended to apply it on consecutive days. Within the scope of the present research, five sessions are enough, only an additional session if necessary were arranged with clients. A pre-test was conducted before the therapy process, a post-test 1 week after the therapy process ended, and a follow-up measurement 1 month after the therapy process ended.

Fidelity

During the process, in-service training was given to the volunteer therapists. In addition, all therapists participated in group supervision once a week during the process. In the project, 17 supervisors who supervised the groups attended to the supervisors' supervision sessions once a week.

Data analysis

Descriptive statistics were calculated for the qualifications of the participants. The Kolmogorov–Smirnov test was used to determine whether the data were normally distributed to decide whether to use parametric or non-parametric analyses in the research. In the Kolmogorov–Smirnov tests for the normality of the distribution of the pre-, post-, and follow-up test scores for the four groups, the *p*-values were completely not significant. For this reason, it was accepted that the distributions were normal, and it was decided to use parametric statistics within the scope of the research. Repeated measures one-way ANOVA was performed to determine the difference in scores between the groups' pre-, post-, and follow-up test IES-R scores. Before the ANOVA, the sphericity test was performed for the total and all subgroups, and the assumption was met. The Bonferroni test, a *post-hoc* technique, was used to determine from which pairs the determined differences originated. All analyses within the scope of the research were carried out using SPSS 22 (IBM Corp., 2015).

TABLE 2 Therapist support meetings and durations.

Supervision sessions	410 Sessions (each session is 1–3 h)
Supervisors meetings	20 meetings
Support team meetings	220 h
Therapy team meetings	660 h
Number of in-service training sessions	10 sessions
Instagram live broadcasts	9 broadcasts

Results

The mean and standard deviations of the pre-test, post-test, and follow-up test PTSD scores of the study groups within the scope of the research are shown in Table 2, and a graph showing the pre-test, post-test, and follow-up scores of the study groups is given in Figure 2.

There was a significant difference between the pre-test, post-test, and follow-up test mean scores of frontline professionals group (F (1.697, 140,815) = 168,658, $p < 0.001$), relatives of coronavirus patients group (F (1.485, 35,644) = 38,211, $p < 0.001$), coronavirus patients group (F (1,263, 26.517) = 32,479, $p < 0.001$) and relatives of someone who died from coronavirus group (F (12;44) = 24.539, $p < 0.001$). Also there is a statistically significant difference at the level of 0.05 between the post-test and the follow-up test of frontline professionals. On the other hand, there was no statistically significant difference between the post-test and the follow-up test of the relatives of coronavirus patients, coronavirus patients and relatives of someone who died from coronavirus (Table 3).

Discussion

The present research was conducted with health and similar professions, relatives of coronavirus patients, coronavirus patients, and relatives of someone who died from coronavirus, which can be defined as high-risk groups during the COVID-19 pandemic. Within the scope of the research, the effect of the 5-session online EMDR R-TEP protocol on PTSD levels was examined.

The analysis of the research findings by the groups determined that there was a significant decrease in the pre-test, re-test, and follow-up test PTSD scores of the frontline professionals who underwent EMDR R-TEP. Considering that due to COVID-19 pandemic frontline professionals working without taking breaks, have to work under intense stress, and have a higher number of patients than usual; the traumatic symptoms decreased rapidly and continued to decrease after the sessions indicates the effectiveness of the practice. This finding is consistent with the results reported by Perez et al. (2020) on frontline professionals during the COVID-19 pandemic. In their study, the EMDR-IGTP group treatment protocol, which is another protocol of EMDR therapy with ongoing traumatic stress, was applied. The research was conducted remotely and it revealed that the PTSD, anxiety,

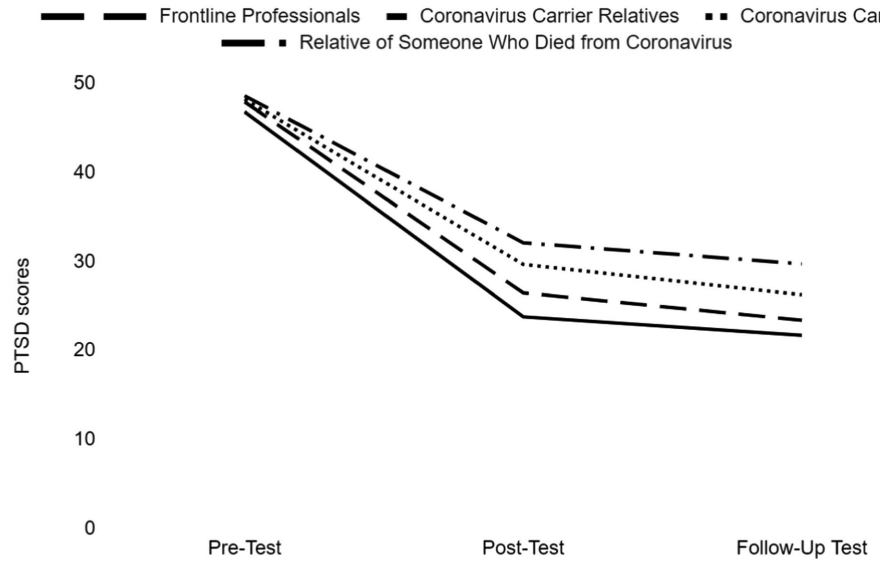

FIGURE 2
Descriptive graph of the study groups.

TABLE 3 Descriptive statistics of the study groups.

Study group	*N*	Pre-test		Post-test		Follow-test		Between time effect size
		Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation	
Frontline professionals	84	47.92	11.72	26.48	11.97	23.41	13.51	0.67**
Coronavirus Patients Relatives	25	46.80	11.32	23.79	11.82	21.72	10.19	0.61**
Coronavirus Patients	22	48.22	13.10	29.68	16.03	26.27	17.09	0.60**
Relatives of Someone Who Died from Coronavirus	23	48.60	13.31	32.11	16.62	29.73	14.77	0.52**

**$p < 0.01$.

and depression results of frontline professionals working with coronavirus patients decreased significantly after the application. Similarly, Moench and Billsten's (2021) research findings showed that EMDR therapy applied to mental health professions during the COVID-19 pandemic was effective in reducing depression, anxiety, and stress levels. In addition, it has been demonstrated that EMDR therapy applied to emergency nurses during the COVID-19 pandemic provides a decrease in COVID-19-related anxiety and depression levels and an increase in sleep quality (El-Abbassy et al., 2021).

Although there was no statistically significant difference between the post-test and the follow-up test of the relatives of coronavirus patients, another subgroup of the study, the IES-R score averages decreased significantly from the pre-test to the post-test. The EMDR R-TEP practice significantly reduced the symptoms of traumatic stress, only in the group the change did not increase in the follow-up period but continued to be the same that can be seen as the effect remain the same. There was no research finding either supporting or not supporting this result. It is thought that different variables that we could not monitor and control, as we were unable to access information about the progression of the diseases of the relatives after the intervention, may have been reflected in the findings.

It is observed that traumatic symptoms decreased after EMDR R-TEP application in the coronavirus patients group and continued decreasing 1 month after the study. But there was no statistically significant difference between the post-test and follow-up test of the coronavirus patients group. This result shows the positive effect of the implication remained the same after 1 month. In the study conducted by Jelveh (2021), EMDR therapy was applied to 19 patients hospitalized due to COVID-19 pandemic, and a significant decrease in the anxiety levels of the patients after the therapy was determined. However, more research is needed to reveal the effect of EMDR therapy on PTSD during the COVID-19 pandemic (Lenferink et al., 2020).

A significant decrease in pre-test–post-test and post-test–follow-up test scores was observed in the group who lost relatives due to coronavirus. However, there was no change in the post-test and follow-up test. In other words, the intervention reduced the PTSD levels of the individuals, and this continued during the monitoring process. This group is in mourning because of the loss they experienced, and still the decrease in

traumatic symptoms similar to other groups. Considering the hypothesis (Solomon, 2018) that for a successful grieving process, traumatic material that may interfere with this process is processed by the brain using the EMDR protocol, it can be inferred that the practice might support a healthy grieving process. The research conducted by Solomon and Hensley (2020) presented data indicating that EMDR therapy can be effective in individuals who have lost relatives due to coronavirus. In fact, some previous research findings demonstrated that EMDR plays a supportive role in a healthy grieving process (Sprang, 2001; Hornsveld et al., 2010; Usta et al., 2016; Solomon, 2018). Examination of the PTSD levels of the total study group showed that EMDR therapy effectively reduced PTSD symptoms in the whole group, and this effect continued with a significant decrease after 1 month. Similar to this finding, studies have revealed that processing memories in EMDR therapy continue after the sessions (Shapiro, 2017). Perri et al. (2021) conducted research comparing the effectiveness of online EMDR R-TEP and online cognitive behavioral therapy for trauma associated with quarantine, isolation, and working in a hospital environment during the COVID-19 pandemic. The findings showed that both therapy methods were effective in reducing PTSD symptoms. On the other hand, it has been found in different studies that the number of similar sessions in different traumatic experiences effectively reduces the level of PTSD. In the study conducted by Saltini et al. (2017), 2–4 sessions of EMDR R-TEP were applied to individuals affected by trauma after an earthquake. It was determined that there was a significant decrease in the stress level of the participants after EMDR R-TEP.

Strengths and limitations

It is thought that the supervision supporting the therapists during the process of helping these groups increases the power of the research design. However, the research has some limitations. The first of these is that our study has no control group. There is a number of arguments on natural regress of post traumatic symptoms during the first 3 months. Riggs et al. (1995) examined 84 non-sexual assault victims after the assault and continuing weekly for 3 months. Although 71% of the women and 50% of the men met symptom criteria for PTSD at the first assessment, 21% of the women but none of the men remained with PTSD at the final assessment. But in contrary, some who were not diagnosed with PTSD at the final assessment retained significant symptoms of PTSD, particularly re-experiencing and arousal symptoms. In order to eliminate this factor studies with true experimental research design or quasi-experimental research design studies needs to be done. Covers et al. (2021) found out that there is no difference in the watchful waiting group who provided psychoeducation and emotional support and two sessions of EMDR therapy group in reducing post traumatic symptoms, depression, sexual dysfunction, feelings of guilt and shame in the rape victims. Our findings should be supported more by randomized controlled trials with control groups. Consequently, our study was a project in which approximately 1,200 applications were made in 7 months, who wanted to participate and get treatment voluntarily from all over Turkey in the first wave of the Covid-19 pandemic. Therefore, it was not possible to create a control group during this period when early intervention was required. Secondly, although the EMDR-R-TEP intervention was applied to 745 people who were in the risk group throughout the process, pre-test, post-test, and follow-up test results were obtained from only 154 of them. The participants with incomplete forms not included in the study resulted in data loss. Filling out the forms online caused problems either not filled out or not filled in at the specific time. We recommend to future studies to using a preventable online system for this problem. We also suggest conducting a similar study with a control group; conducting studies on the effects of online EMDR therapy on different variables such as anxiety, depression, and intolerance to uncertainty during the pandemic; and conducting new studies comparing online EMDR with different therapy methods during the pandemic.

Conclusion

In conclusion, the present research showed that online EMDR therapy significantly reduced the PTSD level of individuals in some risk groups during the COVID-19 pandemic. EMDR R-TEP is a recent event protocol. It was used for ongoing trauma in this study. Based on the results, it can be said that EMDR R-TEP can also be used in ongoing traumas.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Social and Human Sciences Scientific Research and Publication Ethics Committee of Izmir Democracy University (Protocol No: 2020/50; Acceptance Date: 07.08.2020; Decision Number and No: 2020/10-06). The patients/participants provided their written informed consent to participate in this study.

Author contributions

AY, OB, ŞK, SK, and EK contributed to conception and design of the study. AY, OB, and SK wrote sections of the manuscript. AY, ŞK, SK, and EK organized the database. AY and SK performed the statistical analysis and wrote the first draft of the manuscript. All

authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychology

TYPE Perspective
PUBLISHED 29 September 2022
DOI 10.3389/fpsyg.2022.971856

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 17 June 2022
ACCEPTED 05 August 2022
PUBLISHED 29 September 2022

CITATION
Rodríguez-Garay A and Mosquera D (2022) Using EMDR to treat intimate partner relationship break-up issues. *Front. Psychol.* 13:971856. doi: 10.3389/fpsyg.2022.971856

Using EMDR to treat intimate partner relationship break-up issues

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The Break-Up Aid Procedure (BUAP) is a proposed EMDR intervention designed to address the difficulties that some patients experience when trying to overcome a complex break-up. The procedure aims to not only target the consequences of the break-up, but also the difficulties that may be present in starting a new relationship. The latter is often the case when there are either unresolved consequences from the previous break-up or untreated early adverse experiences. By structuring the treatment in three sequential stages (outlined in this article) and including interventions and adaptations to the standard EMDR protocol, we aim to facilitate the clinician's therapeutic approach to intervening for this specific presenting concern and maximizing success.

KEYWORDS

eye movement desensitization and reprocessing, relationship, traumatic experience, attachment, break-ups, abuse

Introduction

A break-up from an intimate partner relationship is one of the most difficult events for individuals to manage. According to a scale measuring vital stressful events (*The Holmes-Rahe Stress Inventory*; Holmes and Rahe, 1967), divorce and separation in marriage rank as one of the top three stressful events in an individual's life. This stressor is only followed by the death of the married partner. A breakup, in and of itself is demanding for individuals but it can become increasingly complicated if either the end of the relationship is traumatic, or the person has previously lived through adverse affective experiences; particularly if those took place during early stages of life.

In both instances, the information processing system that allows us to reach "adaptive solutions" when we suffer difficult experiences could get stuck and affect the natural grief process (Shapiro and Forrest, 2009). This could justify a psychological intervention using Eye Movement Desensitization and Reprocessing (EMDR; Shapiro, 1995).

The intervention introduced in this article, called Break-Up Aid Procedure (BUAP), adapts the standard EMDR Protocol to the treatment of individuals experiencing a relationship break-up process that is complex. Specifically, it is designed to address the difficulties encountered during the grief process or the emotions that are activated after the end of the intimate relationship. With this procedure, our hope is to address a two-fold purpose: first, help patients engage in their grief process in an adaptive manner; and second,

allow the crisis itself to serve as a point of departure to improve the patient's capacity to establish and maintain positive and functional relationships in the future. Moreover, in this article, additional interventions are described to support individuals who will struggle to break away from a harmful relationship or one which they no longer wish to maintain.

