Low-intensity pulsed ultrasound and pulsed electromagnetic field in the treatment of tibial fractures: a systematic review
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CRD summary
The review compared the effectiveness of low-intensity pulsed ultrasound (LIPUS) with pulsed electromagnetic fields (PEMF) for fracture healing and concluded that LIPUS may speed healing of acute tibial fractures, but that comparison studies with PEMF were needed. Review limitations and small sample sizes of the included studies mean that the authors' conclusions should be interpreted with a degree of caution.

Authors' objectives
To compare the effectiveness of low-intensity pulsed ultrasound (LIPUS) or pulsed electromagnetic fields (PEMF) for fracture healing.

Searching
MEDLINE, PEDro and ProQuest were searched (dates ranged from 1929 to 2004) for studies published in English; search terms were reported. Reference lists of included studies were searched to identify further studies.

Study selection
Randomised controlled trials (RCTs) of skeletally mature patients with a current fracture who received either LIPUS or PEMF were eligible for inclusion. Studies had to blind patients and assessors to treatment allocation and had to assess time to fracture healing or proportion of fractures healed (determined radiographically, clinically or both). Patients in all included studies had a fracture of the tibia, with the most common injury being a motor vehicle accident. Studies were of either LIPUS or PEMF. A wide range of casting and fixation approaches were used. LIPUS was always applied 20 minutes daily, although duration of treatment varied. Control groups received placebo treatment. Radiographic healing of three of the four cortices was the commonest outcome measure, although a wide variety of outcomes were reported. Two reviewers independently selected studies for inclusion in the review.

Assessment of study quality
Study quality was assessed with the PEDro (Physiotherapy Evidence Database) 10-point scale of internal validity and provision of adequate statistical information. The authors did not state how many reviewers performed the assessment; disagreements were resolved by discussion/consensus.

Data extraction
Data were independently extracted and risk ratios and standardised mean differences calculated.

Methods of synthesis
The authors conducted a narrative synthesis presented by type of intervention. Differences between studies were discussed in the text and study details and results were tabulated.

Results of the review
Eight studies were included in the review (291 different patients). Sample sizes ranged from 16 to 67 participants. PEDro scores ranged between 8 and 10 out of 10.

Low-intensity pulsed ultrasound (LIPUS; five studies): Three studies reported statistically significant faster radiographic and clinical healing in patients treated with LIPUS compared to placebo. Two studies reported no significant difference in all outcomes.

Pulsed electromagnetic fields (PEMF; three studies): Two studies reported benefit with PEMF at 12 and 15 weeks compared to placebo for radiographic healing; one study found no difference in the rate of nonunion at 24 weeks.

Authors' conclusions
The evidence suggested that LIPUS may speed healing of acute tibial fractures, but comparison studies with PEMF were needed.

**CRD commentary**
The review addressed a clear question and was supported by appropriate inclusion criteria. Attempts to identify relevant studies were undertaken by searching electronic databases and checking references, but the restriction to searching only for studies published in English meant some relevant studies may have been missed. Although it appeared generally that suitable methods were used to minimise the risk of reviewer error and bias throughout the review, the description of the processes used for quality assessment and data extraction could have been clearer.

Study quality was assessed and the assessment used in interpreting the results of the review, but lack of details about the criteria being assessed made interpretation of quality scores difficult; all studies scored highly, but the sample sizes of all included studies appeared small. In light of the clinical heterogeneity between studies the authors appropriately conducted a narrative synthesis. The risk ratios and standard mean differences calculated by the authors were not referred to in the synthesis and instead presented in tables without confidence intervals or p values, which meant it was difficult to interpret their purpose and the significance of the results.

Considering the review limitations and the small sample sizes of included studies, the authors' conclusions should be interpreted with a degree of caution.

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

**Research:** The authors stated that direct comparison studies stratified by fracture status, fixation and smoking may prove useful. They also stated that controlled trials to assess the management of other acute fractures were needed, and that investigators in future PEMF studies should record time to healing in days.

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**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.