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FUNCTIONALIZED PEG HYDROGEL SCAFFOLDS FOR NUCLEUS PULPOSUS CELL ENCAPSULATION

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Lower back pain associated with old age can commonly be attributed to degeneration of the nucleus pulposus (NP) region of the intervertebral disc (IVD). Specifically, age may lead to biochemical changes, leading to a dehydration of the inner gelatinous nucleus pulposus (NP). This may in turn lead to reduced mobility and shock absorption, increasing the risk for tissue fragility and disc damage. Injectable biomaterials that mimic the mechanical properties of a healthy disc capable of stimulate healthy cell growth have generated a lot of interest towards developing a noninvasive treatment. Our aim was to fabricate polyethylene glycol (PEG) hydrogels with NP cells and test its abilities as an injectable cell carrier for potential use for an IVD treatment. Homogenous initial cell dispersion throughout the hydrogel to increase possible cell interaction and cell viability were the main criteria by which the hydrogels were judged. To gather this data, PEG hydrogels were fabricated through Michael addition using either an 8-arm PEG-Acrylate or an 8-arm PEG-Maleimide crosslinked with PEG-dithiol. Porcine NP cells were suspended in media and mixed with the dithiol precursor prior to the addition step to incorporate NP cells into the complete hydrogel. The 3D dispersion of the cells throughout the hydrogel was analyzed using z-stacks generated through confocal microscopy and immunostaining. An acidic pH PEG-maleimide protocol was found to be the most practical in terms of handling. Using this protocol, a preliminary three-day time-lapse study of the hydrogels was conducted using a live/dead assay. The data suggests that the embedded NP cells remained viable in media and a degree of clustering was shown. These results show that the fabrication of cell containing PEG-hydrogels maintains cell viability and evenly diffuses cells throughout which are positive traits for a potential cell carrier.