Stages of intervention in BUAP

A break-up from an intimate partner relationship tends to generate, amongst others: the loss of a person's secure base; subsequent anxiety about the separation; and elevated emotional and physiological activation that may, initially, be very difficult to manage. With the goal of focusing on the main needs of the patient during each stage of recovery from the break-up, and structure the psychological intervention, we propose a three-stage approach.

The proposed intervention modifies the order in which the three-pronged standard EMDR protocol (Shapiro, 1995, 2001) is delivered. We begin working on the present and most recent past, instead of the past as we would traditionally do in the standard protocol. We therefore propose that therapists adopt the following approach (Table 1).

BUAP stage 1: Working with the present situation and recent past

During the initial sessions, assess which of the following interventions may be needed:

While gathering the patient's history, focus on the issues which led to the break-up and the consequences these had and/or are having on the individual's present functioning.

If the therapist determines that the individual is lacking the necessary resources to cope, then one would carry out resource installation and provide adequate psychoeducation.

If required the therapist would use EMDR's recent traumatic episode protocol (R-TEP; Shapiro and Laub, 2008) to reduce the patient's emotional and physiological activation.

Other EMDR procedures may be used to address concrete aspects of the relationship break-up, or the need to stay away from an ex-partner. This may include working with an idealized image (Mosquera and Knipe, 2016, 2017); or the subjective sensation of addiction to the ex-partner which may be addressed using the Craving Extinguished protocol for the addicted memory (Hase, 2010).

When the grief process becomes complex, the therapist identify what impedes the grief from progressing through its natural course to determine how to intervene.

We suggest that for patients where abuse was present in the relationship, the therapist also conducts the following interventions:

Prioritize the patient's safety by conducting a thorough risk assessment. Inform the patient about resources that exist in their local community and from which they may benefit. This will allow for the various psychosocial, legal, and protective measures to be put in place. Do this independently from whether the patient continues therapy or not. Moreover, assess if the patient is putting adequate self-protective measures in place. It is particularly important that the therapy consult be perceived as a safe space.

Turn your attention to whether the patient is struggling to end the relationship. The main goal would be to identify which factors (e.g., fear, ambivalence, financial or psychological dependence, subjective sensation of addiction to the partner or to another component of the relationship, etc.) are blocking the patient's ability to make adaptive decisions for themselves, so we can decide how to intervene.

Determine whether the patient is assigning guilt appropriately. To carry out this intervention ensure that the victim can be freed from guilt, and that the responsibility may be adequately assigned to the person who is perpetrating the abuse and/or violence.

Accompany the victim in the painful and complex process of gaining full awareness of the damaging aspects of their relationship and of the negative aspects of their partner or ex-partner. It is important that the victim understands that their current sense of malaise is mainly a result of the traumatic bond they maintain, or maintained, with their aggressor.

Support the victims by helping them discover that they have other options and that it is possible to overcome the traumatic experiences they lived through. This is done while developing new expectations for the future that are not conditioned by their past.

BUAP stage 2: Process specific past experiences

In this second stage, of our proposed interventions, therapists would process the memories that mediate the symptomatology and those related to the difficulties to overcome the break-up and/or establish healthy and functional relationships. To do so, we propose the following interventions:

Capture the relationship memories that have been dysfunctionally stored; including those from childhood as well as those from previous intimate partner relationships.

Determine which abilities the patient needs to develop and the specific needs they have for psychoeducation.

Process identified targets as well as their current triggers.

In cases where there has been abuse, the therapist needs to address those aspects that increase the patient's vulnerability to being re-victimized (e.g., prior experiences of victimization that

TABLE 1 Break-Up Aid Procedure[1]

Stages of the intervention	Therapeutic goals	Resources and specific interventions
Stage 1 Accompaniment in the end of a relationship that the patient does not want to maintain and/or help in overcoming a complicated breakup of a couple.	In case of maltreatment and/or abuse, gathering of a comprehensive understanding of the victim´s difficulties from a domestic violence perspective, including safety issues and frequent distortions during initial contact.	Informing the patient, guaranteeing safety (self-protection and external protection), addressing guilt, identifying factors that make it difficult for the client to end the relationship in order to intervene on stuck points.
	EMDR Stage 1. Progressive history gathering; extending to stage 2 of the treatment.	In this stage, specific information about the couple's relationship and the break-up is gathered.
	Stabilization. Providing the patient with needed resources and skills that can help with the present difficulties he or she is facing due to the consequences of the break-up.	Psychoeducation and skills acquisition: Introducing adaptive information on couple break-up, manipulative behaviors of abusers, emotional regulation resources, self-care assessment and intervention, etc. Installation of EMDR resources, such as 4 elements, resources to increase motivation to end the relationship, future moment having overcome the break-up, etc. (Popky, 1994, 2005; Hase, 2010)
	Reducing physiological and emotional activation. Addressing specific difficulties in this population, such as idealization, blocking beliefs and emotional dependency experienced as an addiction.	R-TEP (intervention on the present and the recent past). Work on idealized image/s or memories (Mosquera, Knipe, 2016, 2017; Mosquera, 2022). Intervention on blocking beliefs (Knipe, 2019). Desensitizing the urge related to the addictive behavior (Popky, 2005; Hase 2006).
Stage 2 Addressing persistent symptoms after the break-up and preparation of the person to establish healthy relationships.	Continuing with progressive history gathering for a more specific understanding of the dynamics that are getting in the way of improvement. Collecting information about persistent symptoms and their relationship with present difficulties.	Establishing a link between persistent symptoms, present difficulties, and past unresolved adverse and traumatic experiences. Inquiring further into the past, especially attachment, early experiences and previous relationships.
	Assessing consequences and difficulties to identify and work with specific skills that the person needs to acquire.	Building adaptive information. Psychoeducation (e.g. unrealistic expectations about relationships, need for control...) Specific resources (e.g., acquisition of social skills, anxiety management, identification of dysfunctional behaviors...)
	Identification and reprocessing targets with EMDR	Completing target selection from: - Factors of vulnerability to revictimization. - Triggers and persistent symptoms - Identified relationship problems related memories
Stage 3 Accompaniment during the initiation and/or maintenance of new relationships.	Identification difficulties in initiating and/or maintaining healthy relationships Identification and reprocessing triggers that arise as the person initiates a new relationship.	Focusing on communication style, empathy, emotional regulation, anxiety management, etc. Reprocessing triggers that interfere with the capacity to have a healthy relationship focused on the present due to the link with unresolved adverse and traumatic memories. Future templates when needed.

[1]When we use the term Phase we refer to the Phases of EMDR Therapy and Standard Protocol. When we use the term Stage we refer to the Break-up Aid Procedure (BUAP)

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have not been processed; difficulties in maintaining personal boundaries; excess of naivete in relationships; etc.).

BUAP stage 3: Identify difficulties in starting or maintaining a future intimate partner relationship

Interventions during this stage of the suggested procedure are designed to address those difficulties that will emerge as the patient begins to make real changes in their interpersonal relationships and contemplates the beginning of a new intimate partner relationship.

With each difficulty that is noted, work through the standard three-pronged protocol. Begin with current triggers and then work on memories from the past that continue to activate symptoms. You may also need to work on other relevant memories that may not have been previously identified. Close the work with future templates, which will help you discover aspects that have not been resolved so they can be processed.

Help the patient develop the necessary abilities to maintain intimate partner relationships that are healthy, satisfying, and balanced. This aspect is especially important for those individuals who have not been able to establish good relationships throughout their life.

While this work structure has been described as though the therapeutic process is linear, in practice, it may not necessarily work out this way. On occasion, the patient may either be unable or unwilling to work through all the stages. For others, it may be unnecessary to work through any of these stages. For others yet, the stages may overlap (e.g., when the individual starts a relationship with an intimate partner before grieving or working through the difficulties that underlie the reason why their relationships are often affected).

Phases of intervention using EMDR

When a patient seeks consultation for difficulties they experience when confronting the break-up from an intimate partner relationship, the therapist will guide them through the treatment structure of the eight phases of EMDR (Shapiro, 2001). However, some adaptations are strongly suggested when working on this specific presenting concern (Table 2).

Having a structure for intervention is not only useful in the exploration and understanding of the patient's presenting concern, but also in treatment planning and application. Despite this, we must maintain a framework that is flexible enough to not lose sight of the individual, their experiences, doubts, needs, fears, strengths, and vulnerabilities. This flexibility will allow the development of the therapeutic process in a way that supports any interferences or difficulties that may emerge along the way. One of the objectives that will guide the interventions will be our ability to understand the patient's concrete difficulties and limitations, what kept them from overcoming these issues, and how these are connected to their life history.

EMDR phase I: Patient history

When the primary demand being faced by the patient revolves around a break-up from an intimate relationship partner, Phase 1 of EMDR (i.e., collection of the patient's history) will need to be adapted. The patient's current preoccupation with the break-up will interfere with their ability to focus on sharing the underlying problems that would be convenient to address. Therefore, the history taking should be adapted to the needs and resources that the patient has in that moment. This may mean that the case conceptualization will need to be developed in a progressive manner throughout the therapeutic process, making it gradual and continuous.

It is recommended that one begins by focusing more on the present and in understanding the characteristics of the patient's current or past relationship, as well as the factors that may interfere in their ability to overcome the break-up. As the emotional and physiological activation starts to subside and the main interferences in their day-to-day level of functioning begin to decrease, we will be able to explore more aspects of the patient's history. It is then that one can begin to identify the adverse experiences (often during early developmental stages) that gave way to the current difficulties, or that serve to maintain them. During this phase, you will also identify the abilities that the patient will need to develop to be able to enjoy healthy relationships.

TABLE 2 Comparing EMDR'S standard protocol and BUAP.

Standard protocol	Break ups aid procedure
8 phases	The 8 phases of the standard protocol are maintained, but the 1st phase (conceptualization of the case) is carried out progressively, exploring early experiences as the patient is more stabilized.
Order of interventions:	A 3-stage intervention is proposed:
- Past (traumatic memories)	- First stage: Beginning with present and recent past until the person is more stabilized.
- Present (triggers)	- Second and third stage: persistent difficulties are addressed using the standard protocol.
- Future (future templates)	
Reprocessing of traumatic memories.	Reprocessing of pathogenic memories, including early traumatic memories and desensitization of defenses and dysfunctional positive affect.

Part I: Collection of relationship history and current situation

When treating patients with this presenting concern, you are encouraged to explore the following: (a) conscious and unconscious motives influencing the patient's choice of intimate partner or ex-partner; (b) the function(s) of the relationship in the patient's life; (c) factors that brought patient and partner together and separated them; and (d) the impact that the break-up had on the patient's sense of self and their life. In those cases where the patient is struggling to end the relationship, try to inquire about what is hindering them from letting go; what they will lose with the relationship break-up; what worries them most about ending it; and what aspects of the break-up do they fear most.

Below, we propose various sections that we consider important when collecting information for the case conceptualization:

Ending the relationship

Aside from exploring aspects such as who ended the relationship and the motives behind it (e.g., infidelity, lies, betrayal, abuse, violence, etc.), it is important to know if there were previous failed attempts to end the relationship.

Motives for leaving the relationship

We encourage the patient to put together a list of the motives that led them to end the relationship; particularly if there had been instances of abuse. This will be useful when there is: reduced motivation to end the relationship; a desire to get in touch with the ex-partner; or an increased presence of an idealized image rather than a real one. The patient may be more willing to access the motives for why they do not want to continue in the relationship if they are aware of these issues. This information offers some insight into the relationship dynamics as well as some of the personal characteristics of each of the individuals in the relationship.

Ambivalence and internal conflict

To address these aspects we explore the motives for keeping the relationship despite their intention to end it and explore the existence of possible internal conflicts that may interfere in the process of overcoming the break-up. For example, wanting to separate from the intimate partner but not feeling capable of doing so; or oscillating between being clear and feeling sad, angry and/or guilty.

If there the presence of idealization of the partner or of the relationship is encountered, we suggest the exploration of the good moments and the positive memories while evaluating how realistic these might be. The lesser amount of realistic positive memories, the more serious the idealization will be.

Patients who have been victims of abuse may present great ambivalence about the decision to put a definite end to the relationship. This could happen because of feeling incapable, fearful, confused, or guilty. It may also be due to an intense dependency on the partner that they may be idealizing. Generally, victims experience weakness at all levels of functioning because their self-esteem, general mood, and feelings of low self-worth are often impacted. This will be particularly true when they have failed in previous attempts to leave the relationship.

Degree of motivation to leave the relationship

The patient is asked to rate their motivation to leave the relationship on a scale from 0 to 100. To process the proposed targets (when there is a subjective sensation of addiction), the patient would ideally offer a rating of 70% or higher in this motivation scale; however, a rating above 50% is sufficient to attempt the intervention (Knipe, 2019).

It is possible to augment the level of motivation through the installation of resources. For example, the therapist might ask: "What would help increase your motivation to end the relationship?" The answer to this question will help identify the resources the patient may need to increase their motivation through installation.

When there is insufficient motivation or the level of motivation does not increase, we can ask the patient what is impeding them from doing so. This will help you determine how to intervene. A way of doing this may be by asking: "What's good about not having sufficient motivation to end the relationship?" Using the answer to this question we can determine how to address the block that is keeping the patient from ending the relationship or to identify what other resource may be needed.

Characteristics of the relationship

Explore the stage of the relationship they currently find themselves in (e.g., falling in love, engaged, mature love, etc.); how the patient and their partner faced changes in each stage of the relationship; and how they functioned around their sexuality. One also briefly explores each of the following aspects of the relationship.

Negative events

The patient is encouraged to make a list of the negative events experienced in the relationship with their intimate partner or ex-partner. This will offer valuable information about the characteristics of the relationship. Moreover, this knowledge will be useful in identifying targets or in having material more accessible when the patient is ambivalent.

Patterns in the relationship

Attempts are made to identify patterns of conflict that damaged the relationship and affected the patient (i.e., related to their attachment adaptation). This is done to intervene in the present (if necessary and wanted) as well as when patients need support to face future relationships.

Interpersonal boundaries

Difficulties in setting and maintaining healthy boundaries with the intimate partner are explored. Difficulties setting boundaries will be particularly problematic if the patient who wants to leave the relationship has a partner who does not want the relationship to come to an end. On the other hand, if the

patient is the person who is violating others' boundaries, theywill need to be challenged empathically to bring this to their awareness.

Subjective sensation of addiction to the intimate partner or the relationship

It is possible for the patient to feel that an aspect of the relationship (i.e., affectionate, relational, and/or sexual) represents a strong addictive component, or that the relationship is a dysfunctional bond they do not know how to manage. In assessing this factor, the patient's sense of urgency to go back to the relationship or to the intimate partner, needs to be evaluated, despite them having made the decision to not do so or having awareness that the relationship is damaging to them.

