Treadmill training is effective for ambulatory adults with stroke: a systematic review

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CRD summary
The authors concluded that treadmill training, without body-weight support, improved walking for ambulatory patients after stroke, and this improvement was maintained, but it was unclear if it was more beneficial than overground training. The authors’ conclusions reflected the findings, but they should be considered tentative as the evidence was limited and the long-term effects are unclear.

Authors' objectives
To assess the efficacy of mechanically assisted walking, in improving speed and distance, for patients who were able to walk without help, after a stroke.

Searching
MEDLINE, CINAHL, EMBASE, and PEDro were searched up to April 2012 without language restrictions. Search terms were reported. Reference lists were manually searched and relevant authors were contacted to identify further studies.

Study selection
Eligible for inclusion in the review were peer-reviewed randomised or quasi-randomised trials of adults (>18 years old). To be included, at least 80% of participants had to be ambulatory (as defined in the review) and in the subacute or chronic phase after a stroke. Trials had to compare mechanically assisted walking training, such as treadmill training or a gait trainer without body-weight support, versus no intervention, an intervention that did not involve training, or overground walking. The outcomes of interest were walking speed (10-Metre Walk Test) and distance (Six-Minute Walk Test).

The included trials were of patients with a mean age ranging from 50 to 74 years; just over half the trials were of patients living in the community. Where reported, the mean time after stroke ranged from 1.6 to 27 months. The mean walking speed before intervention ranged from 0.34m to 0.8m per second for intervention groups, and from 0.39m to 0.8m per second for control groups. Training consisted of 25- to 40-minute sessions, three to five times per week, over 2.5 to 26 weeks.

Two reviewers independently screened studies for inclusion; discrepancies were resolved by referral to a third reviewer.

Assessment of study quality
Where available, quality scores were from the Physiotherapy Evidence Database (PEDro). Otherwise, one reviewer assessed trial quality using the PEDro scale, with scores ranging between zero and 10. Criteria included randomisation, allocation concealment, blinding, intention-to-treat analysis, similarity of treatment groups at baseline, drop-outs, reporting of between-group differences, and reporting of point estimates and variability.

Data extraction
One reviewer extracted outcome means and standard deviations to calculate the effect of the intervention on walking speed (converted to m/s) and distance (converted to m) immediately after intervention and after a period of no intervention. A second reviewer checked the extracted data for accuracy. Trial authors were contacted, where necessary, to clarify the data.

Methods of synthesis
Statistical heterogeneity was assessed using $I^2$. A random-effects model was used in the presence of statistical heterogeneity ($I^2>50\%$), otherwise a fixed-effect model was used to combine the outcome data and calculate weighted mean differences and their 95% confidence intervals.

Results of the review
Nine randomised controlled trials (RCTs; 434 participants; range 26 to 102; reported as 977 participants in the abstract) were included in the review. The mean quality of the trials (PEDro score) was 6.7 (range 4 to 8); all trials had adequate randomisation, six (67%) had concealed allocation, six (67%) blinded the outcome assessors, and four (44%) used intention-to-treat analysis. Due to the nature of the trials, none blinded participants or intervention providers.

**Walking speed:** Compared with no intervention or non-walking intervention, treadmill training statistically significantly increased walking speed immediately after intervention (MD 0.14m/s, 95% CI 0.09 to 0.19; seven RCTs). This statistically significant increase extended to follow-up (MD 0.12m/s, 95% CI 0.08 to 0.17; four RCTs). There were no statistically significant differences in speed when comparing treadmill with overground training immediately after intervention (three RCTs).

**Walking distance:** Compared with no intervention or non-walking intervention, treadmill training statistically significantly increased walking distance immediately after intervention (MD 40m, 95% CI 27 to 53; six RCTs), and at follow-up (MD 40m, 95% CI 24 to 55; four RCTs). There were no statistically significant differences in walking distance when comparing treadmill with overground training immediately after intervention (two RCTs).

**Authors’ conclusions**
Treadmill training without body weight support resulted in faster walking speed and greater distance than no intervention or non-walking intervention, for people who were ambulatory after a stroke, and the benefits were maintained beyond the intervention period. It remained unclear if treadmill training was more beneficial than overground training.

**CRD commentary**
The review question and supporting inclusion criteria were clearly stated. Appropriate sources were searched, without language restrictions. Only peer-reviewed articles were sought, so relevant data may have been missed. Trial quality was assessed using appropriate criteria; the authors suggested that quality was high, but highlighted some limitations. Study selection and data extraction were performed by two people, but this does not appear to have been the case for quality assessment, which means that reviewer error and bias cannot be ruled out.

Appropriate methods appear to have been used to combine the data. The authors acknowledged the small samples, and the limited follow-up. They also stated that the reported benefits were likely to be conservative estimates, as some of the non-walking controls may have had some effect on walking.

The authors’ conclusions reflect the findings, with the direction of the effect generally being consistent across trials. The findings should be considered tentative as the evidence was somewhat limited and the long-term effects remain unclear.

**Implications of the review for practice and research**

**Practice:** The authors stated that clinicians should be confident in prescribing treadmill training for ambulatory stroke patients, to improve walking speed and distance, regardless of the subacute or chronic stage of their recovery.

**Research:** The authors stated that further studies were needed to investigate whether treadmill training was better than overground training for improving walking speed and distance.

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