Supplementary Material

1 COMPARISON TABLE

Table S1 contains the results of our literature research on robotic hand rehabilitation devices. We restricted our research to devices that allow to train grasping movements and did not include any devices for general upper-limb training. If one of the evaluation criteria was not mentioned in the cited publication or if the device does not possess the functionality described by the evaluation criterion, we marked it with a "-" in the corresponding table entry.

In the **Description**, a very brief summary of the device characteristics is given. It is heavily based on the features which are highlighted by the authors in the corresponding publication. The **DoF** reports the measured and actuated degrees of freedom, the **RoM** describes the range of motion and the **Force** states the achieved continuous force of the devices. In **Setup & adjustments**, we report the necessary adjustments for different hand sizes. This is based on the information available in literature and is not an exhaustive description of the setup process. Finally, in **Haptic rendering**, we list the haptic rendering capabilities of the devices. If available, we present the maximum achieved stable K and B values (i.e., the virtual stiffness and damping of a virtual wall). Note that these values might not occur simultaneously. We refer the interested reader to the corresponding publication for further details.

Table S1: Comparison of robotic devices for hand rehabilitation

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
(Decker and Kim, 2017)	Underactuated exoskeleton with inner glove	12 / 5	0-62 (MCP), 0-88 (PIP)	14	Adjustable rubber straps	yes, with additional vibrotactile stimulation
(Rudd et al., 2019)	Low-cost soft robotic glove, tendon-driven	5 / 5	-	9	Customized parts required for each hand size	-
Reha-Digit, (Hesse et al., 2008)	Passive finger mobilization by actuated plastic rolls	1 / 1	-	-	One size fits all	-
HX-β, (Marconi et al., 2019)	Cable-driven index finger-thumb exoskeleton	9 / 5	0-60 (MCP), 0-60 (PIP), 0-60 (DIP)	4	Adjustable lengths of linkages	-
(Yang et al., 2016)	Jointless tendon-driven exoskeleton	1 / 1	0-90 (MCP), 0-90 (PIP), 0-90 (DIP)	1.5	-	-
HWARD, (Takahashi et al., 2005)	Pneumatically actuated hand orthosis with collective actuation of index to little finger, palm is free	3 / 3	25-90 (fingers overall)[3]	-	Adjustable to hand size	-
Amadeo, (TyroMotion, Austria)	End-effector finger trainer with linear actuators	5 / 5	-	-	Adjustable wrist orthosis, magnets are taped to fingertips	no, but haptic sensitivity training using vibrations
BRAVO, (Leonardis et al., 2015)	Hand exoskeleton with intrinsic adaptability to different hand sizes	2 / 2	-	30	Intrinsic adjustment	-
Hand of Hope, (Ho et al., 2011)	EMG-driven exoskeleton	5 / 5	0-55 (MCP), 0-65 (PIP)	-	Adjustable lengths of linkages	-

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
MERLIN / ArmAssist, (Proxima Medical Technology, Serbia)	Holonomic omni-wheel-driven robotic platform with passive grasping mechanism	-	-	-	-	-
CADEX, (Kim and Park, 2018)	Tendon-driven exoglove for dexterous motion	7 / 7	27-65 (MCP), 0-73 (PIP), -13-34 (DIP)[3]	12	Stretchable fabric, one size fits all	-
CHAD, (Alnajjar et al., 2021)	Assistive, tendon-driven soft robotic glove with integrated drive unit on forearm	3 / 3	-	28	Designed for medium-sized arm/hand	-
(Huang et al., 2020)	Tendon-driven glove with bi-directional actuation	4 / 4	0-31 (MCP), 0-35 (PIP), 0-57 (DIP)	2.5 per finger	Designed to fit the author	-
SCRIPT SAO-i3, (Ates et al., 2015)	Actuated hand and wrist orthosis for assisted extension movements	1 / 1	0-150 (fingers overall)[3]	4-8	Based on SaeboFlex which is available in mutliple sizes	-
CyberGrasp, (CyberGlove Systems, USA)	Cable-driven force feedback glove	5 / 5	-	12 per finger	Must be combined with CyberGlove sensorized glove	yes
(Pu et al., 2020)	Cable-driven exoskeleton	5 / 5	-	-	-	-
(Sooraj et al., 2013)	Haptic orthosis for hand and forearm	6 / 6	0-85 (MCP), 0-100 (PIP), 0-80 (DIP)[3]	8-15 per finger	Adjustable to hand size, with self-adjusting parts	yes
ETH-Mike, (Zbytniewska et al., 2019)	Haptic device for proprioceptive and sensorimotor assesment of index finger	1 / 1	0-90 (MCP only)	5.1 Nm (MCP, peak)	Exchangeable handles	yes, K=80 Nm/rad, B=0.4 Nms/rad
Alpha-Prototype II, (Masia et al., 2007)	Haptic handle of MIT-Manus manipulandum	1 / 1	-	70 - 120	One size fits all	yes, K=50 Nm/rad, B=1 Nms/rad

