Electrical stimulation as an adjunct to spinal fusion: a meta-analysis of controlled clinical trials

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Authors' objectives
To examine whether electrical stimulation has a specific healing effect on spinal fusion.

Searching
MEDLINE and EMBASE were searched; some search terms were provided. In addition, reference lists were checked, and some key publications were handsearched.

Study selection
Study designs of evaluations included in the review
Controlled clinical trials were eligible for inclusion. Randomised controlled trials (RCTs), case-control studies and case series were included in the review.

Specific interventions included in the review
The inclusion criterion was electrical stimulation. This included direct current, pulsing electromagnetic fields and other types of electrical stimulation.

Participants included in the review
Trials that included patients who had received one or more operations for spinal fusion were eligible for inclusion.

Outcomes assessed in the review
The inclusion criteria were not explicitly stated. The outcomes in the review were the completion of bone union and the approximate healing time of bone union, as confirmed radiographically. The review assessed the proportion of cases with a successful outcome, which was usually defined as a union of spine fusion.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The validity of the studies was assessed using published criteria (see Other Publications of Related Interest no.1), based on study population, description of intervention, measurement of outcomes, and data presentation and analysis. These categories were subdivided into 17 criteria weighted according to the guidelines in another systematic review (see Other Publications of Related Interest no.2). Two reviewers assessed study quality after the articles had been masked by a third reviewer. Any disagreements were resolved by consensus among the three reviewers.

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?
Differences in the response rate and 95% confidence intervals (CIs) of the rate difference were calculated. The studies were combined in a meta-analysis using the random-effects model of DerSimonian and Laird.

How were differences between studies investigated?
Studies that were not RCTs were not included in the meta-analysis or in the narrative discussion which accompanied it. Differences between the RCTs were discussed in the narrative discussion and were detailed in tables. A sensitivity analysis was conducted to assess the effect of excluding one RCT that employed a different measure of outcome from the others.

**Results of the review**
Ten studies were included in the review: 5 RCTs (533 patients) and 5 case-control studies or case series (number of patients not given).

The pooled rate difference in successful outcomes in all 5 RCTs (n=477) was 0.191 (95% CI: 0.113, 0.270).

The pooled rate difference in the 4 RCTs that reported union of spine fusion confirmed by radiography (n=442) was 0.170 (95% CI: 0.103, 0.237).

**Authors' conclusions**
Electrical stimulation using various modalities has specific effects on spinal fusion.

**CRD commentary**
The review question and the inclusion criteria were reasonably clear. However, the review included study designs that did not meet the inclusion criterion (controlled clinical trials), although these were subsequently excluded from the analysis. The search was adequate but only published studies were included in the review; this might have led to the exclusion of relevant studies and to the introduction of bias. The authors reported using methods to reduce bias and error in the assessment of study quality, but did not report the use of such methods in the study selection or data extraction processes.

Owing to the significant level of clinical heterogeneity between the trials, a narrative summary may have been more appropriate than the meta-analysis conducted. However, given the decision to employ a meta-analysis, the use of a random-effects model was appropriate, as was the sensitivity analysis conducted. A chi-squared test for heterogeneity would have added useful information to the analysis. The authors' conclusions are reasonable if the results of the meta-analysis are considered to be reliable. However, the level of heterogeneity between the studies may mean that these results should be considered with some caution.

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

Research: The authors stated that improved study designs are needed to establish the most effective therapeutic protocols. They further stated that a study to evaluate the relation between strength of electrical fields employed and efficacy is required.

**Bibliographic details**

**PubMedID**
12224053

**DOI**
10.1002/bem.10041

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Combined Modality Therapy; Controlled Clinical Trials as Topic; Databases, Bibliographic; Electric Stimulation Therapy; Electromagnetic Fields; Humans; MEDLINE; Spinal Fusion /methods; Treatment Outcome

**AccessionNumber**
12003003146

**Date bibliographic record published**
28/02/2005

**Date abstract record published**
28/02/2005

**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.