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Analysis of OPLA scaffolds for bone engineering constructs using human jaw periosteal cells

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Abstract:

For bone regeneration constructs using human jaw periosteal cells (JPC) the extent of osteoinductive ability of different three-dimensional scaffolds is not yet established. We analyzed open-cell polylactic acid (OPLA) scaffolds for their suitability as bone engineering constructs using human JPC. Cell adhesion and spreading was visualized on the surface of scaffolds by scanning electron microscopy. JPC proliferation within OPLA scaffolds was compared with proliferation within collagen and calcium phosphate scaffolds. We found a significant increase of proliferation rates in OPLA scaffolds versus Coll/CaP scaffolds at three time points. Live-measurements of oxygen consumption within the cell-seeded scaffolds indicate that the in vitro culturing time should not exceed 12–15 days. OPLA scaffolds, which were turned out to be the most beneficial for JPC growth, were chosen for osteogenic differentiation experiments with or without BMP-2. Gene expression analyses demonstrated induction of several osteogenic genes (alkaline phosphatase, osterix, Runx-2 and insulin-like growth factor) within the 3D-scaffolds after 12 days of in vitro culturing. Element analysis by EDX spectrometry of arising nodules during osteogenesis demonstrated that JPC growing within OPLA scaffolds are able to form CaP particles. We conclude that OPLA scaffolds provide a promising environment for bone substitutes using human JPC.