CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Stroke Rehabilitation Evidence Tables

Mobility, Balance and Transfers

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on Behalf of the Canadian Stroke Best Practice Recommendations
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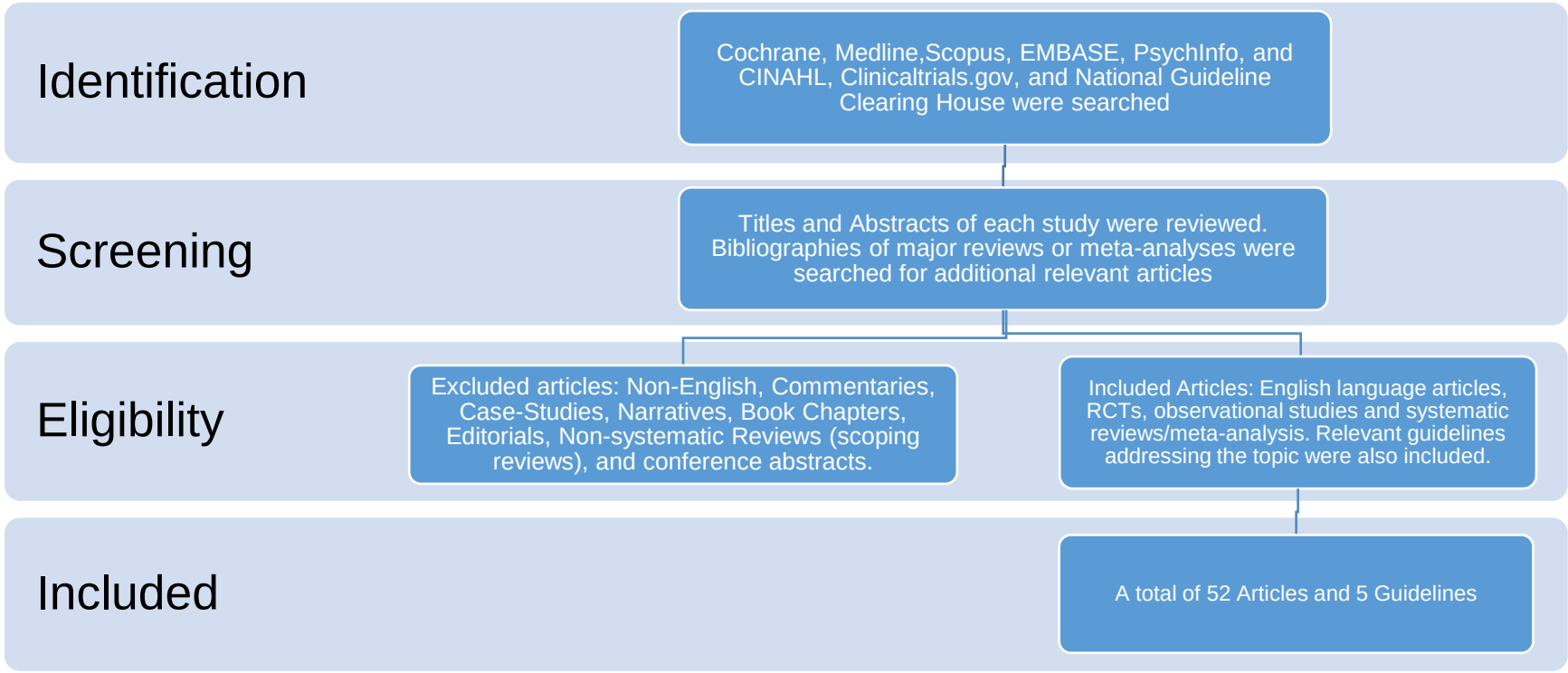
Search Strategy



Cochrane, Medline, and CINAHL, Clinicaltrials.gov, and National Guideline Clearing House, Scopus, EMBASE and PsycINFO were searched using the keywords: (Stroke OR CVD OR “cerebrovascular disease”) AND (“lower limb” OR “lower extremity”) AND gait. The same databases were searched to identify paediatric related evidence using the keywords: (stroke OR CVD OR cerebrovascular disease) AND (rehabilitation OR intervention OR therapy) AND (paediatric OR paediatrics OR youth OR child OR children OR young) AND ("Lower Limb" OR "lower extremity" OR gait OR mobility OR falls). Titles and abstract of each article were reviewed for relevance. Bibliographies were reviewed to find additional relevant articles. Articles were excluded if they were: non-English, commentaries, case-studies, narrative, book chapters, editorials, non-systematic review, or conference abstracts. Additional searches for relevant best practice guidelines were completed and included in a separate section of the review. A total of 52 articles and 5 guidelines were included and were separated into separate categories designed to answer specific questions.

Published Guidelines

Guideline	Recommendations
Scottish Intercollegiate Guidelines Network (SIGN). Management of patients with stroke: rehabilitation, prevention and management of complications, and discharge planning. A national clinical guideline. Edinburgh (Scotland): Scottish Intercollegiate Guidelines Network (SIGN); 2010 Jun. p.p. 15-18	Lower-Limb Function-Summary of Recommendations (4.2.1) **Recommended** AFO, individualized interventions, gait-oriented physical fitness training, repetitive task training, muscle strengthening, increased intensity of rehabilitation **Consider** Treadmill training in people who are independent in walking, FES for drop-foot, electromechanical assisted gait training **Not recommended** Routine treadmill training, and EMG biofeedback, balance platform training with visual feedback **Insufficient evidence** Routine electrostimulation; walking aides Treadmill training is not recommended as a routine gait training intervention after stroke. (B) Treadmill training may be considered to improve gait speed in people who are independent in walking at the start of treatment. (B) EMG biofeedback is not recommended as a routine treatment for gait, balance or mobility problems after stroke. (B) Balance platform training with visual feedback is not recommended for the treatment of gait, balance or mobility problems after stroke. (B) Functional electrical simulation may be considered as a treatment for drop-foot, where the aim of treatment is the immediate improvement of walking speed and/or efficiency. (C) Where the aim of treatment is to have an immediate improvement on walking speed, efficiency or gait pattern or weight bearing during stance, patients should be assessed for suitability for an AFO by an appropriately qualified health professional. (C) Physiotherapists should not limit their practice to one 'approach,' but should select interventions according to the individual needs of the patient. (B) Gait-oriented physical fitness training should be offered to all patients assessed as medically stable and functionally safe to participate, when the goal of treatment is to improve functional ambulation. (A) Electromechanical assisted gait training may be offered to selected patients where the necessary equipment is already available and healthcare professionals are competent in the use of the equipment. (B)

Guideline	Recommendations
	Rehabilitation should include repetitive task training, where it is assessed to be safe and acceptable to the patient, when the aim of treatment is to improve gait speed, walking distance, functional ambulation or sit-to-stand-to-sit. (B) Muscle strength training is recommended when the specific aim of treatment is to improve muscle strength. (B) Where considered safe, every opportunity to increase the intensity of therapy for improving gait should be pursued. (B)
Management of Stroke Rehabilitation Working Group. VA/DoD clinical practice guideline for the management of stroke rehabilitation. Washington (DC): Veterans Health Administration, Department of Defense; 2010. p.80-98	There is insufficient evidence to recommend for or against using neurodevelopmental training (NDT) in comparison to other treatment approaches for motor retraining following an acute stroke. [I] Recommend that motor recovery program should incorporate multiple interventions, emphasizing progressive difficulties, repetition, and functional task practice. [B] Interventions for motor recovery (including improving ambulation) should include cardiovascular exercise fitness and strengthening. [A] (see Strengthening and Exercise and Cardiovascular Conditioning and Fitness below) Consider using strength training as a component of the therapeutic approach in paretic patients. [B] Consider active and passive ROM prolonged stretching program to decrease risk of contracture development (night splints, tilt table) in early period following stroke. [C] Recommend that patients demonstrating balance impairments following stroke should be provided a balance training program: including task-specific balance training [C], aquatic therapy (B), force platform biofeedback training (C), Tai Chi (C), cycling (C) Consider using treadmill training in conjunction with other task specific practice and exercise training techniques in individuals with gait impairments post stroke without known cardiac risks for treadmill exercise. [B] Consider the use of partial bodyweight support for treadmill training (partial BWSTT) (up to 40% of individuals' weight) in conjunction with other task specific and exercise training techniques for individuals with gait impairments post stroke without known cardiac risks for treadmill exercise. [B] Recommend FES as an adjunctive treatment for patients with impaired muscle contraction, specifically for patients with impaired gait due to ankle/knee motor impairment. FES can be utilized for individuals with acute or chronic deficits after stroke. [B] Consider transcutaneous electrical nerve stimulation (TNS or TENS) as an adjunctive treatment for enhancing recovery of gait function after stroke. [C] Consider rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed. [B] Recommend for patient with foot drop, ankle foot orthoses (AFO) to prevent foot drop and improve knee stability during

Guideline	Recommendations
	walking. [B] There is not sufficient evidence supporting use of robotic devices during gait training in patients post stroke. [D] Consider using virtual reality (VRT) to enhance gait recovery following stroke. [B]
Rehabilitation. In: Clinical guidelines for stroke management 2010. Melbourne (Australia): National Stroke Foundation; 2010 Sep. **p.78-95.**	Task-specific circuit class training or video self-modeling should be used to increase the amount of practice in rehabilitation. (B) Practising reaching beyond arm's length while sitting with supervision/assistance should be undertaken by people who have difficulty sitting. (B) Practising standing up should be undertaken by people who have difficulty in standing up from a chair. (A) Task-specific standing practice with feedback can be provided for people who have difficulty standing. (B) People with difficulty walking should be given the opportunity to undertake tailored, repetitive practice of walking (or components of walking) as much as possible. (A) One or more of the following interventions can be used in addition to conventional walking training Cueing of cadence (B), mechanically-assisted gait (via treadmill or automated mechanical or robotic device) (B), joint position biofeedback (C), virtual reality training. (C) Ankle-foot orthoses, which should be individually fitted, can be used for people with persistent drop foot. (C)
Duncan PW, Zorowitz R, Bates B, Choi JY, Glasberg JJ, Graham GD, Katz RC, Lamberty K, Reker D. Management of adult stroke rehabilitation care: a clinical practice guideline. Stroke, 2005;36:e100-e143.	Recommend that the patient participate in a regular strengthening and aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's comorbidities and functional limitations. (B) Recommend that adaptive devices be used for safety and function if other methods of performing the task are not available or cannot be learned or if the patient's safety is a concern. (C) Recommend that lower-extremity orthotic devices be considered if ankle or knee stabilization is needed to improve the patient's gait and prevent falls. (C) Recommend that a prefabricated brace be initially used and that only patients who demonstrate long-term need for bracing have customized orthoses made. (C) Recommend that wheelchair prescriptions be based on careful assessment of the patient and the environment in which the wheelchair will be used. (C) Recommend that walking assistive devices be used to help with mobility efficiency and safety, when needed. (Not rated) Recommend that strengthening be included in the acute rehabilitation of patients with muscle weakness after stroke. (I) Recommend that treadmill training with partial body weight support be used as an adjunct to conventional therapy in patients with mild-to-moderate dysfunction resulting in impaired gait. (Not rated) Recommend treatment with FES for patients who have demonstrated impaired muscle contraction, specifically with patients with ankle/knee/wrist motor impairment. (B)

