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The influence of posture and loading on interfacet spacing: an investigation using magnetic resonance imaging on porcine spinal units.

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Abstract

STUDY DESIGN: Basic scientific investigation using porcine spine segments and magnetic resonance imaging.

OBJECTIVE: To quantify the effects of flexion-extension postures and loading history on the distance between the facet articular surfaces.

SUMMARY OF BACKGROUND DATA: Increased axial twist motion is used clinically to indicate instability and has been implicated as a potential cause of low back pain. Recently, it has been demonstrated that larger twist angles can be achieved when coupled with forward flexion in vivo. These findings suggest a postural mechanism may be responsible for modulating how the facet joints articulate, thereby affecting the moment resisting capability of the facets and altering the load distribution between the facet joints and the disc.

METHODS: Four porcine cervical spine motion segments (C3-C4) were exposed to a compressive preload. Two of these specimens were also exposed to 5000 repeats of flexion-extension motions. The interfacet spacing was measured from magnetic resonance images of 6 postures: neutral, maximum flexed, maximum extended, neutral-twisted, maximum flexed-twisted, and maximum extended-twisted. The range of axial twist angle was quantified in the neutral, flexed, and extended postures.

RESULTS: Flexion-extension postures and loading history caused a difference in the interfacet spacing and twist angle measured. Repetitive loading and flexed postures independently increased the spacing and twist angle, whereas the preload condition and extended postures independently decreased the measures. The 2 specimens that underwent the preload only condition suffered no damage to the disc or vertebrae. Of the

repetitively loaded specimens, 1 had a vertebral fracture with initiation of herniation, and the second had a complete herniation.

CONCLUSION: The findings support a posture-dependent injury mechanism and may account for the previously reported in vivo posture-dependent passive rotational differences quantified for combined postures. The changes in spine mechanics and resulting load distribution due to coupled postures may be a key to understanding the formation of low back injuries and eventually clinical spine instability.

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