Supplementary Material

1 SUPPLEMENTARY TABLES AND FIGURES

1.1 Figures

Sub-group analysis forest plots

Study or Subgroup	With AD Mean	SD	Total	Without AD Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Active devices								
Peters, 2017	27.28	7.85	18	18.56	6.3	18	10.3%	1.20 [0.48, 1.91]
Van der Heide, 2016	72	15.85	10	45	21.86	10	6.1%	1.35 [0.36, 2.35]
Jansen, 2016	20.17	1.6	6	15.5	10.63	6	4.7%	0.57 [-0.60, 1.73]
Lund, 2009	-9.42	3.91	7	-16.25	3.66	7	3.9%	1.69 [0.41, 2.97]
Bastiaens, 2011	14.56	7.45	4	5.05	6.74	4	2.6%	1.16 [-0.44, 2.76]
Ambrosini, 2014	-4.37	1.69	3	-10.63	7.95	3	2.1%	0.87 [-0.94, 2.68]
Van der Heide, 2017	43.45	12.02	3	25.26	16.96	3	2.0%	0.99 [-0.87, 2.85]
Subtotal (95% CI)			**51**			**51**	**31.6%**	**1.16 [0.73, 1.60]**
Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.94$, df = 6 (P = 0.93); $I^2 = 0\%$								
Test for overall effect: Z = 5.25 (P < 0.00001)								
Passive devices								
Gunn, 2016	3.84	0.43	55	3.22	0.59	55	20.6%	1.19 [0.79, 1.60]
Shank, 2017	7.09	2.15	25	3.35	1.82	25	11.3%	1.85 [1.18, 2.52]
Rahman, 2007	-112.6	54.1	13	-126.2	57.4	13	9.2%	0.24 [-0.54, 1.01]
Iwamuro, 2008	0.63	0.2	10	0.41	0.27	10	6.9%	0.89 [-0.04, 1.82]
Van der Heide, 2016	62.44	22.75	9	30	24.24	9	5.6%	1.31 [0.27, 2.36]
Estilow, 2018	88.05	24.82	9	28.6	33.38	9	4.6%	1.92 [0.76, 3.09]
Sanchez, 2004	10.4	6.5	5	9	6.2	5	4.1%	0.20 [-1.05, 1.44]
Kooren, 2015	24.67	17.56	3	15.67	16.8	3	2.5%	0.42 [-1.23, 2.07]
Jansen, 2016	35.5	6.36	2	36.5	24.75	2	1.8%	-0.03 [-2.00, 1.94]
Van der Heide, 2017	26.38	3.43	2	26.07	2.52	2	1.7%	0.06 [-1.93, 2.05]
Subtotal (95% CI)			**133**			**133**	**68.4%**	**0.99 [0.57, 1.42]**
Heterogeneity: $Tau^2 = 0.19$; $Chi^2 = 17.07$, df = 9 (P = 0.05); $I^2 = 47\%$								
Test for overall effect: Z = 4.56 (P < 0.00001)								
Total (95% CI)			**184**			**184**	**100.0%**	**1.09 [0.82, 1.35]**
Test for subgroup differences: $Chi^2 = 0.31$, df = 1 (P = 0.58), $I^2 = 0\%$								

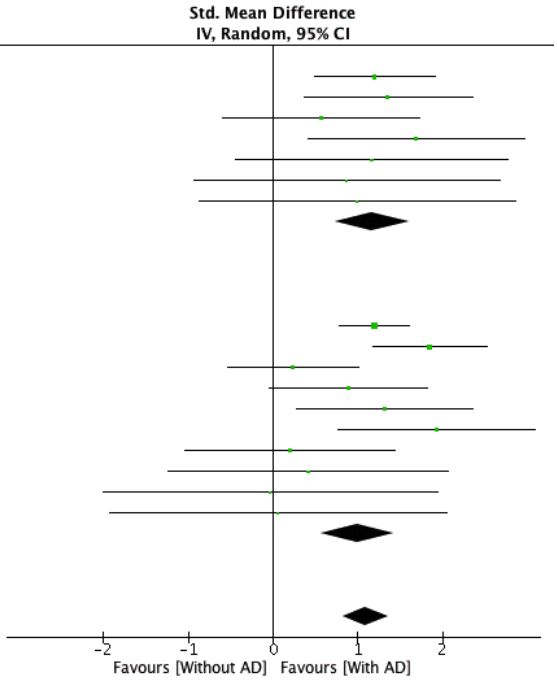

Figure S1. Forest plots of comparison between active and passive devices: Treatment Group (with assistive device) vs. Control Group (without assistive device).