Guideline	Recommendations
	There is insufficient evidence to recommend for or against using NDT in comparison to other treatment approaches for motor retraining after an acute stroke. (I)
Intercollegiate Stroke Working Party. *National clinical guideline for stroke,* 4th edition. London: Royal College of Physicians, 2012.	**6.8 Gait retraining, treadmill retraining, walking aids (including orthoses)** *6.8.1 Recommendations* A Every patient who has limited mobility following stroke should be assessed by a specialist in neurological physiotherapy to guide management. B Patients with limited mobility should be assessed for, provided with and taught how to use appropriate mobility aids (including a wheelchair) to facilitate safe independent mobility. C People who are able to walk with or without assistance should undergo walking training to improve endurance and speed. D An ankle–foot orthosis should only be used to improve walking and/or balance, and should be: • tried in patients with foot-drop (reduced ability to dorsiflex the foot during walking) that impedes safe and efficient walking • evaluated on an individual patient basis before long-term use • individually fitted. **6.13 Neuromuscular electrical stimulation (including functional electrical stimulation)** A Functional electrical stimulation can be used for drop foot of central neurological origin provided normal arrangements are in place for clinical governance, consent and audit. B Therapeutic electrical stimulation for treatment of the upper and lower limbs following stroke should only be used in the context of a clinical trial. **6.16 Repetitive task training** Repetitive task training should be used to improve activities of daily living and mobility: standing up and sitting down, gait speed and gait.
Aerobic Exercise Recommendations to Optimize Best Practices in Care After Stroke (AEROBICS) (2013)	Aerobic training should be incorporated into a comprehensive, inter-professional program of stroke rehabilitation, vascular risk reduction, and secondary stroke prevention. Aerobic training should be implemented as part of an overall exercise program that may also include, but is not limited to, muscle strengthening and task-oriented training of motor control, balance, gait, and functional use of the upper extremity. Physical activity designed to maintain cardiovascular fitness is an important aspect of community reintegration after stroke. Strong A variety of exercise modes can be used to induce an aerobic training effect. Task-specific exercise that activates large muscle masses is recommended. Strong

Guideline	Recommendations
	A minimum of 8 weeks of aerobic exercise is recommended to achieve a clinically meaningful training effect. However, physical activity should be sustained indefinitely to ensure maintenance of health benefits. Although physical activity should be done “most days of the week” for general health, structured aerobic exercise should be conducted a minimum of 3 days/week. On the other days of the week, participants are encouraged to engage in lighter forms of physical activity Aerobic exercise sessions of >20 minutes are recommended, depending on exercise frequency and intensity. In addition, warm-up and cool-down periods of 3-5 minutes are advised. A gradual progression in the duration may be required, starting with bouts of 5 minutes or less, alternating intervals of rest or lower-intensity exercise, as needed. Intensity of aerobic exercise must be determined on an individual basis, depending on response to the exercise stress test, health status (neurologic status, cardiac, and other comorbidities), and planned exercise frequency and duration. Frequent heart rate monitoring and periodic blood pressure monitoring are recommended for safety and assurance that exercise is being performed at the planned intensity. Surrogate markers of intensity, such as rating of perceived exertion (RPE), should be used, particularly when the linear relationship between cardiopulmonary exertion and heart rate is compromised by medication or autonomic dysregulation. Low-intensity exercise: 60% of HRR or RPE0-10 >6 or RPE6-20 of >14 Exercise intensity should be progressed as tolerated by the participant. Strong

SUMMARY OF THERAPEUTIC MOBILITY INTERVENTIONS AND ASSOCIATED STRENGTH OF EVIDENCE FROM SELECTED GUIDELINE DOCUMENTS

Intervention	CBPR 2013	SIGN 118 2010	NSF 2010	VA/DoD 2010	AHA/ASA 2005	RCP 2012
Repetitive task-specific training	A [Early; Late]	B	B	B	-	Recommended
Neurophysiological approaches	I	-	-	I	I	Recommended
Body-weight support treadmill training	A [Early; Late]	-	-	-	Recommended (No rating)	-
Electromechanical-assisted gait training devices	C [Early] B [Late]	B Not recommended routinely	B	D	-	-
FES	A [Early; Late]	C	-	C	-	Recommended
Fitness training	B	A	-	A	B	-
High-intensity training	-	B	-	-	-	-
EMG biofeedback	-	B Not recommended	-	-	-	-
Virtual reality	-	-	C	B	-	-
AFO in selected patients/splinting	A [Early; Late]	C	C	B	C	Recommended
Rhythmic gait cueing	-	-	-	B	-	-
Strengthening	-	B	-	B	B (Home or community) I (Inpatient rehab)	-
Balance platform	-	B Not recommended	-	C	-	-
Additional sit-to-stand reps	C	B	A	-	-	-

I: Insufficient evidence to recommend for/against providing intervention

Evidence Tables

Physiotherapy Approaches

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Pollock et al. 2014 **UK** **Cochrane Review**	N/A	RCTs focused on improving patients sit-to-stand abilities after a stroke.	13 studies (n=603) were included in this review. Interventions included: repetitive sit-to-stand (6 studies), exercise training programs (4 studies), sit-to-stand training program (1 study), augmented feedback (1 study), and altered chair design (1 study). The analysis was completed using 11 of the identified studies.	**Primary Outcomes:** Ability to complete sit-to-stand **Secondary Outcomes**: time to sit-to-stand, lateral symmetry, incidence of falls, reaction forces and joint kinematics.	A single study (judged to be at high risk of bias) found training increased the odds of independent sit-to-stand vs. the control group (OR = 4.86; 95% CI, 1.43 to 16.50). 5 studies showed sit-to-stand interventions improved the time needed for sit-to-stand (SMD= 0.85; 95% CI 0.38 to 1.33). Long-term improvements were shown. Sit-to-stand training on number of falls was imprecise (no benefit or harm).
Pollock et al. 2014 **UK** **Cochrane Review**	N/A	RCTs focused on improving recovery of function of mobility after stroke through the use of physical rehabilitation approaches.	A total of 96 studies (n=10401) were included. Specifically for analysis three groupings were explored: intervention vs. no treatment (41 studies), intervention vs. usual care or attention control (22 studies), and one intervention vs. another (13 studies).	**Primary outcomes:** Independence in Activities of daily living (e.g., FIM, Barthel Activities of Daily Living Index, Modified Rankin Scale, and motor function (e.g., FMA-LE, Motor assessment scale, Rivermead mobility index, Rivermead Motor Assessment) **Secondary Outcomes:** Balance and gait velocity.	Based on 27 studies, treatment was shown to have a beneficial effect when compared to no treatment for functional recovery (SMD=0.78, 95% CI 0.58 to 0.97, I^2=85%). To improve motor function, intervention is more effective than usual care (SMD =0.42, 95% CI 0.24 to 0.61, I^2=42%). It is also more effective for improving balance SMD= 0.31, 95% CI 0.05 to 0.56) and gait velocity (SMD= 0.46, 95% CI 0.32 to 0.60). No one physical rehabilitation approach was more (or less) effective than any other approach for increasing motor function.
Tang et al. 2014 **China** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	48 subjects with severe motor deficit (Stroke Rehabilitation Assessment of Movement score ≤5) after first time stroke. Subjects were 60-74 years of age and within 1	Subjects were divided into two groups. The control group (n=24) received the contemporary Bobath approach (CBA) and the experimental group (n=24) received early	**Primary Outcomes:** STREAM and BBS. Subjects were assessed at baseline and weeks 4 and 8 after treatment.	At 4 weeks the ECBA group had higher scores in the lower extremity (p< 0.001) and basic mobility (p< 0.001) domains, and the overall STREAM score (p<0.01) than the CBA group. Similar results were shown at week 8 (p<0.001). No significant differences were found for the upper extremities after the interventions.

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		month of stroke onset.	sitting, standing, and walking (ECBA) in conjunction with CBA. Treatment was given 5 times per week in 50 minute sessions for 8 weeks.		BBS scores amongst the ECBA group were significantly higher than the CBA group after 4 weeks (p< 0.001), and 8 weeks (p< 0.001).
Nadeau et al. 2013 **LEAPS Trial** **USA** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	408 adult participants who were a mean of 63.8 days post stroke and had residual lower extremity paresis.	There were two treatment groups and a control group. Participants received locomotor training program (LTP; treadmill and over ground training), home exercise program (HEP; strength, balance, coordination exercises provided by a PT) or usual care (UC). Treatment groups received 90minute sessions, 3/week (30-36 sessions).	Primary Outcome: Functional level of walking Secondary outcomes: 10m walking speed, 6MWT, steps taken per day, FMA-LE, BBS, Stroke impact scale, ABC scale, and the Modified Rankin Scale.	The adjusted odds ratio for improving on the functional walking level with LTP vs. UC was 1.94 (95% CI = 1.18-3.21, p=0.010) and 2.04 (95% CI=1.22-3.42, p=0.007) for HEP vs. UC. No difference was shown for LTP vs. HEP. Improvements in walking speed were shown for all groups (p<0.0001). Differences in the gains made for walking speed were 0.13m/s (95% CI = 0.09-0.18) for LTP vs. UC and 0.10m/s (95% CI = 0.05-0.14) for HEP vs. UC. Significant improvements (p<0.0001) were shown for all groups on the FM, BBS, ABC scale, and modified Rankin Score. Greater improvement was shown for the two treatment groups vs. usual care on the BBS, ABC scale and physical mobility (p<0.0014).
Brock et al. 2011 **Australia** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	26 patients who were able to walk for 15m indoors on a level surface, with or without and aid, with supervision who were between 4 and 20 weeks post stroke.	Subjects were randomized to receive 6-1 hour physical therapy sessions over a two-week period using structured task practice or the Bobath approach in addition to task practice. Subjects in the Bobath group received treatment that was individualized and aimed at reducing the severity of	**Primary outcome:** 6MWT (adapted) **Secondary outcomes:** Gait velocity, BBS Assessments were conducted before and after the intervention.	Mean ± SD 6MWT (m) pre-and post-intervention Bobath group: 102.6 ± 64.5 to 192.5 ± 113.5 Task practice group: 78.5 ± 61.3 to 119.5 ± 80.2 Mean change: 89.8 vs. 41, p=0.07 Mean ± SD gait velocity (m/min) pre-and post-intervention Bobath group: 30.6 ± 16.2 to 56.8 ± 28.3 Task practice group: 26.4 ± 18.9 to 36.2 ± 27.9 Mean change: 26.2 vs. 9.9, p<0.01 Mean ± SD BBS scores pre-and post-intervention Bobath group: 40.2 ± 6.1 to 47.3 ± 4.6 Task practice group: 43.3 ± 5.7 to 47.4 ± 5.0 Mean change: 7.1 vs. 4.0, p=0.20

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			impairments where they impacted on function, and optimizing postural and movement strategies to improve function. Subjects in task practice group participated in a supervised exercise programme designed to improve walking outdoors and increase endurance, by practicing walking on slopes, going up and down a single step and walking over rough ground.		Drop outs: 3 (Bobath group n=2, task practice group n=1)
Van Vliet et al. 2005 **UK** **RCT**	CA: ☑ Blinding: assessor ☑ ITT:☒	120 patients admitted for stroke rehabilitation within 2 weeks of event. Inclusion criteria: able to tolerate at least ½ hour to complete the physical tasks required for initial evaluation	Comparison of Bobath based treatment (n=60) vs. motor relearning approach (n=60) Treatment was outpatient based and provided for as long as needed. No details regarding the content of the treatment programs are provided. Therapy was based on written guidelines consisting of theoretical concepts and clinical objectives.	**Primary Outcomes:** Rivermead Motor Assessment (RMA), Motor Assessment Scale (MAS) **Secondary Outcomes:** 6MWT, Modified Ashworth Scale BI, Extended Activities of Daily Living, Nottingham Sensory Assessment Outcomes were assessed at 1, 3 and 6 months after randomization	Median RMA (gross function) at baseline and 6 months: Bobath 2 to 8 vs. Motor relearning 1 to 8, p=0.61 Median RMA (leg & trunk) at baseline and 6 months: Bobath 4 to 7 vs. Motor relearning 2 to 7, p=0.41 Median MAS (balanced sitting): at baseline and 6 months: Bobath 5 to5 vs. Motor relearning 4 to 25 p=0.25 Median MAS (supine to sitting) at baseline and 6 months: Bobath 4 to 6 vs. Motor relearning 2 to 6, p=0.00067 Median MAS (walking) at baseline and 6 months: Bobath 0 to 4 vs. Motor relearning 0 to 3, p=0.27 Median BI scores at baseline and 6 months: Bobath 8 to 18 vs. Motor relearning 8 to 17, p=0.20 Median 6MWT (m/s) at baseline and 6 months: Bobath 0.66 to 0.76 vs. Motor relearning 0.60 to 0.64, p=0.54.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					Adverse events: No reporting Drop outs: Bobath group n=15, Motor learning group n=5

