

Supplementary material to article by I. Franki et al. "The evidence-base for conceptual approaches and additional therapies targeting lower limb function in children with cerebral palsy: A systematic review using the ICF as a framework"

Table SI. Overview of studies using neurodevelopmental treatment (NDT): subjects, interventions, evaluation, results and level of evidence and conduct scores

Study	Design type	Subjects		Age	Type	Method Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Results				Level of evidence (conduct)	
		n (exp)	n (contr)								Exp	Contr	Exp vs Contr	ICF		
1995, Karnish et al. (21)	Prospective intervention ABABAB Single subject	3	–	4.14 and 6 years	Spastic quadriplegia	Training 1: PT in an isolated therapy room Training 2: PT in a natural education setting 2 sessions/day, each of the 2 settings each day, 10 sessions Inhibition/facilitation, transfer, standing balance, motor skill training	1.5	–	14	Motor skill tasking (video scoring): Quality of performance Speed of completion	=	=	=	A	A	II (7/14)
1997, Jonsdottir et al. (22)	Prospective intervention ABAC Single case Alternating Treatments	8	–	10–15 years	Spastic quadriplegia	Phase A: 1 week no treatment (control phase) Phase B: 1 week NDT (daily, 35 min; focus on reaching) (exp) Phase C: 1 week practice (repetition, no focus on quality) (control) ABAC or ACAB design	1	–	7	Postural assessment scale (Bertoti): Postural control (Seated Postural Control Measure) Total displacement of the head and shoulder	↑	=		I/A	I	III (6/14)
1999, Trahan & Malouin (23)	Prospective intervention Cases series	50	–	12–79 months	Quadriplegia (24) Hemiplegia (16) Diplegia (10)	PT as NDT, 45 min/session	35	–	2	Gross motor function (GMFM)	↑			A		IV (4/7)
2000, Adams et al. (24)	Prospective intervention No control group Cases series	40	–	Mean 6 years 2.6 – 10.2 years	Hemiplegia (11) Diplegia (18) Triplegia (3) Ataxia (5) Athetoid (3)	6 weeks intensive NDT 1 h individually defined training	6	–	2	Stride and step length, foot angle, base of support, cadence, velocity (pedograph)	↑			I/A		IV (3/7)
2001, Kerem et al. (25)	Prospective intervention Non-randomized CT	17	17	Mean group 1=48.82 months Mean group 2=47.52 months	Spastic diplegia Moderate	Exp: NDT + Johnstone Pressure Splints Contr: NDT	13	–	5	Spasticity (MAS) Somatosensory evoked potentials ROM (goniometer)	↓	↓	↓	I	I	III (3/7)

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2002, Knox & Evans (26)	Repeated measures ABA design Single subject	15	–	Mean 7 years 4 months Range 2–12	Quadriplegia (9) Diplegia (4) Athetoid (1) Ataxia (1) GMFCS I–V	Exp phase (phase B): NDT, 75 min/session Control phase (phase A): usual therapy	6	18	3	Self-care skills/caregiver assistance (PEDI) Gross motor function (GMFM) Parent questionnaire/individual goals	↑ = ↑ ↑ = ↑ ↑ = ↑	A/P A A	III (8/14)
2002, Trahan & Malouin (27)	Prospective Single subject ABAB	5	–	Mean 33 months Range 10–37	GMFCS IV–V Spastic quadriplegia	Phase A: baseline, conventional PT, 2×/week, 8–20 weeks Phase B: PT4 weeks, 4×/week altered with 8 weeks no PT (total 24 weeks, ABAB design)	4	–	4	Gross motor function (GMFM)	↑ ↑ ↑	A	II (10/14)
2004, Tsorlakis et al. (28)	RCT Smaller RCT	17	17	Mean 7 years 3 months Range 3–14	Hemiplegia (10) Diplegia (12) Tetraplegia (12) GMFCS I–III	Exp: 16 weeks NDT, 2×/week Contr: 16 weeks NDT, 5×/week	16	–	3	Gross motor function (GMFM)	↑ ↑ ↑	A	II (5/7)
2006, Bar-Haim (29)	RCT Smaller RCT	12	12	Group 1: Mean 8.3 years Group 2: 8.1 3.5–6.3 years Mean 4	GMFCS II–IV Diplegia (11) Quadriplegia (12) GMFCS I–III	Exp: Adeli suit Contr: NDT 4 weeks, 2 h/day, 5×/week	4	39	5	Gross motor function (GMFM) Mechanical Efficiency Index during stair-climbing	↑ ↑ = ↑ ↑ ↑	A I	II (6/7)
2007, Cherng (30)	ABA or AAB Single subject Alternating treatment	4	4	3.5–6.3 years Mean 4	GMFCS I–III Spastic diplegia	Group 1: ABA Group 2: AAB Contr=regular physio, 2–3×/week, NDT, 30 min/session Exp=BWST, 20 min/session, 2–3×/week + regular physio	12	6	2,5	Gross motor function (GMFM) Gait (time and distance parameters GaitRite) Muscle tone (MAS) Selective motor control (SMC scores)	↑ = ↑ ↑ = = = = =	A I/A I I	II (8/14)
2008, Christansen et al. (31)	RCT Smaller RCT	10	14	Med 3 years Range 1 year –8 years 1 months NDT studies	Spastic CP GMFCS I–V	Exp: intermittent 4 weeks 4×/week followed by 6 weeks no therapy (total 30 weeks) Contr: continuous training, 1×/week, 30 weeks	30	–	3	Gross motor function (GMFM)	↑ ↑ =	A	II (5/7)
2001, Butler & Darrah (32)	Systematic review	21	–	NDT studies	–	Medline, HealthSTAR, ClinPSYCH, CINAHL, Cochrane Until 2000/2001 Key words: neurodevelopmental treatment, NDT, cerebral palsy	–	–	–	AACPDM level of evidence	–	–	II (8)

