Short-term efficacy of physical interventions in osteoarthritic knee pain: a systematic review and meta-analysis of randomised placebo-controlled trials

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CRD summary

The review assessed the efficacy of physical therapy in short-term pain management of patients with osteoarthritis of the knee. The authors' conclusions that electro-acupuncture, transcutaneous electrical nerve stimulation and low level laser therapy offer clinically meaningful effects, are not fully supported by the evidence presented. Given this, and limitations of the review methodology, the reliability of their conclusions is unclear.

Authors' objectives

To assess the short-term efficacy of physical agents in the treatment of pain associated with osteoarthritis of the knee.

Searching

A computerised search (1966 to April 2006) of the following databases was performed: MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials, CINAHL, DARE, International Network of Agencies for Health Technology Assessment (INAHTA), Physiotherapy Evidence Database (PEDro) and NHS Clinical Knowledge Summaries (formerly PRODIGY). National Guideline Clearinghouse (NGC) and NICE guidelines were also searched. Hand searches of the following sources were performed: the journal Laser Therapy (1994 onwards); published abstracts from conferences arranged by the World Confederation of Physical Therapy and World Association for Laser Therapy (1990 onwards); national Scandinavian physiotherapy journals; conference abstracts; and reference lists of systematic reviews. Experts in the fields were also consulted.

Search terms were reported. The authors stated that papers in English, German and Scandinavian languages eligible for inclusion.

Study selection

Randomised blinded placebo-controlled parallel and cross-over trials of participants with osteoarthritis of the knee (confirmed by clinical examination according to the American College of Rheumatology criteria and/or by x-ray), with symptoms persisting more than three months, were eligible for inclusion in the review.

In the included trials, the median of the reported mean age of patients was 65.1 years, 69.9% were female and all had disease severity grade 2 to 4.

The interventions of interest were acupuncture, low level laser therapy, pulsed electromagnetic fields including short-wave therapy, transcutaneous electrical nerve stimulation, ultrasound and static magnets. Criteria for the optimal dose of each intervention are listed in the review. Control interventions were either placebo or sham intervention.

The outcomes of interest were pain intensity within four weeks of treatment start (primary) or at five to 12 weeks follow-up (secondary). Only studies in which pain was measured either on the Western Ontario and McMaster Universities osteoarthritis index (WOMAC) pain subscale, or on a 100 mm visual analogue scale (VAS) for global or walking pain were eligible. Definitions of a clinically relevant change in pain score were defined a priori. In the included studies, improvement in global health status was also reported as a secondary outcome. Adverse events and side effects were also reported.

The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality

Validity was assessed independently by two reviewers using the Jadad scale; scores were awarded out of a possible 5 (5 being the highest quality).

Data extraction

Data were extracted to derive mean differences and standard deviations between intervention and control groups. Where outcomes were reported at more than one time scale, the largest effect was chosen. If data on overall pain intensity were not reported, the mean intensity scores from the WOMAC (Western Ontario and McMaster Universities osteoarthritis index) pain subscales were used. Pain reported on Likert scales were converted to a VAS (Visual Analogue Scale). If overall pain or WOMAC pain subscale data were not reported, pain on movement measured on a VAS was used instead. The authors did not state how many reviewers performed the data extraction.

Methods of synthesis

The results were combined using a fixed-effect meta-analysis. Results were presented as the weighted mean difference between the intervention and placebo groups measured in mm on VAS (Visual Analogue Scale), with 95% confidence intervals (CI). The results were weighted by the inverse of the variance for each study except in the following instance: for individual studies including fewer than 40 patients, the reviewers used the mean of the standard deviation from all other studies of the same intervention instead of the study's own standard deviation. For global improvement, pooled relative risks were calculated.

Within each intervention, heterogeneity was tested using Q-values. Subgroup analyses were conducted according to baseline pain, methodological quality, criteria for optimal dose and funding source.

Publication bias was assessed graphically using effect size plots (Egger test).

Results of the review

The mean quality score on the Jadad scale of the included studies was 3.8 (range 1 to 5). The most common reasons for low quality were: no description of the randomisation procedure, no allocation concealment and/or inadequate blinding.

Thirty six trials (2,434 participants) were included in the review. It is not clear from the review whether 15 or 16 of these trials were included in the optimum dose analysis.

Transcutaneous electrical nerve stimulation (11 trials): The best weighted mean difference during the first four weeks was 18.8 (95% CI: 9.6, 28.1), indicating a beneficial effect of transcutaneous electrical nerve stimulation (TENS), but there was significant statistical heterogeneity (P<0.001). The effect was slightly stronger when restricted to the trials of optimum dosage (weighted mean difference 22.2, 95% CI: 18.1, 26.3). The effect did not persist at the eight week time point, nor was the relative risk for global improvement at eight weeks significant.