Task Oriented Training (Task-Specific Training)

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
English & Hillier 2010 **Australia** **Cochrane review**	N/A	6 RCTs (292 subjects) Subjects in 2 trials recruited subjects within the first 3 months of stroke, while subjects in 4 trials were recruited 1 to 5 years post stroke.	Included trials where treatment was provided in a group environment, with 1 staff member per 1-3 subjects, where treatment was provided at a frequency of at least weekly for a minimum of 4 weeks. Therapy sessions included repetitive practice of functional tasks arranged in a circuit with the aim of improving mobility. The control condition was UE circuit training, usual care, reaching tasks and education/social groups. Treatment intensity was 1-2 hours/session in all trials. Duration of treatment was 3 or 5 days/ week for 4, 10 and 19 weeks.	**Primary Outcome:** 6MWT **Secondary Outcomes:** Impairment-strength, ROM Activity limitation-ADLs Participation restriction-HR QoL Others-Length of stay, adverse events, self-reported satisfaction, locus of control Outcomes were assessed before and after treatment. Follow-up periods in 3 trials were 2, 3 and 6 months with falls tracked for 1 year in 1 trial.	6MWT (m): MD=76.6, 95% CI 38.4 to 114.7, p<0.0001. Results from 4 studies included Gait speed (m/s): MD=0.12, 95% CI 0.0 to 0.24, p=0.043 Results from 3 studies included TUG (sec): MD=-3.08, 95% CI -7.59 to 1.43, p=0.18 Results from 3 studies included Berg Balance Scale: MD=0.86, 95% CI -1.02 to 2.74, p=0.37. Results from 2 studies included Adverse events: falls (intervention group n=9, control group n=3) with no serious injuries
Langhorne et al. 2009 **UK**	N/A	11 RCTs (564 subjects) specific to LE identified from a Cochrane review	Two trials evaluated whole therapy motor approaches, 4 trials	**Primary Outcomes:** 6MWT, 10-Metre Walk speed, 5-Metrs comfortable	Walking distance (metres)-change from baseline: MD=54.6, 95% CI 17.5 to 91.7, p=0.004 Results from 3 studies included

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Systematic review and meta-analysis		(French et al. 2007) from a total of 14 studies. Subjects in 7 studies were recruited in the first month following stroke; one trial recruited within the first 3 months of stroke; 2 trials recruited within 12 months of stroke and two trials recruited more than 1 year following stroke.	evaluated single tasks related to balance, reach, or sit to stand training, 3 trials evaluated circuit training, 2 trials included functional task practice + additional components [strengthening + treadmill training (n=1) and lower-limb exercises (n=1)] Treatment duration varied widely from a total of 10 to >40 hours provided over 2 to 20 weeks.	walk speed, 6-metre walk speed, Functional Ambulation Classification, Motor Assessment Scale, Timed Up & Go, timed sit to stand, Sodring Motor Evaluation Scale, Step Test, Upright Equilibrium Index, BBS Outcomes were assessed before and after treatment. In 7 studies there were follow-up periods of 2, 3 and 6 months and 4 years.	Walking speed: SMD= 0.29, 95% CI 0.04 to 0.53, p=0.021 Results from 5 studies included Functional ambulation: SMD= 0.25, 95% CI 0.04 to 0.51, p=0.054 Results from 5 studies included Sit to stand: Standardized effect: 0.35, 95% CI 0.13 to 0.56, p=0.018 Results from 7 studies included Lower-limb functional measures: SMD= 0.20, 95% CI -0.10 to 0.50, p=0.19 Results from 4 studies included Standing Balance/Reach: SMD= 0.29, 95% CI -0.06 to 0.63, p=0.10 Results from 3 studies included Comparison of all outcomes (<6 months post treatment): SMD=0.11, 95% CI -0.33 to 0.56, p=0.062 Results from 4 studies included; > 6 months post treatment: SMD=-0.01, 95% CI -0.32 to 0.29, p=0.08. Results from 3 studies included Adverse events: Two trials reported no adverse events. One trial reported a non-significant decrease in falls associated with the intervention group (3/25 vs. 4/23)
van de Port et al. 2012 **The Netherlands** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	250 patients who had completed inpatient rehabilitation following stroke, were able to walk 10 m without physical assistance and were to be discharged home, with the intention of participating in an outpatient rehabilitation program	Subjects were randomized to receive a graded task specific circuit training program (n=126) or usual outpatient physiotherapy. Circuit training involved 8 workstations designed to improve walking ability and consisted of 90 minute sessions, 2/week	**Primary outcome:** Mobility sub scale of the Stroke Impact Scale (SIS) **Secondary outcomes:** Other domains of the SIS, Rivermead Mobility Index, Falls Efficacy Scale, Nottingham Extended Activities of Daily Living, Hospital Anxiety and	Mean ± SD SIS (mobility) scores at baseline, 12 weeks and 24 weeks Circuit training group: 80.9 ± 13.04 to 87.27 ± 12.38 to 86.56 ± 13.19 Control group: 77.8 ± 15.0 to 83.73 ± 13.25 to 84.42 ± 14.48 p<0.001 (baseline to 24 weeks) Mean ± SD RMI scores at baseline, 12 weeks and 24 weeks Circuit training group: 12.67 ± 1.58 to 13.47 ± 11.44

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			over 12 weeks. Subjects in the control group received usual outpatient physiotherapy.	Depression Scale, Fatigue Severity Scale, Motricity Index, 6MWT, Functional Ambulation Categories, TUG, 5 m comfortable walking speed, modified stairs test) Primary outcome was assessed at baseline, 6, 12, 18 and 24 weeks post randomization. Secondary outcomes were assessed at baseline, 12 and 24 weeks.	to 13.50 ± 1.42 Control group: 12.35 ± 2.00 to 12.82 ± 1.90 to 13.03 ± 1.82 p<0.001 (baseline to 24 weeks) Mean ± SD 6MWT (s) at baseline, 12 weeks and 24 weeks Circuit training group: 339 ± 120 to 412 ± 117 to 416 ± 118 Control group: 306 ± 135 to 1354 ± 145 to 1366 ± 151 p<0.001 (baseline to 24 weeks) Drop outs: circuit training group n=1, control group n=7 Adverse events: falls (n=29, circuit training group, n=26, control group). 2 serious adverse events were reported by 2 subjects in the circuit training group.
Salbach et al. 2004, 2005 **Canada** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	91 community-dwelling subjects with a residual walking deficit within one year of a first or recurrent stroke. (Mean chronicity of subjects in both groups was > 6 months).	Subjects were randomized to an intervention group which comprised 10 functional tasks designed to strengthen the lower extremities and enhance walking balance, speed and distance or to a control intervention focusing on upper extremity activities. 18 training sessions were provided 3 days a week x 6 wks.	**Primary outcome:** 6MWT, ABC scale **Secondary outcomes:** 5-m walk (comfortable and maximum pace), Berg Balance Scale and Timed 'Up and Go' test. Outcomes were assessed before and after treatment	Mean ± SD scores before and after treatment for the walking training group and the upper extremity training groups were: 6MWT (m): 209 ± 126 to 249 ± 136 vs. 204± 131 to 209 ±132, p<0.05 Comfortable walking speed (m/s): 0.64 ± 0.33 to 0.78 ±0.40 vs. 0.61 ± 0.37 to 0.64 ± 0.37, p<0.05 Maximum walking speed (m/s): 0.79 ± 0.45 to 0.99 ± 0.56 vs. 0.81 ± 0.49 to 0.81 ± 0.49, p<0.05 TUG (s): 24.4 ± 18.8 to 23.2 ± 20.6 vs. 25.5 ± 21.7 to 27.1 ± 27.1, p=ns BBS: 42 ± 11 to 44 ± 11 vs. 40 ± 13 to 41 ± 13, p=0.854 Mean ± SD Δ in scores from baseline to end of treatment for walking training and upper extremity training groups were:

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					ABC scale: 8.2 ± 18.6 vs. 0.6 ± 13.7, p<0.05 Effect size=0.40 Drop outs: intervention group n=3, control group n=4 Adverse events: 6 falls in total were reported, none resulting in serious injury

Treadmill Based Gait Training Without Body Support

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Nadeau et al. 2013 **LEAPS Trial** **USA** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	408 adult participants who were a mean of 63.8 days post stroke and had residual lower extremity paresis.	There were two treatment groups and a control group. Participants received locomotor training program (LTP; treadmill and over ground training), home exercise program (HEP; strength, balance, coordination exercises provided by a PT) or usual care (UC). Treatment groups received 90minute sessions, 3/week (30-36 sessions).	Primary Outcome: Functional level of walking Secondary outcomes: 10m walking speed, 6MWT, steps taken per day, FMA-LE, BBS, Stroke impact scale, ABC scale, and the Modified Rankin Scale.	The adjusted odds ratio for improving on the functional walking level with LTP vs. UC was 1.94 (95% CI = 1.18-3.21, p=0.010) and 2.04 (95% CI=1.22-3.42, p=0.007) for HEP vs. UC. No difference was shown for LTP vs. HEP. Improvements in walking speed were shown for all groups (p<0.0001). Differences in the gains made for walking speed were 0.13m/s (95% CI = 0.09-0.18) for LTP vs. UC and 0.10m/s (95% CI = 0.05-0.14) for HEP vs. UC. Significant improvements (p<0.0001) were shown for all groups on the FM, BBS, ABC scale, and modified Rankin Score. Greater improvement was shown for the two treatment groups vs. usual care on the BBS, ABC scale and physical mobility (p<0.0014).

Treadmill Training with Body-weight Support

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Moseley et al. 2005 **Australia** **Cochrane review**	N/A	15 RCTs (622 subjects) Of these, 6 included trials that examined treadmill training without body-weight support. Their analyses are not included. Subjects in all trials, except 1 were recruited an average of < 6 months post stroke. Subjects in 4 were dependent in walking at the start of treatment. Subjects in 4 trials were independent ambulators and subjects in 1 trial included independent and dependent ambulators.	Comparisons of: 1) treadmill training with body-weight support vs. other physiotherapy interventions including usual physiotherapy, overground walking training, aggressive bracing and gait trainer with body weight support (n=8, 346 subjects) 2) treadmill training with body-weight support vs. treadmill training without body weight support (n=1, 100 subjects) Body weight support ranged from 0% (falls prevention) to 100%, while 10-30% was reported most frequently. Treatment duration ranged from 2 to 6 weeks. Intensity and frequency of treatment ranged from 20 min to 60 min/session, 3-6 days/week.	**Primary outcomes:** Dependence in walking (inability to walk indoors (with/without an aid) without assistance or supervision. **Secondary outcomes:** QoL, ADL, death/dependency and death/institutional care Outcomes were assessed before and after treatment with follow-ups in 3 trials periods of 3 and 10 months.	**Treadmill training vs. other interventions** Walking dependence at end of treatment: RR=1.10, 95% CI 0.90 to 1.34, p=0.40. Results from 5 trials included. Walking speed (m/sec) at end of treatment among trials of dependent ambulators: WMD=-0.01, 95% CI=-0.08 to 0.06, p=0.80. Results from 4 trials included. Walking speed (m/sec) at the end of treatment among trials of independent ambulators: WMD=0.09, 95% CI=-0.02 to 0.20, p=0.10. Results from 5 trials included. **Treadmill training with BWS vs. treadmill training** Walking dependence at end of treatment: RR=0.54, 95% CI 0.31 to 0.96. Results from a single trial included. Walking speed (m/sec) at end of treatment among dependent ambulators: WMD=0.15, 95% CI=0.05 to 0.25. Walking speed (m/sec) at the end of treatment among independent ambulators: WMD=0.10, 95% CI=-0.14 to 0.34 Adverse events: n=2 (acute MI, n=1, vertigo n=1) Drop outs: experimental group n=18, control group n=26
Bonnyaud 2014 **France** **RCT**	CA: ☒ Blinding: ☒ Assessor	26 hemiparetic subjects, with mean time of 6.7 years post stroke. Patients could walk 10m	Participants were randomized to either Lokomat experimental gait training (LE), or Lokomat conventional gait training	**Primary Outcomes:** 3D gait analysis.	No statistically significant differences between the two groups were shown on any of the spatiotemporal parameters (e.g., gait velocity, step length, cadence).

