Original Article

The Improvement of Walking Ability Following Stroke

A Systematic Review and Network Meta-Analysis of Randomized Controlled Trials

Jan Mehrholz, Marcus Pohl, Joachim Kugler, Bernhard Elsner

Summary

Background: Gait velocity and maximum walking distance are central parameters for measuring the success of rehabilitation of gait after a stroke. The goal of this study was to provide an overview of current evidence on the rehabilitation of gait after a stroke.

Methods: A systematic review of randomized, controlled trials was carried out using network meta-analysis. The primary endpoint was gait velocity; secondary endpoints were the ability to walk, maximum walking distance, and gait stability. The following interventions were analyzed: no gait training, conventional gait training (reference category), training on a treadmill with or without body weight support, training on a treadmill with or without a speed paradigm, and electromechanically assisted gait training with end-effector or exoskeleton apparatus.

Results: The systematic search yielded 40 567 hits. 95 randomized, controlled trials involving a total of 4458 post-stroke patients were included in the meta-analysis. With respect to the primary endpoint of gait velocity, gait training assisted by end-effector apparatus led to significant improvement (mean difference [MD] = 0.16 m/s; 95% confidence interval [0.04; 0.28]). None of the other interventions improved gait velocity to any significant extent. With respect to one of the secondary endpoints, maximum walking distance, both gait training assisted by end-effector apparatus and treadmill training with body weight support led to significant improvement (MD = 47 m, [4; 90], and MD = 38 m, [4; 72], respectively). A network meta-analysis could not be performed with respect to the ability to walk (a different secondary endpoint) because of substantial inconsistencies in the data. The interventions did not differ significantly with respect to safety.

Conclusion: In comparison to conventional gait rehabilitation, gait training assisted by end-effector apparatus leads to a statistically significant and clinically relevant improvement in gait velocity and maximum walking distance after stroke, while treadmill training with body weight support leads to a statistically significant and clinically relevant improvement in maximum walking distance.

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Stroke is one of the most frequently occurring diseases worldwide and leads to permanent disability, diminished quality of life, and thus to a heavy burden of illness. A high proportion of stroke patients have impaired walking ability and can only walk in their own home. Their reduced mobility often means they are unable to go outdoors at all. Approximately 70% of those who retain the ability to walk cannot move at a normal speed and are therefore limited in daily activities such as crossing the road at a stop light (1). Regaining the ability to walk at a speed approaching normal is thus one of the principal goals for stroke patients and their family members.

In recent years interventions such as treadmill training and electromechanical-assisted training have been introduced to help improve walking after stroke (2). During treadmill training the patient is secured by a belt system that bears part of the body weight (3, 4). Another approach is treadmill training with systematic increase of the walking speed (5). In electromechanical-assisted training the patient’s gait cycle is partly automated, which eases the work of the therapist (6). This method increases the number of steps that can be taken during treatment sessions and enables severely affected patients to practice walking earlier and more intensively than was possible previously (7). The GT-1 walking trainer is an example of the end-effector type (1), while exoskeleton models are represented by the Lokomat and LOPES trainers (6, 8). Moreover, studies published particularly in the past few years have described mobile exoskeletons (9–11) and special “limb robots” (12–14).

The exoskeleton system consists of a treadmill and an exoskeleton, i.e., an orthosis with rods and joints designed to imitate the skeleton of the lower extremities that is adapted to the dimensions of each individual patient (1). Integrated into the exoskeleton are programmable power units that move the hip and knee joints during ambulation. The feet are also led or controlled by the device (1). In the end-effector system the patient, secured by straps, stands on two footplates that simulate walking (1). The device moves only the feet, fixed to the footplates; The knee and hip joints follow and are not controlled by the device but have to be actively moved by the patient (1).

The Clinical Perspective

Walking speed and walking distance are important clinical endpoints for walking ability following stroke. Both walking speed and walking distance in stroke patients were enhanced particularly by the use of electromechanical-assisted end-effector devices to move the legs. The clinical improvement was superior to that achieved by conventional rehabilitation techniques. Major clinical improvement can also be achieved by means of treadmill training with partial body-weight support. To improve the clinically important aspects of walking in practice, we recommend end-effector devices providing assistance from distal, rather than completely electromechanical-assisted exoskeleton devices.

It emerged that the use of electromechanical-assisted devices in stroke patients may have clinical advantages over walking rehabilitation without such devices. The added benefit probably lies in the fact that even patients who are unable to walk achieve more repetitions with a device than without. The effects we found can best be explained by assuming that patients whose movements are led to an excessive degree fail to improve in terms of clinically significant parameters of walking. This is in accord with currently prevailing theories about the relearning of motor skills following stroke.

Although the evidence on training stroke patients to walk seems robust, no review has yet been compiled that summarizes and evaluates the results of all studies and interventions regarding the improvement of walking ability after a stroke. The existing Cochrane Reviews, for example, have a narrow focus such as the efficacy of treadmill training or the efficacy of electromechanical-assisted rehabilitation of walking (4, 15). However, there are hardly any comparisons of two or more interventions to improve walking ability, although in practice it is crucial to know which device performs more effectively than others in a given situation. The treating physician also encounters difficulties in deciding which specific form of treatment to prescribe for a stroke patient.

An approach to solving this problem is offered by network meta-analyses. These enable quantitative synopsis of the "evidence network" by combining direct and indirect comparisons of three or more interventions in randomized, controlled trials on the basis of a common comparative intervention (16).

Goals

We set out to gain an overview of the evidence from randomized, controlled trials on the improvement of walking speed, walking distance, walking ability, and safety in stroke patients. A further aim was to estimate the relative efficacy of the various interventions, taking effect modifiers into account.

Method

Study protocol and registration

The study protocol for this systematic review is registered in the PROSPERO database under the ID CRD42017056820 and meets the PRISMA criteria (17).

Inclusion and exclusion criteria

Our analysis embraced all published and unpublished studies on adults following stroke (clinically defined). We compared all types of training designed to improve the walking speed, walking distance, and walking ability of stroke patients. All randomized, controlled trials of parallel-group design and randomized crossover studies that compared walking training with other interventions were included. We combined comparable interventions and approaches into treatment categories.

Endpoints

The primary endpoint was walking speed, while the secondary endpoints were walking ability, walking distance, and walking safety.

Interventions

We defined the following categorization of study interventions in advance:

- No walking training
- Conventional training (walking on the floor, preparatory exercises in sitting position, balance training etc. without technical aids and without treadmill training or electromechanical-assisted training) (reference category)
- Treadmill training without or with body-weight support
- Treadmill training with or without walking speed paradigm
- Electromechanical-assisted training with end-effector devices or exoskeletons

The methods used for tracing of information sources and systematic literature screening, together with the procedures for statistical evaluation (18–26), are described in detail in the *eMethods*.

Results

Our systematic survey yielded 44 567 records. After exclusion of irrelevant records, 95 randomized controlled trials with a total of 4458 patients were included for quantitative analysis *(Figure 1)*.

Study characteristics

Of the 95 publications included, 80% were randomized controlled trials and the remaining 20% were randomized crossover studies. The trial size ranged from five to 282 patients (mean: 26 patients). The patients' mean age ranged from 43 to 76 years *(eTable 1)*. The mean time elapsed since stroke was 3 days to 8 years.

Altogether, 92 of the 95 trials compared an active experimental group with an active control group *(eTables 2–4)*.

Ninety-two (97%) of the 95 publications included reported proper generation of the randomization sequence, 72 (76%) stated adequate concealment of the randomization sequence, and 77 (81%) confirmed satisfactory blinding of the investigators. The methodological quality of the trials, depicted in *eFigures 1–3* and *eTables 2–4*, was included as a covariable in the calculations (adjusted effect mass). SUCRA (surface under the cumulative ranking curve) presentation of the endpoints can be found in *eTables 5–7*.

Summary of network geometry

Walking speed was used as an endpoint in 75 studies with a total of 3614 patients. Most of the trials compared treadmill training against walking rehabilitation without treadmill training *(Figure 2* and *eFigures 1–5)*.

Walking distance was the secondary endpoint in 44 trials with a total of 2509 patients. In these studies too, the majority compared treadmill training against walking rehabilitation without treadmill training *(Figure 3* and *eFigure 6)*.

Achievement of walking ability was a secondary endpoint in 22 studies with a total of 1517 patients. Most of these trials compared electromechanical-assisted walking training with walking training that did not involve electromechanical assistance *(eFigure 3* and *eTable 3)*.

The secondary endpoint safety was reported in 57 trials with a total of 2889 patients, most of which compared electromechanical-assisted walking training with walking training that did not involve electromechanical assistance *(Figure 4* and *eFigure 7)*.

The network structure and geometry are described in more detail in the *eMethods*.

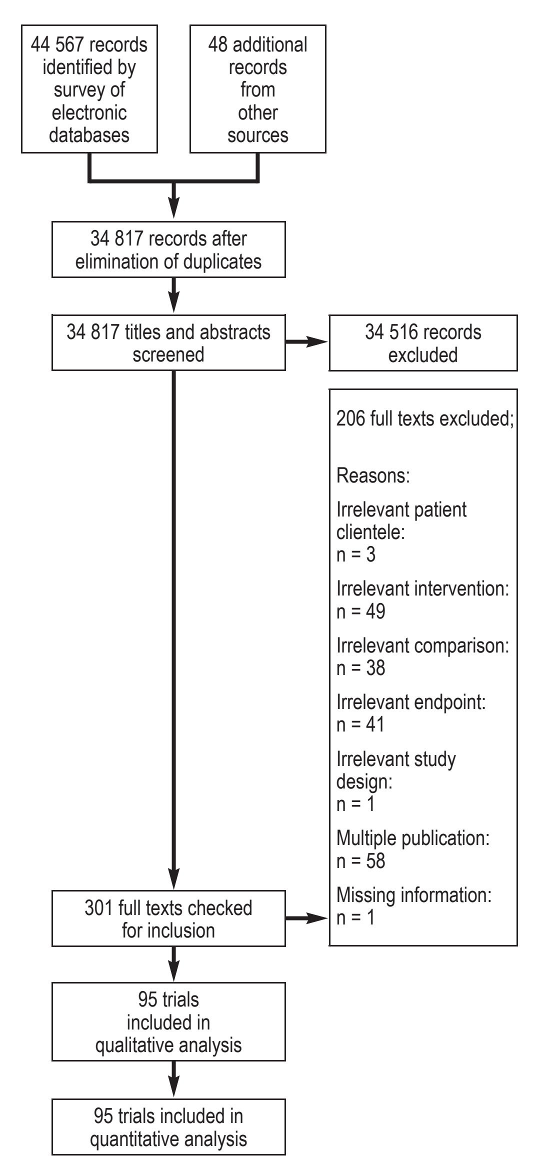
Synthesis

For the primary endpoint of walking speed, end-effector-assisted training achieved significantly greater improvements than conventional walking rehabilitation (mean difference [MD] = 0.16 m/s, 95% confidence interval [CI]: [0.04; 0.28]). None of the other interventions improved walking speed significantly *(Figure 2)*.

With regard to the secondary endpoint of walking distance, both end-effector-assisted training and treadmill training with body-weight support increased the distance walked significantly more than conventional walking rehabilitation (MD = 47 m, 95% CI: [4; 90] and MD = 38 m, 95% CI: [4; 72], respectively). No other interventions improved walking distance significantly in comparison with conventional walking rehabilitation *(Figure 3)*.

No network analysis was carried out for the secondary endpoint of walking ability owing to statistically relevant inconsistency; the central precondition of transitivity was infringed. No approach was statistically significantly superior to any other approach.

FIGURE 1



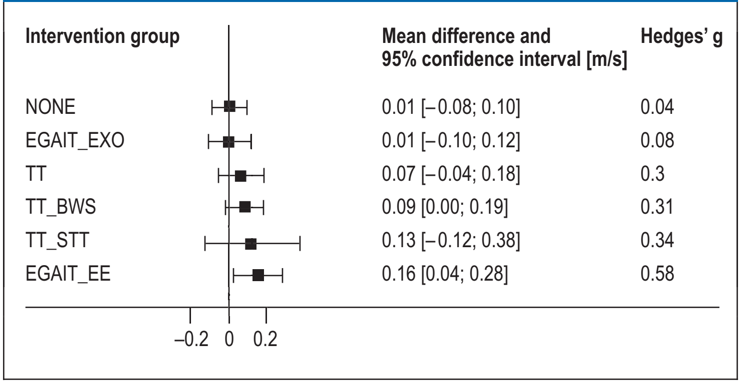
Flow chart of systematic literature survey

Altogether 42 studies with a total of 2207 patients were included for analysis. At the end of treatment 639 patients (29%) were able to walk. Seventy study arms with a total of 1572 patients investigated the efficacy of conventional walking rehabilitation, while 21 study arms with 415 patients examined the efficacy of treadmill training. A detailed account of all trials with regard to patient and study characteristics, age, interventions, and walking ability can be found in *eTables 1–4*.

As for the secondary endpoint of safety, we found no systematic differences among the various interventions for walking rehabilitation following stroke.

Our sensitivity analysis revealed no significant difference in study effects with regard to the methodological quality of the trials included.

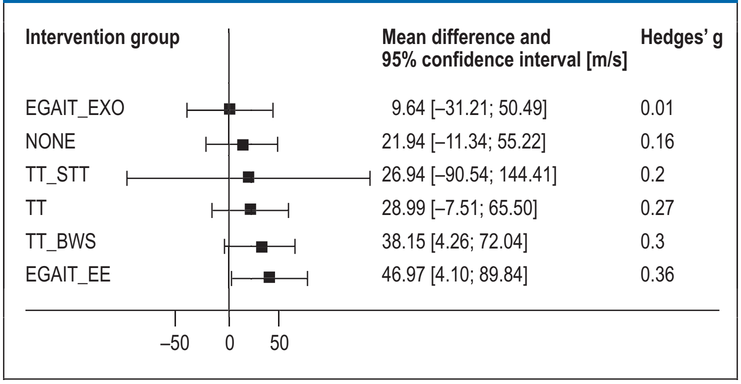
FIGURE 2



Results of the interventions as Forest plot for the primary endpoint, walking speed

NONE No walking rehabilitation
EGAIT_EXO Electromechanical-assisted training with exoskeleton
TT Treadmill training
TT_BWS Treadmill training with body-weight support
TT_STT Treadmill training with walking speed paradigm
EGAIT_EE Electromechanical-assisted training with end-effector

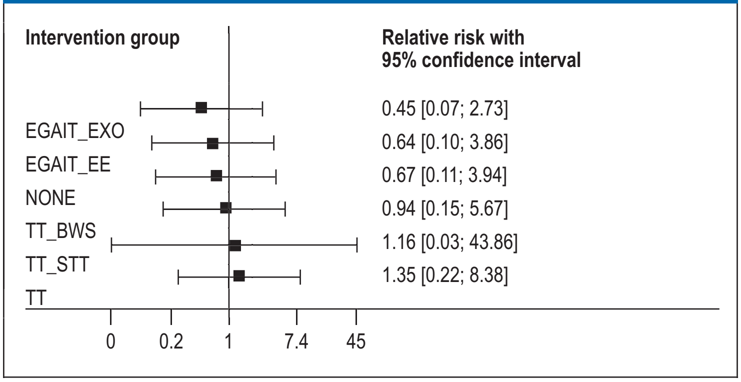
FIGURE 3



Results of the interventions as Forest plot for the secondary endpoint walking distance

EGAIT_EXO Electromechanical-assisted training with exoskeleton
NONE No walking rehabilitation
TT_STT Treadmill training with walking speed paradigm
TT Treadmill training
TT_BWS Treadmill training with body-weight support
EGAIT_EE Electromechanical-assisted training with end-effector

FIGURE 4



Results of the interventions as Forest plot for the secondary endpoint safety

EGAIT_EXO Electromechanical-assisted training with exoskeleton
EGAIT_EE Electromechanical-assisted training with end-effector
NONE No walking rehabilitation
TT_BWS Treadmill training with body-weight support
TT_STT Treadmill training with walking speed paradigm
TT Treadmill training

Discussion

Our systematic review and network meta-analysis embraced a total of 95 trials with 4458 patients. The special feature of this network meta-analysis is that for the first time, competing methods for improvement in walking following stroke are evaluated together and rendered directly statistically comparable with one another, thus enabling nuanced assessment of their effect. Our work can be viewed as complementing the existing Cochrane Reviews. Evaluation of the network meta-analysis showed that electromechanical control of the leg from distal (the end-effector principle) improves walking speed significantly more than conventional walking rehabilitation. The mean increase of 0.16 m/s (corresponding to 0.58 km/h) achieved by end-effector-assisted training is clinically meaningful (27).

