Electromyogram-triggered neuromuscular stimulation and stroke motor recovery of arm/hand functions: a meta-analysis

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CRD summary
This review examined the effectiveness of electromyogram-triggered neuromuscular stimulation on hand and arm function in stroke patients. The authors concluded that this treatment is effective. However, since some trials were non-randomised and the review included only a small number of patients, it is unclear how reliable the authors' conclusions are.

Authors' objectives
To assess the effectiveness of electromyogram (EMG)-triggered neuromuscular stimulation on hand and arm function in stroke patients.

Searching
MEDLINE (1979 to 2003), the Cochrane Database of Systematic Reviews (Issue 3, 2003) and the Cochrane Controlled Trials Register (Issue 3, 2003) were searched; some search terms were given. In addition, relevant bibliographies published between 1973 and 2003 were handsearched. Only studies published in English in peer-reviewed journals were included.

Study selection
Study designs of evaluations included in the review
The inclusion criteria were not stated, but studies included in the review were randomised controlled trials (RCTs), controlled clinical trials and case series. The controlled studies included both parallel and crossover designs.

Specific interventions included in the review
Studies using EMG-triggered neuromuscular stimulation, where surface electrodes both provided active stimulation and monitored muscle activity, were eligible for inclusion in the review.

Participants included in the review
Studies of patients who had suffered a stroke affecting upper extremity motor function were included. All patients included in the review were hemiparetic. The majority of patients (84%) were in the chronic phase of stroke recovery, with a minority (16%) in the acute and sub-acute phases.

Outcomes assessed in the review
The inclusion criteria specified motor recovery in the affected upper extremity as the outcome of interest. The measures employed to assess this in the included trials were the Box and Block timed manipulation task, the Fugl-Meyer upper extremity test, and the Rivermead Motor Assessment Scale. It was unclear whether the use of one of these tests was an inclusion criterion.

How were decisions on the relevance of primary studies made?
The authors stated that two reviewers assessed primary studies for relevance, but did not state how the assessment was conducted.

Assessment of study quality
The quality of studies included in the meta-analysis was assessed on the basis of randomisation, double-blinding, and the assessment of withdrawals and drop-outs. The authors did not state how the papers were assessed for quality, or how many reviewers performed the quality assessment.
Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
Five of the seven studies were combined in a meta-analysis which pooled effect sizes from individual studies. No further details of the analysis were reported.

How were differences between studies investigated?
Statistical heterogeneity was assessed using a chi-squared test. Reasons for excluding two studies and one of the comparisons from an included study from the meta-analysis were discussed.

Results of the review
Seven studies were included in the review, five of which were included in a meta-analysis. Three of the studies were RCTs. It was not possible to determine the total number of patients in the review, but the five studies included in the meta-analysis contained 86 patients.

No statistically significant heterogeneity between the studies was found (chi-squared 1.15, P>0.05).

For standardised and representative response measure for hand arm function, the pooled effect size was 0.82 (95% confidence interval, CI: 0.10, 1.55).

A fail-safe analysis indicated that 15 null effect studies would be required to reduce the effect size from 0.82 (high) to 2.0 (low).

Authors' conclusions
EMG-triggered neuromuscular stimulation is an effective post-stroke therapy.

CRD commentary
The review question was clear but the inclusion criteria were not specified in full. The authors searched relevant electronic databases but they excluded unpublished studies, studies published in non-peer-reviewed journals and studies published in languages other than English. This might have increased the possibility of publication bias or language bias in the review, both of which can lead to the exclusion of studies that are more likely to have negative findings. The authors assessed the methodological quality of the included studies, but they did not report using methods to minimise bias and error in this assessment or in the study selection and data extraction processes of the review. The use of a meta-analysis to combine the studies appeared justifiable. The results of the quality assessment were not used to inform sensitivity analyses, although non-randomised studies were included. The included studies were all small and two of those included in the meta-analysis were non-randomised. As a consequence of these considerations and the fact that the review methodology was not well reported, it is not possible to say whether the authors' conclusions are reliable.

Implications of the review for practice and research
Practice: The authors stated that stroke rehabilitation therapists should employ informed judgement in using their findings to make effective improvements in arm and hand motor rehabilitation.

Research: The authors did not state any implications for further research.

Bibliographic details

PubMedID
15337612

DOI
10.1016/j.jns.2004.05.005

Indexing Status
Subject indexing assigned by NLM

MeSH
Arm /physiopathology /radiation effects; Double-Blind Method; Electric Stimulation; Electromyography /methods; Hand /physiopathology /radiation effects; Humans; Motor Activity /physiology /radiation effects; Neuromuscular Junction /physiopathology /radiation effects; PubMed /statistics & numerical data; Randomized Controlled Trials as Topic /methods; Recovery of Function /physiology /radiation effects; Stroke /physiopathology /rehabilitation; Treatment Outcome

AccessionNumber
12004006590

Date bibliographic record published
31/07/2006

Date abstract record published
31/07/2006

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.