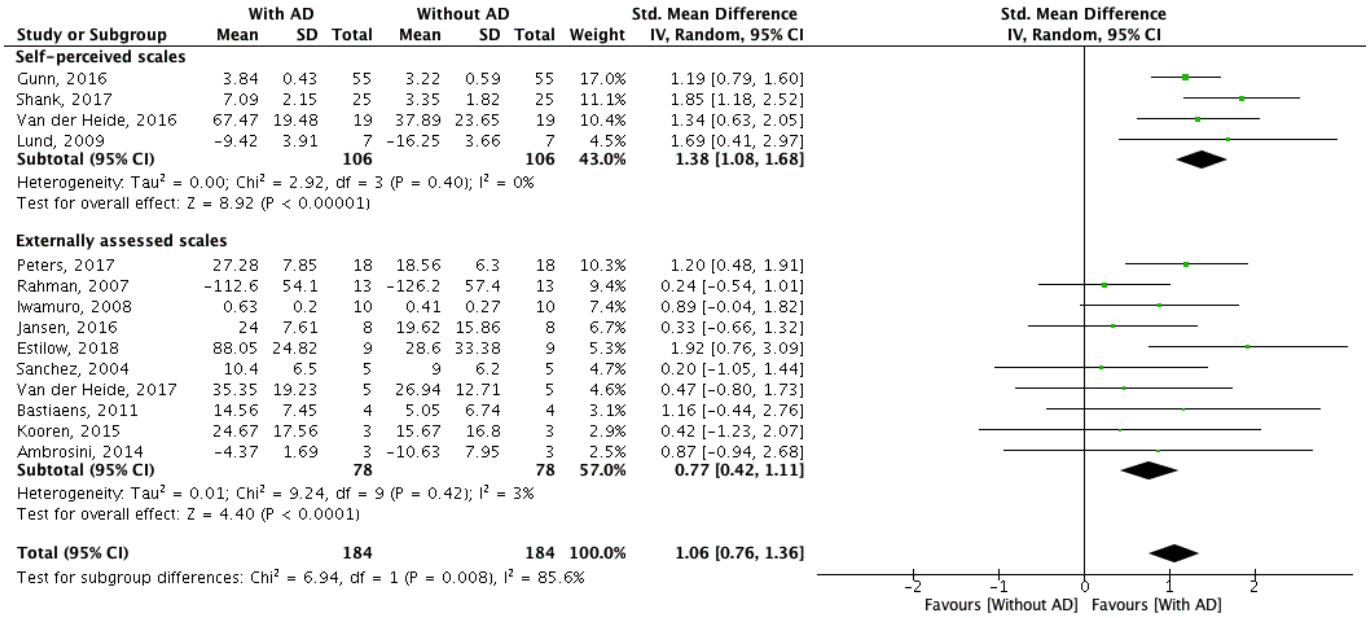

Figure S2. Forest plots of comparison between externally assessed and self-perceived scales: Treatment Group (with assistive device) vs. Control Group (without assistive device).

1.2 Tables

Details of clinical studies included in the meta-analysis

Table S1. Ambrosini et al. (2014)

Methods	Cohort study
Participants	Sample size: 10 Diseases: Spinal cord injuries
Intervention	8 repetitions of elbow flexion-extension with and without myocontrolled-NMES support, while tracking a trapezoidal target. Active device: NMES and passive exoskeleton
Outcome	Root Mean Square Error (RMSE)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Low risk	The outcomes were measured using a goniometer (Biometrics Ltd.) so the outcome measure is unlikely to be influenced by the knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S2. Bastiaens et al. (2011)

Methods	Cohort study
Participants	Sample size: 4 Diseases: Multiple sclerosis
Intervention	Starting from a standardized middle position, move the arm as far as possible in 3 directions: forward, lateral and upward Active device: HapticMaster and Sling
Outcome	Range Of Motion (ROM)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Low risk	The outcomes were measured using an optic system so the outcome measure is unlikely to be influenced by the knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S3. Estilow et al. (2018)

Methods	Cohort study
Participants	Sample size: 9 Diseases: Duchenne Muscular Dystrophy Inclusion criteria: (1) confirmed diagnosis of DMD, (2) Brooke Upper Extremity Scale score between 2 and 5, and (3) wheelchair dependent
Intervention	Elevation of the arm at the shoulder and elbow joint and back to the starting position. Evaluation performed with and without arm support during the same day. Passive device: Wrex
Outcome	Active Range Of Motion (AROM)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Low risk	All participants who would have been eligible for the target trial were included in the study
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Low risk	The outcomes were measured through goniometery so the outcome measure is unlikely to be influenced by the knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S4. Gunn et al. (2016)