For walking distance, it emerged that both an end-effector method and treadmill training with body-weight support can be expected to be superior to conventional walking rehabilitation in increasing the distance walked. According to Flansbjer the smallest clinical improvement was 0.15 to 0.25 m/s in walking speed and 37 to 66 m in walking distance in the 6-minute walking test (27).

The mean improvement over conventional walking rehabilitation of 38 m and 47 m, respectively, in the 6-minute walking test lies in the lower range of clinical relevance but can still be regarded as meaningful (27).

No statements were made with regard to achievement of walking ability. We refrained from statistical evaluation because of the clear statistical inconsistency in the evidence network (26). The individual studies, the interventions used, and the patient characteristics were therefore described qualitatively instead *(eTable 3)*.

Overall, the number of adverse events was relatively low in all studies and the safety level therefore high. No systematic differences were found among the various interventions for walking training following stroke *(eTable 4)*.

Comparison of results with previously published data

Previous reviews of walking rehabilitation after stroke have had a much narrower focus, e.g., the efficacy of treadmill training (15), electromechanical-assisted training (4), or repetitive conventional training (28). The advantage and novelty of the network analysis presented here lie in its inclusion of randomized controlled trials on various methods of walking rehabilitation in one common statistical analysis.

It is well known that treadmill training is appropriate for stroke patients who can already walk (15), and electromechanical-assisted training above all for non-ambulant patients (15, 28). Our network analysis shows that distally supportive electromechanical-assisted training is best for increasing walking speed following stroke and treadmill training with body-weight support best for improving the walking distance. This analysis supplements the existing evidence with the confirmation that the walking training for stroke patients should be highly repetitive with (distal) partial support, rather than relying on complete assistance systems.

In agreement with earlier publications, our analysis points to superiority of walking training with end-effector devices over conventional walking rehabilitation (4, 6). However, there are no controlled trials directly comparing the efficacy of the various devices available.

Potential criticisms

We applied a systematic, comprehensive strategy to search various databases for published and ongoing trials. Nevertheless, publication bias cannot be entirely ruled out because negative results may not have been submitted for publication.

Inconsistent description of treatments by different authors could possibly have resulted in excessively heterogeneous intervention categories, which would limit the generalizability of the findings. However, prior to statistical evaluation we discussed how best to define the intervention groups and then compare them statistically.

One could argue that the treatments within both the control group and the experimental group were heterogeneous. However, on the basis of the information provided in the studies included we strove to categorize all treatments to the best of our ability.

The described effects of some individual interventions—for both walking speed and walking distance—were not only statistically significant but also clinically meaningful. However, no conclusions could be drawn for walking ability in general. We selected a conservative approach and did not perform a network analysis for this parameter; rather, we described the studies in qualitative terms.

It could be reasoned that the initial degree of disability following stroke was a source of bias in the joint analysis of all patients. In this network analysis we used walking ability as one aspect of disability following stroke and employed it as a covariable in the statistical evaluation. However, the fact that no account was taken of other variables, such as stroke site, may have distorted the results—although it is not clear in which direction.

A further potential criticism lies in our categorization of the selected interventions. It could be that certain assisted interventions were used particularly in more severely affected patients (e.g., those who could not walk), as recommended in the current guidelines. However, closer inspection of the studies shows that not all study authors adhered to the latest guideline recommendations. A glance at the tabulated presentation of the interventions in the individual trials *(eTables 1* and *2)* reveals that sometimes mildly affected patients were treated with robotic systems and severely affected patients with treadmill systems, contrary to the recommendations in the guidelines. The effect and the direction of such a distortion on the basis of the study data cannot be assessed with any accuracy.

One can also voice the criticism that we used only the mean values from each trial, not the data from every individual patient. Undoubtedly much more precise estimates of the different effects could have been made on the basis of individual patient data, but this exceeded the remit of our study.

Limitation

One limitation of our systematic review and network meta-analysis is that we did not include mobility, falls, and quality of life as endpoints. We chose to concentrate on endpoints clinically relevant to walking ability, i.e., walking speed and distance, that are also very important for patients in their recovery from stroke. Nevertheless, further studies should focus particularly on other endpoints such as activities of daily life, mobility, social participation, and also falls.

Key messages

- To date, 95 randomized controlled trials have described the treatment effects of walking training following stroke on clinically significant parameters of ambulation such as walking speed and walking distance.
- Both walking speed and walking distance seem to be improved more effectively by electromechanical-assisted end-effector devices that move the patient's legs from distal, and by treadmill training with body-weight support, than by conventional walking rehabilitation.
- For methodological reasons, no conclusions can be drawn with regard to walking ability.
- There are no major safety differences among the various interventions for walking rehabilitation following stroke.

Summary

Our findings show that highly repetitive electromechanical-assisted training is probably the best intervention for improving the walking speed of stroke patients. Walking distance is most likely to be increased by end-effector-assisted training and treadmill training with body-weight support. These results have important consequences for the neurological rehabilitation of stroke patients with impaired walking ability, in that device-supported training must be universally integrated into rehabilitation practice. Furthermore, the findings have considerable implications for the practice of community and inpatient physiotherapy and for the financing of such treatment in the out-of-hospital setting. A change of direction is required—away from special physiotherapy employing neurophysiological techniques (29) towards device-supported walking rehabilitation.

Future studies should investigate both the number of repetitions and the intensity and escalation of treatment in walking rehabilitation for stroke patients. Forthcoming systematic reviews should include individual patient data to enhance the accuracy of description of the effects of walking training.

Conflict of interest statement
The authors declare that no conflict of interest exists.

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► **Supplementary material:**
eMethods, eFigures, eTables:
www.aerzteblatt-international.de/18m0639

CLINICAL SNAPSHOT

Acral Necroses

A 63-year-old man with type 2 diabetes mellitus and chronic renal failure presented to us with painful acral necroses and ulcerations of one year's duration. Six months before presentation, he had undergone amputation of the left second toe and the third right toe. Other potentially causative conditions, including vasculitis, collagenoses, antiphospholipid syndrome, and peripheral arterial occlusive disease, had been excluded before.
Clinical examination revealed necroses of the toes *(Figure)* and of the right ring finger, as well as an erythematous livid macule with central necrosis on the lateral aspect of the right calf. Dermatopathological workup of a skin biopsy showed calcium deposits in the subcutaneous arteries (von Kossa stain). Laboratory testing revealed elevated serum concentrations of phosphate, calcium, and parathyroid hormone. We diagnosed acral calciphylaxis and treated the wounds locally while giving the patient sodium thiosulfate parenterally three times a week and initiating hemodialysis. In the patient's further course, the distal phalanx of the right ring finger was amputated and he terminated the treatment. He did not appear at his subsequent follow-up appointments.

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Supplementary material for:

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eMETHODS

Details of methods

Study protocol and registration

We registered a study protocol which has been published in accordance with the PRISMA criteria in the PROSPERO database under the ID CRD42017056820 (23).

Inclusion and exclusion criteria

We included published and unpublished trials on adults following stroke. We compared all types of walking training for improvement in walking speed, walking distance, and walking ability after stroke. All randomized controlled trials with parallel-group design were included, as were all randomized crossover studies that compared walking training with other interventions. We combined comparable interventions and treatment approaches into treatment categories.

Information sources and search

The following databases formed the basis for our survey (search periods in parentheses):

- CENTRAL; the Cochrane Library (2017, up to edition 8)
- MEDLINE (1948 to 28 August 2017)
- EMBASE (1980 to 28 August 2017)
- CINAHL (1982 to 28 August 2017)
- AMED (1985 to 28 August 2017)
- Web of Science (1899 to 28 August 2017)
- PEDro (to 28 August 2017)
- COMPENDEX (1972 to 16 November 2012)
- SPORTDiscus (1949 to 28 August 2017)
- Rehabdata (to 28 August 2017)

To identify other published and unpublished trials, we searched the following study registers:

- International Standard Randomised Controlled Trial Number Register (www.isrctn.com; to 9 March 2017)
- US National Institutes of Health Ongoing Trials Register ClinicalTrials.gov (www.clinicaltrials.gov; to 9 March 2017),
- Stroke Trials Register (www.strokecenter.org; to 9 March 2017)
- World Health Organization (WHO) International Clinical Trials Registry Platform (ICTRP) (to 9 March 2017).

In addition, we conducted a hand search of reference lists and bibliographies and scrutinized contributions to the following congresses:

- World Congress of NeuroRehabilitation (2006 to 2016)
- World Congress of Physical Medicine and Rehabilitation (2005 to 2015)
- World Congress of Physical Therapy (2007 to 2015)
- Deutsche Gesellschaft für Neurotraumabiologie und Klinische Neurorehabilitation (2005 to 2016)
- Deutsche Gesellschaft für Neurologie (2005 to 2016)
- Deutsche Gesellschaft für Neurorehabilitation (2005 to 2016) und Asian Oceania Conference of Physical and Rehabilitation (2008 to 2016).

Furthermore, we contacted authors and manufacturers of devices.

The search strategy for MEDLINE is described in the *eBox*. This strategy was adapted for all other databases.

Study selection

One of us (BE) screened all titles and abstracts and excluded irrelevant studies. We fetched the full texts of the remaining studies. Two of us (BE, JM) decided whether these publications fitted our study question. Any disagreements were settled by discussions involving the complete author group.

Data acquisition process

Two of us (BE and JM) extracted the study data and results.

Data elements

Using checklists, two of us (BE and JM) independently verified the following points:

- Methods of randomization sequence generation
- Methods of concealed allocation
- Blinding of investigators, participants and personnel
- Adverse events and study drop-outs
- Important differences in prognostic factors
- Study participants (number, age, time from stroke occurrence to study inclusion)
- Description of the interventions in the experimental group and the control group on the basis of the predefined categories.

Geometry of the network

The geometry of the network characterizes the relation and accuracy of the direct comparisons. To enable assessment of network geometry, we produced network diagrams *(eFigures 1–4)* (20). Each intervention is represented by a node in the network. Direct comparisons between interventions are shown by lines connecting the nodes.

Risk of bias for the trials included

We assessed the risk of bias using the Cochrane Risk of Bias Tool for the following dimensions:

- Generation of randomization sequence
- Concealment of allocation sequence
- Blinding of investigators (19)

The results were incorporated into our sensitivity analysis, in which only studies with low risk of bias were considered.

Calculation of effect sizes

When trials used the same test procedure (e.g., walking speed in m/s), we calculated mean differences (MD) and the corresponding 95% confidence intervals (CI). If various result measures were used for a given endpoint, we calculated standardized mean differences (SMD) with 95% CI. For dichotomous endpoints we determined the index of the risk difference (RD) with 95% CI. We generated contrast-based Forest plots for all comparisons. We compiled a relative ranking of the competing interventions on the basis of their surface under the cumulative ranking line (SUCRA) (25). The SUCRA values give the percentage efficacy of each individual intervention in comparison with an “ideal” treatment. All statistical analyses were performed using the software STATA SE Version 15.0 (18, 21).

Analysis method planned and performed

This network meta-analysis was conducted according to a frequentist approach with weighted least squares based on a multivariate regression with random effects. This approach enables adequate consideration of multiple-arm studies and includes restricted maximum-likelihood estimation (26).

Assessment of inconsistency

To test for possible infringement of the transitivity assumption, we assessed global inconsistency by accommodating a consistency and an inconsistency model (24, 26). Transitivity means there are no systematic differences among the various arms of the individual studies. At local level we used the node-splitting approach (22, 26). Alongside the quantitative tests, we performed qualitative verification of the description of the trials included with regard to important effect modifiers.

Risk of bias among the trials

We assessed the risk of bias among the trials for each of the three dimensions (randomization sequence, concealment of randomization sequence, and blinding) as a covariable at study level in network diagrams.

Additional analyses

We viewed generation of the randomization sequence, concealment of the allocation sequence, and blinding of the investigators as potentially important methodological effect modifiers and integrated them into a sensitivity analysis.

Furthermore, for every dependent variable we carried out a meta-regression of the means to identify any further potentially relevant effect modifiers. For this purpose we used walking ability at the beginning of the study and time from stroke event to the beginning of the study.

Presentation of network structure and risk of bias among the trials

The various endpoints (walking speed, walking distance, walking ability, and safety) are depicted in *eFigures 1–4*.

Summary of network geometry

Walking speed

The efficacy of various procedures with regard to walking speed was investigated in the following categories:

- No walking rehabilitation (5 study arms with a total of 142 patients)
- Conventional walking rehabilitation (70 study arms with a total of 1572 patients)
- Treadmill training (21 study arms with a total of 415 patients)
- Treadmill training with body-weight support (29 study arms with a total of 913 patients)
- Electromechanical-assisted walking training with end-effector devices (7 study arms with a total of 252 patients)
- Electromechanical-assisted walking training with exoskeleton devices (17 study arms with a total of 265 patients)
- Treadmill training with speed paradigm (2 study arms with a total of 55 patients)

Walking distance

The efficacy of various procedures with regard to walking distance was investigated in the following categories:

- No walking rehabilitation (5 study arms with a total of 105 patients)
- Conventional walking rehabilitation (40 study arms with a total of 1066 patients)
- Treadmill training (11 study arms with a total of 230 patients)
- Treadmill training with body-weight support (19 study arms with a total of 748 patients)
- Electromechanical-assisted walking training with end-effector devices (5 study arms with a total of 216 patients)
- Electromechanical-assisted walking training with exoskeleton devices (8 study arms with a total of 129 patients)
- Treadmill training with speed paradigm (1 study arm with 15 patients)

Walking ability

The efficacy of various procedures with regard to walking ability was investigated in the following categories:

- Conventional walking rehabilitation (21 study arms with a total of 658 patients)
- Treadmill training (1 study arm with 15 patients)
- Treadmill training with body-weight support (7 study arms with a total of 465 patients)
- Electromechanical-assisted walking training with end-effector devices (6 study arms with a total of 201 patients)
- Electromechanical-assisted walking training with exoskeleton devices (9 study arms with a total of 178 patients)

Safety

The safety of various procedures was investigated in the following categories:

- No walking rehabilitation (5 study arms with a total of 102 patients)
- Conventional walking rehabilitation (50 study arms with a total of 1156 patients)
- Treadmill training (12 study arms with a total of 228 patients)
- Treadmill training with body-weight support (12 study arms with a total of 620 patients)
- Electromechanical-assisted walking training with end-effector devices (10 study arms with a total of 305 patients)
- Electromechanical-assisted walking training with exoskeleton devices (24 study arms with a total of 434 patients)
- Treadmill training with speed paradigm (1 study arm with 44 patients)

Estimation of similarity, inconsistency, and heterogeneity

Similarity

Qualitative analysis of all trials included with regard to possible effect modifiers turned up no relevant factors arguing against the assumption of similarity.