Electroacupuncture (three trials): The best weighted mean difference during the first four weeks was 21.3 (95% CI: 16.3, 26.3), indicating a beneficial effect of electroacupuncture. This beneficial effect was also seen in the relative risks for global improvement at 12 weeks (2.1 (95% CI 1.1, 4.1).

Manual acupuncture (four trials): There was a small beneficial effect of manual acupuncture seen at eight weeks (weighted mean difference 3.6, 95% CI: 0.2, 7.1).

Low level laser therapy (eight trials): The best weighted mean difference during the first four weeks showed a beneficial effect of low level laser therapy (17.7, 95% CI: 8.1, 27.3) but there was significant statistical heterogeneity (P<0.001). The effect was stronger when restricted to the trials of optimum dosage (weighted mean difference 24.2, 95% CI 17.3, 31.1). The effect persisted at six to eight weeks, weighted mean difference 15.5 (95% CI: 9.9, 20.9) and at 12 weeks (weighted mean difference 12.3, 95% CI: 6.7, 17.9).

Pulsed electromagnetic fields (seven trials): The best weighted mean difference during the first 4 weeks showed a small beneficial effect of pulsed electromagnetic fields (6.9, 95% CI: 2.2, 11.6). The results at six, eight and 12 weeks showed no consistent effect.

In the one trial of ultrasound, no significant effect on change in pain was found.

Static magnets (2 trials). The best weighted mean difference during the first four weeks showed a small beneficial effect of static magnets (weighted mean difference 5.1, 95% CI: 0.2, 10.0) but no effect at 12 weeks.

Few side effects were reported for any of the interventions, but no formal assessment of the rates of adverse effects in intervention and control groups was reported in the review.

In subgroup analyses, exclusion of the low quality trials increased the apparent beneficial effect of TENS and low level laser therapy. Fifteen optimal dose trials of electroacupuncture, TENS and low level laser therapy were combined, giving a weighted mean difference of 22.4 (95% CI: 19.6, 25.2, P<0.00001), with no significant heterogeneity between trials.

There was no evidence of publication bias.

Authors' conclusions

An intensive regimen of two to four weeks with transcutaneous electrical nerve stimulation, electroacupuncture or low level laser therapy seems to safely induce clinically relevant short-term pain relief in patients with grade 2 to 4 osteoarthritis of the knee. There is not enough evidence to recommend manual acupuncture, pulsed electromagnetic fields, ultrasound or static magnets for rapid pain relief in osteoarthritis of the knee management.

CRD commentary

The review addressed a clearly defined question. Study design, patient, intervention and outcome inclusion criteria were all clearly stated, reducing the likelihood of subjective decisions being made during the study selection process.

The search strategy covered many electronic sources. The authors supplemented this with hand searches for two interventions only. It is possible that the search strategy might have missed eligible trials for certain interventions, whereas it appears more comprehensive for other interventions. Only trials published in certain languages were eligible. It was not clear whether the authors attempted to search for unpublished material. Consequently, the results may be affected by language or publication biases.

The authors did not report details of the study selection or data extraction procedures, so it is possible that bias and error were introduced to the review. Five trials which met the inclusion criteria were subsequently excluded. The reasons for these exclusions are given in the review, but this suggests that subjective decisions may have been made during the review process. The authors extracted the data for the review by choosing the largest reported treatment effect. This may have overestimated the beneficial effect of the interventions and biased the results towards a favourable outcome.

Validity was assessed and a subgroup analysis of trials of high quality was conducted. The meta-analysis used for the synthesis of results was appropriate. The authors noted significant heterogeneity for some analyses but did not attempt to explore reasons for this heterogeneity or use the random-effects model in these instances.

Although safety was not an a priori outcome criteria, the authors did base their conclusions on the safety data, despite no formal assessment of the safety of the interventions being reported. Instead of this, the authors listed the numbers of patients treated with the intervention who reported adverse effects. This is unlikely to represent sufficient evidence on which to conclude that an intervention is safe.

The authors' conclusions did not appear to be fully supported by the evidence presented. Given this, together with some limitations of the review methodology, the reliability of the authors' conclusions is unclear.

Implications of the review for practice and research

Practice: The authors stated that electroacupuncture, transcutaneous electrical nerve stimulation and low level laser therapy have potential to become useful adjuncts in osteoarthritis of the knee pain management.

Research: The authors stated that larger scale clinical trials are required to verify the results.

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