Efficacy of ultrasound therapy for the management of knee osteoarthritis: a systematic review with meta-analysis

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CRD summary
This review assessed the effectiveness of ultrasound therapy for decreasing pain and improving physical function in people with knee osteoarthritis and concluded that ultrasound could be efficacious. The included studies were of poor quality, but the cautious conclusion is likely to be reliable.

Authors’ objectives
To assess the effectiveness of ultrasound therapy for decreasing pain and improving physical function, patient-perception of disease severity, and cartilage repair in people with knee osteoarthritis.

Searching
MEDLINE, EMBASE, The Cochrane Library, LILACS, MEDCARIB, CINAHL, preCINAHL, AMED, PEDro, SPORTDiscus, REHABDATA and International Clinical Trials Registry Platform were searched for relevant studies published until February 2009 (start dates were reported for most databases). Search terms were reported. No language restrictions were applied. Web of Knowledge, Papers First, Proceedings First and ProQuest for Dissertations and Theses were searched for studies with restricted distribution.

Study selection
Eligible studies were parallel group randomised controlled trials (RCTs) that compared ultrasound with either placebo or no intervention in patients with knee osteoarthritis. Studies where ultrasound was provided in addition to other treatments provided to the comparison group (where ultrasound was an add-on therapy) were eligible for inclusion. Studies were excluded if phonophoresis was the only ultrasonic intervention used, where the ultrasound group included other interventions not provided to the placebo group and where some patients did not have knee osteoarthritis and results for knee osteoarthritis were not reported separately.

Severity of knee osteoarthritis ranged from mild to severe. The proportion of females ranged from 33% to 100%. All studies reported pain using the visual analogue scale (VAS) and time taken to walk either 50 metres or 50 feet. Ultrasound dosages and number of sessions were variable. Comparisons included sham ultrasound and standardised warm-ups. It appeared that average age of patients ranged from 55 to 65 years. Follow-up ranged from two weeks to 12 months.

Two reviewers performed the study selection. Disagreements were resolved by consensus and adjudication with a third reviewer.

Assessment of study quality
The reviewers assessed study quality in terms of randomisation, allocation concealment, blinding, missing data (considered high if over 15% of data were missing) and reporting of results.

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Data extraction
Two authors independently extracted data to calculate standardised mean differences (SMDs) with 95% confidence intervals (CIs). Authors were contacted for data where necessary. Where studies reported pain outcomes by knee rather than by patient, the number of patients rather than knees was extracted.

Methods of synthesis
Standardised mean differences with 95% CIs were pooled using an inverse-variance random-effects model. Statistically
significant differences were assessed using the Z test (p<0.05). Statistical heterogeneity was assessed with \( \chi^2 \) (p<0.10) and quantified using the \( I^2 \) statistic. Standardised mean differences were back transformed using standard deviations reported in observational studies. Clinical heterogeneity was explored through subgroup analyses of disease severity, ultrasound regimen, cointerventions and methodological adequacy.

**Results of the review**

Six trials (n=378) were included in the study. Most had adequate completeness of data and outcome reporting, but were inadequate allocation concealment, randomisation and blinding. As a result, five studies were considered to have a high risk of bias and one study provided insufficient information to allow risk of bias to be estimated.

Ultrasound was associated with reduced pain compared with control at the end of the intervention (SMD -0.49 on VAS, 95% CI -0.79 to -0.18, \( I^2=51\% \)) and 10 months following completion of ultrasound (SMD -0.77 on VAS, 95% CI -1.15 to -0.39, \( I^2=0\% \); two studies). Ultrasound was associated with increases in self-reported physical function and walking performance. Only one study reported what the review authors considered an indirect measure of cartilage repair, which showed a positive effect in the index of arthritis severity measured at eight weeks in patients in the lowest third (mean difference 0.80, 95% CI 0.32 to 1.28) and middle third (mean difference 1.8, 95% CI 0.85 to 2.75), but not the highest third.

No studies were found of patient perception.

Two studies reported no adverse events; the other studies did not report adverse events. A range of clinical subgroup analyses was performed and reported.

**Authors’ conclusions**

Ultrasound could be efficacious for decreasing pain and may improve physical function in patients with knee osteoarthritis.

**CRD commentary**

This review addressed a clear research question. The search was thorough. Study selection, data extraction, quality assessment and synthesis all seemed clear and appropriate; all stages were conducted in duplicate, which reduced the risk of reviewer error and bias. Sufficient primary study details were provided. The authors noted that almost all studies had a high risk of bias and the pooled results and high statistical heterogeneity may have been unduly influenced by studies from a single author (Huang) based in a single country (Taiwan) and which appeared to show significantly more favourable results than other studies. The included studies were of poor quality, but the conclusion was cautious and so likely to be reliable.

**Implications of the review for practice and research**

**Practice**: The authors stated that careful consideration of ultrasound prescription and disease stage was required to assess the optimal therapeutic parameters and subgroups of people likely to benefit most.

**Research**: The authors stated that methodologically rigorous and adequately powered trials were needed to confirm the effectiveness of ultrasound in reducing pain and improving physical function in patients with knee osteoarthritis. Such trials should measure cartilage repair and patient-perception of osteoarthritis severity and assess long-term effects.

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