Personal characteristics

The practitioner should briefly inquire about the following aspects related to the personal characteristics of the patient.

Tolerance for solitude

If the patient encounters difficulties being alone, they will have difficulties breaking the relationship even when it is dysfunctional. It is also likely that the patient will rely on compensatory behaviors or will desperately seek another partner before grieving the end of the last relationship.

Emotional dependence

While it is not recommended that one initially dives into the causes for this type of dependency, it is important that one points it out to the patient, offering them resources to manage it. Doing so will help reduce possible difficulties associated to emotional dependence. Generally, this means that, at a minimum, we will address the concept of differentiation as well as ways to manage and cope with anxiety.

Self-care and problematic behaviors

The *Self-Care Scale* (González-Vazquez et al., 2018) may be used to assess self-care practices as part of this assessment, one must explore if the patient is engaging in behaviors to overcome the relationship break-up. Moreover, therapists need to learn whether the patient can manage difficult emotions; whether such emotions create problems for the individual; or whether the patient are inefficacious regulating them. If so, one finds out how this benefit the patient in the short-and long-term so alternative and more beneficial skills and behaviors can be identified.

Blocking beliefs

May be identified using the blocking beliefs questionnaire (Knipe, 1998b). While this assessment measure was designed for a therapist and their patient to explore which beliefs are keeping the patient from overcoming an addiction, it can also be useful with other presenting concerns. Once the dysfunctional beliefs have been identified, it will be important to process them and even use bilateral stimulation (BLS) to encourage change of these blocking beliefs (Knipe, 2019).

Self-esteem

To evaluate the patient's current level of self-esteem, it is recommended that the therapist explores the patient's realistic view of self (Mosquera and Knipe, 2016). On one hand, one can explore if the individual values oneself; if they feel they deserve to be loved; and if they believe their needs should be met. On the other hand, one can explore if the patient has unrealistic demands and expectations in their interpersonal relationships. In patients who have been victims of abuse, one frequently finds that their self-esteem has been negatively affected as a direct consequence of having a traumatic bond; independently of whether they had low self-esteem prior to the relationship or not.

Guilt

It is expected that in any grief process feelings of guilt will emerge because of the circumstances of the loss. It is also common for the individual to oscillate between blaming others and blaming oneself. Even though part of the recovery process consists in a person assuming one's own responsibility and working through it (Shapiro and Forrest, 2009), on occasion, there is a feeling of maladaptive guilt. This internalization of guilt may have already been present during childhood if the patient had inadequate or deficient parents as caregivers (Knipe, 2019) and is now exacerbated by the relationship break-up.

For some abuse victims, feeling (misplaced) guilt could be the last resource available to them to maintain a sense of control over the terrible experiences they lived through. They prefer to feel guilty than to feel impotent or even victimized. On the other hand, those who abuse their partners often try to convince (gaslight) them that they are responsible for what happened. In this manner, they can elude any responsibility over their actions and keep the victim confused and submissive to their desires.

Defenses

In this article, we refer to defenses as the psychological mechanisms through which individuals protect themselves – generally in an unconscious way – from painful emotions or from information that contradicts or threatens their core beliefs; especially those about their selfconcept. Defenses are ways of coping that have been useful during given moments, but that have currently stopped working, and keep the individual from adaptive functioning.

During case conceptualization, one needs to explore which psychological defenses are used by the patient to cope with their difficult internal experiences. To this end one examines how they interfere with day-to-day moments as well as during the therapy process. Some of the most common defenses that tend to be present are denial, minimization, avoidance, rationalization, idealization, and perfectionism.

Resources to cope with the break-up

Once the patient's vulnerabilities have been identified, the therapist can begin to explore whether the patient has the necessary positive resources at their disposal to manage their

complicated experiences and handle the therapy process. These may include personal strengths such as emotional regulation that is inclusive of positive experiences, social supports, abilities or interests, and healthy activities.

Personal strengths

These can be brought to the fore through exploration of prior situations where the patient was able to overcome difficult moments (i.e., other relationship break-ups), or where they felt in control and had the capacity to manage adversities. If there are no networks of adaptive memories, they will need to be constructed therapeutically during the preparation phase (Shapiro, 2012).

Emotion regulation

Assess whether the patient has the capacity for emotion regulation. Difficulties in this area are one of the primary reasons why patients can experience grief as intolerable. These patients will resort to behaviors to manage their pain that can be counterproductive. When there are critical difficulties in self-regulation, it will be important to identify the reasons why the patient does not tolerate one's emotions, or why they fear or experience them as something intolerable. Such patients may be offered psychoeducation to help them gain and develop the tools and abilities that will allow them to connect, identify, validate, and regulate their emotions. On occasion, it will be necessary to identify the memories associated with difficulties in emotion regulation so they can be processed.

Social supports

Inquire whether the patient has social supports and whether these individuals validate the patient or not. This is particularly important if the patient has been a victim of violence and/or abuse. If there is invalidation or guilting of the victim, it will be necessary to challenge some of the messages they have received from others and teach them to neutralize them. It may also be necessary to teach them how to set boundaries with those individuals.

Where there has been violence and/or abuse, one of the main tasks will consist in identifying patient characteristics that could make them more vulnerable to damaging relationships or make them a victim of manipulation and/or any type of abuse. For example, it will be necessary to explore in which moment the patient started to become aware of their partner's negative aspects; why they were not able to notice these before; and whether they had already identified some indicators that interfered in their ability to protect themselves when they were warned that it could be a damaging relationship.

Part II: Collection of complete history

When the patient is sufficiently stabilized and prepared to face pertinent aspects of their past, we recommend the collection of necessary information to intervene with the three-pronged (past, present, and future) standard EMDR protocol. However, the order in which to process the targets will depend on each concrete case.

When collecting history, one explores early experiences as well as relationship experiences throughout one's lifespan. Present triggers need to be identified; particularly those that interfere in interpersonal relationships and those that may keep the patient from establishing future, healthy relationships.

Early relationships

Attachment style

In Siegel (2012) words: "It is probable that the first attachment experiences in life directly shape cortical processes implicated in corporal regulation; one's capacity to communicate with others; emotional equilibrium; flexibility; empathy; self-understanding; and one's capacity to self-soothe fearful states (p. XVII)." For this reason, as part of assessing the patient's adult attachment style, the therapist needs to identify the type of attachment adaptation the patient had with each of the primary caregivers during infancy. In patients where the attachment to the mother was insecure, one would explore if there was an incident during the perinatal stage that led to physical and/or emotional separation that could have affected the mother–child bond. In turn, this could have affected the development of attachment, for which the mother–child bond is considered a necessary, but not sufficient condition (Madrid, 2012).

Family genogram

Doing a family genogram has a double function: evaluation and intervention. It facilitates the patient gaining awareness of the importance of some trans-generational difficulties; behavioral patterns; and dynamics in interpersonal relationships that may affect their relationship with an intimate partner. Understanding how this transmission of trans-generational difficulties occurs, may bring insight to the patient about their parents' problematic behaviors and/or those of other family members and/or caregivers. This can help some patients gain perspective and may even bring healing to some. It may also be useful to explore if there were hierarchical problems in the family of origin. For example, setting boundaries; accepting authority; and the capacity to give and receive care (Wesselman, 2012).

Assessing differentiation

To establish functional relationships and enjoy psychological wellbeing, it is essential to learn to differentiate ourselves from others. In the context of this article, differentiation refers to an active process in which the patient can connect to their thoughts, feelings, and values while also being close to someone. If the dynamics in the family of origin were healthy, differentiation will have likely taken its natural course and it will not be necessary to intervene. In fact, this differentiation will likely serve as an important resource for the patient. On the other hand, if the process of differentiation did not develop appropriately, it will

be common to find confusing dynamics in the family history where everything is blended as well as current difficulties in interpersonal relationships. Part of the therapeutic process will consist of helping the patient gain awareness of these difficulties, while also helping them differentiate from their family of origin. The latter will involve the dissolving of triangulations in the family system that are maladaptive (Kaslow, 2012).

Emotional environment and early experiences

Using the *EARLY Scale* (Gonzalez-Vazquez et al., 2019) may be useful to gain information about the possible traumatic experiences and deficiencies that may have been present during the patient's upbringing. Together with the patient, the therapist would explore how these could have had a negative impact in the patient's emotional development, interpersonal interactions, and sense of self.

Therapists could then explore the patient's early experiences with peers. These types of experiences as well as how the family of origin responded to them can significantly shape the beliefs the patient develops about oneself, others, and general human relationships. Therefore, it will be important to identify if this type of memory is present, stored dysfunctionally, and whether they are at the root of the patient's current presenting concerns.

Dysfunctional schemas in intimate partner relationships

Schemas are the emotional and cognitive patterns generally learned early in life, which continue to repeat themselves throughout life. Young (1990, 1999) *Schema Therapy* was designed for individuals who suffer from chronic conditions. Schemas are also likely to be present in non-clinical populations (Young et al., 2013). The concept of schemas can help us to identify the aspects of the patient's personality that require intervention,organize the information we obtain and present it to the patient without their feeling pathologized or judged. From an EMDR perspective, identifying the patient's schemas facilitates our ability to classify memories by themes that are at the base of their difficulties and that tend to repeat themselves. This may bring clarity to both patient and therapist.

Lacking experiences

Unconsciously, some individuals try to satisfy unmet infant needs in the present. The cognitive and emotional schemas that generate difficulties in adult relationships emerge from these unmet needs (Young et al., 2013). From the point of view of *Schema Therapy*, the following core emotional needs are noted: (a) bonds with others (including safety, stability, care, and acceptance); (b) self-esteem, competence, and sense of self; (c) freedom to express valid needs and emotions; (d) spontaneity and playfulness; and (e) realistic boundaries and self-control. Apart from these needs, it is important to explore if the patient felt invisible in the relationship with the primary caregivers as well as the feelings associated with the effects of that invisibility (Mosquera, 2018).

In relationships where there has been violence or abuse, it is possible that the perpetrator of the violence has used what was lacking in childhood to hook the victim through apparent satisfaction. If there is ambivalence to leave the damaging relationship, it could be useful to explore what the patient considers that their partner has contributed and which no other or very few had contributed before.

Prior partner relationships

It is beneficial to identify patterns that are repeated in the different relationships and that become problematic for the patient, their partners, and/or the relationship itself.

Role of power in relationships

In this BUAP approach we encourage the therapist to observe if certain patterns around issues of power repeat themselves in the patient's relationships with partners. It is possible that the patient needs to subjugate their partner, and to the contrary, ends up subjugating themselves to them. It is also possible that the patient involves themselves in conflictive relationships, in which there is escalation between both members to achieve power. This can lead them to be pray to more extreme situations each time.

Dysfunctional behaviors

This entails the identification of what type of behaviors are used by the patient in their relationships to feel better in the short-term but that in the medium and/or long-term generate problems for them. There are three important elements that need to be clarified to better understand the behaviors that affect the relationship dynamic: (a) the function that certain behaviors have in the relationship (e.g., controlling the other; protecting them; managing those emotions that activate their attachment bond or difficult subjective experiences; maintaining the relationship or the emotional supply it provides; etc.); (b) the degree of intentionality behind the behavior; and (c) how the patient feels when they rely on these behaviors (e.g., level of awareness in utilizing a dysfunctional behavior and whether there is fault in it or not.)

Unrealistic expectations about couples' relationships

The beliefs that affect couples' relationships are influenced by what is learned in the social and family context and by what the patient experienced throughout their development. Concretely, within the family environment, the patient may have acquired beliefs through internalization of certain comments or through direct observation of interactions between caregivers. Amongst these beliefs we can encounter myths about romantic love (i.e., ideal relationship with a partner to which we must all aspire), or myths that represent an idealized belief about finding the "adequate partner" or "other-half" who will make everything simpler including the relationship as well as life itself. Another myth may include a patient's belief of being incomplete until they find a person they can partner with; they see having a partner as a requisite to feeling fully satisfied. An added difficulty about

these myths is that they make way for abusers to manipulate their partners. In turn, the partners have internalized that romantic love takes place as a series of behaviors that are clearly dysfunctional for both members and are disempowering of the victim.

Need for control

This is one of the facets of personality that can give way to the most damaging aspects of a relationship. Shapiro (2012) orients us to the origin and treatment of this difficulty: "A variety of dysfunctional relational behaviors can be based on childhood experiences that in some way initially gave the individual a sense of security or control… The AIP model encourages therapists to process memories of the interactions that established these patterns (p. 32)." Wesselman (2012) explains that in some cases, control may be the only way a vulnerable person finds to relate to others. This way of behaving, learned early in life, is habitually maintained in adult relationships; especially in those with intimate partners.

Negative memories of the distant past and triggers

Through identification of unprocessed memories and their present triggers, the therapist will find some of the targets which may be used when intervening using the standard EMDR protocol.

Negative memories

Negative memories having the greatest impact on the patient's life need to be identified; particularly in reference to their presenting concerns. This may be done either through the symptomatology these memories create when they are dysfunctionally stored; or by the functional limitations they generate day-to-day (i.e., what they activate with the associated negative beliefs.)

Triggers

These are identified by exploring instances that generate problems in the patient's relationships and that can cause them discomfort, block them, or emotionally activate them in a way that reduce their capacity to function in adaptive ways.

Resources and limitations in meeting future partners and maintaining relationships

One of the goals of the intervention, will be for the patient (if they agree) to have healthy relationships in the future. Once the patient overcomes the grief process (at least the most complex phases of it), it will be time to inquire about the things that went wrong in previous relationships; what they want and do not want in future partnerships; why they are unable to achieve this; and what happens in the relationships they dislike or that generate problems for them. For some people, meeting a new partner can be quite challenging for various reasons. Explore the difficulties or concrete deficiencies that the patient presents with by exploring the following characteristics.

Social skills

Patients whose relationship difficulties are due to deficits in social skills, may be helped to develop them through specific psychoeducation. This will allow the patient to practice these skills in real life while we can process the interactions in therapy. On occasion, the interactions occurring during therapy itself become an ideal opportunity to empathically point out some of the behaviors that are likely to generate difficulties in social situations.

Fears and/or avoidance

If the expressed difficulty is that the patient feels anxious, particularly in social situations, the therapist might want to offer psychoeducation about anxiety and fears. It is likely that there will be a need to identify, desensitize, and process the experiences that mediate the anxiety and those that have worsened it. In some patients, the predisposition to anxiety could be due to biological alterations, which also need to be explored (Bulbena, 2016). The latter may require us to refer the patient to a prescribing professional.

