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Migration Capacity and Viability of Human Primary Osteoblasts in Synthetic Three-dimensional Bone Scaffolds Made of Tricalciumphosphate

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Abstract:

In current therapeutic strategies, bone defects are filled up by bone auto- or allografts. Since they are limited by insufficient availability and donor site morbidity, it is necessary to find an appropriate alternative of synthetic porous bone materials. Because of their osteoconductive characteristics, ceramic materials like tricalciumphosphate (TCP) are suitable to fill up bone defects. Another advantage of TCP implants is the ability of patient-specific engineering. Objective of the present in-vitro study was to analyze the migration capacity and viability of human primary osteoblasts in porous three-dimensional TCP scaffolds in a static cell culture. To obtain data of the cellular supply with nutrients and oxygen, we determined the oxygen concentration and the pH value within the 3D scaffold compared to the surrounding medium using microsensors. After eight days of cultivation we found cells on all four planes. During incubation, the oxygen concentration within the scaffold decreased by approximately 8 %. Furthermore, we could not demonstrate an increasing acidification in the core of the TCP scaffold. Our results suggest that osteoblasts could migrate and survive within the macroporous TCP scaffolds. The selected size of the macropores prevents overgrowth of cells, whereby the oxygen and nutrients supply is sufficiently guaranteed.

Key-words: human primary osteoblasts, tricalciumphosphate, scaffold, hypoxia, acidification, microsensors