Integra® dermal matrix bioengineered with platelet rich plasma (PRP) and mesenchymal stromal cells to serve as niche for skin regeneration

Ferdinando Paternostro¹, Alessia Tani¹, Aida Dama¹, Giulia Lo Russo², Alessandro Quattrini Li², Martina Margheri¹, Carlo Mirabella³, Riccardo Saccardi⁴, Sandra Zecchi-Orlandini¹

¹Department of Anatomy, Histology and Forensic Medicine, University of Florence
²Department of Plastic Surgery, University of Florence
³Immunohaematology and Transfusion Medicine, University Hospital of Careggi, Florence
⁴Department of Haematology, Cord Blood Bank, University Hospital of Careggi, Florence

Regenerative medicine strategies represent one of the main challenges to improve tissue healing and repair after damage or chronic pathologies. In this perspective, the setting of bioengineered scaffolds, namely synthetic matrices enriched with growth factors and stem cells, is considered a hot issue by numerous research groups.

In a previous “in vitro” study we have demonstrated that rat bone marrow-derived mesenchymal stem cells (MSCs) seeded on an artificial dermal matrix Integra®, enriched with platelet-rich plasma (PRP) displayed enhanced proliferative attitude as compared with those cultured in the presence of PRP or on the scaffold alone.

To this purpose, in this study we wanted to extend the experimentation by evaluating the efficacy of the bioengineered Integra® in an in vivo model of skin damage in rats. In particular, we used MSC derived from genetically modified rats overexpressing green fluorescent protein (GFP).

Rats were divided into different groups: those receiving Integra® or PRP alone, Integra® plus PRP, Integra® plus PRP and MSC, and injured and untreated rats. Skin biopsies, obtained at different times from the injury and the implant, were examined to evaluate the regeneration process and neovascularization pattern of the substrate at light an confocal immunofluorescence microscopy. In parallel experiments we evaluated the ability of MSC to release growth factors, namely VEGF and FGF, and immunomodulatory cytokines, to underscore the paracrine effects of these cells on the surrounding host tissue.

Keywords: regenerative medicine, skin