Gene expression modulation in primary human osteoblasts and fibroblasts on zirconia-based surfaces

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Background and Aim

In the context of biomaterial development and evaluation, we examined initial response of dental-implant-relevant target cells, namely primary human alveolar bone osteoblasts and gingival fibroblasts, to novel zirconia-based surfaces by analyzing the expression changes of 84 genes, involved in extracellular matrix (ECM) turnover, cell attachment, proliferation, differentiation and inflammation.

Methods and Materials

Osteoblasts

Rough surfaces

Similar surface topography

3 Zirconia discs per biomaterial

24h / 7 days culture

Total RNA isolation (Pooled to one sample)

Real-time PCR Array (One sample per Array; 3 experiments; n = 3)

Fibroblasts

Smooth surfaces

Similar surface topography / Different surface chemistry

Results

Osteoblasts

On ZrO₂ genes encoding biomarker for bone resorption and remodeling were up-regulated, while genes encoding for ECM proteins and osteoblast differentiation (bone formation) were down-regulated.

Fibroblasts

On day 1 distinctly more genes were differently expressed between Ce-TZP and Y-TZP than at day 7.

Conclusions

By means of global gene expression analysis in periodontal tissue cells on ceramic-based biomaterials, we were able to identify a contra-supportive implant surface for osteogenesis. Moreover, our results indicate that initial cell response of osteoblasts and fibroblasts was modulated by the type of zirconia in a time-dependent manner. The results of the present work further highlight the importance of cell culture-based preclinical screening analysis in the course of implant biomaterial development and evaluation.

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