termis-eu 2013

Abstracts

17-20 June 2013 - Istanbul, Turkey

Complex 3D Architectures using a Textile Technology for Bone Tissue Engineering Applications

V. P. Ribeiro[1,2], A. S. Ribeiro[4], C. J. Silva[4], N. F. Durães[4], G. Bonifácio[5], V. M. Correlo[1,2], A. P. Marques[1,2], R. A. Sousa[1,2], A. L. Oliveira[1,2,3] and R. L. Reis[1,2*]

[1]3Bs Research Group–Biomaterials, Biodegradables and Biomimetics, Univ. of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, AvePark, Guimarães, Portugal
[2]IBB–Institute for Biotechnology and Bioengineering, PT Associated Laboratory, Guimarães, Portugal
[3]Department of Health Sciences, Portuguese Catholic University, Viseu, Portugal
[4]CeNTI, Centre for Nanotechnology and Smart Materials, V.N. Famalicão, Portugal
[5]CITEVE, Technological Center for Textile and Clothing Industry

Textile-based technologies are particularly interesting in tissue engineering since they allow producing finely tuned fibre-based porous structures, offering superior control over the material design (size, porosity, fibre alignment) and manufacturing. Scaffolds with very reproducible and interconnected intra-architectural geometry can be processed increasing the surface area for cell attachment and tissue ingrowth. This work aims to evaluate the potential of recently developed 3D textile structures based on silk fibroin (SF) to support human Adipose-derived Stem Cells (hASCs) adhesion, proliferation and osteogenic differentiation. These cells constitute an emerging possibility for regenerative medicine, including for bone tissue regeneration. A comparative analysis was performed with a more stable polymeric system, polyethylene terephthalate (PET). SF and PET yarns were processed into 3D spacer structures using warp-knitting technology. The obtained complex 3D architectures are composed of two knitted layers assembled/spaced by a PET monofilament to increase the tri-dimensionality of the scaffold. Cells were able to attach to the fibres, proliferate and differentiate into the osteogenic lineage. hASCs were able to deeply penetrate into the scaffold and colonize its interior with great evidences of extracellular matrix mineralization (Fig.1). The efficiency and high level of control of the warp-knitting technology together with the interesting structural properties of the resulting constructs makes this a very versatile and adaptable system to the specific bone tissue anatomy and function.

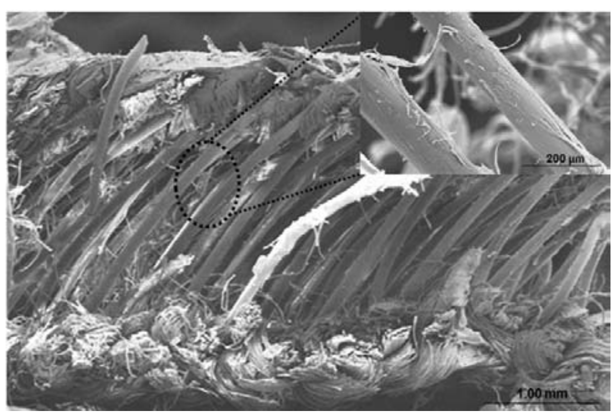

Fig.1- SEM micrograph showing hASCs penetration and attachment to the fibres of the complex 3D spacer architectures.