The relative importance of vertebral bone density and disc degeneration in spinal flexibility and interbody implant performance. An in vitro study

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STUDY DESIGN
An in vitro biomechanical investigation in the human lumbar spine focuses on the functional significance of vertebral bone density and intervertebral disc degenerations.

OBJECTIVE
To determine the interrelationship between vertebral bone density and intervertebral disc degeneration, their effect on normal spine motion, and their significance in the biotechnical performance of interbody fixation techniques.

SUMMARY OF BACKGROUND DATA
A relationship between vertebral bone density and intervertebral disc degeneration has been suggested, but a definitive relationship has not been established. The effect of vertebral bone density and intervertebral disc degeneration on interbody stabilization remains unknown despite the rapidly increasing use of this surgical method for patients with chronic low back pain.

METHODS
The vertebral bone density and intervertebral disc degeneration of 72 functional spinal units were determined using dual energy x-ray absorptiometry scans and macroscopic grading, respectively. A three-dimensional flexibility test was performed on 24 functional spinal units in the intact and stabilised conditions. The compressive behavior of the bone-implant interface was evaluated in 48 functional spinal units.

RESULTS
The vertebral bone density in moderately degenerated disc was significantly lower than at all other levels of intervertebral disc degeneration. Increasing intervertebral disc degeneration resulted in more axial rotation and less lateral bending. In flexion-extension and lateral bending, better vertebral bone resulted in significantly better stabilization. This trend was observed also in axial compression in which higher failure loads were observed with greater bone densities.
CONCLUSION
The authors conclude a significant relationship exists between bone density and disc degeneration, bone density is a highly important factor in the performance of interbody stabilization, and disc degeneration, is of moderate importance in signal motion.

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