

Effects of unisegmental disc compression on adjacent segments: an in vivo animal model

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It is controversial whether fusion of discs in the spine leads to increased degeneration on the remaining discs or whether the degenerative changes are merely a part of the inevitable natural history process. To determine the effects of unisegmental compression and subsequent recovery on adjacent segments, we studied histology, radiology and intradiscal pressure using an in vivo rabbit model. Fifteen New Zealand rabbits were divided into three groups of five. In the first group, the intervertebral disc L4-L5 of the lumbar spine was axially loaded for 28 days with an external loading device. In the second group, the intervertebral disc was compressed for 28 days and allowed to recover for an equal amount of time, with the loading device removed. Five animals underwent a sham operation, in which the external loading device was situated, but their discs remained unloaded for 28 days. The intradiscal pressure was determined in the loaded discs as well as in the cranial and caudal adjacent discs. Lateral radiographs were taken from each subjected intervertebral disc with adjacent vertebral bodies and the cranial and caudal adjacent segments. The compressed discs showed lower intradiscal pressure in comparison with the control group, which remained unloaded. In the cranial and caudal discs adjacent to the loaded discs the average intradiscal pressure was similar to the unloaded controls. The loaded discs demonstrated a significant decrease in disc space. No discs adjacent to the loaded discs changed in height. The lamellar architecture of the inner, middle, and outer annulus became more disorganized in the loaded discs. The nucleus pulposus showed increase of mucoid degeneration and increased cell death. Intervertebral discs from the control group and the adjacent discs to the compressed discs maintained their normal morphology. This study shows that mechanical loading of discs in the spine can cause rapid degeneration. Adjacent discs, however, did not change in terms of radiology, intradiscal pressure, or histology.

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