At the right moment, use the future template to prepare the patient for exposure and to face real life. Once they have been exposed to their feared social situations, it will become possible to process the triggers that are activated in their interactions with others using BLS. Moreover, efforts need to be made to understand and address the origin of difficulties that start to emerge.

Patterns of interaction with others

To understand the patterns of interaction with others, we can rely on *Schema Therapy*, since these patterns are likely related to early development schemas. EMDR is used to identify beliefs, unprocessed emotions, and memories associated to these schemas; hence, to the patient's patterns of interaction.

Communication style

Good communication is fundamental in any human relationship, particularly in intimate relationships. We must identify the patient's communication style while helping them gain awareness of the dysfunctional strategies that they use (e.g., indirect communication and the impact it has in relationships.) Offer positive alternatives of communicating their needs and address conflict.

Empathy and mindsight

Many difficulties in intimate relationships are related with a disparity in the level of empathy between both partners. Empathy has a significant influence in how we perceive others as well as how we interact and relate to them. With individuals who have low empathy, we can intervene to improve their mindsight – defined as one's capacity to see one's own mind in a compassionate and conscious way while also imagining the minds of others with care and empathy (Siegel, 2012). The exception to this type of intervention would be, individuals with marked psychopathic features who have traditionally been considered untreatable (Cleckley, 1976). On the other hand, when there is an excess of

empathy, it will be important to help the patient differentiate themselves from others. Such patients would benefit from being educated in ways to protect themselves by establishing adequate boundaries while noticing and satisfying their own needs. This may imply working to help the patient overcome barriers to attaining that satisfaction (e.g., not feeling deserving, or feeling guilty, when they put their benefit or well-being before that of others.)

EMDR phase II: Preparation

In this phase, the therapist offers the patient the necessary resources to adaptively engage in the therapeutic process by providing them with adequate psychoeducation so they can understand their experiences, and if necessary, re-conceptualize their difficulties. This phase, and the following phases, do not necessarily need to be sequential. This is because, frequently, the processing of memories will be accompanied by concurrent psychoeducation.

During this phase, there are two common themes the therapist addresses in a couple's break-up: (a) any ambivalence about the relationship break-up; and (b) grief related to the loss of the bond and related emotions. This process might be somewhat complicated due to the patient's personal history; the relationship journey and break-up; limited personal resources; and the patient's current circumstances. While it is important to not pathologize grieving that follows its natural course, we can always offer support and psychoeducation to normalize their experience and validate emotions associated to it. When grief is complex, it may be necessary to intervene using a more individualized case conceptualization and interventions.

Installation of resources

To begin working through this phase of EMDR, it is necessary to offer helpful tools to manage any disturbance that may affect the patient during or after therapy sessions (Shapiro, 2012). To do so, we first install one of the resources that we most frequently use in EMDR: the safe place (Shapiro, 2001; Korn and Leeds, 2002). Adaptive information may be introduced to complement this resource, such as psychoeducation on how this supports emotional regulation. If the patient has difficulties working on this type of exercise or the tool does not bring them a sense of calm, alternatives would need to be used.

Often, it is sufficient to install this resource to be able to begin processing stored dysfunctional memories using the procedure that is most adequate for each patient. It is most common that what is most stabilizing for the patient is to be able to process those memories related with emotional hyperarousal and intrusions. If you notice that there is a deficit in emotion regulation, prior to or concurrently, offer the necessary knowledge and tools to improve those abilities. This is an aspect that you must remember to assess in each patient.

Various options are available for cases where we consider appropriate to install additional resources before processing dysfunctional memories. For example:

- If the patient is psychologically weak and/or unable to use their own resources and abilities to self-manage through their external or internal experiences, identify resources that can be installed to make them more accessible. One could include prior situations that they resolved successfully, where they felt in control, or which they were able to handle positively (e.g., previous break-ups from other partners that they have already overcome or any other situation where they felt capable.)
- If the patient presents with deficits in concrete areas (e.g., inability to be alone, to regulate their emotions, or of feeling self-control, etc.), identify and install resources that may help them manage those specific difficulties.
- If there were temporary difficulties in benefiting from social supports – a fundamental resource – the patient would benefit from the installations of moments where they enjoyed the company of others; where they have felt connected; and/or when others served as adequate support.
- If there was difficulty keeping distance from an ex-partner, particularly if there is an addictive component in the maintenance of the relationship, it could be useful to install a moment in the future in which the person has been able to overcome the break-up and be okay (Popky, 1994, 2005; Hase, 2010).

Processing memories

In each stage of this process, we will describe how to apply the different procedures contained in BUAP. We will need to be flexible and adapt to the needs of the patient as we move through the process. On occasion, even if we are in Stage 2 or 3, it may be timely to resort to interventions from Stage 1.

Stage 1: Ending the relationship and overcoming the break-up EMDR's R-TEP

The EMDR Recent Traumatic Episode Protocol (EMDR R-TEP) is an integrative protocol that incorporates and extends existing protocols within a new conceptual framework, together with additional measures for containment and safety (Shapiro and Laub, 2014). Therefore, this protocol can be useful when an individual seeks therapy after a relationship break-up that has been traumatic and in which they are just beginning to consolidate memories in their mind.

The following are the main advantages in using R-TEP after a break-up from an intimate partner relationship:

- It facilitates approaching memories associated with the break-up since they are still being consolidated, so that the different episodes have not been integrated among the rest of the memories (Shapiro, 2013).
- It allows the therapist to work with what is emerging in the patient's mind; what they are prepared to confront; and what is most accessible to them. They do not base the work on their hypotheses about what is the best route for intervention. Instead, therapists allow the patient's adaptive information system to guide the process under their supervision. Nevertheless, the therapist needs to be attentive to the difficulties and needs that emerge during processing and between sessions.
- It gives way to work on the most intrusive material and that which produces the most discomfort or interference in everyday life. This helps the patient in their day-to-day and eases their ability to remain focused and motivated during the therapy sessions.
- It addresses what is most distressing to the patient, which tends to result in quick relief. This allows the patient to use resources they could not initially access given the intensity of the emotional and physiological activation as well as the focus on the relationship loss.

When we intervene using R-TEP, the patient narrates the event fully while the therapist only uses BLS during the first processing session. However, when working with a couple's break-up, it may be useful to repeat this part of the protocol at different times during the therapy process. This will help the patient build a narrative about the relationship and its break-up. The intervention, while therapeutic by itself, also allows us the therapist to identify the changes in that narrative; the aspects of the patient's experience that they are not able to fully integrate; and those things they learned from the patient's own history that are maladaptive.

Idealization: Processing dysfunctional positive affect

To understand the relevance of working with idealization in EMDR, it is important to develop an understanding of memory processing in a wider sense. Therapists need to not only consider as dysfunctionally stored memories those that encompassed negative events, but also those that included dysfunctional positive affect (Knipe, 2010; Mosquera and Knipe, 2017; Mosquera, 2022).

On occasion, patients will present with idealized mental representations. These may be the image of a moment with positive components; a fragment of a memory; or the memory itself. In the construction of the idealized image, different factors may contribute. These can be individual or sociological, but most important is the defense of *idealization* – a mechanism of psychological protection and survival which is habitually found in individuals who grew up in families whose caregivers were not sufficiently good. This defense is automatically learned during childhood to tolerate the intolerable because escaping or fleeing are not realistic options. This mechanism plays a role in the construction of the idealization of a partner. It will often block access to adaptive information and diminish the patient's capacity to make healthy decisions. Moreover, the partner can also contribute to activating the creation of an image that is not very realistic of self (Mosquera and Knipe, 2017, 2019; Mosquera, 2022). Below, we list some cases in which it is common to create an idealized image of the partner:

- People who are in the falling in love phase of the relationship, in which idealization of the partner tends to predominate.
- Those who tend to idealize their partners because they have internalized myths about romantic love, in which they base their relationships.
- Individuals who learned to idealize their caregivers as a defense mechanism in their childhood. This, in turn, is reenacted in their adult relationships.
- People immersed in relationships with partners with psychopathic or malignant narcissistic profiles. These individuals have deliberately managed to accomplish having their partners (i.e., the patient) internalize an idealized image of them through manipulation and deceit.

When a patient grows up with abusive caregivers, the development of this idealization defense can make the individual more vulnerable to violence and/or abuse from others. And, when these patients partner with someone who has similar dysfunctional patterns to those of their childhood caregivers, the defense of idealization will be unconsciously activated. In turn, this will make it difficult for the patient to identify that they are in an emotional trap that impedes them from taking effective measures to distance and protect themselves.

The idealized image can complicate the grieving process that is associated with a relationship breakup; especially if there has been violence or abuse. The idealization is often more damaging in cases where the victim shows ambivalence to leave the relationship (Mosquera and Knipe, 2017). In victims of violence and/or abuse it may be psychologically exhausting to deal with the internal conflict that the partner's two opposing images generates: the idealized image and that which is more realistic. Both images are completely incompatible; particularly when the psycho-biological bond that brings them close to the partner who victimizes them is more intense.

To process the idealized image, we will target the "best moment" by using a procedure developed to help women target the ambivalence that can be present when leaving an abusive partner; specifically, this procedure targets the idealization and dysfunctional positive affect (Mosquera and Knipe, 2017; Mosquera, 2022).

Subjective sensation of addiction to the relationship

On occasion, what keeps a patient from bringing a relationship to a close or from overcoming a breakup (whether wanted or not), is the urgency to contact the partner. This could be because of pressure to restore the closeness or because of a desire to recover an aspect of the relationship (e.g., physical intimacy).

The sensations and impulses that are described by the individual are like those that we see in an addiction; as such, they can generate feelings of guilt and confusion. When there is a subjective sensation of addiction, it will be beneficial to adopt Shapiro's perspective that an addiction is stored in the nervous system, and it is not sufficient to make a cognitive decision to overcome it (Shapiro, 2013). Explaining this to the patient can help normalize and understand the difficulties they have in keeping distance from their ex-partner. We can find various cases where the subjective sensation of addiction makes it difficult to break a damaging relationship or accept a break-up that wasn't chosen. Below, are a few of those instances:

Individuals who find themselves in the falling in love phase of the relationship, since this is one of the most powerful impulses for human beings (Fisher et al., 2006).

Those who are in co-dependent relationships.

People who have been victimized by their partner or ex-partner, who in turn has psychopathic traits. When this is the case, the partner can have a strong hold on the victim through powerful seduction during the initial phase of the relationship. This may include an objectified use of sex and different manipulative tactics (Piñuel, 2016).

Individuals addicted to physical intimacy with their partner.

Patients who present with an intense impulse to reconnect with their ex-partner (even when inconvenient or difficult to do so), will need us to intervene using BLS either on the addictive memory or the implicit memory of positive affect (manifested in their awareness as the impulse to start and repeat the addictive sequence; Hase, 2006.)

To begin processing the addictive memory, we will select one of the components of the addictive behavior as target one. This will be done in function of its accessibility, the patient's preference, and what they consider safer (Mosquera and Knipe, 2017). Aspects of the addictive memory that may be processed include: desensitizing the urgency to start the addictive behavior (Popky, 2005; Hase, 2006); targeting the positive sensation that accompanies the addictive behavior (Popky, 1995; Knipe, 1998, 2005, 2010; Miller, 2010); desensitizing the anxiety and shame that comes after engaging in the dysfunctional compulsive behavior (Greenwald, 2000); or targeting relapses in addiction (Hase, 2006).

Stage 2: Working on impediments to maintain healthy relationships

Once the patient can end the relationship and make progress in their grief process, it will be appropriate to conduct a deeper evaluation; particularly, if aside from overcoming the break-up, their goal is to improve future intimate partner relationships or their difficulties with attachment. In doing so, we need to explore why the patient has difficulties in relationships with partners and how they would like to behave in future relationships. Below, is a list of possible foci for the proposed intervention. You may use these for all cases during this stage:

When there are core attachment difficulties, the patient does not just present problems in the last break-up but is also likely to have experienced difficulties in previous relationships. A concrete case is what Nancy Knudsen (2012) coined as chronic relational dysfunction – defined as "the experience of those who are capable of finding and maintaining a healthy intimate partner relationship but who feel considerable emotional angst about the relationship." The author attributes this to a low level of differentiation (Bowen, 1978), which on occasion will require an intervention on the relationships with the family of origin and the establishment of healthy boundaries.

If the patient cannot care for their own needs or they are not realistic or adaptive, the therapist will help them: identify their needs; evaluate whether they are adaptive or not; and find the way of satisfying them while finding balance between their needs and those of others.

If adequate, proceed with psychoeducation to help the patient achieve capacities and abilities that the patient was not able to develop at the adequate developmental moment due to an insecure attachment.

If difficulties with emotion regulation persist, we can introduce stabilization tools and/or process the memories that are at the source of these difficulties. These types of memories can be negative, but we can also find some that the patient considers to be positive when in fact, they are not. For example, when the patient has grown up in a family where rage explosions and violence are normalized and even valued, a sensation of power and control is manifested in the individual and needs to be resolved.

If the attachment was insecure or damaged, work to repair it by using the EMDR standard protocol on the "attachment injuries" of the individual. Attachment injuries are those that take place when "a significant figure, parent or partner, do not respond during a critical time of need" (Moses, 2012, p. 183).

Work on the traumatic experiences from the last relationship or previous relationships if they have not surfaced during R-TEP or if it's necessary to deepen exploration of them.

Address any associated memories to the patient's schemas that may be making it difficult for them to enjoy healthy relationships. We can arrive at these memories through the negative beliefs or the patterns of dysfunctional interactions that they repeat in relationships. For example, looking for partners who are emotionally unavailable.

Finally, work on current triggers.

Additionally, in cases where there has been violence and/or abuse

If it becomes clear during the previous stage that the patient has vulnerabilities that make them susceptible to others being violent or abusive towards them, working on these vulnerabilities will need to be prioritized.

If necessary, provide psychoeducation about where responsibility resides in instances of violence and/or abuse so that the patient can rid themselves of any maladaptive guilt they may feel. This will also help the patient assume the responsibility that belongs to them in the process of recovery. For example, defining what they can do now, and in the future, to manage interpersonal relationships while concentrating on those aspects that depend on them.

Stage 3: Working with new intimate partner relationships

In this last stage, the goal will be to resolve any difficulties introduced by the patient (if they exist) to meet, initiate, and maintain relationships with new partners. When an individual does not even attempt to establish a relationship with an intimate partner, the main and most common problem is the use of avoidance as a resource to not suffer harm. This behavior may be present because the patient developed a social phobia or due to other motives (e.g., having left a traumatic relationship; not being able to trust others; being fearful of choosing an inadequate partner or someone who mistreats them.)