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2001, Brown & Burns (33)	Systematic review	17 studies	–	NDT studies	–	Medline, CINAHL, Cochrane Library, EMBASE, ERIC, HealthSTAR, PsycINFO, Sociofile Key words: neuromuscular facilitation, NDT, Bobath, motion therapy, exercise therapy, therapeutic exercises, kinetic chain exercises, psychomotor and therapeutic touch	–	–	–	Jadad scale Sackett levels of evidence	–	II (7)
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Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; y: years; mo: months; PT: physical therapy; NDT: neurodevelopmental treatment; GMFM: Gross Motor Function Measure; MAS: Modified Ashworth Scale; PEDI: Pediatric Evaluation of Disability Inventory; ROM: range of motion; AACPD: American Academy of Cerebral Palsy and Developmental Medicine; CP: cerebral palsy; GMFCS: Gross Motor Function Classification System; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity; P: participation; E: environmental factors.

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Table SII. Overview of studies using conductive education (CE): subjects, interventions, evaluation, results and level of evidence and conduct scores

Study	Design type	Subjects			Method						Results				
		n (exp)	n (contr)	Age	Type	Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Exp	Contr	Exp vs Cont	ICF	Level of evidence (conduct)
1995, Coleman et al. (34)	Prospective intervention Control group Non-randomized CT	11	9	19–69 months Mean 45 months	Quadriplegia (11) Diplegia (7) Athetoid (1) Hemiplegia (1)	Exp: conductive education Contr: traditional early intervention 6 months	26		Not reported	Areas of development (Vulpe Assessment Battery) Parental perception and coping (Questionnaire on Resources and Stress (QRS-F))			=	I/A	III (2/7)
1995, Catanese et al. (35)	Prospective intervention Control group Non-randomized CT	17	17	4 years–7 years Matched	Mild (10) Moderate (18) Severe (6)	Exp: conductive education Contr: traditional early intervention 6 months	26		Not reported	Areas of development (Vulpe Assessment Battery) Parental perception and coping (Questionnaire on Resources and Stress (QRS-F)) Standardized test of cognitive ability			=	I/A	III (3/7)
1997, Hur (36)	Prospective intervention Non-randomized CT	19	17	3.5–4.5 years	Severe Mild Moderate	Exp: conductive education Contr: British Special Education Program	156			Skills for independence (Vineland Adaptive Behavior Scales) Child functional level (Development Profile 2)	↑	↑	=	I/A/P	III (2/7)
1998, Reddihough et al. (37)	RCT + matching Smaller RCT	32	34	12–36 months Mean 22 months 3 weeks	Diplegia (11) Quadriplegia (42) Ataxia (2)	Group 1 (randomized): conductive education (2.8 h/week) Group 2 (randomized): neurodevelopmental treatment (2.9 h/week) Group 3 (non-randomized): conductive education (3.2 h/week) Group 4 (non-randomized): neurodevelopmental treatment (2.2 h/week)	26			Areas of development (Vulpe Assessment Battery) Gross motor function (GMFM) Language development (Reynell Dev Lang Scale) Parental coping and stress (Parent Stress Index)	↑	↑	=	I/A	II (4/7)
1999, Woolfson (38)	Prospective intervention Case series					Conductive education + NDT	52		Not reported	Schedule of Growing Skills Semi-structured interviews with the parents on parents' perception of child remediation, parental re-education and redefinition →Remediation (child progress), re-education (parent learning) and redefinition (changes in parental perceptions and expectations)			=	I E	IV (2/7)

