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Strategy optimization of the combination of 3D extruded-based poly (ε-caprolactone) scaffolds with mesenchymal stem cells towards cartilage regeneration

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Hyaline cartilage is a critical tissue to normal articular function. Natural restoring of this tissue in patients with rheumatoid arthritis, osteoarthritis or traumas is extremely limited considering its low regenerative capacity. These conditions cause an enormous constraint to the daily routine and, consequently, lower quality of life and they are managed, according with severity, through the use of pharmaceutics, surgery, transplant or prosthetic procedures. Tissue Engineering (TE) emerges as a new promising tool to provide long lasting regenerating solutions. In this work we used the combination of 3D extruded-based scaffolds made of poly (ε-caprolactone) (PCL) and human bone marrow-derived mesenchymal stem cells (MSC) to provide initial higher cell densities, followed by differentiation in chondrocytes. The aim of this study is to understand the influence in cell behavior of scaffolds manufactured by layer-by-layer extrusion with a pore size (190 – 390 μm) and fiber alignments (0-45º and 0-90º), as well as of two different atmospheric conditions, normoxia (21% O_2) and hypoxia (5% O_2). Results obtained showed that pore size and fiber alignment do not pose a limitation for cell adhesion and proliferation within the range of pore sizes studied. However, cell distribution and dimension of chondrocyte aggregates strongly depend on fiber alignment. The results obtained in this study point out that higher chondrocyte population is obtained, when previously to differentiation stage, MSC are expanded in the PCL under hypoxia condition, rather than normoxia.

Biography

Carla Moura is a PhD student of the MIT-Portugal Program in Bioengineering. Her work is done in collaboration between Centre for Rapid and Sustainable Product Development (CDRsp), Polytechnic Institute of Leiria and Institute of Biotechnology and Bioengineering (IBB), University of Lisbon. This research is sponsored by the Portuguese Foundation for Science and Technology through MIT Portugal Program, Bioengineering Systems Focus Area a PhD grant SFRH/BD/73970/2010 and an Investigator FCT research contract IF/00442/2012.

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