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	ITT: ☒	without assistance and able to walk continuously for 20 minutes.	(LC). The experimental group had a negative kinematic constraint applied to the non-paretic limb and a positive kinematic constraint applied to the paretic limb.		
Cho & Lee 2014 **Korea** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	30 subjects with chronic stroke resulting in hemiparesis (more than 6 months post onset).	The experimental group received treadmill training based real-world video recording (TRWVR) and the control group had only treadmill walking. All participants received standard therapy (Occupational therapy, Physiotherapy, Functional Electrical Stimulation).	**Primary Outcomes**: BBS, Timed up and Go Test (TUG), and gait parameters (e.g., cadence, speed, postural sway, step length and stride length).	Significant differences were noted for the group X time interaction of the BBS (p= 0.001), TUG (p=0.001), gait speed (p= 0.003), cadence (p= 0.028), single limb support period (p= 0.018), double limb support period (p=0.008), step length (p= 0.024), and stride length (p= 0.018).
Ada et al. 2013 **AMBULATE trial** **Australia** **RCT**	CA: ☑ Blinding: ☑ Assessor ITT: ☒	102 community-dwelling individuals participated. Participation occurred within five years of first stroke.	There were three arms to this study: treadmill and over ground walking program (30 min. 3 times per week) for either 2 or 4 months or no intervention.	**Primary Outcomes**: 6MWT, 10m walk test **Secondary Outcomes**: EuroQol (EQ-5D-3L), Adelaide Activities Profile, Walking Self-Efficacy Scale	Assessed using the 6 minute walk test, the 4 month training group walking further than the control group at 2 and 4 months; however, at 12 months, the 4month training group was not walking further than the control (MD 9m; 95% CI -27 to 47). The 2 month training group out walked the control at 2 months but not at 4 months (MD 9m, 95% CI -13 to 31). No improvements in walking speed in the 4 month training group compared to the control remained at 12 months. No between group differences were shown in terms of improvement on the EuroQol, Adelaide Activities Profile or the Walking Self-Efficacy Scale.
Kelley et al. 2013 **USA**	CA: ☑ Blinding: Assessor ☑	20 patients. Male = 13, female = 7. Mean age = 65.75 years. Mean time since stroke onset = 2.87	Participants randomized to either robotic-assisted body weight supported treadmill training using the	**Primary Outcomes:** 10m Walk Test (10m WT), six-minute walk distance (6 MWD).	Time post-stroke differed significantly at baseline between the Lokomat (3.71 yrs) and the OGT (1.44yrs) groups (p=0.025)

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RCT	ITT: ☒	years. National Institutes of Health Stroke Scale Lower Extremity motor score of 1–4 and could walk at least 10m.	Lokomat (n=11), or Overground Gait Training (OGT, n=9). 1 hour, 5 days a week for 8 weeks. Measurements were taken at baseline, post-intervention, and 3 months post.	**Secondary Outcomes:** FMA-LE, Functional Independence Measure locomotion (FIM-L), Barthel Index, Stroke Impact Scale (SIS).	No significant differences were seen between the Lokomat and OGT groups between baseline and post-intervention, or between baseline and 3-month follow-up on the primary outcome measures, the FM-LE or Barthel Index.
Lee et al. 2013 **Korea** **RCT**	CA: ☑ Blinding: ☑ Assessor ITT: ☒	30 stroke patients with the ability to walk 10m independently with or without assistive device.	Both groups participated in standard therapy; however, the experimental group participated in body weight support treadmill training (BWSTT) with power assisted FES and the control only BWSTT.	**Primary Outcomes:** BBS, Timed Up and Go test (TUG), STREAM, and gait parameters.	Within each group, significant improvements were shown post treatment on the BBS, TUG, STREAM, velocity, cadence, paretic side step length and stride length ($P<0.05$). However, the improvements on all the respective measures were greater in the experiment group ($p<0.05$).
Ribeiro et al. 2013 **Brazil** **RCT**	CA: ☒ Blinding: Assessor ☑ ITT: ☒	20 subjects who suffered a stroke a mean time of 27.7 months prior to study were included in the final analysis.	The subjects were randomized into the treadmill training with partial body-weight support (TPBWS) group or to the proprioceptive neuromuscular facilitation (PNF) method on gait training group.	**Primary Outcomes:** STREAM, Motor score of the Functional Independence Measure (FIM), gait analysis.	After training, both groups showed a significant improvements in STREAM scores, motor FIM scores, and symmetry ratio ($p<0.05$). Between groups, the PNF group showed greater improvements in the maximum ankle dorsiflexion over the swing phase ($p= 0.024$).
Duncan et al. 2011 **USA** **RCT**	CA: ☑ Blinding: assessor ☑ ITT: ☑	408 patients with stroke onset of 2 months, who were able to walk 3 m with maximum of one person assist, able to follow 3-step commands, capable of self-selected walking speed of <0.8 sec over 10 m, residing in the community	Subjects were randomized to undergo one of 3 training regimens: 1) early treadmill training with partial body-weight support (within 2 months of stroke) (n=139), 2) late treadmill training with partial body-weight support (6 months after stroke) (n=143) and 3) home-based exercise program (n=126).	**Primary outcome:** The proportion of patients with improved level of functional walking, defined as the ability to walk independently at a speed of >0.4 m/s (severe impairment at baseline) or >0.8 m/s (moderate baseline impairment) at 1 year. **Secondary outcomes:** Gait speed, Fugl-Meyer	At one-year, 52% of all patients had improved functional walking ability. There was no difference in the proportion of improvement found among the 3 groups. The adjusted ORs for improving level of walking were: Early group vs. home group OR=0.83, 95% CI 0.50 to 1.39 Late group vs. home group OR=1.19, 95% CI 0.72 to 1.99 There were no differences among the groups on any of the secondary outcomes at 12 months. Mean ± sd Δ in comfortable walking speed (m/s):

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			All programs consisted of 90 min sessions, 3x/week for 12 to 16 weeks.	Assessment, BBS, activities of daily living and items on the Stroke Impact Scale. Outcomes were assessed at baseline, 6 and 12 months.	Early: 0.23±0.20, Late: 0.24±0.23, home: 0.25±0.22 Mean ± sd Δ in distance walked in 6 min (m): Early: 73.2±69.4, Late: 79.0±75.1, Home:85.2±72.9 Adverse events: Any serious event: n=191 (no significant differences among groups) Falls n=139 (no significant differences among groups) Drop outs: intervention was not completed by 13% of subjects in the early group, 17% in late group and 3% in home-exercise group.
Ada et al. 2010 **Dean et al. 2010** **The MOBILISE Trial** **Australia** **RCT**	CA: ☑ Blinding: assessor ☑ ITT: ☑	126 acute (within 28 days of stroke onset), nonambulatory stroke patients.	Subjects were randomized to an experimental (n=64) or a control group (n=62) and received treatment until they achieved independent walking or for as long as they remained in hospital. Subjects in both groups received 30 minutes of walking practice 5 days/week. Additional lower-limb therapy was provided for an additional 30 minutes/day. Subjects in the experimental group undertook up to 30 minutes per day of treadmill walking with sufficient body weight support such that initially, the knee was within 15 degrees of extension in mid stance. Subjects the control group received up to 30 minutes of overground walking	**Primary outcome:** The proportion of subjects who achieved independent walking (ability to walk 15 m continuously across flat ground) at 6 months. **Secondary outcomes:** Gait speed, stride length, 6MWT, falls Outcomes were assessed at baseline and 6 months	At 6 months 43/59 (71%) subjects in the experimental group were independent ambulators compared with 36/60 (60%) subjects in the control group. The proportion of subjects who were independent ambulators at months 1, 2 and 6 was not significantly different between groups (p=0.13). Subjects in the experimental group achieved independence in ambulation a median of 14 days earlier. At 6 months from baseline the mean ± sd outcomes of independent ambulators in the experimental and control groups were: Walking speed (m/sec): 0.57 ± 0.36 vs. 0.47 ± 0.28, p=ns Walking stride (cm): 73 ± 31 vs. 67 ± 24, p=ns 6MWT (m): 240 ± 130 vs. 183 ±99, Δ 1.0, 95% CI 0.1 to 1.9, p<0.05. No. of fallers 61% vs. 51%, p=ns Drop outs/losses to follow up: n=7 (experimental group n=5, control group n=2) Adverse events: 2 subjects in the control group experienced anxiety related to the treatment and withdrew from the study. There were 47 reports of adverse events in the experimental group and 27

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			training, with the use of aides, if required.		reports in the control group, none of which were attributed to the treatment.

Aerobic Training

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Brazzelli et al. 2011 **UK** **Cochrane Review**	N/A	32 RCTs (1414 subjects) Subjects in 5 studies were recruited within 30 days of stroke, 11 studies were recruited within 6 months of stroke, 15 studies were recruited > 6 months and the chronicity of stroke was not stated in 1 study.	Interventions were grouped into 3 categories 1. Cardiorespiratory training vs. usual care (14 trials, 651 subjects). Intervention included cycle ergometer, treadmill training circuit training, and kinetron. In 8 trials, training began after usual care, in 6 trials it started during usual care. Treatment was provided from 7 to 55 min/day, 2-5 days/week for 2 to 12 weeks. 2. Resistance training vs. usual care (7 trials, 246 subjects). Interventions included weights, exercise machines or elastic devices. In 4 trials, training began after usual care, in 3 trials it started after usual care. Treatment was provided from 30 to 90 min/day, 2-3 days/week for 4 to 12 weeks.	**Primary Outcomes:** Case fatality, death or dependence, disability (FIM, BI, Functional Ambulation Category, Rivermead Mobility Index, Nottingham EADL, Stroke Impact Scale) **Secondary Outcomes:** Adverse events, physical fitness, mobility, HR QoL Outcomes were assessed before and after treatment. In 15 studies there were follow-up periods of 6 weeks, 3, 4, 6 and 12 months.	There were 5 deaths at the end of treatment and 9 at the end of follow-up Cardiorespiratory training Disability (FIM) at the end of treatment: SMD=0.21, 95% CI -0.10 to 0.52, p=0.18. Results from 3 studies included Maximal gait speed (metres/min): MD=8.66, 95% CI 2.98 to 14.3, p= 0.0028. Results from 7 studies included. Preferred gait speed (metres/min): MD=4.68, 95% CI 1.40 to 7.96, p= 0.0052. Results from 4 studies included. Walking capacity (metres/6 min): MD =47.13, 95% CI 19.39 to 74.88, p= 0.00087. Results from 3 studies included. Resistance training Maximal gait speed (metres/min): MD=1.92, 95% CI -3.50 to 7.35, p= 0.49. Results from 4 studies included Mixed training vs. control Preferred gait speed (metres/min): MD=30.6, 95% CI 8.90 to 52.28, p= 0.048. Results from 8 studies included. Walking capacity (metres/6 min): MD =47.13, 95% CI 19.39 to 74.88, p= 0.0057. Results from 3

