Porous Poly(D,L-lactic acid)/Carbon Nanotubes/Nanohydroxyapatite Nanocomposite Scaffold for Osteochondral Tissue Engineering Applications

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The regeneration of articular cartilage injuries remains one of the most important challenges for orthopaedic surgeons and researchers. Frequently the bone located below the cartilage is also damaged, resulting in defects known as osteochondral lesions [1, 2]. Tissue engineering has emerged as potential approach to cartilage and osteochondral defects. The principal challenge of osteochondral tissue engineering is to create a scaffold with potential to regenerate both cartilage and the subchondral bone involved, taking into account the specific intrinsic properties of each tissue [3]. From that perspective, scaffolds based only on bioceramics or polymers singly have shown a series of limitations and composites that combine these biomaterials have been explored. Recent nanocomposites based on the incorporation of nanoscale fillers into polymer matrix has shown promising results for the treatment of osteochondral defects. In a previous study, we developed a novel porous hydrophilic Poly(D,L-lactic acid)/Carbon Nanotubes/Nanohydroxyapatite (PDLLA/CNT/nHap) nanocomposite scaffolds that showed to be able to mimic the bone immature and induced bone remodelling [4]. Based on these findings, in this present study we use the same two methodologies (electrodeposition and immersion in simulated body fluid) to obtain porous PDLLA/CNT/nHap nanocomposite scaffolds, in order to analyse cell behaviour and gene expression of chondrocytes, and then assess the applicability of this nanobiomaterial for osteochondral regenerative medicine. The results demonstrate that PDLLA/CNT/nHap nanocomposite promote chondrocytes adhesion, non-cytotoxic effects and decrease the type I Collagen mRNA expression. Therefore, these finding encourage the use of the novel nanobiomaterial as scaffold for osteochondral tissue engineering applications.

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