

Effects of a Lifting Belt on Spine Moments and Muscle Recruitments After Unexpected Sudden Loading

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Study Design. Ten men and eight women participated in a repeated-measures experiment in which sudden loads were applied unexpectedly to a container held in the hands. Three independent variables were investigated: lifting belt use, preload, and load symmetry.

Objectives. To determine whether a lifting belt would help protect the spine in sudden symmetric and asymmetric loading situations.

Summary of Background Data. Unexpected loading events have long been associated with the onset of back pain. Based on work showing that lifting belts restrict motion of the torso, the hypothesis was that a lifting belt would stiffen the spine, thereby protecting its supporting tissues.

Methods. A weight, equal to 7.5% of the subjects' trunk extension force, was allowed to fall 1 m before the bottom of a box held by blindfolded subjects was pulled. Kinetic and kinematic data, obtained from two force plates and a magnetic motion measurement system, were used in a three-dimensional, dynamic, linked-segment biomechanical model to calculate spine moments. Electromyogram data were simultaneously obtained from eight trunk muscles.

Results. The belt reduced the forward bending of the spine during the symmetric loadings. In the men, the belt also reduced the forward flexion moment acting on the spine. The belt restricted lateral bending in the women and men, when the box was preloaded. The peak electromyogram amplitudes from posterior contralateral erector spinae and latissimus dorsi muscles increased during the asymmetric loadings, whereas three ipsilateral muscles were less active.

Conclusions. The conflicting moment and electromyographic results, combined with the influence of load symmetry, preload, and gender make the benefits of the lifting belt difficult to delineate. Although the data support the hypothesis that the belt stiffens the torso's response to sudden loading, the effects are small, and considerable individual differences exist. The findings show that during unexpected sudden loading, a belt may reduce the net external moment loading. At the same time the belt appears to alter the muscle response strategy so that the belt's overall effect on an individual's safety is hard to determine. [Key words: back support, ergonomics, lifting belt, low back pain, sudden loading] **Spine 2000;25:1569-1578**
