Stoop or squat: a review of biomechanical studies on lifting technique

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Authors' objectives
To assess the biomechanical evidence in support of advocating the squat lifting technique as an administrative control to prevent low back pain.

Searching
MEDLINE, Current Contents, EMBASE and NIOSHTIC were searched using the keywords 'lifting' and 'technique'. The literature retrieved in this way was supplemented with references from reviews with a somewhat broader scope and studies cited in the previously retrieved papers.

Study selection
Study designs of evaluations included in the review
No information is provided on the study designs included.

Specific interventions included in the review
The squat lifting technique versus the stoop lifting technique. In the squat technique or leg lift, the back remains as erect as possible and the knees are flexed. The review was limited to studies comparing the use of the stoop and squat techniques, and to symmetric lifting.

Participants included in the review
No information is provided on the participants included.

Outcomes assessed in the review
Indicators of 4 parameters were of interest: compression and shear acting on the spine, tensile stresses in the posterior spine, and muscle force. Indicators were based on measurement (intra-discal pressure (IDP), intra-abdominal pressure (IAP), spinal shrinkage, and electromyogram (EMG)) or model calculations. The validity of these indicators was evaluated and a score for validity of each indicator and estimation method given: 0=invalid (IAP), and excluded from the review; 1=limited validity; 2=model-based sufficiently validated; 3=highly valid indicators (IDP). A summary of outcomes and their validity is presented in table 1.

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
The authors do not state that they assessed quality. However, the validity of the outcome measures was reported.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the authors performed the data extraction. Data was extracted on dependent variables, method, validity, gender, load, horizontal position, stoop, squat, difference percentage stoop, p-value, and overall conclusion and comments.

Methods of synthesis
How were the studies combined?
Studies were combined in a narrative way.
How were differences between studies investigated?
The authors do not state how differences between the studies were investigated.

Results of the review
In total 27 studies were included, some reported on several dependent biomechanical variables.

Spinal compression as indicated by intra-discal pressure and spinal shrinkage does not appear significantly different between the two lifting techniques. Net moments and compression forces based on model estimates were found to be equal or somewhat higher in squat than in stoop lifting. Only when the load could be lifted from a position in between the feet did squat lifting cause lower net moments, although the studies reporting this finding had a marginal validity. Shear force and bending moments acting on the spine appeared lower in squat lifting. Net moments and compression forces during lifting reach magnitudes, that can probably cause injury, whereas shear forces and bending moments remained below injury threshold in both techniques.

Authors' conclusions
The biomechanical literature does not provide support for advocating the squat technique as a means of preventing low back pain.

CRD commentary
This review presents a clear comparison of two lifting techniques: stoop and squat. However, the review suffers from some methodological flaws: the authors do not report how many reviewers were involved in decisions on inclusion or exclusion of primary studies, and on data extraction. There is no information on participants and study designs of primary studies, and the quality of studies was not assessed. The authors' conclusions follow from the results presented but should be interpreted with caution due to the methodological limitations of the review.

Implications of the review for practice and research
Practice: Controls for preventing LBP associated with lifting should be focused on other aspects of lifting.

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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.