We may also find individuals who have difficulties managing some of the stages of the relationship. For example, some may become overwhelmed by the emotions associated with falling in love or intimacy; others feel ambivalent; and yet others fear they will repeat hurtful patterns or present with a deficit of abilities. In these cases, the goal will be to accompany the patient in the stage of the relationship that is difficult for them. Easing exposure to those aspects that they fear by offering adequate psychoeducation and using EMDR to process triggers that are activated will be beneficial.

When despite the work on the previous stages the patient continues to experience insecurity and doubts in facing a feared situation, the first step will be to look for related memories that have not been previously identified. Once these have been processed along with present triggers, working on a future template will follow. This can be repeated as many times as necessary so the person can solve in their imagination the feared situation in the most effective manner. After applying the future template, we expect that the person will be able to put into practice, in the real world, what they were avoiding or inadequately facing. The latter may help us identify additional aspects to process (Shapiro, 2012).

Finally, work with the abilities that the patient needs to meet new people and maintain healthy relationships. Shapiro (2012) best explained it: "It is much easier for patients to improve their social skills if they do not have old unprocessed memories that make them feel insecure and defective. Consequently, EMDR works from the inside out. It takes care of the internal world before using the excellent modeling tool – *experiential roleplaying tool* - to incorporate a set of skills that help define a healthy adult (p. 32)."

Conclusion

The guidelines proposed in this article to intervene with patients who seek therapy after the break-up from a relationship with an intimate partner, have been introduced with the purpose of addressing the concrete difficulties individuals experience in their process of grief and from the loss of their secure base. These relationship break-ups can interfere with many of the patients' daily experiences and lead them to even abandon therapy if it is not adapted to address the factors that bring them the most discomfort. The proposed framework consists of a series of adaptations of EMDR's standard protocol while keeping in mind the frequent difficulties in these relationship break-ups.

The stages of intervention introduced here are simply a guide or framework to follow. Variations and adaptations must be individualized. It will not be necessary to follow all the proposed steps in this article. Rather, the intervention should be adapted to the difficulties that show up at different moments of the therapeutic process.

Author contributions

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

Acknowledgments

We thank EMDR Europe Association for supporting the publication of this article with a grant.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 12 October 2022
DOI 10.3389/fpsyg.2022.969028

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 14 June 2022
ACCEPTED 27 September 2022
PUBLISHED 12 October 2022

CITATION
Faretta E, Maslovaric G, Garau MI, Marmondi G, Piras L, Rezzola S, Incerti A, Nardoni A, Pagani M and Gallina E (2022) The psychological impact of the COVID emergency on Italian nursing homes staff and the effectiveness of eye movement desensitization and reprocessing. *Front. Psychol.* 13:969028. doi: 10.3389/fpsyg.2022.969028

The psychological impact of the COVID emergency on Italian nursing homes staff and the effectiveness of eye movement desensitization and reprocessing

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Residential nursing homes were particularly badly affected by the first wave of COVID-19, with large numbers of their frail person getting infected with COVID-19 and dying. The staff in these structures were catapulted into a reality very different from what they were used to. They had to adapt the way they used to take care of their patients in a very short space of time and in a scenario that was continually changing. In this manuscript we describe the subjective experience of staff in a number of Italian nursing homes during the first wave of the COVID-19 pandemic; and we report data showing the effectiveness of the Eye Movement Desensitization and Reprocessing (EMDR) treatment provided to support them during this Pandemic.

KEYWORDS

nursing home, EMDR, PTSD, COVID-19, Italy

Introduction

The COVID-19 emergency has been a mass and humanitarian disaster and we are still only able to gauge the tip of the iceberg in terms of the effects it has had on our mental health. The consequent quarantine and isolation have been connected with fear (Rubin and Wessely, 2020), acute stress syndrome, depression, post-traumatic stress disorder, insomnia, irritability, anger, emotional exhaustion, and a perceived loss of control (Jung and Jun, 2020; Xiao, 2020). In their review, Brooks et al. (2020) noted that the most frequently reported negative effects of lockdown were post-traumatic

stress disorder, confusion, and anger. If these effects were true for the general population, we can make the assumption that they were amplified in health workers by three main factors (Tarquinio et al., 2020): social pressure due to the rapid evolution of the emergency situation and the consequent changes in the quality of care they could provide; professional pressure due to a far higher than normal work load and personal pressure due to the fear of transmitting the virus to their loved ones or the distress of being isolated.

This assumption is even more fitting for staff operating in residential nursing homes for the elderly (residenze sanitarie assistite [RSA]). In Italy, RSAs refer to residential communities which accommodate elderly, weak or vulnerable people with multiple assistance needs: physical and medical, emotional, and relational. It was in these places that the sudden COVID-19 pandemic had its most catastrophic impact.

A survey of how the virus spread during the first wave of the Pandemic (Lombardo et al., 2021), covering about 40% of Italian RSAs, showed that 9,154 residents deceased from 1 February to 5 May 2020.

In the same period, 12% of the nursing homes had at least one COVID-positive resident, 35% had at least one resident with "flu-like symptoms" and 21% had at least one COVID-positive health worker. The authors point out that 60% of nursing homes received no precise indications on how to manage the residents or on how to prevent or handle infections. About 8% of nursing homes were unable to isolate residents with suspected or confirmed COVID-19, and the arrival of the Pandemic highlighted critical problems like the shortage of personnel, the difficulty of transferring patients from one structure to another, the lack of personal protective equipment (PPE) and medicines, and the fact that it was impossible to conduct COVID-19 PCR test (molecolar, swab) when necessary. This situation with so many critical issues may have generated a number of stressors with negative effects on the mental health of nurses and other staff, as has already been observed for other major disasters and pandemics (Alharbi et al., 2020; Usher et al., 2020).

During the first wave of the COVID-19 pandemic, the Italian EMDR association (Associazione EMDR Italia) was called on by nursing home directors to organize a cycle of EMDR sessions to support staff through this challenging period. The Eye Movement Desensitization and Reprocessing-Integrative Group Treatment Protocol (EMDR-IGTP) has already been reported to be effective in supporting staff involved in dealing with emergency situations (Tarquinio et al., 2020) and it is suitable to be delivered online (Perri et al., 2021). Recently, however, Lenferink et al. (2020) noted that there is a lack of empirical data to confirm its successfulness in the treatment of post-traumatic stress disorder due to the COVID-19 Pandemic.

We think that our report partially fills this gap by fulfilling two objectives:

- it provides a current picture of the state of psychological health of a group of staff in nursing homes during the first wave of the COVID-19 pandemic; and
- it supplies quantitative data on the effectiveness of the online group EMDR treatment on this hard-hit population.

Research context

The online group EMDR treatment was administered to health care, social, and administrative staff or workers in 6 RSAs throughout Italy. An agreement with the *Associazione EMDR Italia* was reached and signed by each facility. Twenty-six qualified EMDR therapists volunteered to participate in the project.

The aim of the project was to provide the nursing homes workers involved with support to bear the emotional load caused by isolation, to reduce stress and to contain states of anxiety and anger. Also to work through negative feelings and traumatic moments in order to avoid the development of problems related to post-traumatic stress.

The following nursing homes participated in the project:

- RSA Villa San Lorenzo (Trentino Alto Adige): 49 workers divided into in 17 groups;
- RSA Rosa dei Venti (Trentino Alto Adige): 47 workers divided into in 17 groups;
- RSA Padre Odone Nicolini (Trentino Alto Adige): 37 workers divided into 13 groups;
- RSA Telegonia (Sardegna): 11 workers divided into 3 groups;
- RSA Centro Monsignore Siro Silvestri (Liguria): 26 workers divided into 5 groups;
- RSA Centro socio assistenziale del Sacro Cuore (Liguria): 14 workers divided into 3 groups.

Materials and methods

A total of 58 interventions were carried out, each consisting of a minimum of 3 and a maximum of 5 sessions, with groups of 2–5 participants. Each intervention was conducted by an specifically trained, qualified EMDR therapist external to the nursing home. All the meetings were conducted on a digital conferencing platform to guarantee social distancing. All the interventions were carried out during one of the acute phases of the emergency (spring–summer 2020).

In the first meeting participants were given psychoeducational instruction on the reactions caused by

post-traumatic stress disorder in accordance with the CISO model (*Critical Incident Stress Orientation*) (Maslovaric, 2020), which involves:

- giving participants a symptom grid showing normal and common reactions to post-traumatic stress. This allows participants to identify their own symptoms as common, albeit disturbing. It also provides explanations and descriptions of what is meant by a traumatic event, the psychological reactions that can arise following one, and vulnerability factors (in this case level of involvement and exposure);
- providing indications for emotional self-protection to promote coping strategies and resilience;
- providing explanations and an introduction to EMDR therapy and in particular on the brief group protocol (EMDR-IGTP).

This was followed by brief defusing and debriefing interventions to stabilize participants and inform them about acute stress and post-traumatic reactions and to strengthen individual coping resources. Finally, the safe place was established by means of the butterfly hug technique (Artigas and Jarero, 2014; Jarero, 2020).

The butterfly hug technique used in the group protocol (EMDR-IGTP), is a form of self-administered bilateral stimulation used to achieve stabilization, to enhance resources and to create a safe place; and to re-process traumatic events (Artigas and Jarero, 2014; Jarero, 2020).

Following this initial preparatory phase, the main body of the treatment consisted of applying the EMDR-IGTP (Jarero and Artigas, 2009) to reprocess the main traumatic events identified by the participants. These events included being powerless to help elderly patients who were in pain and unable to breathe; watching the death of patients with whom they had had strong emotional bonds; being unable to respond to sick patients' requests for a hug; being unable to take adequate care of the bodies of deceased patients; the fear of transmitting the disease to patients or to their own families; the lack of personal protective equipment and the fear of legal liability for the high number of deaths (in the case of participants in roles with legal responsibility). The following are some of the testimonies collected during the intervention:

- *"I cried for the whole shift and I couldn't stop even when I got home"*;
- "*Watching them die and not being able to touch them because I was scared of getting infected*";
- *"Watching the old people getting worse one by one";*
- *"Rushing from one room to the other without really being able to do anything";*
- *"Not enough space in the morgue for the bodies";*
- *"Not being able to get away from it."*

These perceptions (and others in the paragraph on the participants' experiences) were the target traumatic experiences and events for EMDR treatment during the interventions.

Outcome measurements

The assessment protocol was based on two self-report questionnaires.

The characteristics of the sample were studied through *ad hoc* questions: (1) socio-demographic (age, sex, number of children, number of cohabitants); (2) job-related information (e.g., workplace and occupation). The post-traumatic symptomatology was evaluated through Impact of Event Scale-Revised (IES-R) in accordance with the criteria of the DSM IV-TR (Weiss and Marmar, 1997) validated and translated into Italian (Pietrantonio et al., 2003). The latest PCL-5 (American Psychiatric Association, 2013) was not used, as it is free (in Italian version) as of May 2019. We considered it late and for the reasons of homogeneity we always did the IES-R. This psychometric test consists of 22 items. It includes 3 subscales measuring the following dimensions: intrusion, avoidance, and hyperactivation. Participants were asked to rate their level of post-traumatic symptoms using a 5-point Likert scale ranging from 0 (="not at all") to 4 ("a lot") referring to the previous 7 days. The total score between 0 and 88. The cut-off of 33 highlights a high risk of PTSD; in line with the literature, there are no specific cut-offs for scale interpretations. The Italian translation of IES-R has shown satisfactory internal validity in studies on different populations at risk, as reported by Craparo et al. (2013) (Intrusion, $\alpha = 0.78$; Avoidance, $\alpha = 0.72$; Hyperarousal, $\alpha = 0.83$) and Converso and Viotti (2014) (Intrusion, $\alpha = 0.91$; Avoidance, $\alpha = 0,81$; Hyperarousal, $\alpha = 0.87$). Although the IES-R has not been validated in the general Italian population, it has been used to evaluate the symptomatology of PTSD in many Italian samples, which confirmed its adequate reliability (Gambetti et al., 2011; Priebe et al., 2011; Maslovaric et al., 2017).

The Emotion Thermometer (THERMO, Mitchell et al., 2010), a visual analog self-assessment scale to collect the level of intensity of emotional activation on a Likert scale from 1 to 10 regarding some main emotional experiences (stress, depressed mood, anxiety, anger, sleep problems, need for help) during the previous week was also submitted to the investigated subjects.

These questionnaires were administered by psychologists different to the ones who carried out the group EMDR interventions.

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Respondents

The project involved 184 subjects. Data are reported for the 122 who completed both the pre- and post-treatment questionnaires. The differential attrition in this study was less than 15%. This sample comprised 102 females and 20 males with an average age of 44.

Participants' experiences

- Working in a ward turned upside down by the emergency (rushing from one room to another without really knowing what to do, having to cover staff shortages by working shifts of up to 12 h);
- the tragic deaths of many of the nursing home guests and witnessing their suffering without being able to touch them (patients struggling to breathe and dying);
- not being able to carry out the normal passing rituals associated to death, due to the high numbers of deceased patients;
- fear of infection for themselves and their families; the sense of guilt over having infected someone; social distancing from their own families;
- coincidence of the COVID-19 emergency with personal traumas (like cancer in a family member).

The distress of these experiences was accompanied by workers' negative beliefs about their own ability to deal with the traumatic situation (I don't trust myself, I'm not in control, I'm helpless, I'm in danger, I'm useless, I'm unable to handle this); and by somatic symptoms like sleepiness/difficulty sleeping, anxiety/worry and irritability/restlessness.

The aim of this group EMDR treatment (Jarero and Artigas, 2009) was to enhance positive emotions and internal resources by installing coping strategies and resilience. The following resources were to be reinforced; the sense of belonging to a working group and to a team (humanity, unity, the humbleness to accept help; collaboration, sharing, closeness, solidarity and support), a sense of control in situations where control was possible, a sense of self effectiveness, the ability to appreciate life.

Results

The following Table 1 reports the descriptive statistics for all the analyzed variables, both as such (i.e., subdivided in the pre and post conditions) and, much more relevant for the paired character of the experimental plan, the pre-post difference (deltavariables).

Together with the observables, we report two demographic variables, i.e., sex and age. Given males are coded by 1 and female by 0, the mean of this variable corresponds to the proportion of males in the population that is equal to 0.16, the highly unbalanced gender composition of the data set prevents to use this variable as covariate. The age ranges from 19 to 62 years old and has a mean value of around 45 years (M = 44.63; SD = 10.63).