Inconsistency and heterogeneity

Walking speed

No signs of global inconsistency were found; the consistency model did not differ statistically significantly from the inconsistency model: Chi² (df = 8) = 8.59; P = 0.38. On local inspection of inconsistency there was no statistically significant inconsistency within the various loops and no important loop-specific heterogeneity. Thus there was no sign of infringement of the consistency and homogeneity assumption.

Walking distance

There were no signs of global inconsistency; the consistency model did not differ statistically significantly from the inconsistency model: Chi² (df = 5) = 2.17; P = 0.83. On local inspection of inconsistency there was no statistically significant inconsistency within the various loops and no important loop-specific heterogeneity. Thus there was no sign of infringement of the consistency and homogeneity assumption.

Walking ability

There were signs of global inconsistency; the consistency model differed statistically significantly from the inconsistency model: Chi² (df = 1) = 4.05; P = 0.04. Local inspection of inconsistency revealed statistically significant inconsistency within the sole analyzable loop—conventional walking rehabilitation–treadmill training with body-weight support and electromechanical-assisted walking training with exoskeleton—(inconsistency factor [IF] = 0.74; 95% CI [0.10; 1.37]) and moderate loop-specific heterogeneity. Thus, infringement of the consistency assumption can be assumed.

Safety

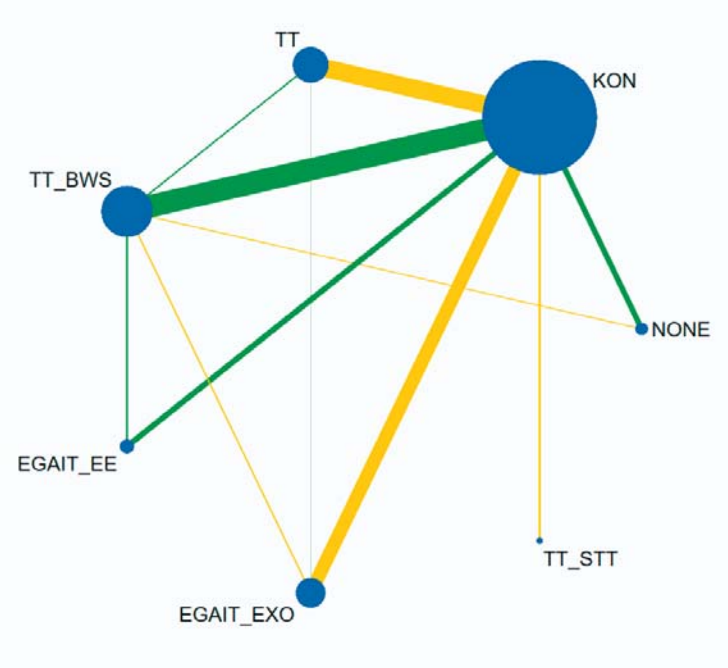
There were no signs of global inconsistency; the consistency model did not differ statistically significantly from the inconsistency model: Chi² (df = 68) = 0.60, P = 1. On local inspection of inconsistency there was no statistically significant inconsistency within the various loops and no important loop-specific heterogeneity. Thus there was no sign of infringement of the consistency and homogeneity assumption.

Results of additional analyses

The sensitivity analysis found no statistically significant effect of internal validity: neither the generation of the randomization sequence nor the concealment of the allocation sequence nor the blinding of the investigators changed the effect estimators significantly.

The meta-regression revealed that neither walking ability at the beginning of the study nor the time from the stroke event to the beginning of the study was a statistically significant effect modifier for the endpoints walking speed, walking distance, walking ability, and safety.

eFIGURE 1



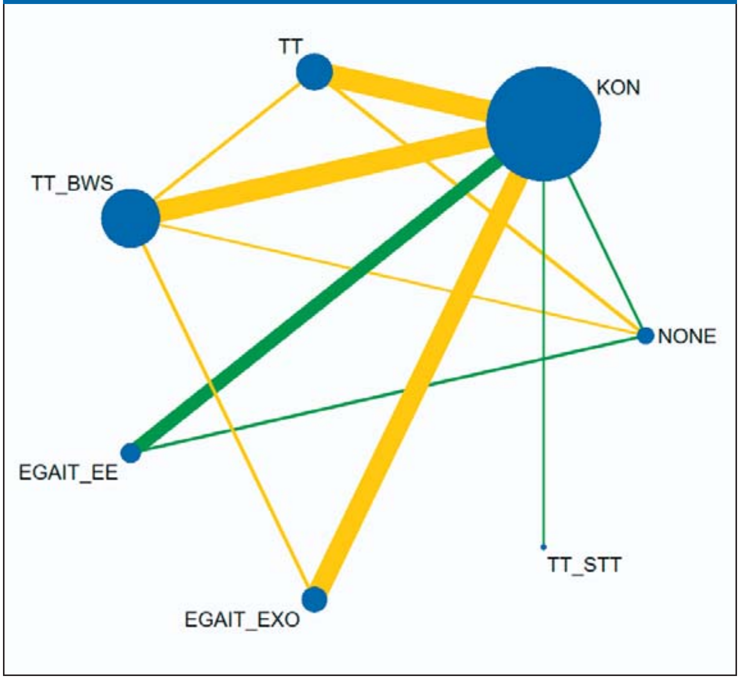
Network diagram for the primary endpoint, walking speed

Each intervention is presented as a node in the network. Direct comparisons between interventions are represented by the lines connecting the nodes.

Network plot of the evidence net of randomized trials for improvement of walking speed following stroke (75 trials with 3614 patients): The blue circles (nodes) represent the different treatment methods, while the connecting lines show the available direct pairwise comparisons between treatment methods. The assignment of interventions to nodes is as listed in the *eMethods*. The size of each node is proportional to the number of studies, and the thickness of the lines proportional to the inverse of the standard error of the comparisons. The colors of the lines show the mean risk of bias as measured with the Cochrane Risk of Bias Tool (green: low risk of bias; yellow: unclear risk of bias; red: high risk of bias).

KON	Conventional walking rehabilitation
NONE	No walking rehabilitation
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
EGAIT_EE	Electromechanical-assisted training with end-effector
TT_BWS	Treadmill training with body-weight support
TT	Treadmill training

eFIGURE 2



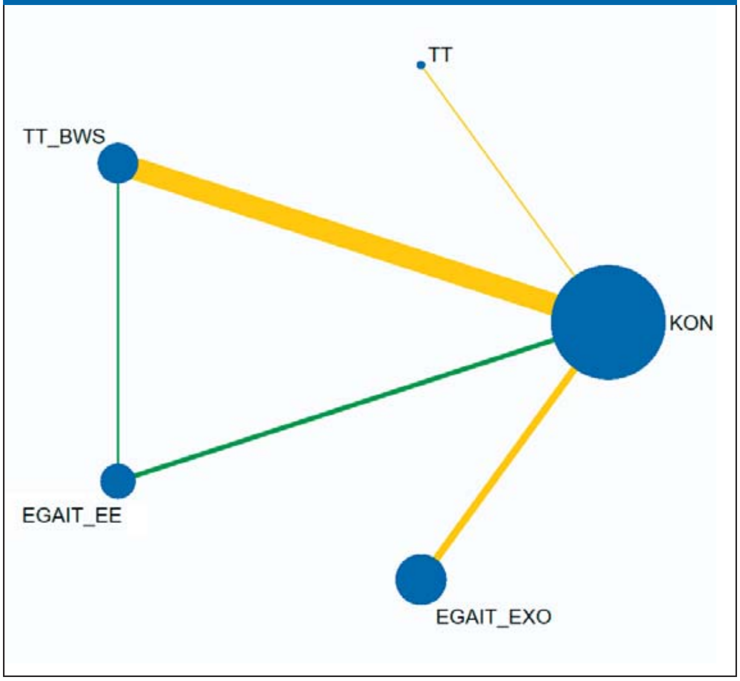
Network diagram for the secondary endpoint walking distance

Each intervention is presented as a node in the network. Direct comparisons between interventions are represented by the lines connecting the nodes.

Network plot of the evidence net of randomized trials for improvement of walking distance following stroke (44 trials with 2509 patients): The blue circles (nodes) represent the different treatment methods, while the connecting lines show the available direct pairwise comparisons between treatment methods. The assignment of interventions to nodes is as listed in the *eMethods*. The size of each node is proportional to the number of studies, and the thickness of the lines proportional to the inverse of the standard error of the comparisons. The colors of the lines show the mean risk of bias as measured with the Cochrane Risk of Bias Tool (green: low risk of bias; yellow: unclear risk of bias; red: high risk of bias).

KON	Conventional walking rehabilitation
NONE	No walking rehabilitation
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
EGAIT_EE	Electromechanical-assisted training with end-effector
TT_BWS	Treadmill training with body-weight support
TT	Treadmill training

eFIGURE 3

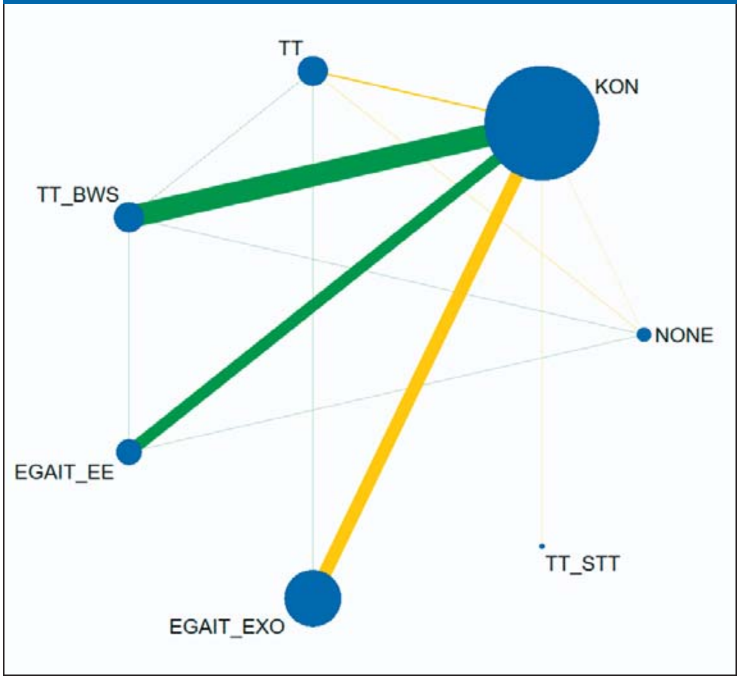


Network diagram for the secondary endpoint walking ability
Each intervention is presented as a node in the network. Direct comparisons between interventions are represented by the lines connecting the nodes.

Network plot of the evidence net of randomized trials for improvement of walking ability following stroke (22 trials with 1517 patients): The blue circles (nodes) represent the different treatment methods, while the connecting lines show the available direct pairwise comparisons between treatment methods. The assignment of interventions to nodes is as listed in the *eMethods*. The size of each node is proportional to the number of studies, and the thickness of the lines proportional to the inverse of the standard error of the comparisons. The colors of the lines show the mean risk of bias as measured with the Cochrane Risk of Bias Tool (green: low risk of bias; yellow: unclear risk of bias; red: high risk of bias).

TT	Treadmill training
KON	Conventional walking rehabilitation
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
EGAIT_EE	Electromechanical-assisted training with end-effector
TT_BWS	Treadmill training with body-weight support

eFIGURE 4



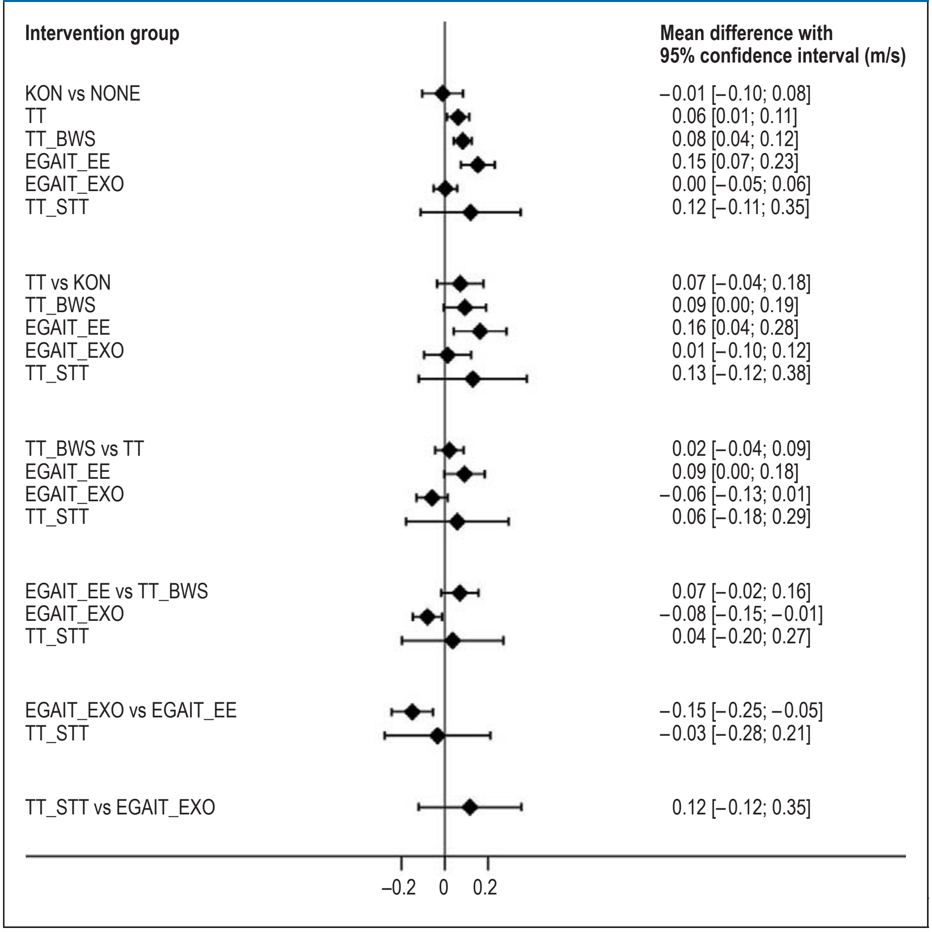
Network diagram for the secondary endpoint safety

Each intervention is presented as a node in the network. Direct comparisons between interventions are represented by the lines connecting the nodes.

