

Development of a dextrin-based hydrogel for bone regeneration

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Bone tissue engineering is a very challenging and promising field, which handles with the limitations of bone regenerative capacity and the failure of current orthopedic implants [1].

This work describes the preparation and characterization of an injectable dextrin-based hydrogel (oDex) able to incorporate nanoparticles, cells, biomolecules or Bonelike[®] granules [2]. Bonelike[®] is a Biosskin-molecular and cell therapies S.A. proprietary synthetic bone graft, and the outcome of the project will result in a novel injectable presentation of this product. The hydrogel was produced by dextrin oxidation with sodium periodate followed by cross-linking with a dihydrazide [3]. In vitro characterization of oDex hydrogel has shown acceptable mechanical properties, overall good biocompatibility and the ability to be combined with other materials such as a nanogel and urinary bladder matrix, without affecting its structure. Subcutaneous implants were performed in Sasco Sprague Dawley rats and, after 3 and 15 days post-implantation, a quantitative evaluation according to ISO 10993 was performed, leading to a classification of the implanted material as slight irritant. The performance of oDex hydrogel combined with Bonelike granules and/or UBM in bone defects was investigated in New Zealand rabbits showing that oDex does not constitute a barrier for cellular colonization and proliferation. A sterilization protocol for oDex hydrogels by gamma and beta radiation was investigated through irradiation of oxidized dextrin solutions. Despite both kinds of radiation induced slight differences in the storage modulus of the hydrogels, indicating the occurrence of chain scission/cross-linking effects on the dextrin chain, all materials were gelable after the irradiation treatments. oDex hydrogels provides a system that can carry and stabilize cells, nanogels, Bonelike[®] granules and other biomolecules. It is a promising biomaterial due to its biocompatibility, and potential to promote an adequate environment for bone regeneration.

This work has been developed in the scope of an European project that allowed collaborations with research groups, which have complementary expertise. The tight collaboration between University of Minho and Bioskin S.A. company, envisioning technology transfer and product valorization, has resulted in a published international patent of the product (WO2011070529A2) [4]. Currently, a new set of pre-clinical trials in sheep models are being planned as well as the submission of a request for the authorization for the clinical trials.

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