Surface-applied functional electrical stimulation for orthotic and therapeutic treatment of drop-foot after stroke: a systematic review

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CRD summary
The review concluded that functional electrical stimulation can have a positive orthotic effect in patients who were in the chronic stage of stroke recovery. In light of the possibility of relevant studies being missed and the moderate or high risk of bias in nearly all included studies, the reliability of the authors’ conclusions remains uncertain.

Authors' objectives
To evaluate the evidence for orthotic and therapeutic effects of surface functional electrical stimulation for the correction of drop-foot after stroke.

Searching
MEDLINE, EMBASE, CINAHL, AMED, Science Direct and Cochrane Central Register of Controlled Trials (CENTRAL) were searched for studies in English published between 1990 and June 2008. Search terms were reported. Reference lists of retrieved articles were searched.

Study selection
Studies of functional electrical stimulation for correction of drop-foot after adult stroke were eligible for inclusion. Studies that solely used implantable electrodes were excluded, as were studies that did not stimulate the lower limb/common peroneal nerve or tibialis anterior muscle.

Most populations were (at least partly) chronic cerebrovascular accident patients. Modes and durations of treatment varied. Comparator group treatments, where they existed, varied and included physiotherapy, botulinum toxin injections, electromechanical gait trainer and different applications of functional electrical stimulation. Several studies used functional electrical stimulation with a cointervention. Studies assessed more than 30 different outcomes; the most common was a measure of walking.

Two reviewers independently selected studies for inclusion. Disagreements were resolved by consensus.

Assessment of study quality
Studies were quality assessed according to the presence of bias in relation to the following criteria (from Guidelines for Cochrane Reviewers): selection of participants; performance of care providers; detection of outcomes; and participant attrition. Studies were given an overall risk of bias (low risk when all criteria were met, moderate risk when one or more criteria were partly met or high risk when one or more criteria were not met).

The authors did not state how many reviewers performed the quality assessment.

Data extraction
The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
A narrative synthesis was performed, grouped by study design or type of intervention.

Results of the review
Thirty studies were included in the review (n=1,159). Studies incorporated a range of study designs. Sample sizes ranged from one to 291 patients (25 studies had a sample size of fewer than 50 patients). Eleven studies had a high risk of bias, five were moderate-high, 12 were moderate and one was low.
Four before-and-after studies reported some orthotic effect using differing stimulators and two studies reported a therapeutic effect. Three studies (two of which had control groups) suggested that functional electrical stimulation may have been better than conventional therapy alone and that a combination of both interventions was more effective than either. No definitive conclusions could be drawn regarding the four studies of functional electrical stimulation with physiotherapy versus physiotherapy alone. Two small studies suggested that botulinum toxin injections followed by three days of functional electrical stimulation may have been more effective than botulinum toxin injections alone. Four studies of functional electrical stimulation and an electromechanical gait trainer with partial body weight support suggested combined therapy may be more effective than over-ground training in both the early and chronic stages of rehabilitation.

Authors' conclusions
Functional electrical stimulation can have a positive orthotic effect, particularly for gait speed and physiological cost index, in patients who were in the chronic stage of stroke recovery (although evidence for a therapeutic effect was less conclusive).

CRD commentary
The review addressed a clear question and was supported by broad inclusion criteria. Although several electronic databases were searched, the restriction to searching only for published studies in English from 1990 onwards (for purposes of practicality) meant that some relevant studies may have been missed. Suitable methods were employed to reduce risks of reviewer error and bias when selecting studies for inclusion; the authors did not report on whether such methods were used for the processes of data extraction and study quality assessment. Sufficient study details were provided, although the presence of statistical significance was inconsistently reported between studies. The narrative synthesis was somewhat difficult to follow and interpret as a very broad range of study designs and outcomes were reported. Study quality was assessed and used in interpreting the results of the review.

Considering that most studies were small, that all studies except one had a moderate or high risk of bias and that some relevant studies may have been missed during the searches, the reliability of the authors' conclusions remains uncertain.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors made many recommendations that included the need for a large randomised controlled trial of surface functional electrical stimulation versus ankle foot orthosis. They suggested that studies should have more standardisation of protocols, employ reliable quantitative outcome measures and be more collaborative between engineers, researchers, clinicians and users.

Funding
Irish Research Council for Science, Engineering and Technology.

Bibliographic details

DOI
10.1179/174328809X405946

Indexing Status
Subject indexing assigned by CRD

MeSH
Electric Stimulation Therapy; Gait Disorders, Neurologic; Humans; Stroke /complications /rehabilitation
AccessionNumber
12009108014

Date bibliographic record published
09/06/2010

Date abstract record published
29/09/2010

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.