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Table SII. *Contd.*

2003, Stiller (39)	RCT Smaller RCT	7	12	2 years 5 months–9 years 2 months	Hemiplegia (2) Diplegia (22) Quadriplegia (14)	Exp: conductive education (6 h/day, 5 days/week) Contr 1: intensive therapy (PT, OT, ST) 5 h/day, 5 days/week Contr 2: special education (6 h/day, 5 days/week)	5	6 h/day	Gross motor function (GMFM) Fine motor function (PDMS) Functional abilities (PEDI)	= = =	↑ (contr1) =	= = =	A A A/P	II (5/7)	
2005, Wright (40)	Prospective intervention Case series	9	–	Year 1: mean 6.5 years (SD 0.8) Year 2: mean 4 years 6 months (SD 1)	GMFCS III-V Diplegia 3 Quadriplegia 1	8 months intensive conductive education class	8	5 d/week	Gross/fine motor function (GMFM, PDMS, QUEST, PEDI, GAS) Self-concept (Pictorial Scale of Perceived Competence for Young Children) Participation at school (Individualized Educational Plan) Family stress (Impact on Family Scale)	↑, ↑, ↑, ↑, ↑	↑	↑	A/P A P E	IV (3/7)	
2005, Odman & Oberg (41)	Prospective intervention Repeated measures Control group	30	24	3–16 years	GMFCS I–V Diplegia 30 Hemiplegia 4 Tetraplegia 5 Dyskinetic 13 Ataxic 2	Exp: conductive education (move & walk) 2–4 h/day, 4–5×/week, 15 days Contr: traditional health care (learning motor skills) 3 h/day, 4×/week; 14 days	2	52	Exp: 4–5×/week Contr: 4×/week	Gross motor function (GMFM) Functional activities (PEDI– Functional Measures)	↑ =	↑ ↑	↓ =	A A	III (3/7)
2006, Odman & Oberg (42)	Prospective intervention Repeated measures Control group	30	24	3–16 years	GMFCS I-V Diplegia 30 Hemiplegia 4 Tetraplegia 5 Dyskinetic 13 Ataxic 2	Exp: conductive education (move&walk), 2–4 h/day, 4–5 days/week Contr: Traditional Health Care (Lemo), 3 h/day, 4 days/week	2		Goup 1: 4-5×/week Group 2: 4×/week	Gross motor function (GMFM) Functional activities (PEDI– Functional Measures) Individualized goals (SRIGM)	↑ = ↑	↑ ↑ ↑	↓ = =	I A A/P	III (3/7)

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2009, Odman et al. (43)	Prospective intervention Case series	15	–	4–17 years	GMFCS I-V Spastic diplegia (2) Spastic hemiplegia (6) Spastic tetraplegia (2) aspecif 1	Intensive group training, 4 4 weeks, 2–4 h/day, 3–5 days/week	3–5 days/ week	Semi-structured interview with the parents	*No stats	I/E	IV (1/7)
1999, Woolfson et al. (44)	Systematic review	10	–	–	–	Medline, ERIC, PsychLit, Social Science Citation Index No time limitations	–	–	–	–	II (4)
2000, Pedersen et al. (45)	Systematic review	9	–	–	–	Medline, ERIC, PsychINFO No time limitations, studies using control groups Key words: conductive education	–	–	–	–	II (3)
2004, Darrah et al. (10)	Systematic review	88	–	–	–	Medline (1966– 2001), HealthSTAR (1975–2000), Cinahl (1982–2001), EMBASE (1988–2001), ERIC (1966–2001), AMED (1985–2001), Psychinfo (1984–2001) Key words: conductive education	–	–	–	–	II (8)

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; PT: physical therapy; OT: occupational therapy; ST: speech therapy; GMFM: Gross Motor Function Measure; PEDI: Pediatric Evaluation of Disability Inventory; PDMS: Peabody Developmental Motor Scales; GAS: Goal Attainment Scale; SRIGM: Self-Reported Individualized Goal Measure; ROM: range of motion; GMFCS: Gross Motor Function Classification System; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity; P: participation; E: environmental factors.

