Distraction results in disc rehydration, stimulated extracellular matrix gene expression, and increased numbers of protein-expressing cells."

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STUDY DESIGN: An animal model of degeneration was used to determine the effects of disc distraction, and was evaluated with magnetic resonance imaging (MRI) as well as gene and protein expression levels.

OBJECTIVE: To investigate gene expression and MRI effects of distraction.

SUMMARY OF BACKGROUND DATA: Disc degeneration can result from hyper-physiologic loading. Distracted discs with degeneration showed histologic signs of tissue recovery.

METHODS: There were 18 rabbits that underwent 28 days of compression (200 N) to induce moderate disc degeneration followed by 28 days of distraction (120 N; attached and loaded distraction device) or sham distraction (attached but unloaded distraction device). Comparison was performed with 56 days of compressed discs without distraction. Quantitative outcome measures were MRI signal intensity and gene expression analysis to determine: messenger ribonucleic acid levels for extracellular matrix genes, including collagen 1, collagen 2, biglycan, decorin, aggrecan, fibromodulin, and osteonectin; and matrix-regulative genes, including matrix metalloproteinase-13, tissue-inhibitor of matrix metalloproteinase-1, and bone morphogenetic protein (BMP)-2. Immunohistology was performed for collagen 2 and BMP-2 to label cells semiquantitatively by staining of the cell-surrounding matrix.

RESULTS: A total of 28 days of compression decreased signal intensity. Distraction over the same period reestablished physiologic signal intensity, however, a persistent reduction was found in sham distraction. Distraction resulted in gene expression up-

regulation of collagen 1 (5.4-fold), collagen 2 (5.5-fold), biglycan (7.7-fold), and decorin (3.4-fold), while expression of fibromodulin (0.16-fold), tissue-inhibitor of matrix metalloproteinase-1 (0.05-fold), and BMP-2 (0.15-fold) was decreased, as compared with 56 days compression. Distracted discs showed more BMP-2 (19.67 vs. 3.67 in 56 days compression) and collagen 2 (18.67 vs. 11.33 in 56 days compression) positive cells per field.

CONCLUSIONS: Distraction results in disc rehydration, stimulated extracellular matrix gene expression, and increased numbers of protein-expressing cells.