Quantitative sensory testing in painful osteoarthritis: a systematic review and meta-analysis
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CRD summary
This review concluded that quantitative sensory testing of pressure pain thresholds can differentiate between people with osteoarthritis and healthy controls. This conclusion is not adequately supported by the data. The secondary conclusion that quantitative sensory testing merits further investigation as a research tool to investigate pain mechanisms in osteoarthritis appears reasonable.

Authors' objectives
To assess the effectiveness of quantitative sensory testing for the investigation of pain in osteoarthritis.

Searching
MEDLINE, EMBASE, AMED, CINAHL and Web of Science were searched from inception to May 2011. An example search strategy was reported. Bibliographies of included articles were screened for additional studies. No language restrictions were applied. Unpublished studies and conference abstracts were excluded.

Study selection
Studies of any design conducted in people with osteoarthritis were eligible for inclusion if they assessed at least one of the quantitative sensory testing modalities of chemical, electrical, mechanical or thermal stimulus. Studies were required to measure perception of noxious or innocuous stimuli applied to skin, muscle or joint and use a testing protocol with controls for stimulus properties (modality, anatomical site, intensity, duration and sequence).

The mean age of study participants was 62 years and 62% were women. Where reported, approximately one third of studies were conducted in the community. Two thirds of included studies focused on people with osteoarthritis of the knee; other joints included hip, hand and multiple joints.

Most studies assessed mechanical stimulus. Pressure was the most common method and the next most common modalities were electrical and thermal; only two studies used chemical stimulus. The most common outcome measure was pain threshold (assessed by approximately three quarters of included studies). Other common outcome measures were first sensation thresholds and pain intensity.

Studies were assessed for inclusion by one reviewer.

Assessment of study quality
The methodological quality of studies included in the meta-analysis was assessed using the Downs and Black criteria, with a maximum possible score of 12.

The authors did not state how many reviewers assessed study quality.

Data extraction
Data were extracted on baseline pain severity on visual analogue scale (VAS) and mean values and estimates of random variability of pain and/or sensory detection threshold measurements for each quantitative sensory testing modality and protocol. Where possible, the standard mean difference (SMD) with 95% confidence interval (CI) between people with osteoarthritis and healthy controls and the effect size (Cohen’s d) were calculated. Data were extracted on test-retest reliability.

Data were extracted by one reviewer and a subset of key variables on quantitative sensory testing modalities, outcome measures and test sites were validated by four co-investigators.

Authors were contacted for additional information as necessary.

Methods of synthesis
Seven studies were combined in a meta-analysis (model not specified) to estimate the pooled standard mean difference, with 95% CIs, in pressure pain threshold between people with osteoarthritis and healthy controls. Subgroup analyses selected from each study the smallest standardised mean difference for the affected joint, distal site and the remote site.

The results of the remaining studies were summarised narratively.

Statistical heterogeneity was assessed using the Q statistic and the I² statistic.

Publication bias was assessed using a funnel plot and Egger’s test.

Results of the review
Forty-one studies (2,281 participants) were included in the review: 23 case-control studies, 15 case only studies, two RCTs and one uncontrolled trial. Full quality assessment results were not reported.

Thirteen of the 41 included studies reported that people with osteoarthritis were more sensitive than normal controls to painful stimuli (eight studies reported pressure pain threshold, two studies reported punctuate pain threshold, one study reported mechanical and thermal pain thresholds and one study reported chemical pain rating). Two further studies applied electrotactile stimuli and reported that the threshold to elicit flexor withdrawal reflex was significantly lower in the osteoarthritis groups than in healthy controls. Three studies reported no significant difference between the osteoarthritis and control groups in piston pressure pain ratings, finger pressure pain ratings and heat and cold pain. Sensory detection thresholds in people with osteoarthritis were either higher (two studies) or similar (three studies) to those of healthy controls.

Pooled SMD for pressure pain threshold calculated by selecting the anatomical test site with the smallest SMD from each study in people with osteoarthritic compared with healthy controls was -0.87 (95% CI -1.08 to -0.66; seven studies; I²=5%). SMDs ranged from -0.47 (95% CI -1.00 to 0.06) to -3.04 (95% CI -3.77 to -2.31) depending on the anatomical site tested.

Where the smallest SMD for the affected joint, distal and the remote anatomical test sites were selected from each study and pooled, the SMD was larger for the affected joint sites (-1.24, 95%CI -1.54 to -0.93) than for remote sites (-0.88, 95%CI -1.11 to -0.65).

There was no evidence of publication bias.

Data on test-retest reliability from three studies were reported.

Authors’ conclusions
Quantitative sensory testing of pressure pain thresholds showed good ability to differentiate between people with osteoarthritis and healthy controls. Lower pressure pain thresholds in people with osteoarthritis in affected sites may suggest peripheral sensitisation and in remote sites may suggest central sensitisation. Quantitative sensory testing merited further investigation as a research tool to help understand pain mechanisms in osteoarthritis.

CRD commentary
The research objective was clearly stated. Inclusion criteria and the approach to addressing the research question were poorly described. Various sources were searched for relevant studies without language restrictions, which increased potential for retrieval of relevant studies. Measures to minimise error and bias in the review process were applied only to some parts of the data extraction and although the methodological quality of included studies was assessed the results of this assessment were not reported. Therefore it was not possible to assess potential effects on the findings of weakness in the methodology of the review or the included studies.

The reported results indicated a difference in the results of quantitative sensory testing between people with osteoarthritis and healthy controls. However, they did not give any indication of the ability of quantitative sensory testing to differentiate between people with and without osteoarthritis where diagnosis was unknown.

The authors’ conclusion that quantitative sensory testing could be a useful research tool to investigate pain mechanisms in osteoarthritis appears reasonable. The conclusion that quantitative sensory testing of pressure pain thresholds can
differentiate between people with osteoarthritis and healthy controls is not adequately supported by the data.

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

**Practice**: The authors did not specify any recommendations for clinical practice.

**Research**: The authors stated that large RCTs were required to assess the ability of quantitative sensory testing to phenotype individual patients in order to direct therapy and improve treatment outcomes. They further stated that adoption of standardised quantitative sensory testing protocols in studies would facilitate comparisons between studies and groups and pooling of data would permit greater confidence in the generalisability of study results.

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