Network plot of the evidence net of randomized trials for improvement of safety following stroke (57 trials with 2889 patients): The blue circles (nodes) represent the different treatment methods, while the connecting lines show the available direct pairwise comparisons between treatment methods. The assignment of interventions to nodes is as listed in the *eMethods*. The size of each node is proportional to the number of studies, and the thickness of the lines proportional to the inverse of the standard error of the comparisons. The colors of the lines show the mean risk of bias as measured with the Cochrane Risk of Bias Tool (green: low risk of bias; yellow: unclear risk of bias; red: high risk of bias).

KON	Conventional walking rehabilitation
NONE	No walking rehabilitation
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
EGAIT_EE	Electromechanical-assisted training with end-effector
TT_BWS	Treadmill training with body-weight support
TT	Treadmill training

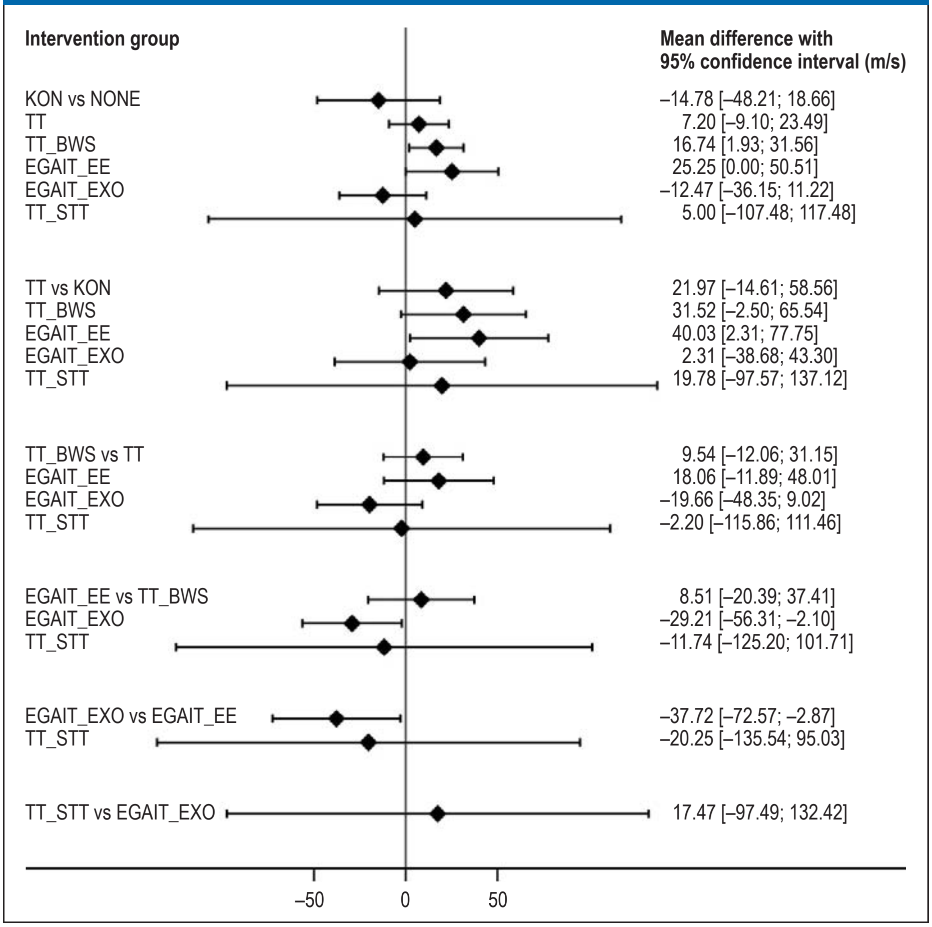
eFIGURE 5



Results of all interventions in direct comparison with one another as Forest plot for the primary endpoint, walking speed

KON vs NONE	Conventional walking rehabilitationversus no walking rehabilitation
TT	Treadmill training
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT vs KON	Treadmill trainingversus conventional walking rehabilitation
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT_BWS vs TT	Treadmill training with body-weight supportversus treadmill training
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EE vs TT_BWS	Electromechanical-assisted training with end-effector versus treadmill training with body-weight support
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO vs EGAIT_EE	Electromechanical-assisted training with exoskeleton versus electromechanical-assisted training with end-effector
TT_STT	Treadmill training with speed paradigm
TT_STT vs EGAIT_EXO	Treadmill training with speed paradigm versus electromechanical-assisted training with exoskeleton

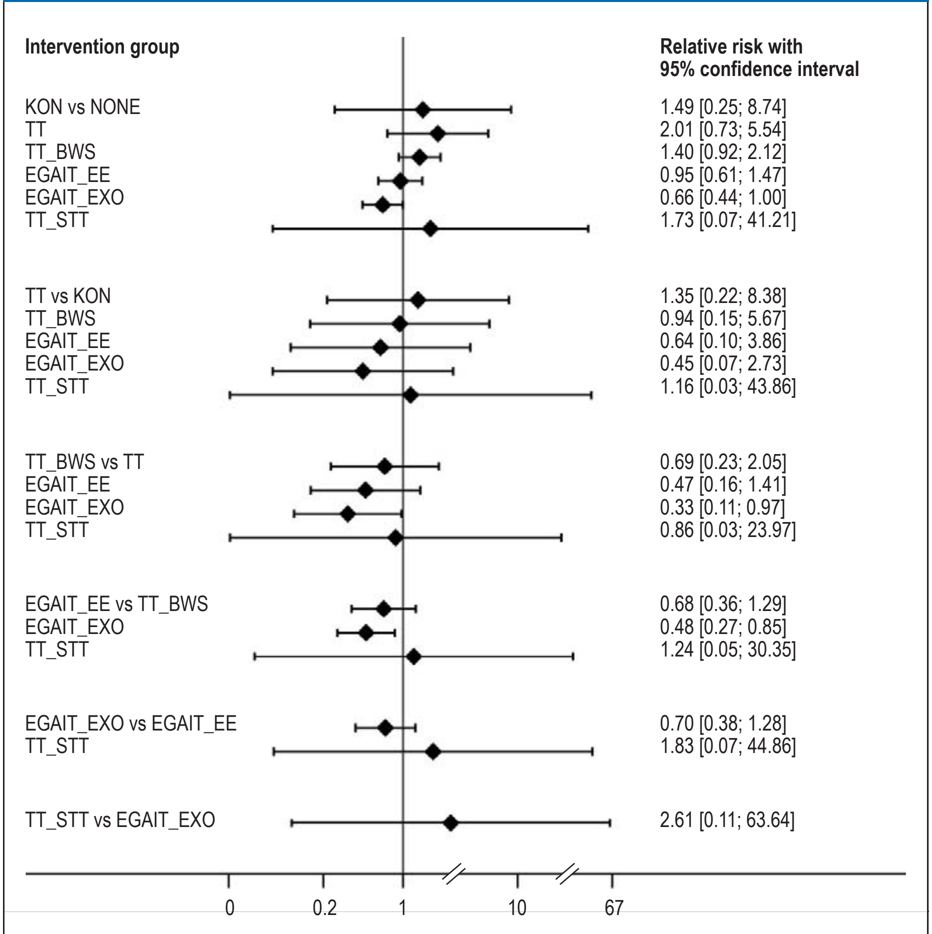
eFIGURE 6



Results of all interventions in direct comparison with one another as Forest plot for the secondary endpoint walking distance

KON vs NONE	Conventional walking rehabilitationversus no walking rehabilitation
TT	Treadmill training
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT vs KON	Treadmill trainingversus conventional walking rehabilitation
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT_BWS vs TT	Treadmill training with body-weight supportversus treadmill training
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EE vs TT_BWS	Electromechanical-assisted training with end-effector versus treadmill training with body-weight support
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO vs EGAIT_EE	Electromechanical-assisted training with exoskeleton versus electromechanical-assisted training with end-effector
TT_STT	Treadmill training with speed paradigm
TT_STT vs EGAIT_EXO	Treadmill training with speed paradigm versus electromechanical-assisted training with exoskeleton

eFIGURE 7



Results of all interventions in direct comparison with one another as Forest plot for the secondary endpoint safety

KON vs NONE	Conventional walking rehabilitationversus no walking rehabilitation
TT	Treadmill training
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT vs KON	Treadmill trainingversus conventional walking rehabilitation
TT_BWS	Treadmill training with body-weight support
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
TT_BWS vs TT	Treadmill training with body-weight supportversus treadmill training
EGAIT_EE	Electromechanical-assisted training with end-effector
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EE vs TT_BWS	Electromechanical-assisted training with end-effector versus treadmill training with body-weight support
EGAIT_EXO	Electromechanical-assisted training with exoskeleton
TT_STT	Treadmill training with speed paradigm
EGAIT_EXO vs EGAIT_EE	Electromechanical-assisted training with exoskeleton versus electromechanical-assisted training with end-effector
TT_STT	Treadmill training with speed paradigm
TT_STT vs EGAIT_EXO	Treadmill training with speed paradigm versus electromechanical-assisted training with exoskeleton

eTABLE 1

Study characteristics and results for the primary endpoint, walking speed

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Ada 2003	Treadmill training with body-weight support	4 weeks	30 min 3× per week	0.75	0.26	11	No	Low	Low	Low	28.00
Ada 2003	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0.56	0.30	14	No	Low	Low	Low	26.00
Ada 2013	Treadmill training with body-weight support	8 or 16 weeks	30 min 3× per week	0.64	0.35	68	Yes	Low	Low	Low	21.00
Ada 2013	No walking rehabilitation	8 or 16 weeks	30 min 3× per week	0.55	0.28	34	Yes	Low	Low	Low	19.00
Baer 2017	Treadmill training with body-weight support	8 weeks	More than 2× per week	0.57	0.36	35	Yes	Low	Low	Low	1.39
Baer 2017	Conventional walking rehabilitation	8 weeks	More than 2× per week	0.59	0.43	34	Yes	Low	Low	Low	1.32
Bang 2016	Electromechanical-assisted walking training with exoskeleton	4 weeks	60 min 5× per week	0.64	0.12	9	Yes	Low	Low	Low	12.00
Bang 2016	Treadmill training	4 weeks	60 min 5× per week	0.55	0.12	9	Yes	Low	Low	Low	13.00
Bonnyaud 2013	Treadmill training	Single session	20 min	0.87	0.17	13	Unclear	Unclear	Unclear	High	72.00
Bonnyaud 2013	Conventional walking rehabilitation	Single session	20 min	0.89	0.17	13	Unclear	Unclear	Unclear	High	72.00
Bonnyaud 2013a	Treadmill training	Single session	20 min	0.88	0.19	30	Yes	Unclear	Unclear	High	72.00
Bonnyaud 2013a	Conventional walking rehabilitation	Single session	20 min	0.84	0.24	30	Yes	Unclear	Unclear	High	72.00
Brincks 2011	Electromechanical-assisted walking training with exoskeleton	3 weeks	Unclear	0.35	0.16	7	Yes	Low	Low	High	1.84
Brincks 2011	Conventional walking rehabilitation	3 weeks	Unclear	0.59	0.27	6	Yes	Low	Low	High	0.69
Buesing 2015	Electromechanical-assisted walking training with exoskeleton	6 to 8 weeks	3× per week to max. 18 sessions	0.87	0.30	25	Yes	Low	High	Low	84.00
Buesing 2015	Conventional walking rehabilitation	6 to 8 weeks	3× per week to max. 18 sessions	0.89	0.30	25	Yes	Low	High	Low	60.00
Chua 2016	Electromechanical-assisted walking training with end-effector	8 weeks	Unclear	0.56	0.45	53	No	Low	Low	Low	0.89
Chua 2016	Conventional walking rehabilitation	8 weeks	Unclear	0.63	0.60	53	No	Low	Low	Low	0.99
Combs-Miller 2014	Treadmill training with body-weight support	2 weeks	30 min 5× per week	0.67	0.23	10	Yes	Unclear	Low	Low	72.00
Combs-Miller 2014	Conventional walking rehabilitation	2 weeks	30 min 5× per week	0.79	0.28	10	Yes	Unclear	Low	Low	60.00
da Cunha Filho 2002	Treadmill training with body-weight support	2 to 3 weeks	20 min 5× per week	0.32	0.42	6	No	Low	High	High	0.52
da Cunha Filho 2002	Conventional walking rehabilitation	2 to 3 weeks	20 min 5× per week	0.26	0.25	7	No	Low	High	High	0.62
Deniz 2011	Treadmill training with body-weight support	4 weeks	60 min 5× per week	0.49	0.18	10	Yes	Unclear	Unclear	Unclear	2.33
Deniz 2011	Conventional walking rehabilitation	4 weeks	60 min 5× per week	0.24	0.13	10	Yes	Unclear	Unclear	Unclear	2.66

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
DePaul 2015	Treadmill training with body-weight support	5 weeks	Up to 30 min, up to 15 sessions	0.77	0.35	36	Yes	Low	Low	Low	4.37
DePaul 2015	Conventional walking rehabilitation	5 weeks	Up to 40 min, up to 15 sessions	0.69	0.31	35	Yes	Low	Low	Low	4.14
Duncan 2011	Treadmill training with body-weight support	12 to 16 weeks	90 min 3× per week	0.24	0.22	282	No	Unclear	Low	High	4.00
Duncan 2011	Conventional walking rehabilitation	12 to 16 weeks	90 min 3× per week	0.23	0.20	126	No	Unclear	Low	High	2.00
Eich 2004	Treadmill training with body-weight support	6 weeks	30 min 5× per week	0.71	0.30	25	Yes	Low	Low	Unclear	1.40
Eich 2004	Conventional walking rehabilitation	6 weeks	30 min 5× per week	0.60	0.22	25	Yes	Low	Low	Unclear	1.45
Fisher 2008	Electromechanical-assisted walking training with exoskeleton	24 units	3–5× per week	0.18	0.23	10	Sometimes	Unclear	Unclear	Low	ND
Fisher 2008	Conventional walking rehabilitation	24 units	3–5× per week	0.18	0.20	10	Sometimes	Unclear	Unclear	Low	ND
Forrester 2014	Electromechanical-assisted walking training with exoskeleton	8 to 10 sessions	60 min	0.37	0.05	21	No	Unclear	High	High	0.39
Forrester 2014	Conventional walking rehabilitation	8 to 10 sessions	60 min	0.34	0.05	18	No	Unclear	High	High	0.36
Franceschini 2009	Treadmill training with body-weight support	5 weeks	60 min 5× per week	0.50	0.44	52	No	Low	Unclear	Low	0.56
Franceschini 2009	Conventional walking rehabilitation	5 weeks	60 min 5× per week	0.60	0.44	50	No	Low	Unclear	Low	0.46
Gama 2007	Treadmill training with body-weight support	6 weeks	45 min 3× per week	0.70	0.30	16	Yes	Low	Unclear	High	60.00
Gama 2007	Conventional walking rehabilitation	6 weeks	45 min 3× per week	0.74	0.34	16	Yes	Low	Unclear	High	54.00
Geroin 2011	Electromechanical-assisted walking training with end-effector	2 weeks	50 min 5× per week	0.59	0.28	20	Yes	Low	Low	High	26.00
Geroin 2011	Conventional walking rehabilitation	2 weeks	50 min 5× per week	0.38	0.20	10	Yes	Low	Low	High	27.00
Globas 2011	Treadmill training	12 weeks	30 to 50 min 3× per week	0.79	0.29	20	Yes	Low	Low	High	60.00
Globas 2011	Conventional walking rehabilitation	13 weeks	60 min 3× per week	0.70	0.46	18	Yes	Low	Low	High	70.00
Hidler 2009	Electromechanical-assisted walking training with exoskeleton	8 to 10 weeks	45 min 3× per week	0.46	0.18	36	Yes	Low	Unclear	High	3.65
Hidler 2009	Conventional walking rehabilitation	8 to 10 weeks	45 min 3× per week	0.60	0.18	36	Yes	Low	Unclear	High	4.57
Hornby 2008	Electromechanical-assisted walking training with exoskeleton	12 sessions	30 min	0.52	0.21	31	Yes	Low	Low	High	50.00
Hornby 2008	Conventional walking rehabilitation	12 sessions	30 min	0.56	0.28	31	Yes	Low	Low	High	73.00
Hoyer 2012	Treadmill training with body-weight support	Minimum 10 weeks	30 min 2–3× per week	0.40	0.27	30	No	Low	Unclear	Low	3.25
Hoyer 2012	Conventional walking rehabilitation	Minimum 10 weeks	30 min 5× per week	0.36	0.24	30	No	Low	Unclear	Low	3.16

