Regeneration of the intervertebral disc

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Degeneration of intervertebral disc (IVD) seems to be one of the main causes associated to lower back pain (LBP), one of the most common painful conditions that lead to work absenteeism, medical visits, and hospitalization in actual society [1,2]. This complex fibro-cartilaginous structure is composed by two structures, an outer multilayer fiber structure (annulus fibrosus, AF) and a gel-like inner core (nucleus pulposus, NP), which are sandwiched in part between two cartilage endplates (CEP) [1]. Existing conservative and surgical treatments for LBP are directed to pain relief and do not adequately restore disc structure and mechanical function [2]. In the last years, several studies have been focusing on the development of tissue engineering (TE) approaches aiming to substitute/regenerate the AF or NP, or both by developing an artificial disc that could be implanted in the body thus replacing the damaged disc [3]. TE strategies aiming to regenerate NP tissue often rely on the use of natural hydrogels, due to the number of advantages that these highly hydrated networks can offer. Nevertheless, several of the hydrogel systems developed still present numerous problems, such as variability of production, and inappropriate mechanical and degradation behaviour. Recently, our group has proposed the use of gellan gum (GG) and its derivatives, namely the ionic- and photo-crosslinked methacrylated gellan gum (GG-MA) hydrogels, as potential injectable scaffolds for IVD regeneration [4,5]. Work has been conducted regarding the improvement of GG mechanical properties either by chemically modifying the polymer (allowing to better control *in situ* gelation and hydrogel stability) [4] or by reinforcing it with biocompatible and biodegradable GG microparticles (enabling the control of degradation rate and cell distribution) [5]. Another strategy currently under investigation relies on the development of a biphasic scaffold that mimics the total disc by using a reverse engineering approach.

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