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			3. Mixed training interventions (11 trials, 517 subjects). Interventions included variables combinations of cardiorespiratory and resistance training methods. In 7 trials, training began after usual care, in 4 trials it started after usual care. Treatment was provided from 45 to 120 min/day, 3-5 days/week for 4 to 12 weeks. Average treatment duration was 1 hour, 2-3x/week for 4 weeks.		studies included. Adverse events: 8 studies reported on the tolerance of the training programmes. None reported adverse events including falls, fractures of injuries that occurred during the training period.
MacKay-Lyons et al. 2013 **Canada** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	50 subjects >18 years, within 1 month of first ischemic stroke who were rehabilitation inpatients at a single site and able to walk 5 m with or without aids, orthoses or assistance.	Comparison of body-weight supported treadmill training (BWSTT) + usual care (UC)(n=24) vs. UC (n=26). Subjects in both groups participated in dose-match sessions that consisted of 60-minute sessions, 5 days/week for 6 weeks, as inpatients, followed by 60-minute sessions, 3 days/week for 6 weeks, as outpatients (48 sessions total)	**Primary outcome:** Cardiovascular Fitness (VO_2 peak), walking ability (6MWT, gait speed). **Secondary outcome:** Functional balance (Berg Balance Scale), Chedoke McMaster Stages of Recovery (CMSR) Leg and Foot components, satisfaction with program Assessments were conducted at baseline, following treatment and at 6 and 12-month	Mean (95% CI) changes from baseline to 12 months in BWSTT and UC groups Peak VO_2 (mL/kg/min): 3.9 (2.1-5.7) vs. 0.5 (−1.0 to 2.00, p=0.004. 6MWT (m): 98.0 (62.9-133.1) vs. 46.2 (13.5-78.9), p=0.015. Gait speed (m/s): 0.26 (0.17-0.35) vs. 0.17 (0.10-0.25), p=0.424. BBS: 10.9 (7.4-14.5) vs. 9.0 (5.2-12.8), p=0.486. CMSR (leg): 1.1 (0.6-1.6) vs. 0.9 (0.5-1.4), p=0.734 CMSR (foot): 1.5 (0.8-2.2) vs. 0.7 (0.0-1.4), p=0.010. Adverse events: None Drop outs/losses to follow-up: n=5

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Globas et al. 2012 **Switzerland** **RCT**	CA: ☒ Blinding: Assessor ☑ ITT: ☑	38 subjects over 60 yrs with residual hemiparetic gait >6 months after stroke	Subjects were randomized to receive 3 months (30-50 min 3x/week) progressive graded, high-intensity aerobic treadmill exercise (TAEX) or conventional care physiotherapy (tone-regulating exercises for upper and lower extremities). At the end of the intervention period, control subjects crossed over and received TAEX.	**Primary outcomes:** Peak exercise capacity ($Vo_{2\ peak}$) and the 6-minute walk test (6MWT). **Secondary outcomes:** Gait velocity (10-m walk), 6MWT, Berg Balance Scale (BBS), functional leg strength (5 chair-rise), self-rated mobility (Rivermead Mobility Index), and quality of life (SF-12). Assessments were conducted at baseline, post intervention and at 12 months.	Mean ± sd $Vo_{2\ peak}$ (mL/kg/min) at baseline and 3 months TAEX group: 18.9 ± 4.6 to 24.4 ± 6.6 Control group: 21.7 ± 7.8 to 20.9 ± 8.9 Mean difference between groups at crossover: 5.5 vs. -0.8 mL/kg/min, p<0.001 Mean ± sd 6MWT (m) at baseline and 3 months TAEX group: 274.4 ± 113 to 332.1 ± 138 Control group: 261.2 ± 177 to 265.9 ± 189 Mean difference between groups at crossover: 58 vs. 4.7, p<0.001. Mean ± sd 10 m walk (comfortable speed) m/s at baseline and 3 months TAEX group: 0.73 ± 0.28 to 0.79 ± 0.29 Control group: 0.70 ± 0.44 to 0.70 ± 0.46 p=ns at crossover Mean ± sd BBS at baseline and 3 months TAEX group: 49.3 ± 6.5 to 51.1 ± 6.4 Control group: 45.2 ± 11.0 to 0.70 ± 0.46 p<0.05 Drop outs: 4 Adverse events: recurrent stroke (n=1), fractures unrelated to study (n=2)
Jin et al. 2012 **China** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	133 persons > 50 years with chronic hemiparesis who were independent ambulators (with or without an aid).	Subjects were randomized to either an exercise training group (n=68) and received 40 minutes of aerobic cycling exercise, with lower extremity weights, at a target intensity of 50-70% heart rate reserve, 5 days a week for 8 weeks, or a control group (n=65) that received low intensity overground walking training at a target heart	**Primary Outcome:** Cardiovascular fitness (peak VO_2) and walking ability (6MWT and the Rivermead Mobility Index). **Secondary Outcomes:** Berg Balance Scale (BBS), Modified Ashworth Scale and Isokinetic dynamometry for isometric knee muscle strength. Outcomes were assessed	**Cardiovascular fitness** Mean ± sd peak VO_2 L/min before and after treatment: Cycle training group: 0.88 ± 0.14 to 1.13 ± 0.17 Control group: 0.87 ± 0.14 to 0.89 ± 0.14 p<0.001 Mean ± sd peak VO_2 L/min/kg before and after treatment: Cycle training group: 13.2 ± 0.9 to 16.8 ± 1.0 Control group: 13.2 ±1.0. to 13.3 ± 1.0 p<0.001 **Walking ability**

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			rate of 20-30% heart rate reserve. Both groups received balance training (30 minutes) and stretching exercises (20 minutes).	before and after treatment	Mean ± sd 6MWT (m): Cycle training group: 212 ± 63.5 to 218.5 ± 63.7 Control group: 212 ±50.1 to 1213.55 ± 50.6 p<0.001 Mean ± sd RMI Cycle training group: 10.3 ± 1.4 to 210.5 ± 1.7 Control group: 10.2 ±1.4 to 10.4 ± 1.6 p<0.557 **Impairment-Level Outcomes** Mean ± sd BBS scores Cycle training group: 147.9 ± 3.1 to 48.6 ± 2.9 Control group: 47.4 ± 3.7to 48.3 ± 3.9 p<0.228 Median (IQR) MAS scores Cycle training group: 1 (0-1) to 1 (0-1) Control group: 1 (0-1) to 1 (0-1) p<0.910 Adverse events: None
Pang et al. 2006 **Canada** **Systematic review & meta-analysis**	N/A	7 RCTs, representing the results from 9 studies (480 subjects) were included. Subjects were mildly or moderately impaired. A portion of the subjects in 1 trial was recovering from brain injury due to causes other than stroke. Subjects were included in the acute, subacute and chronic stage of stroke.	Active treatments included: cycle ergometer (n=4), treadmill walking (n=1), a combination of stepping, brisk walking and repeated sit-to-stand (n=1) and aerobic exercises performed in the water (n=1). Control conditions included usual care, relaxation therapy, range-of-motion exercises, and a seated exercise program, The exercise intensity ranged from 50% to 80% heart rate reserve.	**Primary outcomes:** Aerobic capacity: peak oxygen consumption (Vo2), peak workload. **Secondary outcomes:** Walking velocity and endurance. Cycle ergometry was used to conduct the exercise tests	Vo2: SES= 0.42, 95% CI 0.15 to 0.69, p= 0.001. Peak workload: SES= 0.50, 95% CI 0.26 to 0.73, p< 0.001. Walking velocity: SES= 0.26, 95% CI 0.05-0.48, p= 0.008) Walking endurance: SES= 0.30, 95% CI 0.06 to 0.55, p= 0.008. Adverse events: falls (n=5), recurrent stroke (unrelated to treatment, n=3)

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			Exercise duration ranged from 20-40 min, 3-5 days a week, for 3-19 weeks.		

Electromechanical Gait Training Devices

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Mehrholz et al. 2013 **Germany** **Cochrane review**	N/A	23 RCTs (999 subjects) Trials recruited subjects in the subacute phase: < 3 months (n=14) and ≥ 3 months (n=9) post stroke. Trials included subjects who were ambulators (n=9), non-ambulators (n=5), both ambulators and non-ambulators (n=9).	Comparison of automated electromechnical and robot-assisted gait training devices (with or without electrical stimulation), designed to assist stepping cycles by supporting body weight and automating the walking therapy process + physiotherapy vs. physiotherapy or routine care only. Treatment duration ranged from 10 days to 8 weeks. Frequency of treatment ranged two-three times a week to five times a week. Therapy intensity was from 20-50 min/session.	Primary outcome: The ability to walk independently Secondary outcomes: Walking speed, walking capacity, Rivermead Mobility Index, and death from all causes. Outcomes were assessed before and after treatment with follow-up periods differing between trials: 2 weeks (n=3), 3 weeks (n=5), 4 weeks (n=6), 6 weeks (n=2), 8 weeks (n=1), 9 weeks (n=1), 3 months (n=3) and 6 months (n=5).	Recovery of independent walking at the end of treatment: OR 2.39, 95%CI 1.67 to 3.43; p < 0.00001. Results from 23 trials included OR (< 3 months post stroke) = 2.75, 95% CI 1.86 to 4.08; p < 0.00001. Results from 14 trials included OR (> 3 months post stroke) = 1.20, 95% CI 0.40 to 3.65; p = 0.74. Results from 9 trials included. Recovery of independent walking at follow-up; OR= 3.16, 95% CI 1.76 to 5.65; p < 0.0001. Results from 5 trials included. Walking velocity (m/sec) at the end of treatment: MD= 0.04, 95% CI -0.03 to 0.11; p = 0.26. Results from 17 trials included Walking velocity (m/sec) at follow up: MD= 0.04, 95% CI -0.11 to 0.20; p = 0.59. Results from 6 trials included 6MWT (m) at the end of treatment: MD= 2.91, 95%CI -29.16 to 34.99; p = 0.86. Results from 6 trials included. 6MWT (m) at follow up: MD= -8.26, 95% CI -54.17 to 37.65; p = 0.72. Results from 4 trials included.

