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Bone regeneration process driven to human periodontal ligament stem cells cultured onto cortico-cancellous scaffold

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The aim of our research was to develop tissue-engineerized constructs composed by porcine cortico-cancellous scaffold (Osteobiol Dual Block) (DB) and xeno-free *ex vivo* culture of human Periodontal Ligament Stem Cells (hPDLSCs) induced to osteogenic differentiation. hPDLSCs placed in xeno-free media formulation mantained the stem cells features, the expression of stemness and pluripotency markers, and the capacity to differentiate in different mesenchymal cell lines (1). Micrographs performed by transmission electron microscopy suggested that after one week of culture, both uninduced and osteogenic induced cells joined and grew on DB secreting extracellular matrix, hierarchically assembled in fibrils in osteogenic differentiation induced samples (2). Quantitative RT-PCR (qRT-PCR) of 92 osteogenesis-related assays of hPDLSCs seeded on the DB showed the upregulation of key genes involved in the osteogenic differentiation pathway such as RUNX2, collagens and SMAD. hPDLSCs induced to osteogenic differentiation in presence of DB expressed osteogenic-related transcripts such as BMP1-4-6, RUNX-2, collagens, MSX1-2, TGFβ3 and SMAD. Functional study revealed a significant increased response of calcium transients, in presence of the 3D-DB both in undifferentiated and differentiated cells stimulated with calcitonin and parathormone, suggesting that the biomaterial could drive the osteogenic differentiation process of hPDLSCs. These data were confirmed from the increase of gene expression of L-type voltage-dependent Ca2+ (VDCCL), subunits α1C and α2D1 in undifferentiated cells in presence of DB. Our results propose to consider DB a biocompatible, osteoinductive and osteoconductive biomaterial making it promising tools to regulate cell activities in biological environments and for a potential use for the development of new custom made tissue-engineering.

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References

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Keywords

Tissue engineering; biomaterial; mesenchymal stem cells; periodontal ligament.