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Polyurethane foams as biomimetic composite scaffolds for bone and osteo-chondral tissue repair

Maria Cristina Tanzi

INSTM UdR Politecnico di Milano, Italy

In the last 20 years, we investigated the design of polyurethane (PU) foams suitable for use as scaffolds in Tissue Engineering and we gained a strong know-how on this line of research. In particular, biocompatible composites with calcium phosphates have been developed and tested for bone regeneration. In addition, biomineralization of the PU foams, carried out by activation of the PU surface with a two steps procedure, led to a significant increase of mechanical properties and provided a more suitable surface for rat BMSCs attachment and proliferation. Recently, our research activity was aimed at designing and developing a novel functionally-graded hybrid (FGHY) scaffold with the PU foam representing the load-bearing structure, CaPs with a graded composition the biomimetic component, and pectin gel the cell carrier. Human placenta-derived cells (hPDC) populations encapsulated in pectin gels and injected into the FGHY scaffolds demonstrated the ability to differentiate toward the osteogenic lineage. The ability of these biomimetic hybrid scaffolds to stimulate cell adhesion and proliferation and to support differentiation of hPDCs makes these scaffolds excellent candidates for osteo-chondral tissue repair

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