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Table SIII. Overview of studies using sensory integration and Vojta therapy: subjects, interventions, evaluation, results and level of evidence and conduct scores

Study	Design type	Subjects		Age	Type	Method Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Results				
		n (exp)	n (contr)								Exp	Contr	Exp vs Contr	ICF	Level of evidence (conduct)
Sensory integration 2001, Bumin & Kayihan (15)	RCT Smaller RCT	32	9	Group 1&2: mean 7.06 years Group 3: mean 7 years	Spastic diplegia	Group 1 (n=16): SMP Group 2 (n=16): SMP, group training Group 3 (n=9): home programme SMP: 3×/week, 1.5 h/session, 3 months SMP=sensory training, vestibular training, balance and postural reactions, bimanual activities and motor planning	14	No follow-up	3	Ayers Southern California Sensory Integration Test Physical Ability Test	↑ (1+2) = (3)	= (3)	↑ (1+2) = (3)	I/A A	II (3)
Vojta therapy 2004, Kanda et al. (46)	RCT Smaller RCT	5	5	1–3 months	Spastic diplegia	Group 1 (n=5): Vojta 52 months, 30 min/session, 90–120 sessions/ month Group 2 (n=2): no treatment Group 3 (n=3): insufficient therapy	208	3 years	90–120 sessions/ month	Highest motor developmental level			↑	I/A	II (2)

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; SMP: Sensory Perceptual Motor Training; ↑ the results were significantly higher in the experimental group or during the experimental period; I: Impairment; A: activity.

Table SIV. Overview of studies using functional training: subjects, interventions, evaluation, results and level of evidence with conduct scores

Study	Design type	Subjects		Age	Type	Method Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Results			Level of evidence (conduct)	
		n (exp)	n (contr)								Exp	Contr	Exp vs cont		ICF
2001, Ketelaar et al. (5)	RCT Smaller RCT	28	27	2–7 years Group 1: mean 56, (SD 20) Group 2: mean 54, (SD 20)	Mild or moderate Diplegia (11) Hemiplegia (32) Quadriplegia (12)	Exp: functional therapy (=practicing functional activities) Contr: training based on normalization of motor performance and quality of movement	78	–	Exp: 3.4 Control: 3.8	Gross motor function (GMFM) Functional performance (PEDI)	↑	↑	=	A	II (6/7)
2005, Ahl et al. (6)	Prospective intervention No control Case series	14	–	1 years 6 months–6 years Mean 3 years 7 months	GMFCS II–V	Functional, goal-oriented training 2×/day to 25×/day (varying)	21.7	13	2–25	Individual goals (GAS) Gross motor function (GMFM) Functional performance (PEDI) Measure of Process Care Questionnaire	↑			A	IV (2/7)
2005, Schalow et al. (47)	Prospective intervention Case series	8	–	Mean 15 years 7–27 years	Not reported	Low-intensity coordination dynamics therapy, (including crawling, treadmill walking, jumping, exercising on a special coordination dynamics board)	13	–	4	Motor programmes (EMG) Coordination	=			I	IV (1/7)
2007, Crompton et al. (48)	RCT Smaller RCT	8	7	6–14 years Group 1: mean 9.9 years, (SD 2.5) Group 2: mean 11.2 years, (SD 1.9)	Spastic diplegia GMFCS I–III	Exp: LL training (circuit training: closed kinetic chain, strength, balance, coordination, stretching; 70% of maximum work rate) Contr: UL dexterity training (stretching, games and task requiring manipulation and dexterity, in-hand- manipulation) Children also received usual therapy (0–2×/week)	6	6	2	Gross motor function (GMFM) Timed Up and Go Uptime (mean uptime hours) 10-min walk test (self- selected speed) Strength LL/UL (dynamometer) Hand tasks (BOT– sub 8) Gross manual dexterity (box and block test) Handwriting speed test Rapid hand manipulation (NK dexterity board)	=	=	=	A	II (5/7)
											↓	=	=	A	
											↑	↑	=	A	
											=	=	=	A	
											↑, =	=, ↑	=	I	
											=	↑	↓	A	
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											↑	=	↓	A	

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Table SIV. Contd.

