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Increased Differentiation Of Osteoblasts By Endothelial Progenitor Cells (EPC) On Titanium Surface

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Objectives: Obligate precondition for successful dental implant osseointegration is the development of timely and sufficient periimplant neovascularisation and osteoblasts differentiation. It is widely accepted that especially endothelial progenitor cells (EPC) play an essential role to trigger blood supply during soft and hard tissue regeneration. Objective of our proposal is to test the hypothesis that osteoblasts on titanium surface can positive influenced by endothelial progenitor cells (EPC).

$$\log_2\left(\frac{n^{eGFP}}{x^{eGFP}_{hOB,r}}\right) = \text{median}(\log_2 N_{hOB,r} + ct^{18Srna}_r,\ r \in R)$$

Fig. 1: Linear differential equation of the two marker genes GFP and RFP allowed us to determine the gene expression profile of the two different cell types.

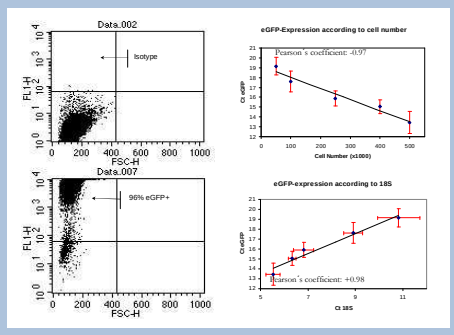

Fig. 2: Correlation between cell number and GFP expression level in osteoblasts.

Material and Method: GFP tagged Osteoblasts and RFP tagged EPC by lentiviral vector were plated on titanium surface. On day one, day three and day seven, cell number of both cell types, expression profile e.g. Type-I-collagen, etc. were measured by RT-PCR. The different marker gene expression (GFP vs. RFP) allowed us to calculate the different expression profile of the different cell lineage: EPC and osteoblasts (Fig.1, 2). Cell morphology was assessed by confocal-laser-scanning-microscopy (CLSM) (Fig.4).

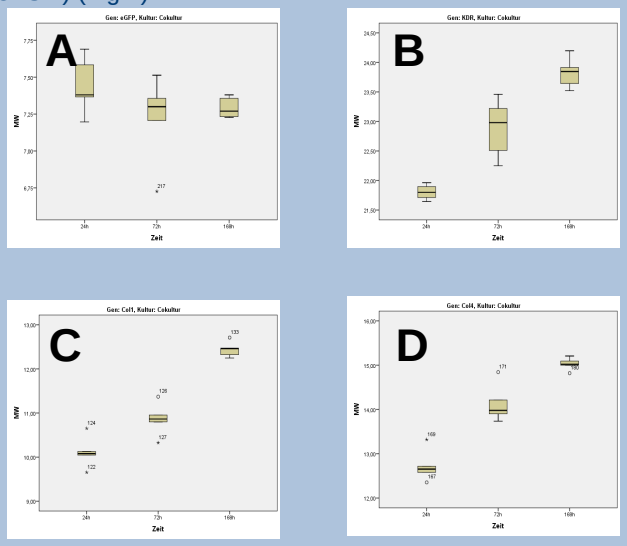

Fig. 3: Gene-expression-analysis: A = Stable GFP expression in osteoblasts, B = KDR Expression in EPC, C = collagen 1 and D = collagen 4 expression in osteoblasts over time.

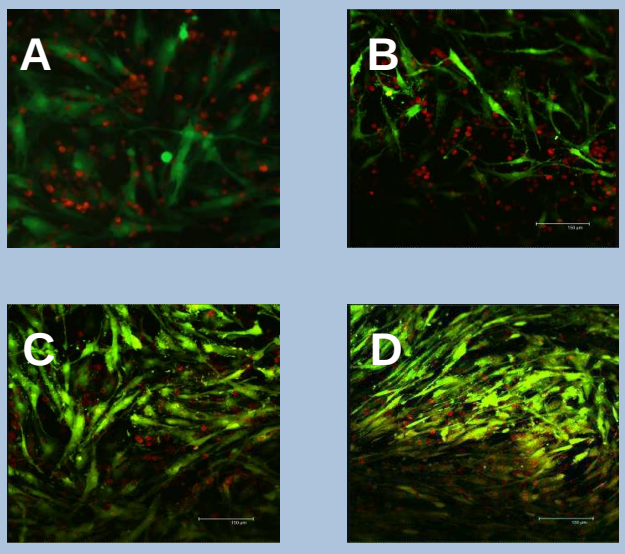

Fig. 4: CLS-Microscopy: Number and differentiation of osteoblasts (green) increased over time. EPC labeled in red. A = Control, B = 1 day culture on Ti-surface (Ti), C = 3 day culture on Ti, D = 4 day culture on Ti-surface.

Results: In contrast to osteoblast-mono-culture, osteoblast-EPC-co-culture increased significantly the differentiation of osteoblasts over time (Fig. 3).

Conclusion: We demonstrate the first time a co-culture analysis of osteoblast-EPC-co-culture on titanium surface. The results underline the importance of angiogenesis and neovascularization by EPC for osteoblast differentiation and therefore osseointegration.

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