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
ReHapticKnob, (Metzger et al., 2011)	Grounded haptic device for sensorimotor grasp training	2 / 2	30 mm-200 mm (finger flexion)[3]	80	One size fits all	yes, K=50 N/mm, B=0.25 Ns/mm
(Cheng et al., 2018)	Modular cable-driven hand exoskeleton	9 / 9	0-116 (PIP), 0-124 (DIP)	-	Adjustable lengths of linkages	-
(Zhang et al., 2014)	Exoskeleton with circuitous joints	6 / 6	-	7.5 - 11	Adjustable lengths of linkages	-
(Sandoval-Gonzalez et al., 2016)	Exoskeleton with force-position control	14 / 10	-	-	Adjustable lengths of linkages	yes
ReHand, (Wang et al., 2018)	EMG and voice controlled exoskeleton	2 / 2	0-65 (MCP), 0-65 (PIP)	-	Adjustable for different palm sizes	-
(Sarac et al., 2016)	Underactuated exoskeleton with self-adaptability to different finger sizes	3 / 3	0-85 (MCP), 0-100 (PIP), 0-80 (DIP)	1.5 Nm (MCP), 0.4 Nm (PIP) per finger	Self-adjusting to finger size	-
Vanderbilt Hand Exoskeleton, (Gasser et al., 2017)	Assistive exoskeleton with simultaneous actuation of index to litte finger	1 / 1	-	50 (peak)	Designed for 50th percentile male hand	-
FINGER, (Taheri et al., 2014)	Grounded, highly backdrivable exoskeleton	2 / 2	-	-	Adjustable lengths of linkages	-
(Yap et al., 2016)	Soft robotic glove for assisted finger extension	- / 5	-	4.25 Nm (extension only)	-	-
HEXORR, (Schabowsky et al., 2010)	Grounded, backdrivable exoskeleton with force assistance mode	2 / 2	0-90 (MCP), 0-90 (PIP)[3]	-	Adjustable lengths of linkages	-

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
BiomHED, (Lee et al., 2014)	Biomimetic soft robotic glove for grasping assistance	- / 4	-	-	Zipper on palmar side facilitates donning	-
(Ueki et al., 2012)	Multi-degree-of-freedom device for assisted hand and wrist rehabilitation	18 / 18	-	0.5Nm (MCP finger), 1.8Nm (CMC thumb) [3]	Adjustable to hand size	-
(Xu et al., 2020)	Underactuated cable-driven soft robotic glove	3 / 1	-	35	-	-
HIRO-III, (Hioki et al., 2011)	Multi-fingered haptic end-effector interface	15 / 15	-	3.6 per finger	One size fits all, magnetic finger holders required	yes
(Yasuhisa Hasegawa et al., 2008)	Exoskeleton for grasping assistance	8 / 8	-	5	-	-
TenoExo, (Bützer et al., 2020)	Light-weight exoskeleton for grasping assistance	2 / 2	-15-90 (fingers overall), -10-45 (thumb overall)	6	Different sizes available	-
Gloreha, (Borboni et al., 2016)	Soft robotic glove with remote pneumatic actuation	5 / 5	-	-	Different sizes available	-
GripAble, (GripAble, UK)	Portable sensorized device for grasp training and grip strength assessment	1 / 0	-	-	One size fits all	-
HandSOME, (Brokaw et al., 2011)	Spring-actuated device for assisted finger extension training	0 / 0	0-90 (MCP fingers), 0-52 (CMC thumb)	4 Nm	Adjustable to hand size	-
HandCARE, (Dovat et al., 2008)	Rehabilitation system for cable-actuated finger training	5 / 5	0-70 (MCP)	15 per finger	Adjustable to hand size	yes