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Husemann 2007	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 5× per week	0.20	0.12	17	No	Low	Low	Low	2.60
Husemann 2007	Conventional walking rehabilitation	4 weeks	30 min 5× per week	0.20	0.18	15	No	Low	Low	Low	2.93
Jaffe 2004	Treadmill training	2 weeks	60 min 3× per week	0.69	0.34	10	Yes	High	Unclear	Low	46.80
Jaffe 2004	Conventional walking rehabilitation	2 weeks	60 min 3× per week	0.72	0.28	10	Yes	High	Unclear	Low	43.20
Kang 2012	Treadmill training	4 weeks	30 min 3× per week	0.60	0.20	22	Yes	Low	Low	Low	14.00
Kang 2012	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0.50	0.10	10	Yes	Low	Low	Low	15.00
Kim 2011	Treadmill training	6 weeks	30 min 5× per week	0.58	0.42	20	Yes	Unclear	High	Unclear	15.00
Kim 2011	Conventional walking rehabilitation	6 weeks	30 min 5× per week	0.59	0.47	24	Yes	Unclear	High	Unclear	14.00
Kosak 2000	Treadmill training with body-weight support	2 to 3 weeks	45 min 5× per week	0.06	0.18	22	No	Low	Low	High	1.28
Kosak 2000	Conventional walking rehabilitation	2 to 3 weeks	45 min 5× per week	0.07	0.17	34	No	Low	Low	High	1.32
Kuys 2011	Treadmill training with speed paradigm	6 weeks	30 min 3× per week	0.63	0.30	15	Yes	Low	Low	Low	1.71
Kuys 2011	Conventional walking rehabilitation	6 weeks	30 min 3× per week	0.68	0.37	15	Yes	Low	Low	Low	1.61
Kyung 2008	Electromechanical-assisted walking training with exoskeleton	4 weeks	45 min 3× per week	0.68	0.36	18	Some-times	Unclear	Unclear	Unclear	22.00
Kyung 2008	Conventional walking rehabilitation	4 weeks	45 min 3× per week	0.60	0.34	17	Some-times	Unclear	Unclear	Unclear	29.00
Lang-hammer 2010	Treadmill training	Circa 10 units	30 min up to max. 5× per week	1.00	0.40	21	No	Low	Low	Low	13.78
Lang-hammer 2010	Conventional walking rehabilitation	Circa 11 units	30 min up to max. 5× per week	0.90	0.40	18	No	Low	Low	Low	11.47
Laufer 2001	Treadmill training	3 weeks	8 to 20 min 5× per week	0.47	0.40	13	No	High	High	Low	1.07
Laufer 2001	Conventional walking rehabilitation	3 weeks	8 to 20 min 5× per week	0.33	0.24	12	No	High	High	Low	1.18
Liston 2000	Treadmill training	4 weeks	60 min 3× per week	0.67	0.33	7	Unclear	Low	High	Low	ND
Liston 2000	Conventional walking rehabilitation	4 weeks	60 min 3× per week	0.66	0.39	8	Unclear	Low	High	Low	ND
Luft 2008	Treadmill training	24 weeks	40 min 3× per week	0.82	0.50	57	Yes	Low	High	Low	55.00
Luft 2008	Conventional walking rehabilitation	24 weeks	40 min 3× per week	0.71	0.50	56	Yes	Low	High	Low	63.00
MacKay-Lyons 2013	Treadmill training with body-weight support	6 weeks	40 min 6× per week	0.75	0.22	24	Yes	Low	Low	Low	0.76
MacKay-Lyons 2013	Conventional walking rehabilitation	6 weeks	40 min 6× per week	0.71	0.20	26	Yes	Low	Low	Low	0.76
Macko 2005	Treadmill training	24 weeks	40 min 3× per week	0.95	0.45	25	Yes	Low	High	Low	35.00

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Macko 2005	Conventional walking rehabilitation	24 weeks	40 min 3× per week	1.00	0.49	20	Yes	Low	High	Low	39.00
Mao 2015	Treadmill training with body-weight support	3 weeks	30 min 5× per week	0.50	0.20	15	No	Unclear	Unclear	High	49.00
Mao 2015	Conventional walking rehabilitation	3 weeks	30 min 5× per week	0.33	0.12	14	No	Unclear	Unclear	High	48.00
Middleton 2014	Treadmill training with body-weight support	1.5 weeks	60 min 5× per week	0.69	0.39	27	No	High	High	Low	50.40
Middleton 2014	Conventional walking rehabilitation	1.5 weeks	60 min 5× per week	0.52	0.27	23	No	High	High	Low	29.00
Moore 2010	Treadmill training with body-weight support	4 weeks	2–5× per week	0.63	0.30	15	Yes	Unclear	Unclear	Unclear	13.00
Moore 2010	No walking rehabilitation	ND	ND	0.58	0.23	15	Yes	Unclear	Unclear	Unclear	13.00
Morone 2011	Electromechanical-assisted walking training with end-effector	4 weeks	40 min 5× per week	0.43	0.16	24	No	Low	Low	Low	0.62
Morone 2011	Conventional walking rehabilitation	4 weeks	40 min 5× per week	0.25	0.11	24	No	Low	Low	Low	0.66
Nilsson 2001a	Treadmill training with body-weight support	9 to 10 weeks	30 min 5× per week	0.51	0.40	24	No	Low	Low	Low	0.72
Nilsson 2001a	Conventional walking rehabilitation	9 to 10 weeks	30 min 5× per week	0.46	0.35	25	No	Low	Low	Low	0.56
Nilsson 2001b	Treadmill training with body-weight support	9 to 10 weeks	30 min 5× per week	0.78	0.30	8	Yes	Low	Low	Low	0.72
Nilsson 2001b	Conventional walking rehabilitation	9 to 10 weeks	30 min 5× per week	0.84	0.27	9	Yes	Low	Low	Low	0.56
Noser 2012	Electromechanical-assisted walking training with exoskeleton	Unclear	Unclear	0.20	0.10	11	Yes	Unclear	Unclear	Low	44.52
Noser 2012	Conventional walking rehabilitation	Unclear	Unclear	0.27	0.27	9	Yes	Unclear	Unclear	Low	17.26
Ochi 2015	Electromechanical-assisted walking training with exoskeleton	4 weeks	20 min 5× per week	0.38	0.43	13	No	Unclear	Unclear	Low	0.76
Ochi 2015	Conventional walking rehabilitation	4 weeks	20 min 5× per week	0.19	0.08	13	No	Unclear	Unclear	Low	0.85
Olawale 2009	Treadmill training	12 weeks	25 min 3× per week	0.42	0.20	20	Yes	Unclear	Unclear	Unclear	10.20
Olawale 2009	Conventional walking rehabilitation	12 weeks	25 min 3× per week	0.46	0.19	40	Yes	Unclear	Unclear	Unclear	10.50
Park 2013	Treadmill training	1 week	2× 30 min 5 days per week	0.60	0.32	20	Yes	Low	Unclear	High	21.00
Park 2013	Conventional walking rehabilitation	1 week	2× 30 min 5 days per week	0.60	0.32	20	Yes	Low	Unclear	High	16.00
Park 2015	Treadmill training	3 weeks	30 min 5× per week	0.35	0.14	9	Yes	High	High	High	10.00
Park 2015	Conventional walking rehabilitation	3 weeks	30 min 5× per week	0.32	0.16	10	Yes	High	High	High	13.00
Peurala 2005	Electromechanical-assisted walking training with end-effector	3 weeks	20 min 5× per week	0.51	0.38	30	Some-times	Low	Low	High	30.00
Peurala 2005	Conventional walking rehabilitation	3 weeks	20 min 5× per week	0.39	0.20	15	Some-times	Low	Low	High	48.00

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Pohl 2002	Treadmill training with speed paradigm	4 weeks	30 min 3× per week	1.43	0.79	40	Yes	Unclear	Unclear	High	3.80
Pohl 2002	Conventional walking rehabilitation	4 weeks	45 min 3× per week	0.97	0.64	20	Yes	Unclear	Unclear	High	3.71
Pohl 2007	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	0.44	0.47	77	No	Low	Low	Low	0.97
Pohl 2007	Conventional walking rehabilitation	4 weeks	20 min 5× per week	0.32	0.36	78	No	Low	Low	Low	1.04
Ribeiro 2013	Treadmill training with body-weight support	4 weeks	30 min 3× per week	0.50	0.20	13	Yes	High	High	High	33.00
Ribeiro 2013	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0.40	0.10	12	Yes	High	High	High	20.00
Richards 1993	Treadmill training	5 weeks	105 min 5× per week	0.26	0.14	9	No	Unclear	Unclear	Unclear	0.43
Richards 1993	Conventional walking rehabilitation	5 weeks	105 min 5× per week	0.31	0.20	9	No	Unclear	Unclear	Unclear	0.43
Richards 2004	Treadmill training	8 weeks	60 min 5× per week	0.60	0.38	32	Yes	Low	Low	Low	0.27
Richards 2004	Conventional walking rehabilitation	8 weeks	60 min 5× per week	0.57	0.35	31	Yes	Low	Low	Low	0.29
Salbach 2004	Conventional walking rehabilitation	6 weeks	3× per week	0.99	0.56	44	Unclear	Low	Low	Low	7.86
Salbach 2004	No walking rehabilitation	6 weeks	3× per week	0.80	0.49	47	Unclear	Low	Low	Low	7.13
Saltuari 2004	Electromechanical-assisted walking training with exoskeleton	2 weeks	ABA study; in phase A 30 min 5× per week	0.20	0.12	8	Some-times	Low	Unclear	Unclear	3.60
Saltuari 2004	Conventional walking rehabilitation	2 weeks	ABA study; in phase A 30 min 5× per week	0.23	0.19	8	Some-times	Low	Unclear	Unclear	1.90
Srivastava 2016a	Treadmill training with body-weight support	4 weeks	30 min 5× per week	0.46	0.27	13	No	Low	Unclear	Low	12.88
Srivastava 2016a	Treadmill training	4 weeks	30 min 5× per week	0.45	0.28	12	No	Low	Unclear	Low	14.53
Srivastava 2016a	Conventional walking rehabilitation	4 weeks	30 min 5× per week	0.55	0.25	15	No	Low	Unclear	Low	21.44
Srivastava 2016b	Electromechanical-assisted walking training with exoskeleton	3 weeks	40 min 5× per week	0.70	0.30	6	Unclear	Unclear	Unclear	Unclear	53.80
Srivastava 2016b	Treadmill training with body-weight support	3 weeks	40 min 5× per week	0.75	0.30	6	Unclear	Unclear	Unclear	Unclear	15.30
Stein 2014	Electromechanical-assisted walking training with exoskeleton	6 weeks	60 min 3× per week	0.49	0.36	12	Yes	Unclear	Unclear	Low	49.00
Stein 2014	Conventional walking rehabilitation	6 weeks	60 min 3× per week	0.52	0.25	12	Yes	Unclear	Unclear	Low	89.00
Sullivan 2007	Treadmill training with body-weight support	6 weeks	60 min 4× per week	0.66	0.34	60	Yes	Low	Low	Low	23.80
Sullivan 2007	Conventional walking rehabilitation	6 weeks	60 min 4× per week	0.44	0.28	20	Yes	Low	Low	Low	28.40
Suputti-tada 2004	Treadmill training with body-weight support	4 weeks	25 min 7× per week	0.49	0.23	24	Yes	Unclear	Unclear	Low	27.30
Suputti-tada 2004	Conventional walking rehabilitation	4 weeks	25 min 7× per week	0.28	0.16	24	Yes	Unclear	Unclear	Low	21.60

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Takami 2010	Treadmill training with body-weight support	4 weeks	30 min 3× per week	1.47	0.45	24	Yes	Unclear	Low	Unclear	14.00
Takami 2010	Conventional walking rehabilitation	4 weeks	80 min 5–6× per week	1.11	0.49	12	Yes	Unclear	Low	Unclear	13.70
Tanaka 2012	Conventional walking rehabilitation	4 weeks	ABA study; in phase B 20 min circa 2–3× per week	0.85	0.45	7	Yes	Low	Unclear	High	55.00
Tanaka 2012	No walking rehabilitation	ND	ND	0.88	0.15	5	Yes	Low	Unclear	High	65.00
Thaut 1997	Treadmill training	6 weeks	60 min 5× per week	0.80	0.30	10	Unclear	Unclear	Unclear	Low	0.53
Thaut 1997	Conventional walking rehabilitation	6 weeks	60 min 5× per week	0.53	0.17	10	Unclear	Unclear	Unclear	Low	0.52
Thaut 2007	Treadmill training	3 weeks	30 min 5× per week	0.58	0.11	43	Unclear	Unclear	Low	Low	0.70
Thaut 2007	Conventional walking rehabilitation	3 weeks	30 min 5× per week	0.34	0.11	35	Unclear	Unclear	Low	Low	0.73
Tong 2006	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	0.51	0.31	33	No	Low	Low	Low	0.58
Tong 2006	Conventional walking rehabilitation	4 weeks	20 min 5× per week	0.19	0.26	21	No	Low	Low	Low	0.62
Van Nunen 2012	Electromechanical-assisted walking training with exoskeleton	8 weeks	30 min 2× per week	0.28	0.21	16	Some-times	Unclear	Low	High	2.10
Van Nunen 2012	Conventional walking rehabilitation	8 weeks	60 min 1× per week	0.27	0.21	14	Some-times	Unclear	Low	High	2.10
Wade 1992	Conventional walking rehabilitation	Unclear	Unclear	0.24	0.15	48	Yes	Low	Low	Low	53.10
Wade 1992	No walking rehabilitation	Unclear	Unclear	0.21	0.17	41	Yes	Low	Low	Low	59.60
Watanabe 2014	Electromechanical-assisted walking training with exoskeleton	4 weeks	20 min up to max. 12 sessions	0.85	0.43	17	No	Low	Unclear	High	1.94
Watanabe 2014	Conventional walking rehabilitation	4 weeks	20 min up to max. 12 sessions	0.63	0.50	15	No	Low	Unclear	High	1.68
Weng 2004	Treadmill training with body-weight support	4 weeks	20 min 5× per week	1.31	0.57	25	Yes	Unclear	Unclear	Unclear	1.19
Weng 2004	Conventional walking rehabilitation	4 weeks	20 min 5× per week	0.86	0.38	25	Yes	Unclear	Unclear	Unclear	1.17
Weng 2006	Treadmill training	3 weeks	30 min 5× per week	0.95	0.28	13	Yes	Low	Low	Unclear	2.04
Weng 2006	Conventional walking rehabilitation	3 weeks	60 min 5× per week	0.72	0.27	13	Yes	Low	Low	Unclear	2.07
Werner 2002a	Treadmill training with body-weight support	2 weeks	15 to 20 min 5× per week	0.07	0.19	15	No	Low	Low	Unclear	1.70
Werner 2002a	Electromechanical-assisted walking training with end-effector	2 weeks	20 min 5× per week	0.11	0.19	15	No	Low	Low	Unclear	1.59
Westlake 2009	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 3× per week	0.72	0.38	8	Yes	Unclear	Low	High	44.00
Westlake 2009	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0.65	0.29	8	Yes	Unclear	Low	High	37.00

