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Abstract

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DESIGN AND CHARACTERIZATION OF SYNTHETIC BIODEGRADABLE FILMS FOR MUSCULOSKELETAL TISSUE ENGINEERING

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To repair soft tissue, it is vital to ensure that the biomaterial is able to mimic the complex elasticity of the native tissue. It has been demonstrated that substrate stiffness has a huge influence on cellular growth, differentiation, motility and phenotype maintenance. The goal of the present study is to characterize extensively a set of polymeric films with variable mechanical profiles. A range of synthetic biodegradable polymers was selected according to the physico-chemical intrinsic properties of aliphatic polymers. They have similar chemistry (absorbable polyesters made from lactic acid, glycolic acid, trimethylene carbonate, dioxanone & β-caprolactone), however show different mechanical and degradation properties. The films were manufactured by thermal presser and then characterized by scanning electron microscopy (SEM), differential scanning calorimetry (DSC), nuclear magnetic resonance spectroscopy (NMR) and Fourier transform infrared spectroscopy (FTIR). The mechanical properties of the films were assessed by uniaxial tensile tests in wet conditions and also by atomic force microscopy (AFM) to assess the material's stiffness at a micro-level. *In vitro* assays were performed to assess the cell cytocompatibility, proliferation and differentiation potential of the films. The mechanical properties of the materials are within the range intended for musculoskeletal tissue repair. Biological assays showed good cell adhesion, cell proliferation and cell viability. Stem cells were able to differentiate into adipogenic, osteogenic, chondrogenic and tenogenic lineages. Overall the selection of polymers gave good options for a potential tissue repair scaffold. In the future, the combined effect of stiffness and topography will be assessed on cell phenotype maintenance.

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