Annulus Fibrosus Cell

The aim of the Weill Cornell Brain and Spine Center in New York, is assessing the in vivo efficacy of annulus fibrosus (AF) cells seeded into collagen by enhancing the reparative process around annular defects and preventing further degeneration in a rat-tail model.

Treating disc herniation with discectomy may relieve the related symptoms but does not address the underlying pathology. The persistent annular defect may lead to re-herniation and further degeneration.

Moriguchi et al., demonstrated that riboflavin crosslinked high-density collagen gels (HDC) can facilitate annular repair in vivo.

42 rats, tail disc punctured with an 18-gauge needle, were divided into 3 groups: untreated (n=6), injected with crosslinked HDC (n=18), and injected with AF cell-laden crosslinked HDC (n=18). Ovine AF cells were mixed with HDC gels prior to injection. X-rays and MRIs were conducted over 5 weeks, determining disc height index (DHI), nucleus pulposus (NP) size, and hydration. Histological assessments evaluated the viability of implanted cells and degree of annular repair.

Although average DHIs of both HDC gel groups were higher than those of the puncture control group at 5 weeks, the retention of disc height, NP size and hydration at 1 and 5 weeks was significant for the cellular group compared to the punctured, and at 5 weeks to the acellular group. Histological assessment indicated that AF cell-laden HDC gels have accelerated reparative sealing compared to acellular HDC gels.

AF cell-laden HDC gels have the ability of better repairing annular defects than acellular gels after needle puncture.

This project addresses the compelling demand of a sufficient treatment strategy for degenerative disc disease (DDD) perpetuated by annulus fibrosus (AF) injury, a major cause of morbidity and burden to Healthcare systems.

The study is designed to answer the question of whether injectable, photo-crosslinked, high density collagen gels can seal defects in the annulus fibrosus of rats and prevent disc degeneration. Furthermore, we investigated whether the healing of AF defects will be enhanced by the delivery of AF cells (fibrochondrocytes) to these defects. The use of cell-laden collagen gels in spine surgery holds promise for a wide array of applications, from current discectomy procedures to future nucleus pulposus reparative therapies, and our group is excited about this potential [1)].

1)
Moriguchi Y, Borde B, Berlin C, Wipplinger C, Sloan SR, Kirnaz S, Pennicooke B, Navarro-Ramirez R, Khair T, Grunert P, Kim E, Bonassar L, Härtl R. In Vivo Annular Repair using High-Density Collagen Gel Seeded with Annulus Fibrosus Cells. Acta Biomater. 2018 Jul 4. pii: S1742-7061(18)30402-1. doi: 10.1016/j.actbio.2018.07.008. [Epub ahead of print] PubMed PMID: 29981494.