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Silk-based 3D biotextiles support human adipose derived stem cells towards osteogenic differentiation

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Textile-based technologies are considered as potential routes for TE applications, since they allow for producing finely tuned fibre-based porous scaffolds with a very reproducible and interconnected intra-architectural geometry, increasing the surface area for cell attachment and tissue ingrowth. Human Adipose-derived Stem Cells (hASCs) constitute an emerging possibility for regenerative medicine and tissue replacement therapies. Their osteogenic differentiation potential, easy isolation, expansion and *in vitro* proliferation demonstrate their promising prospects in bone regeneration. The present work aims at evaluating the potential of recently developed 3D silk-based biotextile structures to support hASCs adhesion, proliferation and osteogenic differentiation. The 3D spacer structures were processed by using a knitting technology. Two knitted silk layers were assembled and spaced by a monofilament of polyethylene terephthalate (PET). A 3D structure made entirely of PET was also used for comparative purposes. Cells were seeded over the constructs for 7, 14, 21 and 28 days in basal and osteogenic conditions. HASCs adhesion, proliferation and the osteogenic differentiation potential of the textile structures were analysed through Scanning Electron Microscopy (SEM) and preliminary biological assays: alkaline phosphatase (ALP), DNA and Ca^{2+} quantification. The obtained results validate the developed constructs as suitable for hASCs adhesion, proliferation and differentiation into an osteoblastic lineage. Great evidences of extracellular matrix mineralization were observed as well as a deeply cell penetration and colonization into the scaffolds interior. The positive influence of the produced fibre-base architecture on the osteogenic differentiation of hASCs and ECM production validates thistechnology for being used in bone TE. Moreover, the versatility and reproducibility of this knitting technology can allow for further industrialization of TE products.