A review of therapeutic ultrasound: effectiveness studies
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Authors' objectives
To assess the effectiveness of therapeutic ultrasound used alone or in combination with other treatments.

Searching
MEDLINE, CINAHL and physical therapy journals (1975 to 1999) were searched for publications in the English language. Relevant review articles and reference lists were examined and colleagues of the authors were consulted.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) that met all of the criteria developed by Sackett et al. (see Other Publications of Related Interest) were eligible.

Specific interventions included in the review
Comparisons of therapeutic ultrasound with placebo ultrasound treatment were eligible if both groups otherwise received identical treatments. Ultrasound frequency varied from 0.89 to 3.28 MHz; the output included pulsed and continuous; the space-averaged time-averaged intensity ranged from 0.02 to 2.6 W/cm²; the applicator size ranged from 1 to 10 cm²; the time per typical initial session ranged from 2 to 15 minutes; the estimated total energy ranged from 30 to 11,600 joules; the estimates of area ranged from 10 to 125 cm²; and energy density ranged from 2 to 150 joules/cm². The control interventions included placebo ultrasound and a true control intervention in which the patients received neither active nor placebo ultrasound.

Participants included in the review
Patients with pain or musculoskeletal or soft tissue injuries were eligible. Participants with the following conditions were included: surgical extraction of third molar, lateral epicondylitis, perineal trauma, breast engorgement, osteoarthritis of the knee, shoulder pain, calcific tendinitis, pressure sores and carpal tunnel syndrome.

Outcomes assessed in the review
Studies judged to have assessed at least one outcome with face validity were eligible. The actual outcomes assessed included electroneurological tests, pain, facial swelling, trismus, serum C-reactive proteins, plasma cortisol, weight test, pain and power with wrist dorsiflexion, and grip strength.

How were decisions on the relevance of primary studies made?
Both authors read the identified studies and applied the inclusion criteria.

Assessment of study quality
Study validity was assessed using the criteria developed by Sackett et al. (see Other Publications of Related Interest): adequate controls, including placebo treatment and randomised allocation; adequate blinding of observers, participants and therapists; adequate description of treatment variables including checking of machine output; meaningful outcome measures; adequacy of sample size for trials showing no treatment effect; and acceptable statistical analysis of results (including equivalence of treatment groups). The authors estimated that to reach an 80% probability of detecting a treatment effect with an alpha value of 0.05, a minimum of 26 patients is required in each treatment group in a two-group trial analysed using a parametric statistic. Both authors applied the methodological filters described by Sackett et al (see Other Publications of Related Interest).

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data
Methods of synthesis
How were the studies combined?
The studies were combined in a narrative review.

How were differences between studies investigated?
Some potential causes of differences were discussed in the text of the review.

Results of the review
Ten RCTs were included. The number of patients was not reported.

The diversity of the clinical problems treated with ultrasound limited comparisons between the studies.

Two of the 10 RCTs suggested that active therapeutic ultrasound is more effective than placebo ultrasound in treating some clinical problems (carpal tunnel syndrome and calcific tendinitis of the shoulder). The other 8 RCTs suggested there was no difference between ultrasound and placebo for surgical extraction of the third molar, epicondylitis, perineal trauma, breast engorgement, osteoarthritis of the knee, shoulder pain and pressure sores.

There was no obvious source of differences in the dosages of ultrasound between the studies reporting positive benefits and those reporting no benefit from ultrasound.

Authors' conclusions
There is little evidence that active ultrasound is more effective than placebo treatment for treating patients with pain or a range of musculoskeletal injuries, or for promoting soft tissue healing. The few studies judged to have adequate methodology examined a diverse range of medical conditions and the dose of ultrasound varied, often for no discernable reason.

CRD commentary
The aims were stated and the inclusion criteria were defined in terms of the study design, intervention, participants, and broadly in terms of the outcome. The inclusion criteria included adequate controls and adequate blinding of observers, participants and therapists. However, studies with neither active ultrasound nor placebo ultrasound appear to have been included and it is not clear how participants in such studies can be adequately blinded. Several relevant sources of studies were searched, although the keywords used were not reported and the physical therapy journals searched were not specified. Restricting the included studies to English language publications may have resulted in the omission of other studies. The methods used to select the studies were partially described and reasons were given for those studies excluded. It was not reported whether the two authors selected the studies independently or whether there were any disagreements between the authors. The included studies were restricted to RCTs meeting all the specified validity criteria.

The tabulated information on the included studies was limited to the medical condition of the participants and some details of the ultrasound intervention. The information on the sample size, duration of intervention, number of sessions, outcomes, methods used to assess outcomes, and results of all the included studies was lacking. The methods used to extract the data were not described. A narrative synthesis was appropriate given the clinical heterogeneity among the studies, and some potential causes of differences in results among studies were discussed. More complete details of the methods used to conduct the review, and of the individual studies, are required before the evidence can be considered adequate to support the authors' conclusions.
Implications of the review for practice and research

Practice: The authors state that there is little evidence of the clinical effectiveness of therapeutic ultrasound.

Research: The authors state that research is required to identify those clinical problems for which ultrasound is effective, and then to establish experimental and treatment protocols and standardised methods for ensuring the output of all ultrasound equipment used.

Bibliographic details

PubMedID
11444997

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Humans; Musculoskeletal Diseases /therapy; Randomized Controlled Trials as Topic /methods; Reproducibility of Results; Ultrasonic Therapy /methods

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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.