Efficacy of electrical stimulation in preventing or reducing subluxation of the shoulder after stroke: a meta-analysis
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CRD summary
In this review, the authors concluded that electrical stimulation can prevent shoulder subluxation if used soon after stroke, but will not reduce subluxation if used later. The conclusions were partly based on analyses of a small number of potentially biased studies, which themselves involved very few patients.

Authors' objectives
To examine the efficacy of surface electrical stimulation in preventing and reducing subluxation of the shoulder, in improving shoulder function early and late after stroke, and in preventing and reducing pain in the shoulder.

Searching
MEDLINE, CINAHL, AMED, EMBASE and the Cochrane Controlled Trials Register (Cochrane Library Issue 2, 2002) were searched from inception to 2002; details of the search were provided. Additional studies were identified by checking the reference lists of retrieved articles and by handsearching relevant conference proceedings.

Study selection
Study designs of evaluations included in the review
Randomised or quasi-randomised trials were included in the review.

Specific interventions included in the review
Studies evaluating the efficacy of surface electrical stimulation were selected for the review. The stimulation frequency used in the studies had to be greater than 30 Hz, or they otherwise had to report that a motor response was obtained. The electrical stimulation frequencies in the included studies ranged from 10 to 35 Hz. The treatment sessions lasted between 30 minutes and 7 hours, with one to four sessions per day for five or seven days per week, for four or six weeks.

Participants included in the review
Studies were included in the review if the participants had a clinical diagnosis of stroke and were, on average, older than 50 years. Studies of participants with other neurological conditions were omitted. The average age of the participants in the included studies ranged from 53 to 73 years. The average time since the stroke ranged from 2 to 434 days.

Outcomes assessed in the review
Studies were included in the review if subluxation, function or pain were measured as outcomes. These outcomes were measured using a range of different scales and techniques across the selected studies.

How were decisions on the relevance of primary studies made?
One reviewer ordered the full papers if they appeared relevant on the basis of the titles and abstracts. Two reviewers independently selected studies for review on the basis of the full papers, with any disagreements resolved by discussion.

Assessment of study quality
The validity of the individual studies was assessed using the PEDro scale to assign a quality score of 1 (the lowest to 10 (the highest) (see Other Publications of Related Interest). Items on the scale relate to specification of eligibility criteria, method of randomisation, concealment of allocation, group similarity at baseline, blinding, follow-up, statistical comparisons and reporting of the results. One reviewer assessed the methodological quality of the included studies.
Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction. Data were extracted on the mean and standard deviation or standard error for each outcome from published raw data, or estimates were derived from graphs. Additional data on quality, study design, inclusion criteria, sample characteristics and application of electrical stimulation were also extracted.

Methods of synthesis
How were the studies combined?
Studies with similar outcome measures and follow-up for subluxation, function or pain were considered for pooling. Where the same outcome measures were used, the study outcomes were combined as weighted mean differences (WMDs) with 95% confidence intervals (CIs) using a fixed-effect model. Where different outcome measures were used, the study outcomes were combined as standardised mean differences with 95% CIs using a random-effects model. Separate analyses were performed for early (stroke within 2 months of admission) and late (stroke more than 2 months prior to admission) electrical stimulation.

How were differences between studies investigated?
Heterogeneity was assessed using the Q statistic and, wherever significant (P<0.1), a sensitivity analysis was undertaken to identify the source.

Results of the review
Seven trials (n=183) were included in the review.

The mean PEDro score was 5.8 (range: 4 to 9) for the early trials and 4.3 (range: 4 to 5) for the late trials.

Subluxation.
Early electrical stimulation plus conventional therapy (4 homogeneous studies, n=144) was statistically significantly superior to early conventional therapy for the prevention of subluxation (WMD 6.5, 95% CI: 4.4, 8.6, P<0.001). There was no statistically significant difference between late electrical stimulation plus conventional therapy (3 homogeneous studies, n=38) and late conventional therapy for the reduction of subluxation (WMD 1.9, 95% CI: -2.3, 6.1, P=0.40).

Shoulder function.
Early electrical stimulation plus conventional therapy (4 heterogeneous studies (P=0.06), n=82) was statistically significantly superior to early conventional therapy for improving shoulder function (WMD 18.6, 95% CI: 0.4, 36.7, P=0.06). The difference between late electrical stimulation plus conventional therapy (2 homogeneous studies, n=22) and late conventional therapy for improving shoulder function did not reach statistical significance (WMD 14.4, 95% CI: -5.4, 34.2, P=0.15).

Pain.
The difference between early electrical stimulation plus conventional therapy (3 homogeneous studies, n=82) and early conventional therapy for preventing pain did not reach statistical significance (WMD 3.7, 95% CI: -1.2, 8.6, P=0.14). Late electrical stimulation plus conventional therapy (2 homogeneous studies, n=22) was statistically significantly superior to late conventional therapy for reducing pain (WMD 1.6, 95% CI: 0.1, 3.0, P=0.04).

Authors’ conclusions
The evidence supported the use of electrical stimulation early after stroke for the prevention of shoulder subluxation, but not late after stroke for the reduction of shoulder subluxation.

CRD commentary
The review question was based on reasonably, clearly defined inclusion criteria and an adequate search of the literature.
It was unclear whether the search was limited to English language studies, if so there was the potential for relevant studies to have been missed. Two reviewers decided on whether to include articles on the basis of full publications; however, it does not appear that multiple reviewers were used to limit errors and bias elsewhere in the review process. The validity of the individual trials was assessed using published criteria, although the results of this validity assessment were not incorporated into the synthesis. This is of particular importance in this review where some of the 'late' intervention meta-analyses only included two very small quasi-randomised studies, both of which were by the same authors. The authors' main conclusions broadly follow from the evidence presented, though it should be noted that this evidence is reasonably sparse.

Implications of the review for practice and research
Practice: The authors stated that electrical stimulation should be started as early as possible as part of best practice for those patients who are at risk of developing subluxation as a result of paralysis of shoulder muscles after stroke.

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

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