Gait retraining post stroke
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CRD summary
This review found some evidence to support the use of strength training, electromyographic biofeedback, and functional electrical stimulation in gait training for stroke rehabilitation, and weaker evidence to support the use of ankle-foot orthosis, treadmill training and partial body-weight support. The participants, comparators and outcomes varied among the studies, hence it may not have been appropriate to combine the findings.

Authors’ objectives
To examine the efficacy of gait retraining techniques currently used in practice, including strength training, functional electrical stimulation (FES), treadmill training, partial body-weight support, electromyographic (EMG) biofeedback, and splinting of the lower extremity.

Searching
The search strategy was reported to have been described in a previous issue of Topics in Stroke Rehabilitation (vol. 10, part 1). According to a review from this journal volume (see Other Publications of Related Interest no.1), MEDLINE (from 1968 to 2001) and EMBASE, MANTIS, Pascal and SciSearch (from 1995 to 2001) were searched.

Study selection
Study designs of evaluations included in the review
Studies of any design appear to have been eligible for inclusion, although non-experimental or uncontrolled studies were only used to formulate conclusions in the absence of randomised controlled trials (RCTs).

Specific interventions included in the review
Studies investigating the efficacy of strength training, FES, treadmill training, partial body-weight support, EMG biofeedback, and splinting of the lower extremity were included in the review.

Participants included in the review
The authors did not explicitly state which participants were eligible for inclusion. The groups of participants varied among the included studies. An associated paper (see Other Publications of Related Interest no.1) stated that patients who had had radiologically confirmed ischaemic and haemorrhagic stroke were included.

Outcomes assessed in the review
The outcomes of interest, and the methods by which they were measured, were not explicitly stated.

How were decisions on the relevance of primary studies made?
In the related publication (see Other Publications of Related Interest no.1), one reviewer assessed all abstracts for inclusion and the study coordinator re-examined each selected abstract.

Assessment of study quality
The validity assessment was reported to have been described in a previous issue of Topics in Stroke Rehabilitation (vol. 10, part 1). According to a review from this journal volume (see Other Publications of Related Interest no.1), the PEDro scoring system was used to assess the quality of the included RCTs (see Other Publications of Related Interest no.2). Ten criteria were applied, all requiring yes or no answers. Each of the following criteria were given equal weighting of one point (where 10 represents the highest quality score): randomisation; allocation concealment; similarity of the baseline characteristics; blinding of the patient, therapist and assessor; adequate follow-up (were all randomised patients accounted for at the end of the study?); intention-to-treat analysis; and statistical comparisons between groups with point estimates and variability measures.
Trials assigned a PEDro score of 9 to 10 were rated as 'excellent'; trials scoring 6 to 8 were considered 'good'; trials scoring 4 to 5 were rated as 'fair'; and trials scoring less than 4 were of 'poor' quality. Non-RCTs were given 'no score' and were used to generate conclusions in the absence of RCTs. The following levels of evidence were defined and used to weight the findings: strong evidence was provided by two or more RCTs of at least 'fair' quality; moderate evidence was provided by one RCT of at least 'fair' quality; limited evidence represented at least one non-RCT; and conflicting evidence was termed as a disagreement between the findings of multiple RCTs.

In the related publication (see Other Publications of Related Interest no.1), two reviewers assessed validity independently.

Data extraction
In the related publication (see Other Publications of Related Interest' no.1), two reviewers extracted the data independently. Outcomes in the intervention and control groups were compared within each trial and were expressed as dichotomous variables.

Methods of synthesis
How were the studies combined?
The findings were combined in a narrative, grouped by intervention. The level of evidence was used in the discussion of the findings.

How were differences between studies investigated?
There was no investigation of differences between the studies. Study differences were evident from the tables of included studies.

Results of the review
Forty-six studies (48 publications) were included in the review, of which 29 were RCTs.

Strength training (6 studies: 3 RCTs).
Two RCTs of 'fair' quality found strength training to significantly improve the efficiency of gait, measured as distance walked in a 6-minute test, when compared with no intervention in one study, or with a control therapy which aimed to improve function of affected upper limb in the other study. Three non-RCTs also found an improvement in gait with strength training.

One 'fair' RCT found moderate evidence of the benefits of progressive strengthening exercise on activities of daily living.

FES (7 studies: 4 RCTs).
Two 'fair' RCTs found an improvement in hemiplegic gait with FES combined with gait retraining when compared with self-exercise and physical therapy programmes and physiotherapy. Two RCTs of 'good' quality found a significant improvement in gait with combined therapy of FES and EMG biofeedback in comparison with either of the two treatments alone.

Treadmill training (8 studies: 2 RCTs).
One 'good' RCT found there to be a significant improvement in walking speed, length of stride and function with structured speed-dependent training. Another 'good' RCT found no significant differences in several outcomes, including activities of daily living and the assessment of mobility among patients receiving treadmill training and conventional care.

Partial body-weight support and treadmill training (8 studies: 6 RCTs).
Two ‘good’ RCTs found partial body-weight support and treadmill training to improve gait performance. One ‘good’ RCT found no significant difference between the treatment and control groups. Three ‘fair’ RCTs did not find an improvement in gait performance.

EMG biofeedback (11 RCTs).

Four RCTs of ‘good’ quality and 4 ‘fair’ RCTs found biofeedback training to improve gait and standing post stroke. One ‘good’ RCT found no significant difference between EMG and physical therapy on gait. Two RCTs were of ‘poor’ quality.

Splinting of the lower extremity (6 studies: 3 RCTs).

One ‘fair’ RCT found there to be no significant difference in gait improvement with ankle-foot orthosis (AFOs) when compared with partial body-weight-supported treadmill training. One ‘poor’ RCT found a significant improvement in postural stability with AFOs. Two non-RCTs found improvements in various parameters of gait with AFOs.

One ‘good’ RCT found a reduction in spasticity with deinnervating the posterior tibial nerve and the use of AFOs. This intervention also showed a significant increase in passive range of motion in one non-RCT.

**Authors’ conclusions**

There was either strong or moderate evidence to support the use of strength training, EMG biofeedback, and FES as an adjunctive therapy in gait training. There was either limited or conflicting evidence to support the use of AFOs, treadmill training and partial body-weight support.

**CRD commentary**

The authors addressed a specific question with regard to interventions for gait retraining, yet there was a lack of specific inclusion criteria relating to the participants and outcomes. Relevant databases appear to have been searched, although no attempt to identify unpublished literature was made and the possibility of publication bias was not assessed. It was unclear whether any language restrictions were applied. The study selection, data extraction and quality assessment processes appear to have been carried out in duplicate. However, this is based on reference to the methods used in an associated publication. The studies were combined using study design and quality scores to inform the conclusions. There was variation among studies evaluating the same intervention, with regard to the participants, comparators and measures of gait improvement; therefore, it might not have been appropriate to combine the findings.

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

The authors did not state any implications for practice or further research.

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