2009, Salem & Goodwin (49)	RCT Single-blind Smaller RCT	5	5	Range 4.9–10.2 years Mean 6.53 years, (SD 1.8)	GMFCS I – III Diplegia (8) Quadriplegia (2)	Contr: conventional PT focused on improving walking and balance through facilitation and normalization of movement patterns. Exp: task-oriented training; strengthening the lower extremities and practicing functional tasks	5	–	2	Timed Up and Go Gross motor function (GMFM)	↑ = ↑ ↑ = ↑	A A	II (5/7)
2010, Löwing et al. (50)	Prospective intervention Longitudinal ABA design Single case	22	–	Mean 46 months (SD 16)	GMFCS I-IV	Phase B: goal-directed functional activities (focus on learning new skills in the context of daily life) Phase A: follow-up, usual intervention? ABA-design	12	12	In ADL 7	Gross motor function (GMFM) Individual functional goals (GAS) pROM hip, knee and ankle (goniometer) Spasticity (MAS) Selectivity (selective motor control)	↑ = ↑ = ↑ = ↓ = ↑ =	A A I I I	IV (8/14)

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; GMFCS: Gross Motor Classification System; GMFM: Gross Motor Function Measure; PEDI: Pediatric Evaluation of Disability Inventory; GAS: Goal Attainment Scale; LL: lower limb, UL: upper limb; BOT: Bruininks-Oseretsky Test of Motor Proficiency; MAS: Modified Ashworth Scale, pROM: passive range of motion; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity; P: participation; E: environmental factors .

Table SV. Overview of studies using goal-oriented physical therapy (PT): subjects, interventions, evaluation, results and level of evidence and conduct scores

Study	Design type	Subjects		Age	Type	Method Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Results			
		n (exp)	n (contr)								Exp	Contr	Exp vs cont	Level of evidence ICF (conduct)
1996, Bower et al. (13)	RCT 2×2 factorial Smaller RCT	22	22	Mean group 1=6.3 years Mean group 2=5.5 years Mean group 3=5.8 years Mean group 4=5.6 years	Spastic quadriplegia	Group 1: usual PT based on general aims Group 2: intensive PT (1 h/day) based on general aims Group 3: usual PT based on specific goals Group 4: intensive PT (1 h/day) based on specific goals 2 weeks Selection of goals/aims based on GMFM Treatment type was mixed (eclectic)	2	–	7	Gross motor function (GMFM)	↑	=	A	II (4/7)
2001, Bower et al. (51)	RCT 2×2 fact ABA Smaller RCT	28	28	Mean 5.9 years Range 3–12 years	GMFCS III–V Spastic diplegia Spastic quadriplegia	Group 1 (n=15): usual physiotherapy based on general aims (12 h/6 months) Group 2 (n=13): intensive physiotherapy (1 h/day) based on general aims Group 3 (n=13): usual physiotherapy based on specific goals (12 h/6 months) Group 4 (n=15): intensive physiotherapy (1 h/day) based on specific goals ABA design: 6 months baseline observation, 6 months intervention, 6 months follow-up	26	26	7	Gross motor function (GMFM and GMPM) Measure of Process Care Questionnaire	=	=	A	II (7/7)
2009, Löwing et al. (52)	Prospective intervention Multicentre Non-randomized Controlled trial	22	22	4 years 1 months (1 years 5 months)	GMFCS I–IV Unilateral 17 Bilateral 27	Exp: goal-directed therapy (group training and day-to-day practice, 1×/week, individual goals) Contr: activity-directed therapy (1×/week, based on general aims)	12	–	1	Functional abilities (PEDI) Gross motor function (GMFM)	↑	=	↑	A/P II (4/7)

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; GMFCS: Gross Motor Classification System; GMFM: Gross Motor Function Measure; GMPM: Gross Motor Performance Measure; PEDI: Pediatric Evaluation of Disability Inventory; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; I: Impairment; A: activity, P: participation; E: environmental factors .