The paired character of the variables prompted us to adopt a paired-test strategy, correspondent to a one sample test on the null hypothesis of delta variables = 0 (identity of pre and post condition) (Table 2). The inferential tests were of three types: (1) a parametric test (Student's *t*-test, T), (2) a non-parametric binary test on the (sign of the difference, M), and (3) a non-parametric (Mann–Whiney U on ranks, S).

TABLE 1 Descriptive statistics of variables analyzed.

Variable	*N*	Mean	Standard deviation
Sex	122	0.1639344	0.3717427
Age	122	44.6311475	10.6337999
IES_Avoidance_PRE	122	10.8032787	6.2663200
IES_Intrusivenss__PRE	122	12.7868852	6.7996469
IES_Hyperarousal_PRE	122	9.1229508	5.8980006
IES_TOTAL_PRE	122	32.7131148	16.8696899
IES_Avoidance_POST	122	8.0491803	5.9887670
IES_Intrusivenss__POST	122	7.7377049	6.3059768
IES_Hyperarousal_POST	122	5.4508197	5.2050555
IES_TOTAL_POST	122	21.2377049	16.2867148
THERMO__PRE_STRESS	122	5.3565574	2.6162868
THERMO__PRE_ANXIETY	122	4.6229508	3.1177388
THERMO__PRE_MOOD	122	3.0286885	2.7740676
THERMO__PRE_ANGER	122	3.6967213	3.1317868
THERMO__PRE_SLEEP	122	3.9180328	3.3865074
THERMO__PRE_AHELP	122	4.0371901	2.8063657
THERMO__POST_STRESS	122	4.0204918	2.5417160
THERMO__POST_ANX	122	3.1598361	2.7342837
THERMO__POST_MOOD	122	2.1024590	2.3905276
THERMO__POST_ANGER	122	2.3934426	2.3795179
THERMO__POST_SLEEP	122	2.3442623	2.6403434
THERMO__POST_HELP	122	2.2581967	2.2528527

TABLE 2 Statistical variables.

	N	Mean	SD	Median	Min	Max
deltaavoidance	122	2.75410	6.43250	2.00000	−17.00000	18.00000
deltaintrusiveness	122	5.04918	7.20061	4.00000	−15.00000	25.00000
deltahyperarousal	122	1.38525	6.34341	1.00000	−17.00000	16.00000
deltaiestotal	122	11.47541	17.10648	9.50000	−31.00000	54.00000
deltastress	122	1.33607	2.85203	1.00000	−5.00000	8.00000
deltanxiety	122	1.46311	2.67771	1.00000	−6.00000	8.00000
deltamood	122	0.92623	2.69041	0	−8.00000	8.00000
deltaanger	122	1.59426	3.23356	1.00000	−8.00000	9.00000
deltasleep	122	1.57377	2.73610	1.00000	−7.00000	10.00000
deltahelp	121	1.78512	2.67537	2.00000	−6.00000	9.00000

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Here below the results showing a marked significance for all the test for all the observed variables with only one exception for deltahyperarousal sign test (Table 3).

The statistical significance of all the differential variables comes from the strong pairwise correlation between the different test here reported in terms of Spearman correlation coefficient (Table 4). It is worth noting the stronger correlation existing among tests of the same battery (IES and Emotion Thermometer) with respect to tests pertaining to different batteries.

In any case all the correlation coefficient (both intra- and inter- batteries) were highly statistically significant, this gave rise to a very clear principal component structure, with a leading component (PC1) reporting the "consensus" among all the tests with all positive loadings, a clear "shape" component pointing to the difference among IES and Thermometer variables (that have opposite loading sign on PC2), and a minor third component (PC3) pointing to an opposition between the magnitude on the effect on anger and on sleep.

PC1 accounts for almost the half of entire variance (45%) while PC2 and PC3 account for 24% and 8% of total variance so pointing to a global consistency of the results of different tests that collapse into a "consensus" (PC1) major component (Tables 5, 6).

The PC1 scores were used to detect (if any) an effect of covariates on the global amelioration of subjects (PC1). No covariate (sex, age, center, having had COVID) gave rise to a statistical significance at Analysis of variance. It is very important the lack of a statistical significant effect of "center" covariate. This result points to the feasibility of a general analysis encompassing all the different centers.

TABLE 3 Inferential tests.

		Mu0 = 0			
Variable	**Test**		**Statistical**	***P*-value**	
deltaavoidance	Student's *t*-test	t	4.729.112	Pr > | t|	<0.0001
	Sign	M	22	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	1624.5	Pr >= | S|	<0.0001
deltaintrusiveness	Student's *t*-test	t	7.745.179	Pr > | t|	<0.0001
	Sign	M	34	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	2401	Pr >= | S|	<0.0001
deltahyperarousal	Student's *t*-test	t	2.412.039	Pr > | t|	0.0174
	Sign	M	9.5	Pr >= | M|	0.0928
	Mann–Whiney *U*	S	778	Pr >= | S|	0.0290
deltaiestotal	Student's *t*-test	t	7.409.476	Pr > | t|	<0.0001
	Sign	M	35	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	2491	Pr >= | S|	<0.0001
deltastress	Student's *t*-test	t	5.174.328	Pr > | t|	<0.0001
	Sign	M	20.5	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	1407.5	Pr >= | S|	<0.0001
deltanxiety	Student's *t*-test	t	6.035.249	Pr > | t|	<0.0001
	Sign	M	27	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	1622	Pr >= | S|	<0.0001
deltamood	Student's *t*-test	t	3.802.593	Pr > | t|	0.0002
	Sign	M	12.5	Pr >= | M|	0.0097
	Mann–Whiney *U*	S	903	Pr >= | S|	<0.0001
deltaanger	Student's *t*-test	t	5.445.762	Pr > | t|	<0.0001
	Sign	M	19.5	Pr >= | M|	0.0001
	Mann–Whiney *U*	S	1411	Pr >= | S|	<0.0001
deltasleep	Student's *t*-test	t	6.353.151	Pr > | t|	<0.0001
	Sign	M	25.5	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	1429.5	Pr >= | S|	<0.0001
deltahelp	Student's *t*-test	t	7.339.679	Pr > | t|	<0.0001
	Sign	M	29	Pr >= | M|	<0.0001
	Mann–Whiney *U*	S	1710	Pr >= | S|	<0.0001

Discussion

Our study provides a snapshot of one of the populations most exposed to physical and emotional distress during the most critical time of the COVID-19 pandemic. The picture is one of long shifts and a sense of complete exhaustion, no time to drink or eat, rushing from one patient to another without really being able to help and feeling helpless themselves.

Eye movement desensitization and reprocessing treatments helped re-process traumas experienced during the emergency by giving participants somewhere share what was happening to them. The prompt timing of the treatment enabled participants to recover their capacity to face the prolonged stress and may have prevented the consequent problems from becoming chronic and leaving permanent scars. The EMDR meetings also had the important benefit of joining into work groups and providing them with a space where participants could express their emotions and re-process the most difficult moments together, creating a greater sense of unity and strength.

Consistently with this description, the IES-R (Weiss and Marmar, 1997) scores obtained by participants following the treatment phase of the treatment were significantly lower on the intrusiveness, avoidance and arousal scales. The percentage of participants with a score above the PTSD threshold went down from 35.1 to 18.85%. The pre- and post-treatment emotion thermometer scores also showed a significant decrease in levels of stress, anxiety, depressed mood, anger, difficulty sleeping, and perceived need for help. These differences show that our online EMDR treatment was successful in reducing PTSD symptoms and lead to increased wellbeing of the participants.

Health workers involved in responding to the emergency, whether in clinical or community settings, are key to the success of our battle against the pandemic. As much effort as possible should be invested in protecting their mental and physical health: psychological support, both during and following the emergency period can enable them to adapt and empower them individually and collectively.

TABLE 4 Spearman correlation coefficient.

	deltaavoidance	deltaintrusiveness	deltahyperarousal	deltaiestota	deltastress	deltanxiety	deltamood	deltaanger	deltasleep	deltahelp
deltaavoidance	1.00000	0.58713	0.57086	0.80406	0.189	0.130	0.0900	0.1304	0.2155	0.107
		<0.0001	<0.0001	<0.0001	0.036	0.152	0.3241	0.1522	0.0171	0.240
	122	122	122	122	122	122	122	122	122	121
deltaintrusiveness	0.58713	1.00000	0.84394	0.91240	0.207	0.187	0.1848	0.3397	0.3185	0.177
	<0.0001		<0.0001	<0.0001	0.022	0.038	0.0415	0.0001	0.0003	0.051
	122	122	122	122	122	122	122	122	122	121
deltahyperarousal	0.57086	0.84394	1.00000	0.85978	0.223	0.193	0.2089	0.3965	0.2482	0.147
	<0.0001	<0.0001		<0.0001	0.0135	0.0329	0.0209	<0.0001	0.0058	0.1062
	122	122	122	122	122	122	122	122	122	121
deltaiestotal	0.80406	0.91240	0.85978	1.00000	0.275	0.228	0.2003	0.3374	0.3375	0.213
	<0.0001	<0.0001	<0.0001		0.002	0.011	0.0269	0.0001	0.0001	0.018
	122	122	122	122	122	122	122	122	122	121
deltastress	0.18913	0.20718	0.22302	0.27531	1.000	0.772	0.5555	0.5274	0.4736	0.472
	0.0369	0.0220	0.0135	0.0021		<0.0001	<0.0001	<0.0001	<0.0001	<0.000
	122	122	122	122	122	122	122	122	122	121
deltanxiety	0.13031	0.18754	0.19328	0.22816	0.772	1.000	0.6243	0.5089	0.4061	0.513
	0.1526	0.0386	0.0329	0.0115	<0.0001		<0.0001	<0.0001	<0.0001	<0.000
	122	122	122	122	122	122	122	122	122	121
deltaumood	0.09002	0.18487	0.20895	0.20033	0.555	0.624	1.0000	0.5771	0.3793	0.448
	0.3241	0.0415	0.0209	0.0269	<0.0001	<0.000		<0.0001	<0.0001	<0.000
	122	122	122	122	122	122	122	122	122	121
deltaanger	0.13041	0.33977	0.39658	0.33749	0.527	0.50	0.5771	1.0000	0.2254	0.441
	0.1522	0.0001	<0.0001	0.0001	<0.0001	<0.00	<0.0001		0.0125	<0.000
	122	122	122	122	122	122	122	122	122	121
deltasleep	0.21558	0.31852	0.24824	0.33751	0.473	0.40	0.3793	0.2254	1.0000	0.322
	0.0171	0.0003	0.0058	0.0001	<0.0001	<0.00	<0.0001	0.0125		0.000
	122	122	122	122	122	122	122	122	122	121
deltahelp	0.10757	0.17761	0.14759	0.21309	0.472	0.51	0.4484	0.4415	0.3222	1.00
	0.2402	0.0513	0.1062	0.0189	<0.0001	<0.00	<0.0001	<0.0001	0.0003	
	121	121	121	121	121	121	121	121	121	121

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TABLE 5 Eigenvalues of the correlation matrix: Total = 10 Mean = 1.

	Eigenvalue	Difference	Proportion	Cumulative
1	4.52693273	2.08378055	0.4527	0.4527
2	2.44315218	1.64263147	0.2443	0.6970
3	0.80052071	0.15599193	0.0801	0.7771
4	0.64452878	0.09131861	0.0645	0.8415
5	0.55321017	0.17980396	0.0553	0.8968
6	0.37340621	0.08551461	0.0373	0.9342
7	0.28789160	0.06847095	0.0288	0.9630
8	0.21942065	0.08439755	0.0219	0.9849
9	0.13502310	0.11910921	0.0135	0.9984
10	0.01591389		0.0016	1.0000

TABLE 6 Loading pattern.

	PC1	PC2	PC3
deltaavoidance	0.59898	−0.58646	0.21103
deltaintrusiveness	0.76229	−0.53916	−0.09758
deltahyperarousal	0.73656	−0.53417	−0.17753
deltaiestotal	0.79636	−0.58924	0.01524
deltastress	0.68855	0.48597	0.24739
deltanxiety	0.66312	0.54209	0.17247
deltamood	0.62445	0.53589	−0.17941
deltaanger	0.68201	0.33747	−0.49469
deltasleep	0.59928	0.21619	0.55662
deltahelp	0.53134	0.44513	−0.19246

The events witnessed during the first wave of the pandemic showed that nursing homes staff could benefit from EMDR treatments beyond the acute phase of the pandemic. This backs up the importance of conducting further research into the effectiveness of EMDR conducted online, as asserted by Lenferink et al. (2020) in their review. Although the study they reviewed reported good results for internet-delivered EMDR for PTSD, it lacked a control group and the only criterion for inclusion was the patient's need for psychological support.

Group EMDR seems to be a useful instrument for both prevention and treatment. Our results are in line with those of other studies in showing that the standard EMDR protocol can be successfully adapted for use online to conduct EMDR therapy online (Fisher, 2021), including on workers involved in healthcare during the COVID-19 emergency (Tarquinio et al., 2020).

In conclusion, future research involving larger samples and control groups is necessary to properly assess the effectiveness of group psychotherapy conducted online.

COVID-19 had a significant impact on the wellbeing of healthcare workers that need for mental health protection, support, and treatment. This study demonstrated that interventions with EMDR for this population had a positive effect to significantly decrease symptoms such as stress, depressed mood, anxiety, anger, sleep problems, and need for help.

This confirms that working with EMDR in emergency situations provokes immediate relief, prevents chronicization.

Also, the study confirmed that EMDR protocol in online modalities could protect healthcare workers from the consequences of acute stress.

In conclusion, the possibility in the future of collecting further data may improve the statistical strength of the study and observe the resilience of a specific population as time goes on, in order to understand if an early intervention with EMDR, during a critical event, can help the growth of this evolutionary skill.

Limitations

The emergency situation did not give the possibility to deepen further aspects that would have been important for the research, however it was possible to have a not treatment group, in order to understand the effectiveness of the EMDR protocol on a specific population.

Although the results of the present study are encouraging several limitations are present.

A limitation is represented by the use and analysis of only two standardized tests. In addition, other psychopathologies were not investigated as an outcome measure. The administration of other psychometric tests for the assessment of other psychopathologies may be functional for future research.

Moreover, the efficacy of EMDR treatment was evaluated in only two times (pre-post) without a possibility of *follow up* and, therefore, the absence of a longitudinal control aimed at following the reduction of PTSD symptoms over time.

