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Basic Science

Intervertebral Disc Repair Using Adipose Tissue-Derived Stem and Regenerative Cells: Experiments in a Canine Model

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Metrics

Abstract

In Brief

Study Design.

Therapeutic treatment of intervertebral disc repair using cells.

Objective.

The goal of the study was to test the hypothesis that repair of a damaged disc is possible using autologous adipose tissue derived stem and regenerative cells (ADRCs).

Summary of Background Data.

Degradation resulting from either acute or chronic repetitive disc injury leads to disc degeneration. However, if a damaged disc could be repaired in the early stages, before the onslaught of degradation, then the disc degeneration process may be slowed down.

Methods.

Twelve dogs underwent a partial nucleotomy at 3 lumbar levels (L3–L4, L4–L5, and L5–L6); adjacent levels served as nonoperated controls. The animals (or discs) were allowed to recover from the surgery for 6 weeks. At that time subcutaneous adipose tissue was harvested and ADRCs were isolated. The 3 experimental discs that had undergone a partial nucleotomy were randomized to receive: (1) ADRCs in hyaluronic acid carrier (Cells/HA); (2) HA only; or (3) No Intervention. Assessments of the 3 experimental discs plus the 2 adjacent untouched discs were made using MRI, radiography, histology, and biochemistry. The animals were killed at 6 months and at 12 months.

Results.

Repair in this study was specifically demonstrated through histology and biochemical analysis. Disc levels receiving ADRCs more closely resembled the healthy controls as evidenced in matrix translucency, compartmentalization of the anulus, and in cell density within the nucleus pulposus. Matrix analysis for Type-II collagen and aggrecan demonstrated evidence of a statistically better regenerative stimulation to the disc provided by ADRCs when compared to either the HA only or no intervention treatments.

Conclusion.

Autologous adipose tissue derived stem and regenerative cells, as used in this disc injury model, were effective in promoting disc regeneration, as evidenced by disc matrix production and overall disc morphology.

A study was carried out in a dog model to test the hypothesis that repair of the damaged disc is possible using adipose tissue derived stem and regenerative cells therapy. The results show that adipose tissue derived stem and regenerative cells were effective in promoting disc regeneration, as evidenced by disc matrix production and overall disc morphology.

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