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					Drop outs: n = 89 in all 23 trials. Adverse events: No adverse events reported in 10 studies.
Mehrholz et al. 2007 **Germany** **Cochrane review**	N/A	17 RCTs (837 subjects) Subjects were recruited < 6 months (n=10) and ≥ 6 months (n=5) post stroke. Timing of stroke onset unclear in 2 trials. Trials included subjects who were ambulators (n=5), non-ambulators (n=8), both ambulators and non-ambulators (n=3). Ambulation status of subjects in 1 trial not stated.	Comparison of electromechnical and robot-assisted gait training devices (with or without electrical stimulation), designed to assist stepping cycles by supporting body weight and automating the walking therapy process + physiotherapy vs. physiotherapy or routine care only. Treatment duration ranged from 10 days to 8 weeks. Frequency of treatment ranged from 20-45 min/session, 3-5 days/week.	**Primary outcome:** The ability to walk independently **Secondary outcomes:** Gait speed, walking capacity, Rivermead Mobility Index Outcomes were assessed before and after treatment with follow-up periods of 3 and 6 months in 7 trials.	Recovery of independent walking at the end of treatment: OR=2.21, 95% CI 1.52 to 3.22, p<0.0001. Results from 17 trials included OR (< 3 months post stroke) =2.56, 95% CI 1.67 to 3.94, p<0.0001. Results from 10 trials included OR (> 3 months post stroke) =0.63, 95% CI 0.20 to 2.01, p=0.44. Results from 5 trials included. Recovery of independent walking at follow-up; OR=3.24, 95% CI 1.95 to 5.39, p<0.001. Results from 5 trials included. Gait speed (m/sec) at the end of treatment: MD=0.04, 95% CI -0.05 to 0.13, p=0.39. Results from 9 trials included Gait speed (m/sec) at follow up: MD=0.08, 95% CI -0.13 to 0.29, p=0.43. Results from 4 trials included 6MWT (m) at the end of treatment: MD=6.88, 95% CI -31.80 to 45.55, p=0.73. Results from 6 trials included. 6MWT (m) at follow up: MD=-4.46, 95% CI -69.35 to 60.43, p=0.89. Results from 3 trials included. Drop outs: experimental group n=30, control group n= 48 Adverse events: No adverse events reported in 5 studies.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Dragin et al. 2014 **Serbia** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	22 sub-acute stroke patients who sustained their first stroke.	Patients were randomized to the treatment body postural support (BPS) group (assisted by the Walkaround) or the control group (assisted by conventional means – therapist/ cane) during gait training. Gait training was for 30 minutes, 5 days a week for 4 weeks.	**Primary Outcome**: Gait speed. **Secondary Outcomes:** Barthel Index, FMA-LE, BBS	Significant differences were found in the BBS after 6-months in both groups. The BPS group also showed statistically significant improvements in gait speed at end of therapy (4 weeks) and 6-months post treatment ($p<0.05$). Significant differences between groups were found in the BBS after 4 weeks and in gait speed at 4 weeks and 6 months ($p<0.05$).
Morone et al. 2011, 2012 **Italy** **RCT**	CA: ☒ Blinding: assessor ☑ ITT: ☑	48 participants, an average of 20 days post stroke with motor and gait dysfunction were stratified by the Motricity Index (MI) into high (<29) and low (≥ 29) impairment groups.	Subjects in each arm were randomized to a robotic or control group (RG or CG). All patients underwent standard rehabilitation (3 hours/day, 5x/week x 3 months). After one week of standard therapy, subjects in the RG group underwent additional robotic-assisted gait training instead of a second therapy session (20 sessions in total). These sessions lasted 40 minutes, 20 of which were active GT therapy. Walking speed was advanced from 1 to 1.5 km/hrs, with BWS of 0% to 50%. Subjects in the control group participated in a second therapy session (40 min/day-total of 20 sessions)	**Primary outcome:** Functional Ambulation Category (FAC) **Secondary outcomes:** Rivermead Mobility Index (RMI), Barthel Index and 6MWT. Outcomes were assessed at hospital admission, following intervention, and at hospital discharge. Follow-up assessments at 2 years were also conducted.	At the end of treatment subjects in the Low MI RG had improved significantly more than subjects in the Low MI CG on the FAC ($p < .001$), RMI ($p = .001$) and 6MWT ($p = .029$). Although subjects in the Hi MI groups also improved over time, there were no significant between-group differences on any of the outcomes. Similar results were found at hospital discharge. At the 2 year follow-up, the Low MI RG continued to demonstrate significantly improved scores in terms of FAC ($p=0.002$), BI ($p= 0.024$) and RMI ($p=0.01$), relative to the Low MI CG. There were no significant differences between High RG and CG on any of the outcomes at 2 year follow-up. Adverse events: RG hypotension (n=3), knee pain (n=1), CG knee pain (n=1) Drop outs: RG Low MI arm-7 CG Low MI arm-5 RG High MI arm-5 CG High MI arm-4

Balance Training

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Barclay-Goddard et al. 2004 **Canada** **Cochrane Review**	N/A	7 RCTs (246 subjects) Subjects with abnormal weight bearing in the standing position or impaired standing balance. Subjects in 6 trials were recruited an average of < 6 months post stroke. Timing of stroke onset was not stated in 1 trial. Subjects in 4 were dependent in walking at the start of treatment. Subjects in 2 trials were inpatients. Subjects in the remaining trials were treated as outpatients, or the location of treatment was not provided.	Comparisons of: 1) Force platform balance training with visual or auditory feedback vs. conventional treatment 2) Force platform balance training with visual or auditory feedback vs. other balance treatment 3) Force platform balance training with visual or auditory feedback vs. placebo balance training In all studies force platforms with dual force plates with continuous visual display (with/without auditory) feedback was used. Treatment duration ranged from 2 to 8weeks. Intensity and frequency of treatment ranged from 20 min to 60 min/session, 2-5 days/week.	Primary outcome: Standardized measures of standing balance and timed walking Secondary outcomes: Laboratory measures of standing balance using force platform indicators, ADL instruments. Outcomes were assessed before and after treatment with follow-ups in 3 trials periods of at least 1 month.	Results from studies using interventions that provided visual feedback alone (end of treatment) Berg Balance Scale: MD=-1.98, 95% CI -5.55 to 1.59, p=0.28. Results from 2 trials included. Timed up & Go: MD=7.31, 95% CI -1.32 to 15.94, p=0.097. Results from 2 studies included. Centre of Pressure Position (stance symmetry): SMD=-0.68, 95% CI -1.31 to -0.04, p=0.037. Results from 2 studies included. Centre of Pressure Position (sway): SMD=-0.10, 95% CI -0.57 to -0.36, p=0.667. Results from 3 studies included. Results from studies using interventions that provided visual & auditory feedback (end of treatment) Centre of Pressure Position (stance symmetry): SMD=-4.02, 95% CI -5.99 to -2.04, p<0.0001. Results from 2 studies included. Drop outs: Not reported in 3 trials. Among the remaining, experimental group n=21, control group n=23 Adverse events: No reporting
Mohan et al. 2013 **India** **RCT**	CA: ☒ Blinding: Assessor ☑ ITT: ☒	22 patients with hemiparesis after first time stroke. The mean time since stroke onset = 6.41 days, mean age = 62.95 years.	Two treatment methods were compared: conventional stroke rehabilitation (n=11), and mirror therapy (n=11). Conventional treatment included sensory motor re-education, active exercises, mobility,	Primary Outcomes: FMA-LE, Brunnel Balance Assessment (BBA), and Functional Ambulation Categories (FAC). Secondary Outcomes: Brunnstrom stage of recovery and modified composite spasticity index	Within group analyses showed both groups significantly improved on all assessed outcomes (FMA-LE, p=0.003; BBA, p=0.005; FAC, mirror p=0.000) after treatment, with the exception of the control group on the FAC (p=0.053). The mirror group showed greater improvement than the control group on the FAC (p=0.02). Change scores for the FMA and BBA did not differ significantly between groups (p=0.894 and p=0.358,

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			balance and gait training (1h/6d x 2 wks). The experimental group received standard therapy in addition to mirror therapy (30min) in which the non-paretic limb was used.	(MCSI).	respectively).
Rao et al. 2013 **USA** **RCT**	CA: ☒ Blinding: ☑ Assessor ITT: ☒	28 individuals with acute stroke (3-14 days before study recruitment). Excluded if they had any history of other neurological diseases.	Patients were randomized into two groups. The experimental group received treatment on balance using biofeedback and body weight support harness. The control group received conventional treatment. Both groups were receiving similar physical therapy and other services (OT, SLP, neuropsychology, etc.).	**Primary Outcomes:** FMA-LE, Fugl-Meyer Balance test, the Functional Independence Measure for gait (FIM-G).	Fugl-Meyer Balance scores increased significantly for both the experimental (6.23±1.75 to 8.29±1.59, p= 0.001), and control (6.64±1.08 to 8.50±2.1, p=0.001) groups after treatment. However, the improvement in FM-B scores between groups was not statistically significant. FIM-G scores increased for both the experimental (1.64±1.15 to 3.57±1.34, p=0.001) and control groups (1.71±0.91 to 3.43±1.34, p=0.001). There was no statistically significant difference between groups. FMA-LE scores also improved for the experimental (15.28±6.41 to 19.36±5.72, p= 0.0002) and control (12.5±5.7 to 18.14±5.7, p= 0.00001) groups. No significant difference found between groups (p-0.22).

Strength Training

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Flansbjer et al. 2008 & **Flansbjer et al. 2012 (4-yr**	CA: ☒ Blinding: Assessor ☑	24 community-dwelling stroke subjects a minimum of 6 months post stroke who were able to ambulate at least	Subjects were randomized to a training group (n = 15) and participated in supervised progressive resistance training of the	**Primary Outcome:** Muscle strength **Secondary Outcomes:** Modified Ashworth Scale,	Outcome data from baseline, 5 months and 4 years are reported. Mean ± sd dynamic knee muscle strength extension of (paretic)(Nm) side

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
follow-up) **Sweden** **RCT**	ITT: ☒	200 m without supervision, with or without an aid.	knee muscles (80% of maximum) twice weekly for 10 weeks, or to a control group (n = 9) who continued their usual daily activities.	Timed Up & Go (TUG), Fast gait speed, 6-Minute Walk test (6MWT), stroke impact Scale (SIS) Outcomes were assessed before and after treatment and 5 months post intervention and at 4 years	Training group: 41.0 ± 13.6 to 59.4 ± 22.6 to 61.1 ± 15.8 Control group: 40.1 ± 18.7 to 42.0 ± 20.1 to 43.7 ±22.4, p<0.001 Mean ± sd dynamic knee muscle strength flexion of (paretic)(Nm) side Training group: 43.5 ± 19.5 to 70.6 ± 26.7 to 69.0 ± 23.8 Control group: 50.7 ± 18.7 to 53.0 ± 22.1 to 55.0 ± 24.3 p<0.001 Mean ± sd isokinetic knee muscle strength extension of (paretic)(Nm) side Training group: 64.2 ± 31.1 to 76.3 ± 34.6 to 77.5 ± 24.2 Control group: 58.6 ± 35.3 to 61.7 ± 30.6 to 57.4 ± 34.4 p<0.05 Mean ± sd isokinetic knee muscle strength flexion of (paretic)(Nm) side Training group: 15.3 ± 19.0 to 26.5 ± 24.8 to 22.4± 20.9 Control group: 16.1 ± 15.7 to 20.0 ± 14.1 to 19.5 ±19.2 p=ns Mean ± sd TUG (sec) Training group: 28.6 ± 13.9 to 23.6 ± 11.1 to 20.5 ±8.7 Control group: 26.9 ± 15.2 to 26.7 ± 18.9 to 27.7 ± 21.8 p=ns Mean ± sd fast gait speed over 10 m (m/sec) Training group: 0.86 ± 0.47 to 0.96 ± 0.41 to 0.92 ±0.41 Control group: 0.86 ± 0.51 to 0.86 ± 0.41 to 0.73 ±0.4

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					p=ns Mean ± sd 6MWT (m) Training group: 228 ± 137 to 251 ± 144 to 275 ± 135 Control group: 234 ± 134 to 240 ± 140 to 223 ± 1370.4 p=ns (all significance levels refer to the comparison of baseline scores to 4-year follow-up) Drop-outs: 6 (training group n=4, control group n=2) Adverse events: No reporting
Cooke et al. 2010 **UK** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☑	109 stroke subjects, a mean of 34 days after stroke, with some voluntary muscle contraction in the lower paretic limb	Subjects were randomized to one of three groups that received treatment for 1 hr/day x 4 days/week x 6 weeks (24 hrs total). The 3 groups were, conventional physiotherapy (CPT) (n=35), CPT+CPT (n=35) and functional training (FST) + CPT (n=38). Experimental CPT included interventions that emphasized control/quality of movement and gave prominence to sensory stimulation and preparation of joint and muscle alignment prior to activating muscle or a functional task. Content of FST focused on repetitive, progressive resistive exercise during	**Primary Outcome:** Walking speed (m/s). **Secondary outcomes**: Ability to walk >0.8m/s (i.e. community ambulation), knee extensor torque, and functional mobility. Outcomes were measured 6 weeks after baseline and at follow-up 12 weeks thereafter.	Mean ± sd walking speed (m/sec) before and after treatment CPT: 0.17 ± 0.24 to 0.30 ± 0.35 CPT + CPT: 0.27 ± 0.36 to 0.55 ± 0.49 FST + CPT: 0.23 ± 0.29 to 0.42 ± 0.39 p=0.031 (CPT vs. CPT+CPT), p=ns (CPT vs. FST+CPT) % of subjects able to walk ≥0.8m/sec before and after treatment CPT: 2.6 to 13 CPT + CPT: 14.3 to 35 FST + CPT: 2.8 to 20 p=0.038 (CPT vs. CPT+CPT) p=ns (CPT vs. FST+CPT) Mean ± sd Modified Rivermead Mobility Index scores before and after treatment CPT: 29.4 ± 10.1 to 34.6 ± 10.8 CPT + CPT: 28.9 ± 11.0 to 36.6 ± 10.4 FST + CPT: 30.3 ± 10.2 to 37.7 ± 8.6 p=ns (CPT vs. CPT+CPT), p=ns (CPT vs. FST+CPT) There were no significant differences between groups on any of the other outcome measures at the end of treatment and no significant differences

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			goal-directed functional activity. Subjects performed repetitive exercise of functional tasks such as sit-to-stand-to-sit, stair climbing/ step ups, inside and outside walking, transfer training, bed mobility, and treadmill training.		between groups on any of the outcomes assessed at follow-up Adverse events: No reporting Drop outs: at end of treatment n=10, at end of follow-up n=28
Clark & Patten 2013 **USA** **RCT**	CA: ☒ Blinding: ☑ Assessor ITT: ☒	33 patients who sustained a unilateral stroke 6 to 18 months prior to enrollment and completed the study. Patients able to ambulate independently for 25 feet with a walking aid and/or AFO at a minimum of 0.3 m/s.	Patients were randomized to either concentric resistance training (CON) or eccentric resistance training (ECC). Both groups also received gait training.	**Primary Outcomes:** Neuromuscular activation, walking speed, and strength of knee extensors.	Neuromuscular activation results are not presented. Self-selected and fast walking speeds increased in both groups by 0.12 m/s (CON, p= 0.002; ECC, p<0.0001). Fast walking speed also increased in the CON and ECC group (p=0.0006 and p=<0.0001, respectively). No significant differences in improvement were shown between groups for self-selected walking speed (p=0.86) and fast walking speed (p=0.73).