Methods	Cohort study
Participants	Sample size: 55 Diseases: Arthrogryposis Multiplex Congenital, Cerebral Palsy, Muscular Dystrophy, Spinal Muscular Atrophy, others Inclusion criteria: (1) had used the device in the last 3 years, and (2) were less than 18 years of age when first fitted with the device
Intervention	During the same session respond to ten questions on personal functional ability with and without the AD after having used it for the last two to four years. Passive device: Wrex
Outcome	Five-point Likert Scale

Bias	**Author's judgment**	**Support for judgment**
Confounding	Serious risk	Serious residual confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	No information is reported on whether there is deviation from the intended intervention
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Serious risk	The outcome measure was subjective
Selection of result	Low risk	Number of subjects included in the study higher than 20

Table S5. Iwamuro et al. (2008)

Method	Cohort study
Participants	Sample size: 10 Diseases: Chronic hemiparesis after stroke Inclusion criteria: (1) at least 3 months post-stroke, (2) with 1 impaired upper extremity, characterized as stage 2 to stage 3 on the Chedoke-McMaster Stroke Assessment scale for the arm, and (3) not participating in a current rehabilitation therapy program
Intervention	36 reaching trials towards 12 targets positioned at the edge of the arm workspace of each subject with and without arm support during two sessions on separate days. Passive device: T-Wrex
Outcome	Fraction of full reach toward the target (FOR)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Moderate risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S6. Jan Burgers (2015)

Methods	Cohort study
Participants	Sample size: 8
	Active device: Top/Help Inclusion criteria: (1) wheelchair dependent, (2) confirmed diagnosis of DMD, (3) unable to touch the top of their head with at least one hand, and (4) able to use hands for tabletop activities
Intervention	19 items of grasp, grip, pinch, and gross movements evaluated with and without arm support during the same session. Active (Top/Help Electrical) or Passive (Top/Help Mechanical)
Outcome	Action Research Arm Test (ARAT)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Moderate risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S7. Kooren et al. (2015)

Methods	Cohort study
Participants	Sample size: 3 Diseases: Duchenne Muscular Dystrophy
Intervention	Standardized single joint movements of shoulder and elbow and ADL tasks extracted from the "Performance of the Upper Limb Scale" Passive device: A-Gear
Outcome	Performance of the Upper Limb (PUL)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Moderate risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study equal to 10

Table S8. Lund et al. (2009)

Methods	Cohort study
Participants	Sample size: 7 Diseases: Amyotrophic Lateral Sclerosis, Arthrogryposis Multiplex Congenita, Post Traumatic Dystrophy, Spinal Muscular Atrophy Inclusion criteria: (1) no cognitive impairments
Intervention	During the same interview rate the difficulty of performing 7 activities considered important by the patient himself with and without arm support Active device: ARMON
Outcome	Individually Prioritized Problem Assessment (IPPA)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Serious risk	Serious residual confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Serious risk	The outcome measure was subjective
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S9. Peters et al. (2017)

Methods	Cohort study
Participants	Sample size: 18 Diseases: stroke Inclusion criteria: (1) volitionally activated paretic biceps brachii EMG amplitude >= 5uV, (2) 1 stroke experience more than 12 months prior to study enrollment, (3) Mini-Mental State Examination score >= 24, (4) age between 21 and 80, (5) medically stable, (6) active shoulder abduction >= 20and active shoulder flexion =>30, and (7) more than a trace of Manual Muscle Testing (1/5) in biceps/triceps
Intervention	4 functional tasks turning on a light switch, lifting a laundry basket bilaterally, bringing a spoon to the mouth and drinking from a cup evaluated with and without arm support during two sessions on the same day. Active device: EMG signal (MyoPro Motion-G) that controls a powered orthosis
Outcome	Upper Extremity Section of the Fugl-Meyer Scale

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Low risk	All participants who would have been eligible for the target trial were included in the study
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Moderate risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Moderate risk	Number of subjects included in the study between 10 and 20

Table S10. Rahman et al. (2007)