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Yen 2008	Treadmill training with body-weight support	4 weeks	30 min 3× per week	0.92	0.32	7	Yes	Low	Low	High	2.00
Yen 2008	Conventional walking rehabilitation	4 weeks	50 min 2–3× per week	0.87	0.43	7	Yes	Low	Low	High	2.00
Zhu 2004	Treadmill training with body-weight support	4 weeks	5× per week	0.19	0.11	10	Unclear	Low	Unclear	High	4.10
Zhu 2004	Conventional walking rehabilitation	4 weeks	5× per week	0.17	0.13	10	Unclear	Low	Unclear	High	3.10

ABA, A-B-A study design (A = baseline phase, B = intervention phase); ND, no data; SD, standard deviation

eTABLE 2

Study characteristics and results for the secondary endpoint walking distance

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Ada 2003	Treadmill training with body-weight support	4 weeks	30 min 3× per week	379	122	11	No	Low	Low	Low	28.00
Ada 2003	Conventional walking rehabilitation	4 weeks	30 min 3× per week	269	123	14	No	Low	Low	Low	26.00
Ada 2013	Treadmill training with body-weight support	8 or 16 weeks	30 min 3× per week	271	134	68	Yes	Low	Low	Low	21.00
Ada 2013	No walking rehabilitation	8 or 16 weeks	30 min 3× per week	263	115	34	Yes	Low	Low	Low	19.00
Baer 2017	Treadmill training with body-weight support	8 weeks	More than 2× per week	132	114	35	Yes	Low	Low	Low	1.39
Baer 2017	Conventional walking rehabilitation	8 weeks	More than 2× per week	137	81	34	Yes	Low	Low	Low	1.32
Chua 2016	Electromechanical-assisted walking training with end-effector	8 weeks	Unclear	145	121	53	No	Low	Low	Low	0.89
Chua 2016	Conventional walking rehabilitation	8 weeks	Unclear	157	144	53	No	Low	Low	Low	0.99
Combs-Miller 2014	Treadmill training with body-weight support	2 weeks	30 min 5× per week	249	116	10	Yes	Unclear	Low	Low	72.00
Combs-Miller 2014	Conventional walking rehabilitation	2 weeks	30 min 5× per week	272	110	10	Yes	Unclear	Low	Low	60.00
da Cunha Filho 2002	Treadmill training with body-weight support	2 to 3 weeks	20 min 5× per week	87	111	6	No	Low	High	High	0.52
da Cunha Filho 2002	Conventional walking rehabilitation	2 to 3 weeks	20 min 5× per week	57	59	7	No	Low	High	High	0.62
Deniz 2011	Treadmill training with body-weight support	4 weeks	60 min 5× per week	148	22	10	Yes	Unclear	Unclear	Unclear	2.33
Deniz 2011	Conventional walking rehabilitation	4 weeks	60 min 5× per week	70	61	10	Yes	Unclear	Unclear	Unclear	2.66
DePaul 2015	Treadmill training with body-weight support	5 weeks	Up to 30 min, up to 15 sessions	239	120	36	Yes	Low	Low	Low	4.37
DePaul 2015	Conventional walking rehabilitation	5 weeks	Up to 40 min, up to 15 sessions	268	135	35	Yes	Low	Low	Low	4.14
Duncan 2011	Treadmill training with body-weight support	12 to 16 weeks	90 min 3× per week	186	135	282	No	Unclear	Low	High	4.00
Duncan 2011	Conventional walking rehabilitation	12 to 16 weeks	90 min 3× per week	202	144	126	No	Unclear	Low	High	2.00
Eich 2004	Treadmill training with body-weight support	6 weeks	30 min 5× per week	199	81	25	Yes	Low	Low	Unclear	1.40
Eich 2004	Conventional walking rehabilitation	6 weeks	30 min 5× per week	164	69	25	Yes	Low	Low	Unclear	1.45
Franceschini 2009	Treadmill training with body-weight support	5 weeks	60 min 5× per week	160	84	52	No	Low	Unclear	Low	0.56
Franceschini 2009	Conventional walking rehabilitation	5 weeks	60 min 5× per week	170	119	50	No	Low	Unclear	Low	0.46
Gama 2007	Treadmill training with body-weight support	6 weeks	45 min 3× per week	291	148	16	Yes	Low	Unclear	High	60.00
Gama 2007	Conventional walking rehabilitation	6 weeks	45 min 3× per week	283	139	16	Yes	Low	Unclear	High	54.00
Globas 2011	Treadmill training	12 weeks	30 to 50 min 3× per week	332	138	20	Yes	Low	Low	High	60.00

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Globas 2011	Conventional walking rehabilitation	13 weeks	60 min 3× per week	266	189	18	Yes	Low	Low	High	70.00
Hidler 2009	Electromechanical-assisted walking training with exoskeleton	8 to 10 weeks	45 min 3× per week	168	59	36	Yes	Low	Unclear	High	3.65
Hidler 2009	Conventional walking rehabilitation	8 to 10 weeks	45 min 3× per week	218	64	36	Yes	Low	Unclear	High	4.57
Hornby 2008	Electromechanical-assisted walking training with exoskeleton	12 sessions	30 min	186	88	31	Yes	Low	Low	High	50.00
Hornby 2008	Conventional walking rehabilitation	12 sessions	30 min	204	96	31	Yes	Low	Low	High	73.00
Hoyer 2012	Treadmill training with body-weight support	Minimum 10 weeks	30 min	138	95	30	No	Low	Unclear	Low	3.25
Hoyer 2012	Conventional walking rehabilitation	Minimum 10 weeks	30 min 5× per week	115	84	30	No	Low	Unclear	Low	3.16
Kang 2012	Treadmill training	4 weeks	30 min 3× per week	251	22	22	Yes	Low	Low	Low	14.00
Kang 2012	Conventional walking rehabilitation	4 weeks	30 min 3× per week	241	22	10	Yes	Low	Low	Low	15.00
Kim 2016	Treadmill training	4 weeks	30 min 3× per week	36	32	10	Yes	Unclear	Low	Unclear	7.50
Kim 2016	Conventional walking rehabilitation	4 weeks	60 min 5× per week	33	48	17	Yes	Unclear	Low	Unclear	14.94
Kosak 2000	Treadmill training with body-weight support	2 to 3 weeks	45 min 5× per week	23	76	22	No	Low	Low	High	1.28
Kosak 2000	Conventional walking rehabilitation	2 to 3 weeks	45 min 5× per week	31	72	34	No	Low	Low	High	1.32
Kuys 2011	Treadmill training with speed paradigm	6 weeks	30 min 3× per week	284	139	15	Yes	Low	Low	Low	1.71
Kuys 2011	Conventional walking rehabilitation	6 weeks	30 min 3× per week	279	163	15	Yes	Low	Low	Low	1.61
Langhammer 2010	Treadmill training	Circa 10 units	30 min to max. 5× per week	321	154	21	No	Low	Low	Low	13.78
Langhammer 2010	Conventional walking rehabilitation	Circa 11 units	30 min to max. 5× per week	310	164	18	No	Low	Low	Low	11.47
Luft 2008	Treadmill training	24 weeks	40 min 3× per week	227	146	57	Yes	Low	High	Low	55.00
Luft 2008	Conventional walking rehabilitation	24 weeks	40 min 3× per week	205	158	56	Yes	Low	High	Low	63.00
MacKay-Lyons 2013	Treadmill training with body-weight support	6 weeks	40 min 6× per week	279	89	24	Yes	Low	Low	Low	0.76
MacKay-Lyons 2013	Conventional walking rehabilitation	6 weeks	40 min 6× per week	232	80	26	Yes	Low	Low	Low	0.76
Macko 2005	Treadmill training	24 weeks	40 min 3× per week	281	120	25	Yes	Low	High	Low	35.00
Macko 2005	Conventional walking rehabilitation	24 weeks	40 min 3× per week	265	136	20	Yes	Low	High	Low	39.00
Middleton 2014	Treadmill training with body-weight support	1.5 weeks	60 min 5× per week	338	204	27	No	High	High	Low	50.40
Middleton 2014	Conventional walking rehabilitation	1.5 weeks	60 min 5× per week	239	166	23	No	High	High	Low	29.00

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Moore 2010	Treadmill training with body-weight support	4 weeks	2–5× per week	276	130	15	Yes	Unclear	Unclear	Unclear	13.00
Moore 2010	No walking rehabilitation	ND	ND	201	134	15	Yes	Unclear	Unclear	Unclear	13.00
Noser 2012	Electromechanical-assisted walking training with exoskeleton	Unclear	Unclear	57	26	11	Yes	Unclear	Unclear	Low	44.52
Noser 2012	Conventional walking rehabilitation	Unclear	Unclear	70	60	9	Yes	Unclear	Unclear	Low	17.26
Olawale 2009	Treadmill training	12 weeks	25 min 3× per week	145	75	20	Yes	Unclear	Unclear	Unclear	10.20
Olawale 2009	Conventional walking rehabilitation	12 weeks	25 min 3× per week	146	65	40	Yes	Unclear	Unclear	Unclear	10.50
Pang 2005	Conventional walking rehabilitation	19 weeks	60 min 3× per week	393	151	32	Yes	Low	Low	Low	62.40
Pang 2005	No walking rehabilitation	19 weeks	60 min 3× per week	342	133	31	Yes	Low	Low	Low	61.20
Park 2013	Treadmill training	1 week	2× 30 min, 5 days per week	234	42	20	Yes	Low	Unclear	High	21.00
Park 2013	Conventional walking rehabilitation	1 week	2× 30 min, 5 days per week	225	47	20	Yes	Low	Unclear	High	16.00
Park 2015	Treadmill training	3 weeks	30 min 5× per week	126	50	9	Yes	High	High	High	10.00
Park 2015	Conventional walking rehabilitation	3 weeks	30 min 5× per week	123	39	10	Yes	High	High	High	13.00
Peurala 2005	Electromechanical-assisted walking training with end-effector	3 weeks	20 min 5× per week	164	103	30	Some-times	Low	Low	High	30.00
Peurala 2005	Conventional walking rehabilitation	3 weeks	20 min 5× per week	135	68	15	Some-times	Low	Low	High	48.00
Picelli 2016	Electromechanical-assisted walking training with end-effector	1 week	30 min 5× per week	200	53	11	Yes	Low	Low	Low	72.00
Picelli 2016	No walking rehabilitation	ND	ND	159	79	11	Yes	Low	Low	Low	72.00
Pohl 2007	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	134	126	77	No	Low	Low	Low	0.97
Pohl 2007	Conventional walking rehabilitation	4 weeks	20 min 5× per week	93	105	78	No	Low	Low	Low	1.04
Salbach 2004	Conventional walking rehabilitation	6 weeks	3× per week	249	136	44	Unclear	Low	Low	Low	7.86
Salbach 2004	No walking rehabilitation	6 weeks	3× per week	209	132	47	Unclear	Low	Low	Low	7.13
Saltuari 2004	Electromechanical-assisted walking training with exoskeleton	2 weeks	ABA study; in phase A 30 min 5× per week	81	62	8	Some-times	Low	Unclear	Unclear	3.60
Saltuari 2004	Conventional walking rehabilitation	2 weeks	ABA study; in phase A 30 min 5× per week	58	43	8	Some-times	Low	Unclear	Unclear	1.90
Srivastava 2016a	Treadmill training with body-weight support	4 weeks	30 min 5× per week	285	85	13	No	Low	Unclear	Low	12.88
Srivastava 2016a	Treadmill training	4 weeks	30 min 5× per week	279	72	12	No	Low	Unclear	Low	14.53

Study	Intervention	Duration	Frequency and time	Mean (m/s)	SD	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Srivastava 2016a	Conventional walking rehabilitation	4 weeks	30 min 5× per week	290	67	15	No	Low	Unclear	Low	21.44
Srivastava 2016b	Electromechanical-assisted walking training with exoskeleton	3 weeks	40 min 5× per week	260	110	6	Unclear	Unclear	Unclear	Unclear	53.80
Srivastava 2016b	Treadmill training with body-weight support	3 weeks	40 min 5× per week	258	72	6	Unclear	Unclear	Unclear	Unclear	15.30
Stein 2014	Electromechanical-assisted walking training with exoskeleton	6 weeks	60 min 3× per week	213	108	12	Yes	Unclear	Unclear	Low	49.00
Stein 2014	Conventional walking rehabilitation	6 weeks	60 min 3× per week	195	83	12	Yes	Unclear	Unclear	Low	89.00
Sullivan 2007	Treadmill training with body-weight support	6 weeks	60 min 4× per week	236	126	60	Yes	Low	Low	Low	23.80
Sullivan 2007	Conventional walking rehabilitation	6 weeks	60 min 4× per week	171	123	20	Yes	Low	Low	Low	28.40
Toledano-Zarhi 2011	Treadmill training	6 weeks	90 min 2× per week	469	190	14	Yes	Unclear	Unclear	Unclear	0.36
Toledano-Zarhi 2011	No walking rehabilitation	ND	ND	484	123	14	Yes	Unclear	Unclear	Unclear	0.36
Waldman 2013	Electromechanical-assisted walking training with end-effector	6 weeks	60 min 3× per week	217	107	12	Yes	Unclear	High	High	41.00
Waldman 2013	Conventional walking rehabilitation	6 weeks	60 min 3× per week	209	121	12	Yes	Unclear	High	High	30.00
Watanabe 2014	Electromechanical-assisted walking training with exoskeleton	4 weeks	20 min to max. 12 sessions	157	138	17	No	Low	Unclear	High	1.94
Watanabe 2014	Conventional walking rehabilitation	4 weeks	20 min to max. 12 sessions	135	132	15	No	Low	Unclear	High	1.68
Westlake 2009	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 3× per week	278	177	8	Yes	Unclear	Low	High	44.00
Westlake 2009	Conventional walking rehabilitation	4 weeks	30 min 3× per week	212	114	8	Yes	Unclear	Low	High	37.00