Table SVI. Overview of studies using aquatic therapy – subjects, interventions, evaluation, results and level of evidence and conduct scores

Study	Design type	Subjects		Age	Type	Method Intervention	Duration of intervention (weeks)	Duration of follow-up (weeks)	Freq of intervention (×/week)	Evaluation	Results		Level of evidence (conduct)		
		n (exp)	n (contr)								Exp	Contr		Exp vs cont	ICF
1998, Hutzler et al. (53)	RCT Smaller RCT	23	23	5–7 years Group 1: mean 5.7 years (SD 1) Group 2: mean 5.5 (SD 0.9)	Hemiplegia (17) Diplegia (19) Quadriplegia (6) Ataxia/athetosis (4) Walkers and non-walkers	Group 1: swimming sessions + physical activity at gym Exp: NDT; 30 min, 4×/week	26	–	2	Lung function (VC, spirometer) Water Orientation Score	↑		I	II (1/7) I/A	
1998, Hutzler et al. (54)	RCT Smaller RCT	23	23	5–7 years Mean 5.7 years	Diplegia (19) Hemiplegia (17) Quadriplegia (6) Ataxia/athetosis (4)	Exp: movement and swimming programme (3×/week, 30 min) + group movement + NDT Contr: NDT 30 min, 4×/ week	26	–	3	Water Orientation Score Self-perception (Martinek-Zaichkowsky Self Concept Scale)	↑	=	I	I/A II (2/7)	
2005, Thorpe et al. (55)	Prospective intervention AB Single subject	7	–	7–13 years Mean 9.7 years (SD 1.8)	Spastic diplegia (6) Spastic hemiplegia (1)	Phase A: individual aquatic exercise sessions, 45 min Phase B: usual therapy	10	11	3	Leg strength (handheld dynamometer) Gait velocity (3 min walking test) Energy expenditure (resting heart rate) Gross motor function (GMFM) Functional mobility (TUG)	=	=	=	I A I A	IV (8/14)
2007, Ozer et al. (56)	Prospective intervention Smaller RCT	13	10	Exp: mean 8.1 years (SD 1.5) Contr: mean 8.9 years (SD 1.5)	Not described	Exp: 14 weeks swimming training + traditional PT Contr: traditional PT only	14	26	3	Child Behaviour Check List: Body awareness Competence Problem behaviour	↑	=	=	I	II (3/7)

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; NDT: neurodevelopmental treatment; VC: vital capacity; TUG: Timed Up and Go test; GMFM: Gross Motor Function Measure; GMPM: Gross Motor Performance Measure; PEDI: Pediatric Evaluation of Disability Inventory; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity; E: environmental factors .



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Table SVII. *Contd.*

2002, Sterba et al. (62)	Prospective Repeated measures Single subject AB design	17	–	Mean 9 years 10 months (SD 10)	Diplegia (12) Quadriplegia (3) Hemiplegia (2) GMFCS I-V	Phase A : horse back riding therapy (Exercises during riding, prone lying,...) Phase B: usual PT	18	6	1	Gross motor function (GMFM) Functional independence (WeeFIM)	↑ = = =	↑ = = =	A A	IV (10/14)
2003, Benda et al. (63)	Prospective intervention Control group Smaller RCT	7	8	4–12 years	Spastic Independent sitting, standing	Exp: 8 min of hippotherapy (additional component of rhythmic multidimensional movement of the horse) – 1 session Contr: 8 min astride a stationary barrel (neutral warmth for a fleece saddle, symmetrical forward-sitting posture)-1session	–	–	–	EMG of trunk, upper leg muscles during sitting, standing and walking Asymmetry score		↓	I/A I	II (4/7)
2004, Cherng et al. (64)	Prospective intervention Repeated measures AB design Single subject	14	–	3 years 1 months–11 years 5 months Group 1: mean 92,3 months Group 2: mean 93 months	Quadriplegia (5) Diplegia (7) Hemiplegia (2) Ambulant Non-ambulant	Exp: AB Contr: BA Phase A=PT only Phase B: usual PT + horseback riding therapy 40 min, 2×/week (16 weeks)	16	16	2	Gross motor function (GMFM) Muscle tone of hip adductors (MAS)	↑ = = =	↑ = = =	A I	IV (10/14)
2004, Casady (65)	Prospective intervention Repeated measures Single subject ABA design	10	–	2.3–6.8 years Mean 4.1 years (SD=1.7)	Spastic quadriplegia (2) Spastic diplegia (1) Hemiplegia (3) Athetosis (1) Non-specified (11)	Phase B: 10 weeks, 1×/week hippotherapy Phase A: 20 weeks usual PT ABA design	10	10	1	Functional abilities (PEDI) Gross motor function (GMFM)	↑ = ↑ =	↑ = ↑ =	A/P A	IV (6/14)
2008, Zurek (66)	Prospective intervention Case series	16	–	14–16 years Mean 9.3 years (SD 3.8)	Spastic diplegia (7) Spastic hemiplegia (5) Other (4)	Hippotherapy: 15–35 min on saddle (1 session)	–	–	–	Limb skin surface temperature	↑		I	IV (2/7)

