NOVEL HYDROGELS FOR TISSUE ENGINEERING OF INTERVERTEBRAL DISC

Authors

Pereira DR [1,2], Silva-Correia J [1,2], Caridade SG [1,2], Sousa RA[1,2], Oliveira JM [1,2], Mano JF [1,2], Reis RL[1,2]

Affiliations

[1] 3B's Research Group - Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, AvePark, Guimarães, Portugal; [2] ICVS/3B's - PT Government Associate Laboratory, Braga/Guimarães, Portugal

Abstract text

Objectives: Centrally situated in the intervertebral disc (IVD) structure, nucleus pulposus (NP) is a gel-like tissue containing proteoglycan (PG) such as versican, biglycan, decorin, fibromodulin, luminican and especially aggrecan. NP has an important structural role in the IVD, and upon damage it possesses a limited sel-repair capacity. Therefore, the main purpose of this work was to develop novel gellan gum-based hydrogel (GG) formulations consisting of GG MPs dispersed in a GG matrix for finding application as a NP substitute.

Methods: Several GG MP/hydrogels discs formulations were prepared by means of mixing high and low acyl GG at different ratio, namely 75%:25% (v/v); 50%:50% (v/v), 25%:75% (v/v); HAGG 0.75% and LAGG 2%, respectively. The GG MP/hydrogel discs formulations were investigated by dynamic mechanical analysis (DMA), swelling behaviour and degradation rate. The possible cytotoxicity of MP/hydrogel discs leachables was screened *in vitro* by means of using a rat lung fibroblast-like cell (L929 cells) line. In order to qualitatively investigate the encapsulation efficacy of L929 cells into the GG MP/hydrogel discs a Live/Dead cell viability assay was also carried out.

Results and Discussion: The developed GG MPs/hydrogel discs were physico-chemically characterized by FTIR and ^{1}H-NMR, and GG MPs size was measured by a stereo microscope by means of staining the MPs with Toluidine Blue-O. From DMA analysis, we observed that the optimal outcome to reinforce GG matrices may be in the range of 50-500 mg/mL of incorporated MPs. The cell culture studies demonstrated that MP/hydrogels discs are non-cytotoxic over L929 cells. Complementarily, it was also demonstrated that L929 cells can be successfully encapsulated in the GG MP of different formulation and that were viable after 72 hours of culturing.

Conclusions: The developed GG MPs/hydrogel discs are promising hydrogels for being used in IVD tissue engineering applications.