Methods	Cohort study
Participants	Sample size: 13 Disease: Becker Muscular Dystrophy, Congenital Muscular Dystrophy, Duchenne Muscular Dystrophy, Spinal Muscular Atrophy Inclusion criteria: (1) arm strength of less than 5 on the Manual Muscle Test scale, and (2) wheelchair dependent
Intervention	7 activities of daily living writing, turning cards, manipulating small objects, feeding, stacking checkers, lifting large light objects and lifting large heavy objects. Evaluation was performed first without the arm support and then with it after 2 weeks of home use. Passive device: Wrex
Outcome	Jebsen Taylor Hand Function Timed Test

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Moderate risk	There were deviations from intended intervention since few patients did not practice at home with the AD, but their impact on the outcome is expected to be slight
Missing data	Moderate risk	Proportion of and reason for missing participants differ slightly across intervention groups
Measurement of outcomes	Low risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Moderate risk	Number of subjects included in the study between 10 and 20

Table S11. Sanchez et al. (2004)

Methods	Cohort study
Participants	Sample size: 5 Disease: chronic stroke
Intervention	14 functional tasks evaluated with and without arm support during the same session. Passive device: T-Wrex
Outcome	Upper Extremity Section of the Fugl-Meyer Scale

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Moderate risk	The method of outcome assessment was comparable across intervention groups and the outcome measure was unlikely to be influenced by knowledge of the intervention received by study participants
Selection of result	Serious risk	Number of subjects included in the study lower than 10

Table S12. Shank (2017)

Methods	Cohort study
Participants	Sample size: 25 Diseases: Arthrogryposis Multiplex Congenital, Cerebral Palsy, Muscular Dystrophy, Spinal Muscular Atrophy, others Inclusion criteria: (1) arm weakness between 1 and 3 on the Manual Muscle Test, (2) passive elbow range of motion >= 50, and (3) passive shoulder flexion >= 90
Intervention	During the same interview rate the ability to perform identified important tasks with and without arm support. Passive device: Wrex
Outcome	Canadian Occupational Performance Measure (COPM)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Serious risk	Serious residual confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	No information is reported on whether there is deviation from the intended intervention
Missing data	Low risk	Data were reasonably complete
Measurement of outcomes	Serious risk	The outcome measure was subjective
Selection of result	Low risk	Number of subjects included in the study higher than 20

Table S13. van der Heide and de Witte (2016)

Methods	Cross sectional study
Participants	Sample size: 19 Diseases: Amyotrophic Lateral Sclerosis, Ehlers-Danlos Syndrome, Limb-Girdle Muscular Dystrophy, Multifocal Motor Neuropathy, Multiple Sclerosis, Spinal Cord Injury, Spinal Muscular Atrophy
Intervention	During the same interview rate the ability to perform activities of daily living with and without arm support. Active or passive devices: Armon Edero (A), Armon Ayura (A), Darwing (A), Balancer (P)
Outcome	Perceived Functional Benefit (VAS scale)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Moderate risk	Selection into the study may have been related to intervention and outcome
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Proportions of and reasons for missing participants were similar across intervention groups
Measurement of outcomes	Serious risk	The outcome measure was subjective
Selection of result	Moderate risk	Number of subjects included in the study between 10 and 20

Table S14. van der Heide et al. (2017)

Methods	Cohort study
Participants	Sample size: 5 Diseases: Amyotrophic Lateral Sclerosis, Muscular Dystrophy, Stroke, Spinal Stenosis Inclusion criteria: (1) use of the arm support in the previous week, (2) age >18, and (3) no cognitive impairments
Intervention	9 functional tasks touching the ipsilateral ear, eating with a spoon, drinking from a glass, touching the opposite axilla, touching the seat between the upper legs, combing hair, stroking a pet, grabbing a door handle and Grabbing a book from the shelf. Evaluation performed with and subsequentially without arm support. Active or passive devices: Top/Help (A), Sling (P)
Outcome	Range Of Motion (ROM)

Bias	**Author's judgment**	**Support for judgment**
Confounding	Low risk	No confounding expected
Selection of participants	Serious risk	Quote: "Participants were selected on the basis of convenience sampling"
Classification	Low risk	Intervention status is well defined
Deviations	Low risk	There were no deviations from the intended interventions
Missing data	Low risk	Proportions of and reasons for missing participants were similar across intervention groups
Measurement of outcomes	Low risk	The outcomes were measured using the MMAAS motion capturing instrument so the outcome measure is unlikely to be influenced by the knowledge of the intervention received by study participants
Selection of result	Serious risk of bias	Number of subjects included in the study lower than 10

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