IJAE
Vol. 120, n. 1 (Supplement): 24, 2015
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

In vivo angiogenic activity induction by collagen-soaked Poly-L-lactic acid scaffolds

Gaetano Felice Caldara[1], Salvatrice Rigogliuso[1], Francesco Carfì[2], Valerio Brucato[2], Giulio Ghersi[1]

[1] Dipartimento di Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche, University of Palermo, Palermo, Italy - [2] Dipartimento di Ingegneria Chimica, Gestionale, Informatica, Meccanica, University of Palermo, Palermo, Italy

Angiogenesis is essential in tissue integration and it is involved in the biological response to biomaterials. Poly-L-lactic acid (PLLA), a synthetic polymer, is utilized as scaffolding to regenerate new tissues. This study investigated the short and long term degradation and the induction of neovascularization of both native PLLA (n-PLLA) and collagen type I soaked PLLA (c-PLLA) porous scaffolds, implanted subcutaneously in balb/c mice.

The comparative analysis by phase contrast, optical, and scanning electron microscopy (SEM) of scaffolds 7 and 21 days after implantation showed a mild inflammatory response at the implant site of c-PLLA scaffold. No significant difference in systemic immune response was detected by hematology analyzer, and by histological evaluation of lymph node and spleen features. On the contrary, immune reaction was moderate in n-PLLA. Pores of both PLLA networks laying on the muscle fibers were partially infiltrated by appositional collagen/elastin tissue, phagocytic cells, and fibroblast, with respect to the inner side. The presence of numerous and large blood vessels into pores of c-PLLA scaffolds showed an enhancing vascularization rate. These characteristics appeared to be less conspicuous in n-PLLA.

At longer time points (42 and 84 days), there was low difference in inflammatory cell presence into scaffold pores and the number of cells infiltrating each implant was significantly decreased. In fact, we did not observe difference in the migration of inflammatory cells into PLLA scaffolds. Polymer degradation was detected in both PLLA networks, but there are no considerable differences, as confirmed by the SEM analysis.

Our results suggest that tissue integration of PLLA is enhanced when it is soaked with collagen, as well as the angiogenic activity on c-PLLA. Furthermore, the collagen soaking makes PLLA polymer more suitable for supporting cell attachment, proliferation, and function by mimicking the natural extra cellular matrix.

Keywords

PLLA; collagen; angiogenesis; immune response.