ABA, A-B-A study design (A = baseline phase, B = intervention phase); ND, no data; SD, standard deviation

eTABLE 3

Study characteristics and results for the secondary endpoint walking ability

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of random-ization sequence)	Risk of bias (concealment of randomi-zation sequence)	Risk of bias (blinding of investigators)	Months after stroke
Ada 2010	Treadmill training with body-weight support	4 weeks	30 min 3× per week	40	64	No	Low	Low	Low	28.00
Ada 2010	Conventional walking rehabilitation	4 weeks	30 min 3× per week	48	62	No	Low	Low	Low	26.00
Aschbach-er 2006	Electromechanical-assisted walking training with exoskeleton	3 weeks	30 min 5× per week	0	11	Some-times	Unclear	Unclear	Unclear	Unclear
Aschbach-er 2006	Conventional walking rehabilitation	3 weeks	30 min 5× per week	0	12	Some-times	Unclear	Unclear	Unclear	Unclear
Chang 2012	Electromechanical-assisted walking training with exoskeleton	1.5 weeks	100 min 5× per week	4	24	Some-times	Unclear	Unclear	High	0.53
Chang 2012	Conventional walking rehabilitation	1.5 weeks	100 min 5× per week	1	24	Some-times	Unclear	Unclear	High	0.59
da Cunha Filho 2002	Treadmill training with body-weight support	2 to 3 weeks	20 min 5× per week	3	6	No	Low	High	High	0.52
da Cunha Filho 2002	Conventional walking rehabilitation	2 to 3 weeks	20 min 5× per week	3	7	No	Low	High	High	0.62
Duncan 2011	Treadmill training with body-weight support	12 to 16 weeks	90 min 3× per week	135	282	No	Unclear	Low	High	4.00
Duncan 2011	Conventional walking rehabilitation	12 to 16 weeks	90 min 3× per week	61	126	No	Unclear	Low	High	2.00
Fisher 2008	Electromechanical-assisted walking training with exoskeleton	24 units	3–5× per week	9	10	Some-times	Unclear	Unclear	Low	Unclear
Fisher 2008	Conventional walking rehabilitation	24 units	3–5× per week	9	10	Some-times	Unclear	Unclear	Low	Unclear
France-schini 2009	Treadmill training with body-weight support	5 weeks	60 min 5× per week	0	52	No	Low	Unclear	Low	0.56
France-schini 2009	Conventional walking rehabilitation	5 weeks	60 min 5× per week	0	50	No	Low	Unclear	Low	0.46
Husemann 2007	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 5× per week	0	17	No	Low	Low	Low	2.60
Husemann 2007	Conventional walking rehabilitation	4 weeks	30 min 5× per week	0	15	No	Low	Low	Low	2.93
Kosak 2000	Treadmill training with body-weight support	2 to 3 weeks	45 min 5× per week	20	22	No	Low	Low	High	1.28
Kosak 2000	Conventional walking rehabilitation	2 to 3 weeks	45 min 5× per week	28	34	No	Low	Low	High	1.32
Kyung 2008	Electromechanical-assisted walking training with exoskeleton	4 weeks	45 min 3× per week	12	18	Some-times	Unclear	Unclear	Unclear	22.00
Kyung 2008	Conventional walking rehabilitation	4 weeks	45 min 3× per week	7	17	Some-times	Unclear	Unclear	Unclear	29.00
Mayr 2008	Electromechanical-assisted walking training with exoskeleton	8 weeks	45 min 5× per week	9	37	Some-times	Unclear	Unclear	Unclear	Unclear
Mayr 2008	Conventional walking rehabilitation	8 weeks	45 min 5× per week	7	37	Some-times	Unclear	Unclear	Unclear	Unclear
Morone 2011	Electromechanical-assisted walking training with end-effector	4 weeks	40 min 5× per week	19	24	No	Low	Low	Low	0.62

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of random-ization sequence)	Risk of bias (concealment of randomi-zation sequence)	Risk of bias (blinding of investigators)	Months after stroke
Morone 2011	Conventional walking rehabilitation	4 weeks	40 min 5× per week	10	24	No	Low	Low	Low	0.66
Nilsson 2001a	Treadmill training with body-weight support	9 to 10 weeks	30 min 5× per week	4	24	No	Low	Low	Low	0.72
Nilsson 2001a	Conventional walking rehabilitation	9 to 10 weeks	30 min 5× per week	4	25	No	Low	Low	Low	0.56
Peurala 2005	Electromechanical-assisted walking training with end-effector	3 weeks	20 min 5× per week	14	30	Some-times	Low	Low	High	30.00
Peurala 2005	Conventional walking rehabilitation	3 weeks	20 min 5× per week	9	15	Some-times	Low	Low	High	48.00
Peurala 2009	Electromechanical-assisted walking training with end-effector	3 weeks	55 min 3× per week	5	22	Some-times	Low	Low	High	0.26
Peurala 2009	Conventional walking rehabilitation	3 weeks	55 min 3× per week	5	34	Some-times	Low	Low	High	0.26
Pohl 2007	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	41	77	No	Low	Low	Low	0.97
Pohl 2007	Conventional walking rehabilitation	4 weeks	20 min 5× per week	17	78	No	Low	Low	Low	1.04
Saltuari 2004	Electromechanical-assisted walking training with exoskeleton	2 weeks	ABA study; in phase A 30 min 5× per week	1	8	Some-times	Low	Unclear	Unclear	3.60
Saltuari 2004	Conventional walking rehabilitation	2 weeks	ABA study; in phase A 30 min 5× per week	1	8	Some-times	Low	Unclear	Unclear	1.90
Scheidt-mann 1999	Treadmill training with body-weight support	3 weeks	60 min 5× per week	10	15	No	Unclear	Unclear	Unclear	1.71
Scheidt-mann 1999	Conventional walking rehabilitation	3 weeks	60 min 5× per week	11	15	No	Unclear	Unclear	Unclear	1.71
Schwartz 2006	Electromechanical-assisted walking training with exoskeleton	6 weeks	3× per week	20	37	Some-times	Unclear	Unclear	High	0.72
Schwartz 2006	Conventional walking rehabilitation	6 weeks	3× per week	8	30	Some-times	Unclear	Unclear	High	0.79
Tong 2006	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	12	33	No	Low	Low	Low	0.58
Tong 2006	Conventional walking rehabilitation	4 weeks	20 min 5× per week	6	21	No	Low	Low	Low	0.62
Van Nunen 2012	Electromechanical-assisted walking training with exoskeleton	8 weeks	30 min 2× per week	12	16	Some-times	Unclear	Low	High	2.10
Van Nunen 2012	Conventional walking rehabilitation	8 weeks	60 min 1× per week	8	14	Some-times	Unclear	Low	High	2.10
Werner 2002a	Treadmill training with body-weight support	2 weeks	15 to 20 min 5× per week	13	15	No	Low	Low	Unclear	1.70
Werner 2002a	Electromechanical-assisted walking training with end-effector	2 weeks	20 min 5× per week	10	15	No	Low	Low	Unclear	1.59

ABA, A-B-A study design (A = baseline phase, B = intervention phase); SD, standard deviation

eTABLE 4

Study characteristics and results for the secondary endpoint safety

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Ada 2003	Treadmill training with body-weight support	4 weeks	30 min 3× per week	3	14	No	Low	Low	Low	28.00
Ada 2003	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0	15	No	Low	Low	Low	26.00
Ada 2010	Treadmill training with body-weight support	4 weeks	30 min 3× per week	0	64	No	Low	Low	Low	0.59
Ada 2010	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0	62	No	Low	Low	Low	0.59
Aschbacher 2006	Electromechanical-assisted walking training with exoskeleton	3 weeks	30 min 5× per week	1	11	Some-times	Unclear	Unclear	Unclear	Unclear
Aschbacher 2006	Conventional walking rehabilitation	3 weeks	30 min 5× per week	3	12	Some-times	Unclear	Unclear	Unclear	Unclear
Baer 2017	Treadmill training with body-weight support	8 weeks	More than 2× per week	2	35	Yes	Low	Low	Low	1.39
Baer 2017	Conventional walking rehabilitation	8 weeks	More than 2× per week	0	34	Yes	Low	Low	Low	1.32
Bang 2016	Electromechanical-assisted walking training with exoskeleton	4 weeks	60 min 5× per week	0	9	Yes	Low	Low	Low	12.00
Bang 2016	Treadmill training	4 weeks	60 min 5× per week	0	9	Yes	Low	Low	Low	13.00
Brincks 2011	Electromechanical-assisted walking training with exoskeleton	3 weeks	Unclear	0	7	Yes	Low	Low	High	1.84
Brincks 2011	Conventional walking rehabilitation	3 weeks	Unclear	0	6	Yes	Low	Low	High	0.69
Buesing 2015	Electromechanical-assisted walking training with exoskeleton	6 to 8 weeks	3× per week to max. 18 sessions	0	25	Yes	Low	High	Low	84.00
Buesing 2015	Conventional walking rehabilitation	6 to 8 weeks	3× per week to max. 18 sessions	0	25	Yes	Low	High	Low	60.00
Chang 2012	Electromechanical-assisted walking training with exoskeleton	1.5 weeks	100 min 5× per week	3	24	Some-times	Unclear	Unclear	Unclear	0.53
Chang 2012	Conventional walking rehabilitation	1.5 weeks	100 min 5× per week	4	24	Some-times	Unclear	Unclear	Unclear	0.59
Cho 2015	Electromechanical-assisted walking training with exoskeleton	8 weeks	60 min 5× per week	0	13	No	Unclear	High	High	15
Cho 2015	Conventional walking rehabilitation	8 weeks	60 min 5× per week	0	7	No	Unclear	High	High	13
Chua 2016	Electromechanical-assisted walking training with end-effector	8 weeks	Unclear	7	53	No	Low	Low	Low	0.89
Chua 2016	Conventional walking rehabilitation	8 weeks	Unclear	13	53	No	Low	Low	Low	0.99
da Cunha Filho 2002	Treadmill training with body-weight support	2 to 3 weeks	20 min 5× per week	0	7	No	Low	High	High	0.52
da Cunha Filho 2002	Conventional walking rehabilitation	2 to 3 weeks	20 min 5× per week	0	8	No	Low	High	High	0.62
Dias 2006	Electromechanical-assisted walking training with end-effector	5 weeks	5× per week	0	20	Yes	Unclear	Low	High	47.00

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of random-ization sequence)	Risk of bias (concealment of random-ization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Dias 2006	Conventional walking rehabilitation	5 weeks	5× per week	0	10	Yes	Unclear	Low	High	48.00
Duncan 2011	Treadmill training with body-weight support	12 to 16 weeks	90 min 3× per week	104	282	No	Unclear	Low	High	4.00
Duncan 2011	Conventional walking rehabilitation	12 to 16 weeks	90 min 3× per week	35	126	No	Unclear	Low	High	2.00
Eich 2004	Treadmill training with body-weight support	6 weeks	30 min 5× per week	0	25	Yes	Low	Low	Unclear	1.40
Eich 2004	Conventional walking rehabilitation	6 weeks	30 min 5× per week	0	25	Yes	Low	Low	Unclear	1.45
Fisher 2008	Electromechanical-assisted walking training with exoskeleton	24 units	3–5× per week	3	10	Some-times	Unclear	Unclear	Low	Unclear
Fisher 2008	Conventional walking rehabilitation	24 units	3–5× per week	0	10	Some-times	Unclear	Unclear	Low	Unclear
Forrester 2014	Electromechanical-assisted walking training with exoskeleton	8 to 10 sessions	60 min	3	21	No	Unclear	High	High	0.39
Forrester 2014	Conventional walking rehabilitation	8 to 10 sessions	60 min	2	18	No	Unclear	High	High	0.36
Frances-chini 2009	Treadmill training with body-weight support	5 weeks	60 min 5× per week	2	52	No	Low	Unclear	Low	0.56
Frances-chini 2009	Conventional walking rehabilitation	5 weeks	60 min 5× per week	0	50	No	Low	Unclear	Low	0.46
Gama 2007	Treadmill training with body-weight support	6 weeks	45 min 3× per week	0	16	Yes	Low	Unclear	High	60.00
Gama 2007	Conventional walking rehabilitation	6 weeks	45 min 3× per week	0	16	Yes	Low	Unclear	High	54.00
Geroin 2011	Electromechanical-assisted walking training with end-effector	2 weeks	50 min 5× per week	0	20	Yes	Low	Low	High	26.00
Geroin 2011	Conventional walking rehabilitation	2 weeks	50 min 5× per week	0	10	Yes	Low	Low	High	27.00
Han 2016	Electromechanical-assisted walking training with exoskeleton	4 weeks	60 min 5× per week	0	30	No	Unclear	Unclear	Low	0.73
Han 2016	Conventional walking rehabilitation	4 weeks	60 min 5× per week	4	30	No	Unclear	Unclear	Low	0.59
Hidler 2009	Electromechanical-assisted walking training with exoskeleton	8 to 10 weeks	45 min 3× per week	3	36	Yes	Low	Unclear	High	3.65
Hidler 2009	Conventional walking rehabilitation	8 to 10 weeks	45 min 3× per week	6	36	Yes	Low	Unclear	High	4.57
Hornby 2008	Electromechanical-assisted walking training with exoskeleton	12 sessions	30 min	4	31	Yes	Low	Low	High	50.00
Hornby 2008	Conventional walking rehabilitation	12 sessions	30 min	10	31	Yes	Low	Low	High	73.00
Husemann 2007	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 5× per week	1	17	No	Low	Low	Low	2.60
Husemann 2007	Conventional walking rehabilitation	4 weeks	30 min 5× per week	1	15	No	Low	Low	Low	2.93
Jaffe 2004	Treadmill training	2 weeks	60 min 3× per week	0	11	Yes	High	Unclear	Low	46.80
Jaffe 2004	Conventional walking rehabilitation	2 weeks	60 min 3× per week	0	12	Yes	High	Unclear	Low	43.20