Certainly, these limitations reduce the generalization of the results and may have affected the study.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GiM, EF, MG, GaM, LP, SR, AI, AN, and MP contributed to the conception and design of the study.

MG, GiM, LP, SR, AI, and AN organized the database. MP performed the statistical analysis. All authors wrote the first draft and sections of the manuscript, contributed to manuscript revision, read, and approved the submitted version.

Acknowledgments

We thank RSA Villa San Lorenzo, RSA Rosa dei Venti, RSA Padre Odone Nicolini, RSA Telegonia, RSA Centro Monsignore Siro Silvestri, and RSA Centro socio assistenziale del Sacro Cuore for their contribution in the acquisition of data. Special thanks EMDR Italy Association for the enthusiasm and the logistic support. We also thank all the healthcare workers we have met.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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frontiers | Frontiers in Psychology

TYPE Original Research
PUBLISHED 16 November 2022
DOI 10.3389/fpsyg.2022.1059134

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Psychology for Clinical Settings, a section of the journal Frontiers in Psychology

RECEIVED 30 September 2022
ACCEPTED 20 October 2022
PUBLISHED 16 November 2022

CITATION
Lazzaroni E, Tosi D, Pontiggia S, Ermolli R, Borghesi L, Rigamonti V, Frisone E and Piconi S (2022) Early psychological intervention in adult patients after hospitalization during COVID-19 pandemia. A single center observational study. *Front. Psychol.* 13:1059134. doi: 10.3389/fpsyg.2022.1059134

Early psychological intervention in adult patients after hospitalization during COVID-19 pandemia. A single center observational study

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The coronavirus disease 2019 pandemic has represented an individual and collective trauma with an impact on mental health. COVID-19 survivors need to be screened for psychological distress regularly for timely intervention. After March 2020, an outpatients clinic for follow up of discharged COVID-19 patients was set up at Infectious Diseases Department of the Hospital of Lecco, Italy. Blood exams, specialistic visits were performed for each patients and IES-R and BDI scales were dispensed. 523 patients were referred to the clinic; 93 of them resulted positive at IES-R and/or BDI self-report and 58 agreed to have early interviews with psychologist specialist. Patients could receive only a short psychoeducation/psychological support intervention or in addition to the same, even a specific trauma-focused psychotherapeutic intervention with EMDR where clinically indicated. IES-R e BDI were administered pre- and post-intervention. The results show that the average of the post-traumatic stress scores detected at IES-R is above the clinical cut-off for the entire sample. There is an overall change in the decrease in mean scores on the IES and BDI scales before and after psychological intervention. Among the patients for whom psychopharmacological therapy was also necessary, those who had COVID-mourning in family improved the most at IES-R scale post- intervention. With respect to EMDR treatment, there is a significant improvement in depressive symptoms noticed at BDI for male patients who have received neither psychotropic drugs nor CPAP. Being hospitalized for coronavirus has a significant impact on the patient's mental health and it is a priority to arrange early screening to intercept psychological distress and give it an early response.

KEYWORDS

COVID-19 survivors, psychological support, EMDR, hospitalization, prevention

Introduction

The coronavirus disease 2019 (COVID-19) pandemic caused death in 2–5% of COVID patients due to progressive respiratory failure and massive alveolar damage (Xu et al., 2021) and has represented an individual and collective trauma with an impact on mental health (Cucinotta and Vanelli, 2020; Lazzaroni et al., 2021). The entire scientific community has invested both in deeply and promptly analyzing all the available data (Tosi et al., 2020; Tosi and Campi, 2020; Tosi and Campi, 2021; Cappi et al., 2022) beyond developing clinical trials in order to identify new treatments.

Several studies have shown that during the first lockdown measures, in the general population were found high levels of psychological distress such as anxiety, depression, post-traumatic symptoms (Liang et al., 2020, p:1165; Liu et al., 2020; Wang et al., 2020; Xi et al., 2020). Moreover, it was shown that these psychological evidences turn out to be more present in younger patients than in the older. Cai et al. (2020) reported that older COVID-19 survivors have less emotional reactivity to infection, fewer anxiety and stress reaction symptoms than younger survivors.

This psychological impact is even more evident for COVID-19 patients who experienced medium- or high-intensity hospitalization. Patients who required hospitalization with severe physical symptoms and isolation from their family members for a long time, developed and lived concern for their family members' health, elevated death anxieties, experiences of helplessness and alertness, personal vulnerability, altered sleep patterns, dissociated perception of their body as the object of invasive care actions and negative perceptions of the bodily self, exposure to vicarious trauma (e.g., death of patients admitted to the same ward), experiences of guilt for becoming infected, psychosocial difficulties related to job loss. These conditions are qualified as risk factors for the development of psychological distress or psychopathological symptoms. Special attention should be paid to patients required admission to the intensive care unit (ICU). It is known that these patients are at high risk to develop PTSD, depression, anxiety, sleep abnormalities, and cognitive impairments (McGiffin et al., 2016). A recent meta-analysis found self-reported PTSD symptoms in 24% of ICU patients between one and 6 months after discharge, and 22% at 7 months (Parker et al., 2015; Demiselle et al., 2021). As psychological dysfunction can persist for years after ICU discharge, its management is becoming an important strategy to improve quality of life together with early detection of post-traumatic stress disorder and anxiety and depression (Vlake et al., 2020).

Previous studies conducted on Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) outcomes, reported that survivors had shown the prevalence of PTSD, depression, and anxiety beyond 6 months after hospitalization (Ahmed et al., 2020; Shi et al., 2020). In particular, fears, stigma and isolation due to quarantine appeared to be the key determinants of the psychological impact of illness and hospitalization on long-term mental health (Lam et al., 2009). Mazza et al. (2020) screened for psychiatric symptoms 402 adults at 1 month after hospitalization for COVID-19 (265 male, mean age 58): a significant proportion of patients had self-rated in the psychopathological range (28% for PTSD, 31% for depression, 42% for anxiety, 20% for OC symptoms, and 40% for insomnia). Multiple lines of evidence indicate that stress-related disorders including depression, PTSD, and sleep disorders are associated with suicidal ideation, suicide attempts, and death by suicide (Sher, 2019, 2020).

Psychological distress among the COVID-19 survivors in convalescence was high, highlighting the need for all COVID-19 survivors to be screen for psychological distress for timely intervention (Cai et al., 2020).

The aim of this study was to evaluate, through a quantitative analysis, the presence of peri- and posttraumatic stress and depression linked to coronavirus hospitalization experience in followed up patients and to analyze any changes in terms of traumatic stress and levels of depression detected at the end of a brief psychological intervention. It is also intended to test whether there are any correlations between these highlighted changes and demographic variables, intensity of the level of care, and whether psychopharmacological treatment.

Materials and methods

Setting

After March 2020, COVID-19 outclinic for discharged patients was set up at Infectious Diseases Department of Alessandro Manzoni Hospital of Lecco, Italy. Blood exams, infectious diseases specialistic visits were performed for each patients and Impact of Event Scale-Revised (IES-R) and Beck Depression Inventory (BDI) questionnaires were dispensed to assess how COVID-19 disease and the hospitalization during the pandemic impacted to their psychological wellness. These type of screening questionnaires were chosen to avoid overloading patients with excessive tests and easy to use by physician. If psychological report was positive, patients were referred to psychologist specialist for a brief cycle of specific interviews after their agreement. At the end of psychological intervention, scales were repurposed to assess any changes. In case of needing of cardiological, neurological, pneumological investigations, the patients were referred to the competent medical specialists.

Study population

For this study, inclusion criteria were: (i) hospitalization for SARS CoV-2 infection confirmed by nasopharingeal swab RT-PCR and screening visit at outpatient clinic; (ii) positive score at psychological screening self-report; (iii) patients agreement to start brief cycle of psychological support.

Exclusion criteria were: (i) presence of suicidal ideation, severe psychopathological conditions and/or known cognitive deficit.

For each subject, a personal data sheet was compiled, which included demographic information, pharmacotherapy, COVID-19 disease information such as pneumonia severity (mild, moderate or severe) type of oxygen support used (i.e. Continuous Positive Airway Pressure -CPAP or lower intensive oxygen devices); presence of family members died for COVID-19.

Assessment

After first specialistic visit, patients with positive scores at psychological questionnaires were referred for psychological evaluation. Patients were hospitalized in different departments of A. Manzoni Hospital, according to the severity of COVID-19 disease (i.e., General Medicine, Infectious Diseases, Intensive Care Unit).

A trauma-focused psychological support intervention was proposed to patients with positive scores aimed to facilitating the resumption of the daily life by reducing the impact of this recent traumatic experience. The psychologist who followed the patients is also an experienced trauma-therapist qualified in the use of Eye Movement Desensitization and Reprocessing (EMDR).

Study instruments

Self-report scales were

Impact of Event Scale-Revised (*IES-R*): used to measure stress levels and symptomatology due to the impact of the traumatic event of the pandemic. The IES-R (Weiss and Marmar, 1997) is a 22-item self-report questionnaire consisting of three subscales (eight items relate to intrusions, eight items evaluate avoidance, and six items assess hyperarousal). The scale assesses the subjective distress caused by traumatic events. Participants were asked to rate each item on a scale from 0 (not at all) to 4 (extremely), based on their experience with the traumatic event in the previous 7 days. An IES-R score ≥ 33 represents the best cut-off for a probable diagnosis of PTSD. The IES-R was found to be highly internally consistent (Cronbach's alpha, $\alpha = 0.96$; Creamer et al., 2003).

Beck Depression Inventory (*BDI*; Beck, 1972): BDI (in the short form of 13 item) is a self-report instrument to assess the severity of depressive symptomatology (Beck et al., 1974). Respondents rated each item based on four response choices according to the severity of the symptoms, ranging from the absence of a symptom to an intense level, during the past week. The score obtained can vary from 0 to 39 (10–19: mild depression; 20–29: moderate depression; >30: severe depression). The BDI maps a wide spectrum of depressive symptomatology (Beck et al., 1961) and features high reliability and validity. Both the original and short forms have reasonable internal consistency for normal and depressed older adults and adequate test–retest reliability in older adult patient and nonpatient populations (Edelstein et al., 2004). Moderate to high correlations show concurrent validity with different depression scales. Albeit no exact value is listed for the diagnosis of a depressive disorder, a comparing statement is possible.

Intervention

The psychological intervention proposed to patients included a cycle of 4–6 interviews according to progressive modes of intervention. If posttraumatic symptomatology was found to be relevant and intrusive, specific treatment with a few sessions of EMDR was carried out in addition to psychoeducational intervention and psychological support.

The EMDR treatment proposed is according to the *brief EMDR group treatment* protocol created by the re-elaboration of the guidelines for the stabilization-decompression of Critical Incident Stress Management (CISM; Everly Jr. et al., 2001; Quinn, 2009) and the specific EMDR protocols for Acute and Recent Traumatic Events (Shapiro and Laub, 2008). Eye Movement Desensitization and Reprocessing (EMDR) is a therapeutic approach used for the treatment of trauma and traumatic stress-related issues (Shapiro, 2000) based on the Adaptive Information Processing (AIP) model (Shapiro, 2000). According to the AIP, the traumatic event experienced by the subject is stored in memory together with the disturbing emotions, perceptions, cognitions, and physical sensations that characterized that moment. All the information stored in a dysfunctional way remains "frozen" within the neural networks and cannot connect to other networks with useful data (Fernandez and Giovannozzi, 2012); unable to be processed, it continues to cause discomfort in the subject, up to the onset of diseases such as PTSD and other psychological disorders. The aim of EMDR is to restore the natural way of processing the information in the memory to achieve an adaptive resolution through the creation of new, more functional connections. A distinct characteristic of EMDR therapy is the use of alternating bilateral stimulation (e.g., eye movements, tactile stimulation, auditory stimulation, and butterfly hug), which appears to produce a physiological effect promoting accelerated reprocessing of dysfunctionally stored information related to the traumatic event (Jeffries and Davis, 2013; Carletto et al., 2017; Pagani et al., 2017). EMDR is considered as one of the elective psychotherapeutic treatments for PTSD, according to several meta-analyses and clinical guidelines, and its neurobiological effects are also supported by neuroimaging findings (Pagani et al., 2012; Carletto et al., 2018, p: 2). At present, it is recognized as an evidence-based method for the treatment of post-traumatic disorders (Baek et al., 2019; Maddox et al., 2019) approved by the *American Psychological Association* (1998–2002), the *American Psychiatric Association* (2004), the *International Society for Traumatic Stress Studies* (2010), and the *Italian Ministry of Health* in 2003. The WHO in August 2013 recognized EMDR as an effective treatment for trauma and trauma-related disorders.

Data analysis

Analysis of the collected data was carried out by comparing the averages and resulting delta between the pre and post psychological intervention scores of the IES-R and BDI scales.

IES-R and BDI scale cut offs were 33 and 10, respectively.

One-way analysis of variance (ANOVA, Analysis of Variance) was performed on the whole study population focusing on specific subgroups of patients: psychodrugs assumption started during hospitalization; use of oxigen invasive devices such as CPAP, ICU admission, family mourning for COVID-19. Value of $p < 0.05$ was considered statistically significant. We also conducted a correlation study (Spearman's correlation) between specific subgroups of patients and variables such as "pre treatmentBDI or IES-R," "Delta BDI or IES-R," "pre treatmentBDI vs. BDI post psychodrugs treatment," etc. However, none of the conducted analysis highlighted moderate or strong correlation levels (i.e., >0.4). For space reason, we do not report the correlation study.

Results

Demographic and clinical characteristics of study population

523 hospitalized patients for COVID-19 disease from March 2020 to November 2021 were referred to outpatient clinic for follow up and performed IES-R and BDI questionnaires. 93 (17,7%) of them reported positive scores and 58 (62,3%) agreed to have early interviews with psychologist specialist. Data about age and type of oxigen treatment that meaning COVID-19 severity were reported in Table 1.

It is important to observe that the average age (60 years) of our dataset is in line with the median age of Italian population contracting COVID-19 (51 years), requiring the hospitalization (75 years), and requiring ICU (71 years), as ISS (Istituto Superiore di Sanità, 2022) reported.

TABLE 1 Demographic and oxigen therapy information of patients referred for follow up visit after hospitalization for COVID19.