Virtual Reality

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
McEwen et al. 2014 **USA** **RCT**	CA: ☑ Blinding: Assessor ☑ ITT: ☒	59 individuals who suffered a stroke began intervention while on an inpatient unit.	Patients were randomized to either: (1) standard rehabilitation plus a program of virtual reality (VR) exercises (challenged balance while standing), or (2) the control group which received standard therapy plus VR exercises that did not challenge balance (sitting).	Primary Outcomes: Timed Up and Go (TUG). Secondary Outcomes: Two Minute Walk Test (TMWT), Chedoke McMaster Stroke Assessment Scale Leg domain. Balance and mobility were assessed before, after, and 1 month after training.	More participants in the treatment group showed improvements on the Chedoke McMaster Stroke Scale Leg domain right after treatment (p=0.04) and 1- month post (p=0.02) than the control group. Both groups improved on the post-treatment assessment; however, the two groups did not differ significantly on the TUG or TMWT.

EMG-Biofeedback

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Woodford & Price 2007 **UK** **Cochrane review**	N/A	13 RCTs, 8 of which directed treatment at the lower extremity. Subjects were recruited an average of < 6 months (n=2) and ≥ 6 months (n=5) post stroke. Timing of stroke onset unclear in 1 trial.	Treatment contrasts included physiotherapy alone vs. physiotherapy plus EMG-BFB. Treatment duration ranged from 4 to 16 weeks. Intensity and frequency of treatment ranged from 15 min to 60 min/session, 2-3 days/week.	**Primary outcome:** Motor strength (MRC scale) **Secondary outcomes:** ROM, improvement in gait, ADL Outcomes were assessed before and after treatment. 12 week follow-up in one study.	Change in MRC scale (tibialis anterior): MD=1.09, 95% CI 0.48 to 1.70, p<0.0001. Results from a single trial included. Change in ROM (ankle joint): SMD=-0.17, 95% CI -1.15 to 0.81, p=0.82. Results from 5 trials included Change in stride length (no. of steps needed to walk 6 or 10 metres): MD=-0.51, 95% CI -3.27 to 2.25, p=0.72. Results from 2 studies included. Change in time taken to walk a specific distance: SMD=0.13, 95% CI -0.55 to 0.80, p=0.37. Results from 3 trials included. Adverse events: Not reported Drop outs: Not reported

AFO/Splinting

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Tyson & Kent 2013 **UK** **Systematic review & meta-analysis**	NA	13 RCTs (334 subjects). Subjects in all studies were in the subacute or chronic stage of stroke and were able to stand and walk alone for at least 10 m. Subjects in 2 studies were not functional ambulators	Comparisons of subjects walking with and without an AFO. Most of the AFOs were rigid, molded plastic and custom-made. All trials were crossover design. Most subjects had worn the AFO for at least a week prior to testing. Some were regular users	**Primary Outcomes:** Measures of mobility and balance Outcomes were assessed testing in a single testing session, whereby use of an AFO was compared with no AFO.	Gait speed (m/s): mean difference= 0.06, 95% CI, 0.03 to 0.08, p<.0001. Results from 11 trials included. Step or stride length: SMD= 0.28, 95% CI 0.05 to 0.51, p=0.02. Results from 7 trials included. Functional Ambulation Categories: SMD= 1.34; 95% CI 0.95 to 1.72, p<.001. Results from 3 trials included. Timed-up and Go: SMD= 0.39, 95% CI -0.83 to

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			of the device. Subjects in 4 trials had worn the orthosis for< 1 week or had no time to habituate prior to testing.		0.06, p=0.09. Results from 2 trials included. Weight distribution while standing: SMD=0.32, 95% CI- 0.52 to-0.11, p=0.003. Results from 5 trials included. Postural sway: SMD= -0.18, 95% CI -0.40 to 0.04, p=0.10. Results from 4 trials included.
Choi et al. 2013 **South Korea** **RCT**	CA: ☒ Blinding: ☒ Assessor ITT: ☒	30 patients with hemiplegia resulting from stroke.	Subjects were randomized to either the experimental group which received proprioceptive neuromuscular facilitation (PNF) combination patterns and kinesio taping, or the control group which received neurodevelopmental treatment.	**Primary Outcomes:** Joint range of motion (ROM) at the hip and ankle for both sides using a goniometer, BBS, 10 meter walking test	Significant differences were found between groups in ankle dorsiflexion, BBS, and 10-m walking times ($p<0.05$). Significant differences in pre and post-test scores were found in the experimental group on the BBS and 10 m walking times ($p<0.05$), while the control group showed a statistically significant difference on the 10m walking time ($p<0.05$).
Clark & Patten 2013 **USA** **RCT**	CA: ☒ Blinding: ☑ Assessor ITT: ☒	33 patients who sustained a unilateral stroke 6 to 18 months prior to enrollment and completed the study. Patients able to ambulate independently for 25 feet with a walking aid and/or AFO at a minimum of 0.3 m/s.	Patients were randomized to either concentric resistance training (CON) or eccentric resistance training (ECC). Both groups also received gait training.	**Primary Outcomes:** Neuromuscular activation, walking speed, and strength of knee extensors.	Neuromuscular activation results are not presented. Self-selected and fast walking speeds increased in both groups by 0.12 m/s (CON, p= 0.002; ECC, $p<0.0001$). Fast walking speed also increased in the CON and ECC group ($p=0.0006$ and $p=<0.0001$, respectively). No significant differences in improvement were shown between groups for self-selected walking speed ($p=0.86$) and fast walking speed ($p=0.73$).
Erel et al. 2011 **Turkey** **RCT**	CA: ☑ Blinding: assessor ☒ ITT: ☒	32 subjects with a maximum MAS score of 3, at least 6 months following stroke and scored 3-5 on the Functional Ambulation Classification	Subjects were randomized to wear a custom dynamic ankle-foot orthosis worn inside tennis shoes, or tennis shoes only for 3 months. No therapy was provided.	**Primary outcomes:** Functional Reach, Timed Up and Go (TUG), Time up stairs (TUS), time down stairs (TDS), gait velocity and Physiological Cost Index (PCI). Assessments were conducted at baseline and 3 months	Mean ±sd outcomes at baseline and at 3 months for AFO and control groups were: Functional reach (cm): 28.50±8.48 to 33.43±9.59 vs. 27.11±5.41 to 28.46±4.4, p=0.065 TUG (sec): 16.57±10.01 to 14.79±10.36 vs. 22.50±13.53 to 19.07±8.19, p=0.065 TDS (sec): 15.29±12.72 to 13.29±11.21 vs. 18.11±10.38 to 15.36±8.37, p=0.117

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					TUS (sec): 13.64±12.59 to 12.00±10.21 vs. 18.93±15.99 to 15.00±7.29, p=0.040 Gait velocity (m/s): 0.84±0.40 to 0.99±0.45 vs. 0.65±0.19 to 0.72±0.20, p=0.001 PCI (beats/min): 0.19±0.10 to 0.12±0.06 vs. 0.31±0.23 to 0.28±0.13, p=0.001 Drop outs: n=4, 2 from each group Adverse events: no reporting
Wang et al. 2007 **Turkey** **RCT (crossover)**	CA: ☑ Blinding: assessor ☒ ITT: ☑	58 stroke patients with hemiparesis of duration of less than 6 months who were able to walk for 10 m without an assistive device and had never worn an AFO previously.	Measures of gait performance and balance were assessed with and without an AFO on the affected side. Assessments took place 2 hrs apart.t the end of the study.	**Measures of Balance:** Weight bearing distribution, limit of stability were assessed using the Balance Master System **Measures of Gait:** Gait speed, cadence, cycle time, swing time, stance time, step length, stride length were assessed using the GAITRite system	Mean ±sd for outcomes assessed with and without AFOs **Balance** Weight-bearing difference (degrees): 8.86±9.31 vs. 12.12±8.25, p=0.044 Movement velocity (deg/sec) affected: 4.53±1.48 vs. 3.39±1.62, p=0.040 Maximal excursion (%) affected: 74.81±20.46 vs. 68.70±23.61, p=0.046 **Gait** Gait speed (cm/sec): 66.94±29.47 vs. 62.83±26.71, p=0.006 Cadence: 90.31±22.98 vs. 88.62±19.06, p=0.357 Cycle time (sec): 1.45±0.48 vs. 1.45±0.49, p=0.962 Swing time (sec) affected: 0.53±0.19 vs. 0.52±0.15, p=0.355 Stance time (sec) affected: 0.92±0.34 vs. 0.93±0.38, p=0.620 Step length (cm): affected: 44.58±13.19 vs. 42.29±12.27, p=0.010

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
					Stride length (cm): 86.86±26.47 vs. 82.53±22.95, p=0.002 Drop outs: 0
deWit et al. 2004 **Netherlands** **RCT (crossover)**	CA: ☑ Blinding: assessor ☒ ITT: ☑	20 chronic stroke patients (> 6 months) who were able to walk independently with shoes with/without a walking aid and who had been wearing an AFO for at least the previous 6 months	Subjects who had been wearing a rigid, nonarticulated AFO daily were assessed with and without their AFO included, the order of which was randomized. AFO types included an AFO with a small posterior steel, AFO with big posterior heel and an AFO with 2 crossed posterior steels and an open heel	**Primary outcomes:** Comfortable walking speed, Timed Up & Go (TUG) test and stairs test TUG+ stair ascent/decent). Clinically relevant differences based on literature were defined for walking speed (20 cm/s), and the TUG test (10 s).	Mean ±sd for outcomes assessed with and without AFOs Gait speed (cm/s): 49.6±24.3 vs. 44.9±24, p=0.020 TUG (sec): 25.6±11.7 to 29.2±12.9, p<0.0001 TUG stairs (sec): 73.0±37.8 to 81.6±44.4, p=0.04 Drop outs: 0