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Table SVII. *Contd.*

2009, Shurtleff (67)	Prospective intervention Single subject AB design	11 CP	8 (Non- CP)	5–13 years Mean 8 years	Diplegia	Phase A: hippotherapy, 45 minutes, (no riding lesson, participant had no control over the horse) + usual PT Phase B: wash-out, usual PT only AB design	12	12	1	3D analysis of head/trunk stability Reaching/grasping	↑  ↑	A	IV (4/7)
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Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; GMFM: Gross Motor Function Measure; BOT: Bruininks-Oseretsky Test of Motor Proficiency; MAS: Modified Ashworth Scale; PEDI: Pediatric Evaluation of Disability Inventory; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity; P: participation; E: environmental factors .

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Table SVIII. Overview of studies using hippotherapy or therapeutic horse-riding (part 2: subjects, interventions, evaluation, results and level of evidence and conduct scores)

Study	Design type	Subjects		Age	Type	Method Intervention	Inter- vention (weeks)	Follow- up (weeks)	Freq of inter- vention (×/week)	Evaluation	Results			
		n (exp)	n (contr)								Exp	Contr	Exp vs contr	Outcome level ICF
2009, McGibbon et al. (68)	RCT Smaller RCT	25	22	Group 1: mean 8 years 5 months Group 2: mean 8 years 8 months	GMFCS I–IV Diplegia (25) Quadriplegia (9) Hemiplegia (7) Mixed (6)	Phase 1: 10 minutes hippo (group 1) /10minutes barrel (group 2) Phase 2: 12 weekly hippotherapy sessions	12		1	Adductor spasticity (EMG) Gross motor function (GMFM) Self-perception (self- perception profiles) Gross motor function (GMFM) Health status (CHQ) Quality of life (CP QoL, KIDSCREEN)	↓ ↑ =,=,=,=,=	= = =,=,=,=,=	I A I	II (6/7)
2009, Davis et al. (69)	RCT Smaller RCT	50	49	4–12 years Exp: mean 7 years 8 months Contr: mean 8 years 2 months	GMFCS I–III	Exp: therapeutic horse-riding, 30–40 min Contr: usual activities	10		1			= = =	A I/P QoL	II (6/7)
2009, Debus et al. (70)	Retrospective Qualitative study Multicentre case-series	17	–	4–63 years	GMFCS I–V	6 weeks–several years Hippotherapy	Not reported	Not reported	Not reported	Semi-structured interviews			I A P E	IV (1/7)
1995, Mac Kinnon et al. (71)	Systematic review	11	–	–	–	–	–	–	–	–				II (0)
2007, Sterba (72)	Systematic review	11	–	–	–	Cochrane Library, DARE, Medline, CINAHL Key words: HBRT, hippotherapy, developmental riding therapy, equine-movement therapy, riding for disabled, therapeutic horse-riding therapy, therapeutic riding, cerebral palsy, exercise therapy, horseback riding, horses, physical therapy techniques, recreational therapy, rehabilitation, therapeutic exercise 1981–2005	–	–	–	Critical Review Form (Law et al. 1998)				II (8)

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Table SVIII. *Contd.*

2007, Snider et al. (73)	Systematic review	9 studies	-	-	-	PEDro, Medline, CINAHL, ERIC, HealthSTAR	-	-	-	Levels of evidence according to Sackett	II (8)
						Key words: horse-riding, hippotherapy, horseback riding, equine movement therapy				PICO format	
						,,,–2005					

Exp: experimental group or experimental period; Contr: control group or control period; Freq: frequency; Int: intervention group or intervention period; ICF: International Classification of Functioning, Disability and Health; RCT: randomized controlled trial; SD: standard deviation; GMFCS: Gross Motor Classification System; GMFM: Gross Motor Function Measure; CHQ: Child Health Questionnaire; MAS: Modified Ashworth Scale; PEDI: Pediatric Evaluation of Disability Inventory; = results were not significantly different between the control and the experimental group; ↑ the results were significantly higher in the experimental group or during the experimental period; ↓ the results were significantly lower in the experimental group or during the experimental period; I: Impairment; A: activity, P: participation; E: environmental factors.