

Injectable Hydrogel Provides Growth-Permissive Environment for Human Nucleus Pulposus Cells

Priyanka Priyadarshani

Faculty: Li Yao

Department of Biological Science, Fairmount College of Liberal Arts and Sciences

Intervertebral discs within the human spine act as shock absorbers between each of the vertebrae in the spinal column. As we age, disc cells are constantly subjugated to degenerating stress by various mechanical and environmental factors leading to musculoskeletal impairment and lower back pain. Nucleus pulposus cells (NP cells), jelly-like avascular tissue within the middle of the intervertebral disc, are the crucial component of the disc and the starting point for disc degeneration. Research into regenerating the NP cells in degenerating intervertebral discs may provide a breakthrough in treating spine disorders. This experiment is designed to fabricate and characterize hydrogel composites to investigate the growth and viability of human nucleus pulposus (HNP) cells and the gene expression of the extracellular matrix by the HNP cells in the hydrogel. Specifically, we tested collagen type II and hyaluronic acid hydrogels cross-linked with the ethyl-3(3-dimethylaminopropyl) carbodiimide(EDC) and N-hydroxysuccinimide crosslinker (NHS). The hydrogels were cross-linked using varying concentrations of the crosslinkers. The hydrogel without the crosslinker was used as the control. HNP were seeded into crosslinked and non-crosslinked hydrogels. Results from live/dead assay and alamar blue assay showed cell growth and proliferation in both crosslinked and crosslinked hydrogel. Cell cultured in EDC cross-linked hydrogel exhibited amplified proliferations. Quantitative PCR assay demonstrated the gene expression of extracellular matrix by the cells cultured in non-crosslinked gel and the crosslinked gel. The results of gene expression study indicated the adaption of cells to the environment after long term cell culture in these hydrogels. This study suggests that the type II collagen-HA hydrogel and crosslinked hydrogel with EDC at low concentration is permissive matrix for the growth of HNP cells and can be potentially applied in the NP repair.