	TOT	Positive IES-R/ BDI scores	Positive IES-R/BDI scores agreed psychological treatment
	$n = 523$	$n = 93$	$n = 58$
M, n (%)	344 (65,8)	59 (63,5)	31 (53,4)
F, n (%)	179 (34,2)	34 (36,5)	27 (47,5)
Age, median (IQR)	65 (55–74)	65 (55–75)	61 (55–69)
Other oxigen treatment or none, n (%)	400 (76,5)	63 (68)	28 (48,2)
CPAP and or ICU, n (%)	123 (23,5)	30 (32)	30 (51,8)

IES-R and BDI results

Whole population

Table 2 shows the results of pre and post psychological treatment IES-R and BDI scores of the patients of this survey. For both scales analyzed, there is an improvement between the pre and post scores after psychological intervention even not statistical significant.

The overall clinical changes do not correlate with any of the demographic variables (sex and age) of the patients, from which it appears independent (data not shown).

Subgroups population

Psychotropic drug administration

It was evaluated the effects of association between pharmacological interventions (anxiolytics as benzodiazepines and/or antidepressants as SSRIs) and psychological interventions on IES-R and BDI differences reported in Table 2. The improvement of patients treated with both interventions appears lower (−28.7% for IES-R and − 17.6% for BDI scores) compared to the improvement of whole study population. In contrast, for patients treated with only psychological interviews IES and BDI scores improvement was higher (+8.3% and + 5.3%, respectively).

Psychotropic drug administration and COVID-19 family mourning

Patients treated with psychotropic drugs and that lived COVID-19 family bereavements (Table 2), statistically significant improvement values for delta IES were found ($p = 0.03$) than those who did not have family bereavements. Not statistically difference was reported for BDI scale.

Our data show that family mourning for COVID-19 should be the event associated to the worse pretreatment IES-R score but it resulted to the better recovery as noted in post treatment IES-R score (Delta −25.75).

Regard gender differences, only for female patients treated with psychotropic drugs plus psychological interventions, we observed a significant change between pre and post treatments in IES-R scale compared to not psycodrugs treated-patients ($p = 0.01$, data not shown).

Intensity of care (CPAP)

Regarding the intensity of care received, we do not find any significant difference in both psychological scales in patients treated with CPAP device compared to not-treated CPAP patients as showed in Table 3.

EMDR treatment (Eye movement desensitization and reprocessing)

In Table 4 it was reported the results of the EMDR intervention in whole population and in different subgroups described above.

In whole population we found better improvement in both psychological questionnaires in patients treated with EMDR

TABLE 2 Averages values of IES-R and BDI scores of patients agreed psychological treatment and stratified for use or not of psychotropic drug and presence or not of family mourning.

	N	IES pre treatment	IES post treatment	DELTA IES	*p* Value	BDI pre treatment	BDI post treatment	DELTA BDI	*p* Value
All patients	58	41,03	20,68	20,4	n.s	6,97	5,66	1,31	n.s
psychotropic drug	13	45,85	31,31	14,54	n.s	9,23	8,15	1,08	n.s
without psychotropic drug	45	39,6	17,58	22,09	n.s	6,31	4,93	1,38	n.s
psychotropic drug + mourning	4	53,25	27,5	25,75	**0,03**	12	7,5	4,5	n.s
without psychotropic drug - mourning	9	42,56	33	9,56	n.s	8	8,44	-0,44	n.s

TABLE 3 Averages values of IES-R and BDI scores of patients stratified for the use of CPAP device during hospitalization and EMDR treatment during psychological interviews.

	N	IES pre treatment	IES post treatment	DELTA IES	*p* Value	BDI pre treatment	BDI post treatment	DELTA BDI	*p* Value
CPAP device_total	29	41,1	21,93	19,17	n.s	6,62	5,62	1	n.s
Without CPAP device_total	29	40,1	19,34	21,62	n.s	7,31	5,69	1,62	n.s

intervention compared to not treated patients, despite not statistically significant (Delta 20.97 and 2.41 for IES-R and BDI scale, respectively).

Among patients not treated with psychotropic drugs, we found a statistical difference in BDI scale values between patients treated with EMDR compared to not EMDR treated patients ($p = 0.04$; Table 4). Moreover, it was noted the better improvement in BDI scale compared to the whole population (delta BDI +111.5%). Among patients treated both with psychotropic drugs and EMDR (7 patients out of 29), we found a non-significant Delta of IES-R (Delta 18.43) and BDI (Delta 1.29). These variations are lower than the ones observed for patients treated with EMDR but without psychotropic drugs.

In not EMDR treatment patients, pretreatment scores for BDI scale are slightly lower than the mean of whole study population but BDI delta is almost nil.

In CPAP treated patients we found better improvement in both psychological questionnaires in patients treated with EMDR intervention compared to not EMDR treated patients, despite not statistically significant (Delta 24.9 and 1.05 for IES-R and BDI scale, respectively). Significant positive results, especially for BDI scores, were found in mild COVID-19 disease patients (not CPAP treated patients) after EMDR intervention ($p = 0.011$) compared to not EMDR treated patients (Table 4). The same trend was found for IES-R scores, despite not statistically significant.

Regard gender differences, male patients treated with EMDR intervention showed a statistically significant improvement in BDI scores (Table 4), $p = 0.033$.

Discussion

In the whole study population analyzed, it is possible to observe that the mean scores of post-traumatic stress detected at the IES-R are above the clinical cut-off for the entire sample considered, highlighting how SARS-CoV-2 infection might have a significant impact on a patient's mental health (Shi et al., 2020; Xiong et al., 2020; Lazzaroni et al., 2021). There is an overall quantitatively detected change in decreasing mean scores on the IES and BDI scales pre and post psychological intervention, suggesting that early psychological interventions may contribute positively to the reduction of psychological distress caused by traumatic events, as coronavirus disease 2019, as reported extensively in different systematic reviews and meta-analyses (Roberts et al., 2019). The result is particularly interesting if we consider that the psychological intervention was very short (4–6 interviews). It is also interesting to note that in this survey patient adherence to psychological intervention was very high (64%).

No statistically significant correlations emerged between the demographic variables and the changes found in the sample considered.

In our study population that included only patients older than 40 years (mean age: 61 years), it is not possible to demonstrate greater improvements in younger patients due to this type of patients were not generally hospitalized for COVID-19. Despite some recent studies reported that younger people seemed to have better coping skills (Buzzi et al., 2020; Kar et al., 2021), subjects interviewed in this study had the same abilities to overcome adverse living conditions experienced during the COVID-19 pandemic.

Regarding the assumption of psychotropic drugs, for female patients there is a significant change between psychotropic drugs treated patients compared to who did not receive such therapy. IES-R values were above the cut-off of that scale for both subgroups of patients, but remain above the threshold only for patients who assume psychotropic drugs, in contrast to those who did not use psychotropic drugs that reported a drastic drop in IES post-treatment. Female patients in fact have suffered more the

TABLE 4 Averages values of IES-R and BDI scores of patients agreed psychological and EMDR treatment with/without use of psychotropic drug.

	N	IES pre treatment	IES post treatment	DELTA IES	*p* Value	BDI pre treatment	BDI post treatment	DELTA BDI	*p* Value
With EMDR	29	43,86	22,90	20,97	n.s	7,83	5,41	2,41	n.s
Without EMDR	29	38,21	18,38	19,83	n.s	6,10	5,90	0,21	n.s
Male with EMDR	17	44,24	22,29	21,95	n.s	8,24	4,88	3,36	**0,033**
Male without EMDR	14	33,07	16,50	16,57	n.s	6,29	6,79	-0,50	n.s
With EMDR + without psychotropic drug	22	41,23	19,45	21,77	n.s	6,86	4,09	2,77	**0,04**
Without EMDR + without psychotropic drug	23	38,13	15,74	22,39	n.s	5,78	5,74	0,04	n.s
With EMDR + with psychotropic drug	7	52,14	33,71	18,43	n.s	10,86	9,57	1,29	n.s
CPAP device + EMDR	19	44,42	25,53	18,89	n.s	7,47	6,42	1,05	n.s
CPAP device - EMDR	10	34,80	13,30	21,50	n.s	5,00	3,60	1,40	n.s
Without CPAP device + EMDR	10	42,80	17,90	24,90	n.s	8,50	3,50	5,00	**0,011**
Without CPAP device - EMDR	19	40,00	20,11	19,89	n.s	6,68	6,84	-0,16	n.s

traumatic impact of COVID-19-related events compared to males (Xiong et al., 2020.) and, as consequence, they more often received a psychopharmacological therapy. For those patients, the only brief psychological intervention was deemed insufficient for patient care (Lill, 2015; Zhou et al., 2017). Among the patients that required psychopharmacological therapy, those who presented family Covid-19 mourning improve the most in IES scale score post- psychological intervention. It is possible hypothesize that COVID-19 family bereavements may be considered a factor of greater impact in terms of post-traumatic stress and depressive experiences on patients then hospitalized for COVID-19 (such that psychopharmacological therapy is also needed), but psychological intervention contributes more to psychological recovery facilitating the processing of prior bereavement, having untied the clinical "knot" of unprocessed bereavement.

Regarding severe COVID-19 disease in our sample, despite of what reported in literature (McGiffin et al., 2016), we do not find any significant difference in both psychological scales in patients treated with CPAP device compared to not-treated CPAP patients. The experience of severe Sar-Cov-2 infection such that one needs hospitalization (both ordinary admissions and ICU admissions) with the related death risk perceived, it is an experience that generates high traumatic distress regardless the intensity care received. However, it is shown (Table 4) specifically among patients treated with EMDR and not required CPAP, they improve more than the remaining clinical population, specifically with regard to depressive symptomatology detected on the BDI scale. In particular, for patients treated with CPAP device there is less improvement in depressive symptomatology compared to who was not treated with the device. This observation allows us to consider that focal treatment with EMDR may result in a more positive clinical change for patients who had not experienced complex forms of Intensive Care Unit, promoting a more rapid recovery for this category of patients.

We observe a positive improvement in depressive symptomatology detected by the BDI scale for the following categories of EMDR treated patients: patients treated with psychopharmacological therapy, patients not treated with CPAP device, and male patients. Conversely, EMDR not-treated patients had post-treatment values for the BDI scale equal to or greater than pre-treatment values. We also found better improvement in IES-R scales in patients treated with EMDR intervention compared to not treated patients, despite not statistically significant.

It is thus clear that EMDR treatment played, for these subgroups, a key role in improvement with regard to depressive symptomatology. EMDR is a well-established treatment for post-traumatic stress disorder (Cuijpers et al., 2020). Although recent research suggested that it may be effective in treating depressive disorders as well (Hofmann et al., 2014). These findings confirm earlier suggestions that EMDR therapy may provide additional benefit in the treatment of depression (Hase et al., 2018).

Study limitations

The main limitation of the study concerns the very small sample size and the high average age of the sample. It is also possible to highlight among the limitations the absence of control group with patients who did not receive any psychological intervention.

Another limitation is the absence of a self-report scale to detect psychopathological diagnoses of any instrument for general psychopathology.

Conclusion

The coronavirus disease 2019 (COVID-19) pandemic has represented an individual and collective trauma with an impact on mental health. There is an overall quantitatively detected change in the decrease in mean scores on the IES and BDI scales pre- and post-psychological intervention, suggesting how early psychological interventions can contribute positively to the reduction of psychological distress caused by traumatic events, as coronavirus disease 2019.

Intensity of care is not a determinant factor for post-traumatic stress and depressive symptoms in hospitalized patients. The improvement of patients treated with both

pharmacological and psychological interventions appears lower compared to the improvement of whole study population. Among the patients needing psychopharmacological therapy, those who had COVID-19 family mourning improved the most at IES-R scale post- intervention.

With respect to EMDR treatment, there is a significant improvement in depressive symptoms noticed at BDI for male patients who have received neither psychotropic drugs nor CPAP. It would be interesting in the future to investigate whether with a greater number of interviews it would have been possible to obtain more significant results on the IES scale for patients treated with EMDR.

It appears to be a priority to carry out early screening of possible post-traumatic and depressive symptoms in order to intercept psychological needs to treat by setting up early psychological support interventions and promote the physiological resumption of life routines.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval were not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

RV and SPi: conceptualization, study design, methodology, writing—review and editing. EL: methodology, data collection, formal analysis, and writing—original draft. SPo and LB: data collection and organization. DT and RE: statistical analysis. EL, SPo, and SPi: development of literature review/background context, manuscript review and editing. VR, SPi, and EF: resources and supervision. All authors contributed to the article and approved the submitted version.

Acknowledgments

We would like to thank all the healthcare staff of the Infectious Diseases Department of the Hospital of Lecco (Italy) for their attentive care of all COVID-19 patients and for contributing to the detection of psychological need and the referral of patients to the post-COVID-19 psychological outpatient clinic as well as to the acquisition of data for this research and ASST Lecco (Department of Mental Health and Addictions) and the Social-Health Management for their constant attention to the psychological health of patients. Thanks to Chiara Paleari for the support in the first step implementation of the outpatient clinic. We also thank EMDR Italy Association for their support - special thanks to Isabel Fernandez for the enthusiasm and the logistic support - and all the COVID-19 patients we have met during these difficult pandemic years who have gone through this emergency with us.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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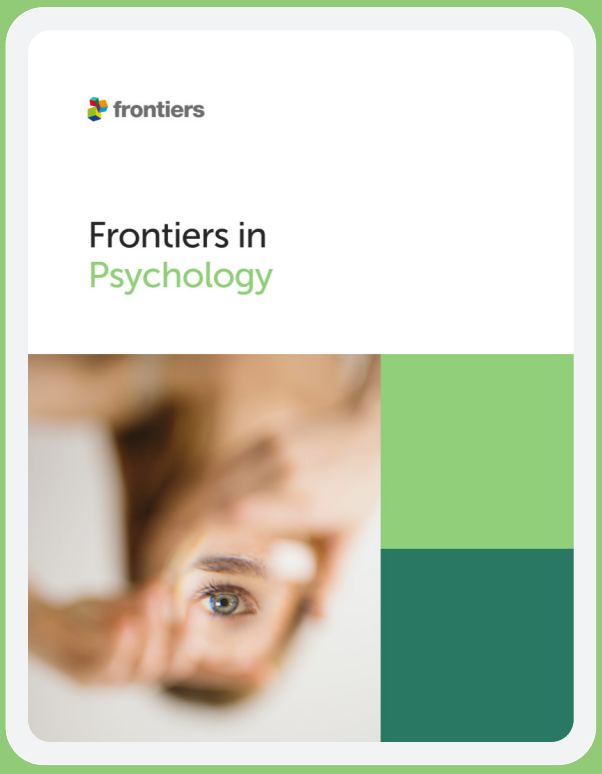

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