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Kim 2011	Treadmill training	6 weeks	30 min 5× per week	0	20	Yes	Unclear	High	Unclear	15.00
Kim 2011	Conventional walking rehabilitation	6 weeks	30 min 5× per week	0	24	Yes	Unclear	High	Unclear	14.00
Kyung 2008	Electromechanical-assisted walking training with exoskeleton	4 weeks	45 min 3× per week	1	18	Sometimes	Unclear	Unclear	Unclear	22.00
Kyung 2008	Conventional walking rehabilitation	4 weeks	45 min 3× per week	9	17	Sometimes	Unclear	Unclear	Unclear	29.00
Laufer 2001	Treadmill training	3 weeks	8 to 20 min 5× per week	0	15	No	High	High	Low	1.07
Laufer 2001	Conventional walking rehabilitation	3 weeks	8 to 20 min 5× per week	0	14	No	High	High	Low	1.18
Liston 2000	Treadmill training	4 weeks	60 min 3× per week	2	10	Unclear	Low	High	Low	Unclear
Liston 2000	Conventional walking rehabilitation	4 weeks	60 min 3× per week	0	8	Unclear	Low	High	Low	Unclear
MacKay-Lyons 2013	Treadmill training with body-weight support	6 weeks	40 min 6× per week	0	24	Yes	Low	Low	Low	0.76
MacKay-Lyons 2013	Conventional walking rehabilitation	6 weeks	40 min 6× per week	0	26	Yes	Low	Low	Low	0.76
Macko 2005	Treadmill training	24 weeks	40 min 3× per week	11	32	Yes	Low	High	Low	35.00
Macko 2005	Conventional walking rehabilitation	24 weeks	40 min 3× per week	0	29	Yes	Low	High	Low	39.00
Mayr 2008	Electromechanical-assisted walking training with exoskeleton	8 weeks	45 min 5× per week	4	37	Sometimes	Unclear	Unclear	Unclear	Unclear
Mayr 2008	Conventional walking rehabilitation	8 weeks	45 min 5× per week	9	37	Sometimes	Unclear	Unclear	Unclear	Unclear
Morone 2011	Electromechanical-assisted walking training with end-effector	4 weeks	40 min 5× per week	12	24	No	Low	Low	Low	0.62
Morone 2011	Conventional walking rehabilitation	4 weeks	40 min 5× per week	9	24	No	Low	Low	Low	0.66
Nilsson 2001	Treadmill training with body-weight support	9 to 10 weeks	30 min 5× per week	0	36	No	Low	Low	Low	0.72
Nilsson 2001	Conventional walking rehabilitation	9 to 10 weeks	30 min 5× per week	0	37	No	Low	Low	Low	0.56
Noser 2012	Electromechanical-assisted walking training with exoskeleton	Unclear	Unclear	0	11	Yes	Unclear	Unclear	Low	44.52
Noser 2012	Conventional walking rehabilitation	Unclear	Unclear	1	10	Yes	Unclear	Unclear	Low	17.26
Ochi 2015	Electromechanical-assisted walking training with exoskeleton	4 weeks	20 min 5× per week	0	13	No	Unclear	Unclear	Low	0.76
Ochi 2015	Conventional walking rehabilitation	4 weeks	20 min 5× per week	0	13	No	Unclear	Unclear	Low	0.85
Peurala 2005	Electromechanical-assisted walking training with end-effector	3 weeks	20 min 5× per week	0	30	Sometimes	Low	Low	High	30.00
Peurala 2005	Conventional walking rehabilitation	3 weeks	20 min 5× per week	0	15	Sometimes	Low	Low	High	48.00
Peurala 2009	Electromechanical-assisted walking training with end-effector	3 weeks	55 min 3× per week	5	22	Sometimes	Low	Low	High	0.26

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of randomization sequence)	Risk of bias (concealment of randomization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Peurala 2009	Conventional walking rehabilitation	3 weeks	55 min 3× per week	4	34	Sometimes	Low	Low	High	0.26
Picelli 2016	Electromechanical-assisted walking training with end-effector	1 Woche	30 min 5× per week	0	11	Yes	Low	Low	Low	72.00
Picelli 2016	No walking rehabilitation	ND	ND	0	11	Yes	Low	Low	Low	72.00
Pohl 2002	Treadmill training with speed paradigm	4 weeks	30 min 3× per week	1	44	Yes	Unclear	Unclear	High	3.80
Pohl 2002	Conventional walking rehabilitation	4 weeks	45 min 3× per week	0	25	Yes	Unclear	Unclear	High	3.71
Pohl 2007	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	5	77	No	Low	Low	Low	0.97
Pohl 2007	Conventional walking rehabilitation	4 weeks	20 min 5× per week	6	78	No	Low	Low	Low	1.04
Richards 1993	Treadmill training	5 weeks	105 min 5× per week	0	10	No	Unclear	Unclear	Unclear	0.43
Richards 1993	Conventional walking rehabilitation	5 weeks	105 min 5× per week	0	8	No	Unclear	Unclear	Unclear	0.43
Richards 2004	Treadmill training	8 weeks	60 min 5× per week	2	32	Yes	Low	Low	Low	0.27
Richards 2004	Conventional walking rehabilitation	8 weeks	60 min 5× per week	1	31	Yes	Low	Low	Low	0.29
Saltuari 2004	Electromechanical-assisted walking training with exoskeleton	2 weeks	ABA study; in phase A 30 min 5× per week	0	8	Sometimes	Low	Unclear	Unclear	3.60
Saltuari 2004	Conventional walking rehabilitation	2 weeks	ABA study; in phase A 30 min 5× per week	0	8	Sometimes	Low	Unclear	Unclear	1.90
Scheidtmann 1999	Treadmill training with body-weight support	3 weeks	60 min 5× per week	0	15	No	Unclear	Unclear	Unclear	1.71
Scheidtmann 1999	Conventional walking rehabilitation	3 weeks	60 min 5× per week	0	15	nein	Unclear	Unclear	Unclear	1.71
Schwartz 2006	Electromechanical-assisted walking training with exoskeleton	6 weeks	3× per week	4	37	Sometimes	Unclear	Unclear	Hoch	0.72
Schwartz 2006	Conventional walking rehabilitation	6 weeks	3× per week	2	30	Sometimes	Unclear	Unclear	Hoch	0.79
Smith 2008	Treadmill training	4 weeks	12 sessions of 20 min	0	10	ja	Unclear	Unclear	Hoch	Unclear
Smith 2008	No walking rehabilitation	ND	ND	0	10	Yes	Unclear	Unclear	High	Unclear
Stein 2014	Electromechanical-assisted walking training with exoskeleton	6 weeks	60 min 3× per week	0	12	Yes	Unclear	Unclear	Low	49.00
Stein 2014	Conventional walking rehabilitation	6 weeks	60 min 3× per week	0	12	Yes	Unclear	Unclear	Low	89.00
Tanaka 2012	Conventional walking rehabilitation	4 weeks	ABA study; in phase B 20 min circa 2–3× per week	0	7	Yes	Low	Unclear	High	55.00
Tanaka 2012	No walking rehabilitation	ND	ND	0	5	Yes	Low	Unclear	High	65.00
Toledano-Zarhi 2011	Treadmill training	6 weeks	90 min 2× per week	0	14	Yes	Unclear	Unclear	Unclear	0.36

Study	Intervention	Duration	Frequency and time	e	n	Severity (able to walk unaided)	Risk of bias (generation of random-ization sequence)	Risk of bias (concealment of random-ization sequence)	Risk of bias (blinding of investigators)	Months after stroke
Toledano-Zarhi 2011	No walking rehabilitation	ND	ND	0	14	Yes	Unclear	Unclear	Unclear	0.36
Tong 2006	Electromechanical-assisted walking training with end-effector	4 weeks	20 min 5× per week	0	33	No	Low	Low	Low	0.58
Tong 2006	Conventional walking rehabilitation	4 weeks	20 min 5× per week	4	21	No	Low	Low	Low	0.62
Ucar 2014	Electromechanical-assisted walking training with exoskeleton	2 weeks	30 min 5× per week	0	11	Yes	Low	Unclear	Low	Unclear
Ucar 2014	Conventional walking rehabilitation	2 weeks	30 min 5× per week	0	11	Yes	Low	Unclear	Low	Unclear
Van Nunen 2012	Electromechanical-assisted walking training with exoskeleton	8 weeks	30 min 2× per week	0	16	Some-times	Unclear	Low	High	2.10
Van Nunen 2012	Conventional walking rehabilitation	8 weeks	60 min 1× per week	0	14	Some-times	Unclear	Low	High	2.10
Visintin 1998	Treadmill training	6 weeks	20 min 4× per week	0	50	Some-times	Low	Low	Low	2.24
Visintin 1998	Treadmill training with body-weight support	6 weeks	20 min 4× per week	0	50	Some-times	Low	Low	Low	2.56
Waldman 2013	Electromechanical-assisted walking training with end-effector	6 weeks	60 min 3× per week	0	12	Yes	Unclear	High	High	41.00
Waldman 2013	Conventional walking rehabilitation	6 weeks	60 min 3× per week	0	12	Yes	Unclear	High	High	30.00
Watanabe 2014	Electromechanical-assisted walking training with exoskeleton	4 weeks	20 min, max. 12 sessions	6	17	No	Low	Unclear	High	1.94
Watanabe 2014	Conventional walking rehabilitation	4 weeks	20 min, max. 12 sessions	4	15	No	Low	Unclear	High	1.68
Werner 2002a	Treadmill training with body-weight support	2 weeks	15 to 20 min 5× per week	0	15	No	Low	Low	Unclear	1.70
Werner 2002a	Electromechanical-assisted walking training with end-effector	2 weeks	20 min 5× per week	0	15	No	Low	Low	Unclear	1.59
Westlake 2009	Electromechanical-assisted walking training with exoskeleton	4 weeks	30 min 3× per week	0	8	Yes	Unclear	Low	High	44.00
Westlake 2009	Conventional walking rehabilitation	4 weeks	30 min 3× per week	0	8	Yes	Unclear	Low	High	37.00

ABA, A-B-A study design (A = baseline phase, B = intervention phase); ND, no data; SD, standard deviation

eTABLE 5

SUCRA for the primary endpoint, walking speed

Intervention	SUCRA
Electromechanical-assisted walking training with end-effector	92.2
Treadmill training with speed paradigm	69.3
Treadmill training with body-weight support	69.1
Treadmill training	57.3
Electromechanical-assisted walking training with exoskeleton	23.5
No walking rehabilitation	20.0
Conventional walking rehabilitation	18.6

SUCRA is a relative ranking of the competing interventions on the basis of their surface under the cumulative ranking line. This represents the percent efficacy or safety of a given treatment in relation to an "ideal" treatment.

eTABLE 6

SUCRA for the secondary endpoint walking distance

Intervention	SUCRA
Electromechanical-assisted walking training with end-effector	86.7
Treadmill training with body-weight support	76.8
Treadmill training	57.4
Treadmill training with speed paradigm	49.0
No walking rehabilitation	39.5
Electromechanical-assisted walking training with exoskeleton	20.8
Conventional walking rehabilitation	19.9

SUCRA is a relative ranking of the competing interventions on the basis of their surface under the cumulative ranking line. This represents the percent efficacy or safety of a given treatment in relation to an "ideal" treatment.

eTABLE 7

SUCRA for the secondary endpoint safety

Intervention	SUCRA
Electromechanical-assisted walking training with exoskeleton	88.6
Electromechanical-assisted walking training with end-effector	64.1
No walking rehabilitation	59.1
Treadmill training with speed paradigm	42.1
Conventional walking rehabilitation	41.1
Treadmill training with body-weight support	33.8
Treadmill training	21.3

SUCRA is a relative ranking of the competing interventions on the basis of their surface under the cumulative ranking line. This represents the percent efficacy or safety of a given treatment in relation to an "ideal" treatment.

eBOX

Search strategy

The following strategy was used for the MEDLINE search via OvidSP and in modified form for the searches in the remaining databases:

1. exp cerebrovascular disorders/ or brain injuries/ or brain injury, chronic/
2. (stroke$ or cva or poststroke or post-stroke).tw.
3. (cerebrovasc$ or cerebral vascular).tw.
4. (cerebral or cerebellar or brain$ or vertebrobasilar).tw.
5. (infarct$ or isch?emi$ or thrombo$ or emboli$ or apoplexy).tw.
6. 4 and 5
7. (cerebral or brain or subarachnoid).tw.
8. (haemorrhage or hemorrhage or haematoma or hematoma or bleed$).tw.
9. 7 and 8
10. hemiplegia/ or exp paresis/
11. (hempar$ or hemipleg$ or brain injur$).tw.
12. Gait Disorders, Neurologic/
13. 1 or 2 or 3 or 6 or 9 or 10 or 11 or 12
14. physical therapy modalities/ or exercise therapy/ or motion therapy, continuous passive/ or musculoskeletal manipulations/
15. *exercise/ or *exercise test/ or exercise therapy/ or motion therapy, continuous passive/
16. robotics/ or automation/ or orthotic devices/ or man-machine systems/ or self-help devices/ or therapy, computer-assisted/
17. body weight/ or weight-bearing/
18. ((gait or locomot$) adj5 (train$ or therapy or rehabilitat$ or re-educat$ or machine$ or powered or device$)).tw.
19. (electromechanical or electro-mechanical or mechanical or mechanised or mechanized or driven or assistive device$).tw.
20. ((body-weight or body weight) adj3 (support$ or relief)).tw.
21. (robot$ or orthos$ or orthotic or automat$ or computer aided or computer assisted or power-assist$).tw.
22. (bws or harness or treadmill or exercise$ or fitness train$ or Lokomat or Locomat or GaiTrainer or GT1 or Kinetron or Haptic Walker or Anklebot or LOPES or AutoAmbulator).tw.
23. ((continuous passive or cpm) adj3 therap$).tw.
24. or/14–23
25. gait/ or exp walking/ or locomotion/
26. „Range of Motion, Articular“/
27. recovery of function/
28. (walk$ or gait$ or ambulat$ or mobil$ or locomot$ or balanc$ or stride).tw.
29. or/25–28
30. body weight/ or weight-bearing/
31. (treadmill$ or tread mill$ or running wheel$ or running machine$).tw.
32. ((walking or walk or exercise) adj5 (machine$ or device$)).tw.
33. ((walking or gait or locomotor or ambulation) adj5 (train$ or re-train$ or retrain$)).tw.
34. exp walking/ and (machine$ or device$ or train$ or re-train$ or retrain$).tw.
35. ((weight or body-weight or bodyweight) adj5 (support$ or suspen$ or relief)).tw.
36. ((walk or walking or ambulat$ or locomot$ or gait or overhead) adj5 support$).tw.
37. harness$.tw.
38. or/30–37
39. exp walking/ or gait/ or mobility limitation/ or locomotion/ or exercise movement techniques/
40. (walk$ or gait$ or ambulat$ or mobil$ or locomot$ or stride).tw.
41. 39 or 40
42. (overground or over ground or surface or floor).tw.
43. 24 or 29 or 38 or 41 or 42
44. Randomized Controlled Trials as Topic/
45. random allocation/
46. Controlled Clinical Trials as Topic/
47. controlgroups/
48. clinical trials as topic/ or clinical trials, phase i as topic/ or clinical trials, phase ii as topic/ or clinical trials, phase iii as topic/ or clinical trials, phase iv as topic/
49. double-blind method/
50. single-blind method/
51. Placebos/
52. placebo effect/
53. cross-over studies/
54. Therapies, Investigational/
55. Research Design/
56. evaluation studies as topic/
57. randomized controlled trial.pt.
58. controlled clinical trial.pt.
59. (clinical trial or clinical trial phase i or clinical trial phase ii or clinical trial phase iii or clinical trial phase iv).pt.
60. (evaluation studies or comparative study).pt.
61. random$.tw.
62. (controlled adj5 (trial$ or stud$)).tw.
63. (clinical$ adj5 trial$).tw.
64. ((control or treatment or experiment$ or intervention) adj5 (group$ or subject$ or patient$)).tw.
65. (quasi-random$ or quasi random$ or pseudo-random$ or pseudo random$).tw.
66. ((multicenter or multicentre or therapeutic) adj5 (trial$ or stud$)).tw.
67. ((control or experiment$ or conservative) adj5 (treatment or therapy or procedure or manage$)).tw.
68. ((singl$ or doubl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).tw.
69. (coin adj5 (flip or flipped or toss$)).tw.
70. versus.tw.
71. (cross-over or cross over or crossover).tw.
72. placebo$.tw.
73. Sham.tw.
74. (assign$ or alternate or allocat$ or counterbalance$ or multiple baseline).tw.
75. or/31–61
76. 13 and 43 and 75
77. exp animals/ not humans.sh.
78. 76 not 77