Application of surface electromyography in the assessment of low back pain: a literature review
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Authors' objectives
To assess the clinical application of surface electromyography (SEMG) in the assessment of people with chronic lower-back pain (LBP).

Searching
CINAHL, MEDLINE and BIDS were searched for articles published in the English language between 1985 and 1999. The keywords were 'surface electromyography', 'lumbar muscles', 'LBP', 'median frequency', 'comparison study', 'muscle fatigue', 'paraspinal muscle', 'endurance' and 'classification'. The references in relevant publications were also reviewed.

Study selection
Study designs of evaluations included in the review
The inclusion criteria were not defined in terms of the study design. The primary studies included comparative studies.

Specific interventions included in the review
Studies that used SEMG to assess paraspinal muscles were eligible. In the included studies, the electrodes were located at L1 to L5, rectus abdominis, upper trapezius, erector spine, iliocostalis, gluteus maximus, multifidus and combinations of these. The EMG parameters assessed were: raw EMG, integrated EMG, average EMG, median frequency, median frequency slope, EMG activity and magnitude of myoelectrical activity. The test positions included: sitting with and without back support; standing; trunk flexion, extension or rotation; stooping; walking; isometric trunk testing; isometric extension; prone position; lifting two-pound disks; and unsupported trunk holding test.

Reference standard test against which the new test was compared
The reference standard was not explicitly stated but appears to have been a clinical diagnosis (no details provided) of lower-back pain.

Participants included in the review
Studies that included patients with LBP were eligible. The participants in the included studies that investigated the reliability of the EMG assessment were people with and without LBP, normal people and healthy females.

Outcomes assessed in the review
The inclusion criteria were not defined in terms of the outcomes. In the review, the outcomes were classified as positive if the original authors concluded there was a difference in measures recorded by EMG in LBP patients in any position, compared with normal people, in the total group or in a subgroup of the study population. The outcomes were classified as negative if the original authors concluded there was no difference between chronic LBP patients and normal people, in terms of the EMG measures.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the reviewers performed the selection.

Assessment of study quality
Validity was not formally assessed, although some aspects of it were mentioned in the text.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.

The following information were tabulated in the review: author and year of publication; test position; number of people with and without chronic LBP; electrode location; EMG parameter; and results and conclusions.

**Methods of synthesis**

*How were the studies combined?*

The numbers of studies classified as positive or negative were counted.

*How were differences between studies investigated?*

Differences between the studies were discussed in the text of the review with respect to the reliability and validity of the diagnostic procedures.

**Results of the review**

Thirty-eight studies (2,102 people) were included. This included 14 studies (428 people) that investigated the reliability of an EMG assessment of LBP.

Methodological flaws in the primary studies included: small sample sizes; the lack of a common definition for LBP; designs that combined various diagnostic subgroups of chronic LBP; the lack of standardised methods of analysing SEMG signals; the lack of reliable SEMG parameters; inter-individual variability in physical fitness, gender and age; and the lack of standardised electrode placement.

Thirty of the 38 studies reported differences in SEMG measures for LBP patients, compared with normal people, when tested in one or more postural positions (classified as positive studies). Eight studies found no difference in SEMG between people with LBP and normal people (classified as negative studies).

Ten of the 12 studies that monitored rehabilitation programmes reported positive results, while 2 studies found no change in SEMG after rehabilitation.

Seventeen of the 21 studies that tried to identify LBP patients from normal people reported positive results.

**Authors' conclusions**

There was great variation in the included studies regarding the methodology, procedure, type of muscle contraction, sample size, and the duration, degree and source of the patients' pain. However, based on this review, there appears to be convincing evidence that SEMG is a reliable and valid tool for differentiating LBP patients from normal people and for monitoring rehabilitation programmes.

**CRD commentary**

The aims of the review were stated, and the inclusion criteria were broadly defined in terms of the reference test and participants. The inclusion criteria were not defined in terms of the study design, reference standard or outcomes. The criteria used to define people with LBP and normal controls were not described. Several databases were searched, but restricting the search to studies published in the English language may have resulted in the omission of other relevant studies. The lack of an attempt to locate unpublished material raises the possibility of publication bias.

The methods used to select the studies were not reported and validity was not formally assessed, although some aspects of validity were mentioned in the text. Some relevant information was tabulated, but the methods used to extract the data were not described. The studies were combined by counting the number of studies classified as having positive or negative conclusions without assessing the validity of the original authors' conclusions. The review contained insufficient details of the methods used to conduct the review, and no information on the internal or external validity of the results. The review examined whether the SEMG levels were different in people with LBP and 'normals', rather than assessing the diagnostic accuracy of SEMG in LBP.
The information presented does not provide adequate support for the authors' conclusions.

**Implications of the review for practice and research**
Practice: The authors state that SEMG is a reliable and valid tool for differentiating LBP patients from normal people and for monitoring rehabilitation programmes.

Research: The authors state that there is a need for further research on the classification of various subgroups of LBP patients and the identification of individuals at risk of developing LBP.

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