TS053
Suitability of silk-based 3D biotextiles seeded with human adipose-derived stem cells for a bone tissue engineering approach

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Human Adipose-derived Stem Cells (hASCs) became an emerging possibility for tissue replacement therapies, such as bone tissue regeneration. Due to their osteogenic differentiation potential, easy isolation, expansion and *in vitro* proliferation, they have become a highly potential source of seed cells to be seeded in bone tissue engineering (TE) constructs and have demonstrated promising prospects in bone regeneration [1, 2]. To date several strategies have been proposed with more or less success to prepare porous three-dimensional biodegradable scaffolds for bone TE. Among them, textile technologies are particularly interesting since they can allow for producing finely tuned, fibre-based complex structures, offering superior control over the design (ex: size, shape, porosity, fibre alignment), manufacturing and reproducibility. The aim of this work is to evaluate the potential of recently developed silk-based biotextile structures [3] to promote hASCs adhesion, proliferation and osteoblastic differentiation. Natural silk yarns were processed into different 3D structures using standard knitting or warp-knitting technologies to increase the scaffold's tridimensionality. In the latter case two knitted silk layers are assembled and spaced by a monofilament of polyethylene terephthalate (PET). These constructs were characterized in terms of their morphology by Microcomputed Tomography (μ-CT) and scanning electron microscopy (SEM). The mechanical properties were investigated through compressive tests and dynamic mechanical analysis (DMA). All constructs disclose a biocompatible behavior, assessed using a mouse fibroblastic cell line (L929; ECACC, UK). hASCs were seeded onto the scaffolds and cultured for 14, 21 and 28 days in osteogenic medium. All textile constructs were analysed in terms of cell adhesion, proliferation and differentiation potential influence through the biological assays, alkaline phosphatase (ALP), DNA and Ca^{2+} quantification and histological, confocal, SEM and Real-Time PCR analysis. The obtained constructs present very reproducible intra-architectural scaffold geometry with high surface area and exhibiting a wide range of porosities. By the above mentioned assays it was possible validate the developed constructs as suitable for hASCs adhesion, proliferation and differentiation into an osteoblastic lineage. The positive influence of the developed 2D/3D textile structures on the osteoblastic differentiation potential of hACSs is an important outcome that validates future bone tissue enginnering approaches using these fibre-based architectures.

References:

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