Functional Electrical Stimulation

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Pomeroy et al. 2006 **UK** **Cochrane review**	N/A	24 RCTs, (888 subjects) of which 12 included interventions and outcomes associated with mobility. Subjects were recruited an average of < 6 months (n=7) and ≥ 6 months (n=3) post stroke. Subjects in 1 trial included subjects with a stroke chronicity of both < and > 6 months. Timing of stroke onset was	Comparison of internal and external electrode devices that included single channel, multi-channel, patterned multichannel stimulators, EMG-triggered FES, TENS +/- conventional therapy vs. control condition (no stimulation, sham stimulation). Intensity and frequency of intervention varied from 20-30 minutes, 2-3x/week,	**Primary outcomes:** Walking endurance, Timed Up & Go test, Motor Assessment Scale **Secondary outcomes:** Muscle tone, muscle function, gait velocity, cadence, stride length. Outcomes were assessed before and after treatment. 8-9 week follow-up in one study.	Gait speed: SMD= -0.02, 95% CI -0.30 to 0.26, p=ns. Results from 5 trials included Stride length: SMD=0.36, 95% CI -0.93 to 1.63, p=ns. Results from 2 trials included. Drop outs: No reporting in 8 trials. In the remaining trials n=16 Adverse events: no reporting

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		unclear in 1 trial.	20-60 minutes 5x/week, with duration of 3 to 12 weeks. Details of the specific magnitudes of the stimulation and treatment protocols are difficult to summarize		
Tan et al. 2014 **China** **RCT**	CA: ☒ Blinding: ☑ Assessor ITT: ☑	45 subjects who sustained a first time ischemic stroke (within 3 months of onset). A Brunnstrom stage of I, II, or IV	Subjects were randomized into a four-channel FES group, a placebo group (sham four-channel FES), or a dual-channel group. All groups received conventional stroke rehabilitation in addition to the experimental treatments. 30 minutes per day, for 5 days, over 3 weeks.	**Primary Outcomes:** FMA-LE, the Postural Assessment Scale for Stroke Patients (PASS), BBS, Functional Ambulation Category (FAC), and the Modified Barthel Index (MBI).	A significant difference in FMA-LE scores after treatment was found between the four channel and dual-channel groups (p= 0.024), but not between the four-channel and placebo groups (p=0.062). After treatment a significant difference between the four-channel and placebo groups was found in the PASS (p= 0.031) and BBS (p= 0.022). On the MBI, the four-channel group had significantly greater improvement compared to the placebo (p= 0.039) and dual channel groups (p= 0.021). Significant differences were found only between the four-channel and placebo groups on the BBS (p= 0.028), and MBI (p= 0.047) at the 3 month follow up.
Ambrosini et al. 2011 **Italy** **RCT**	CA: ☑ Blinding: assessor ☑ ITT: ☒	35 patients with stroke onset of < 6 months who were able to sit for up to 30 minutes and had sufficient mobility in their joints to enable pedaling.	Subjects were randomized to receive FES-induced cycling training using a motorized cycle-ergometer or placebo FES. An 8-channel stimulator with surface electrodes attached on the quadriceps, hamstrings, gluteus maximum and tibialis anterior of both legs was used. Stimulus intensity was set to induce muscle contraction. 20 treatment sessions, each lasting 25 minutes were provided. In addition, subjects in both group	**Primary outcomes:** Motricity Index (MI) leg subscale, gait speed during a 50-meter walking test. **Secondary outcomes:** Trunk Control Test (TCT), Upright Motor Control Test (UMCT) Assessments were conducted before training, after training, and at 3- to 5-month follow-up visits.	Mean ± sd at baseline and follow-up for FES and control groups MI scores: 39 ± 26 to 79 ± 24 vs. 45 ±35 to 63 ±25, p<0.001 Gait speed (m/s): 0.11±0.25 to 0.57±0.34 vs. 0.11±0.24 to 0.48±0.46. p=0.366 TCT: 46±19 to 85±22 vs. 58±20 to 69±17, p<0.001 UMCT: 1.4±1.5 to 4.1±2.1 vs. 1.7±1.9 to 2.9±1.7, p=0.005 Drop outs: FES group n=4, control group n=4 Adverse events: No reporting

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			participated in a standard 3 –hour/day rehabilitation program.		
Burridge et al. 1997 **UK** **RCT**	CA: ☑ Blinding: assessor ☒ ITT: ☒	32 hemiplegic patients who had suffered a single stroke at least 6 months prior to start of study who exhibited single drop foot but with sufficient dorsiflexion of the ankle with stimulation to enable heel strike when walking and without undue comfort. Patients had the ability to stand unsupported and walk 10m; ability to stand from sitting without help and the ability to walk 50m before stroke independently.	Subjects were randomized to receive either FES using the Odstock Dropped Foot Stimulator while receiving a course of physiotherapy (PT) based on the Bobath method or to receive a course of PT alone (control). Subjects in both groups received 10 physiotherapy sessions each lasting 60 minutes.	**Primary outcomes:** Gait speed over 10 m. **Secondary outcome:** Walking efficiency assessed using the Physiological Cost Index (PCI) Assessments were conducted at baseline, between 4 and 5 weeks and between 12 and 13 weeks.	Mean ± sd at baseline and follow-up for FES and control groups Gait speed (m/s): 0.68±0.49 to 0.77±0.43 vs. 0.48±0.25 to 0.51±0.27. p=0.044 PCI (beats/min per m/min): 0.59±0.49 to 0.54±0.56 vs. 1.03±0.67 to 1.00±0.69. p=0.083 Drop outs: n=1 Adverse events: No reporting

Neuromuscular Electrical Stimulation

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Knutson et al. 2013 **USA** **RCT**	CA: ☒ Blinding: ☑ Assessor ITT: ☒	24 stroke patients (onset ≥6 months) with footdrop during ambulation and less than normal ankle dorsiflexion strength (Medical Research Council Scale score of ≤4/5) completed the study.	Patients were randomized into 6 weeks of treatment in either the contralaterally controlled neuromuscular electrical stimulation (CCNMES) group (n=12) or the cyclic neuromuscular electrical stimulation (NMES) group (n=12). The assigned stimulator was used at home and both groups also received	**Primary Outcomes:** FMA-LE **Secondary Outcomes:** modified Emory Functional Ambulation Profile, and gait velocity.	There were no significant differences between groups in the outcome trajectories for any of the measures. When the data after treatment from both groups was pooled, there were significant changes shown for the modified Emory Functional Ambulation Profile (p=0.01) and the FMA-LE (p<0.01).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			conventional post-stroke gait training from a physical therapist in lab sessions.		

Foot Drop Stimulator

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Everaert et al. 2013 **Canada** **Cross-over RCT**	CA: ☑ Blinding: Assessor ☒ ITT: ☒	93 stroke patients with hemiparesis and foot drop (<1 year post stroke). Participants had no prior experience with an AFO, and could ambulate 10m, FIM ambulation score ≥4.	Participants completed two phases for the study: 6 weeks with one device then 6 weeks with another. The three treatment groups were: (1) WalkAide then Ankle-Foot Orthosis (AFO), (2) AFO then WalkAide, and (3) AFO for both phases.	**Primary Outcomes**: Figure-of-8 walking speed and Physiological Cost Index **Secondary Outcomes**: 10m walking speed, modified Rivermead Mobility Index, Perceived Safety Level, and Device preference.	All groups showed significant increases on the Figure-8 task and 10m walk ($p<0.01$), and on the modified Rivermead Mobility index ($p<0.001$). When comparing WalkAide to AFO for walking performance, improvements on the Figure 8 and 10m walk were not significantly different at phase 1 ($p=0.89$ and $p=0.75$, respectively) or phase 2 ($p=0.25$ and $p=0.66$, respectively). Greater orthotic effect was shown at phase 1 and 2 for the AFO compared to the WalkAide.
Kluding et al. 2013 **USA** **Cross-over RCT**	CA: ☑ Blinding: ☑ Assessor ITT: ☑	197 participants who sustained a stroke ≥3 months before intervention and had a gait speed of ≤0.8m/s.	Patients were randomized into either the foot drop simulator (FDS) or the standard AFO group. Both groups received physical therapy treatment as well. At 30 weeks, the AFO group switched to FDS and continued for 12 weeks, whereas the FDS group continued with the same treatment.	**Primary Outcome**: 10 meter walk test. Secondary Outcomes: FMA-LE, Timed-up and go test, 6-minute walk test, BBS, Functional Reach test, Stroke Impact Scale.	Results provided are prior to the cross-over. At 30 weeks, significant improvements were identified in both groups for comfortable and fast gait speed ($p<0.001$), among other within group improvements. However, between groups, immediate device effects were shown for fast gait speed ($p=0.018$) and BBS ($p=0.039$) and for long-term effect on the BBS ($p=0.022$). User Satisfaction was significantly higher in the FDS group compared to the standard treatment with the AFO ($p<0.001$).
Sheffler et al. 2013 **USA** **RCT**	CA: ☑ Blinding: ☒ Assessor ITT: ☑	110 individuals with hemiparetic stroke (≥12 weeks post stroke). Participants could ambulate ≥30ft without	Participants were placed in either an ambulation training group with peroneal nerve stimulator (PNS – Odstock Dropped-	**Primary Outcomes:** FMA-LE **Secondary Outcomes**: Modified Emory Functional	There was no significant treatment group main effect on the FMA-LE ($p=0.797$), the mEFAP ($p=0.968$), or the SSQOL scale ($p=0.360$).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		an AFO and ≥24 on the BBS.	Foot Stimulator), or usual care group (AFO or no device).	Ambulation Profile (mEFAP), Stroke Specific Quality of Life (SSQOL) scale.	

Mobility and Transfer Reviews

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Pollock et al. 2014 **UK** **Cochrane Review**	N/A	RCTs focused on improving patients sit-to-stand abilities after a stroke.	13 studies (n=603) were included in this review. Interventions included: repetitive sit-to-stand (6 studies), exercise training programs (4 studies), sit-to-stand training program (1 study), augmented feedback (1 study), and altered chair design (1 study). The analysis was completed using 11 of the identified studies.	**Primary Outcomes:** Ability to complete sit-to-stand **Secondary Outcomes**: time to sit-to-stand, lateral symmetry, incidence of falls, reaction forces and joint kinematics.	A single study (judged to be at high risk of bias) found training increased the odds of independent sit-to-stand vs. the control group (OR = 4.86; 95% CI, 1.43 to 16.50). 5 studies showed sit-to-stand interventions improved the time needed for sit-to-stand (SMD= 0.85; 95% CI 0.38 to 1.33). Long-term improvements were shown. Sit-to-stand training on number of falls was imprecise (no benefit or harm).
Pollock et al. 2014 **UK** **Cochrane Review**	N/A	RCTs focused on improving recovery of function of mobility after stroke through the use of physical rehabilitation approaches.	A total of 96 studies (n=10401) were included. Specifically for analysis three groupings were explored: intervention vs. no treatment (41 studies), intervention vs. usual care or attention control (22 studies), and one intervention vs. another (13 studies).	**Primary outcomes:** Independence in Activities of daily living (e.g., FIM, Barthel Activities of Daily Living Index, Modified Rankin Scale, and motor function (e.g., FMA-LE, Motor assessment scale, Rivermead mobility index, Rivermead Motor Assessment) **Secondary Outcomes:** Balance and gait velocity.	Based on 27 studies, treatment was shown to have a beneficial effect when compared to no treatment for functional recovery (SMD=0.78, 95% CI 0.58 to 0.97, I^2=85%). To improve motor function, intervention is more effective than usual care (SMD =0.42, 95% CI 0.24 to 0.61, I^2=42%). It is also more effective for improving balance SMD= 0.31, 95% CI 0.05 to 0.56) and gait velocity (SMD= 0.46, 95% CI 0.32 to 0.60). No one physical rehabilitation approach was more (or less) effective than any other approach for increasing motor function.

Glossary

RCT= Randomized Controlled Trial
N/A = Not Applicable
CA = Concealed Allocation
ITT = Intention to treat
ESD = Early Supported Discharge
ADL = Activity of Daily Living
6MWT = 6 Minute Walk Test
ABC scale = Activities-specific Balance Confidence Scale
BBS = Berg Balance Scale
FMA-LE = Fugl Meyer Assessment – Lower extremity motor subscale
ROM = Range of Motion
STREAM = Stroke Rehabilitation Assessment of Movement
UE = Upper extremity
OR = Odds Ratio
IQR = Interquartile Range
SMD = Standardized Mean Difference
CI = Confidence Interval

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