Cell-loaded gellan gum-based hydrogels for nucleus pulposus regeneration

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Limitations of current treatments for intervertebral disc (IVD) degeneration encourage the development of tissue engineering approaches. Injectable hydrogels loaded with cells can be used as substitute material for the inner part of the IVD, the nucleus pulposus (NP), and provide an opportunity for minimally invasive treatment of IVD degeneration. The NP is populated by chondrocyte-like cells, therefore, chondrocytes or mesenchymal stem cells (MSC), stimulated to differen-
tiate along the chondrogenic lineage could be used to promote NP regeneration. Here we present an in vitro response of bone marrow-derived MSC and nasal chondrocytes (NC) to modified gellan gum-based hydrogels. Both ionic- (GG-MA) and photo-crosslinked (phGG-MA) methacrylated gellan gum showed no cytotoxicity in extraction assays with MSC and NC. Furthermore, the materials did not induce pro-inflammatory responses in endothelial cells. MSC and NC attached and formed a monolayer on the hydrogel surface. Moreover, both cell types could be encapsulated into the hydrogels and remained viable for at least 2 weeks, as shown by live cell staining and histochemistry. Importantly, encapsulated MSC and NC showed an increased expression of chondrocytic markers in response to chondrogenic conditions. Altogether, the data confirm the potential of modified gellan gum-based materials in NP tissue engineering.

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