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
iHandRehab, (Li et al., 2011)	Interactive exoskeleton for active and passive rehabilitation	20 / 20	0-84 (MCP), 0-102 (PIP), 0-47 (DIP)[3]	-	Adjustable by fastening screws	yes
Maestro, (Yun et al., 2017)	Impedance-controlled cable-actuated exoskeleton	8 / 8	-	-	Adjustable lengths of linkages	-
(Just et al., 2019)	Hand module for ARMin upper-limb exoskeleton	1 / 1	-	200	One size fits all	-
Inmotion Hand, (BIONIK Laboratories, Canada)	Hand module for Inmotion ARM end-effector robot	1 / 1	-	-	Adjustable to hand size	-
(Frisoli et al., 2007)	Haptic interface for index finger and thumb with potential application in rehabilitation	6 / 6	-	4	-	yes
KULEX-Hand, (Hong et al., 2019)	Underactuated index finger and thumb exoskeleton for grasping assistance	1 / 1	-	10	-	-
Mano, (Randazzo et al., 2018)	Light-weight exoskeleton for grasping assistance	5 / 5	-	5 per finger	-	-
ManovoPower, (Hocoma, Switzerland)	Hand module for ArmeoPower upper-limb exoskeleton	1 / 1	-	-	One size fits all	-
Graspy Glove, (Popov et al., 2017)	Soft robotic glove for grasping assistance	4 / 4	-	16	Adjustable straps, soft structure	-
(Birouaş et al., 2020)	Underactuated exoskeleton	4 / 4	-	-	Customized parts required for each hand size	-

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

Device	Description	DoF[1]	RoM[2] (°)	Force (N)	Setup & adjustments	Haptic rendering
Gentle / G, (Loureiro and Harwin, 2007)	Hand module of the Gentle / G reach and grasp therapy system	3 / 3	0-70 (MCP), 0-90 (PIP), 10-60 (MCP thumb)	14 (fingers) / 12 (thumb)	Adjustable lengths of linkages, hinge mechanism for quick setup	yes
ReachMAN2, (Zhu et al., 2014)	Grounded device for arm reaching and grasping training	3 / 3	10-110 (fingers overall)	1.5 Nm	Height-adjustable for subjects in wheelchair	yes
SAFE, (Ben-Tzvi and Ma, 2015)	Underactuated exoskeleton with force sensing and haptic rendering	6 / 6	-30-90 (MCP), 0-100 (PIP), -5-70 (DIP)[3]	10 per finger	Designed for medium size, adjustable/ deformable fingertip fixation	yes
DexoHand, (Pu et al., 2016)	Grounded cable-driven exoskeleton	5 / 5	-5-75 (MCP), 0-90 (PIP), 0-60 (DIP)[3]	-	-	-
PLUTO, (Nehrujee et al., 2021)	Grounded robotic device with multiple exchangeable end-effectors for hand and forearm rehabilitation	1 / 1	12 cm[3]	55[3]	One size fits all, fingers are clamped to the handle	-

[1] Measured / acutated degrees of freedom. [2] Range of motion [3] The ranges of motion or forces for some degrees of freedom are missing in the table, see reference for additional information.

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