

Cellular growth on rough surfaces after removing of biofilms by brush and/or atmospheric pressure plasma

Kathrin Duske^{1,2}, Lukasz Jablonowski¹, Ina Koban¹, Klaus-Dieter Weltmann³, Barbara J. Nebe² and Thomas Kocher¹

¹ *University of Greifswald, Dental School, Unit of Periodontology, Greifswald, 17489, Germany*

² *University of Rostock, Biomedical Research Centre, Department of Cell Biology, Rostock, 18057, Germany*

³ *Leibniz Institute for Plasma Science and Technology, Greifswald, 17489, Germany*
E-mail: kathrin.duske@med.uni-rostock.de

In dental implantology the use of titanium (Ti) implants with rough surfaces are common. The development of peri-implantitis in consequence of bacterial deposits is a problem of great importance and approximately one quarter of patients with a dental implant develop peri-implant lesions ten years after installation [1]. It is necessary to re-establish the surface characteristics to create the preconditions for bone regeneration [2]. Atmospheric pressure argon/oxygen plasma is able to establish a hydrophilic and therefore cell-adhesive surface [3].

We used rough Ti surfaces (SLA, diameter 5 mm, Straumann, Switzerland) and cultured a saliva biofilm on it. Beside the untreated biofilm surface (BIO), an autoclaved (AUTO), with brush treated (BR), with argon/1% O₂ plasma treated (PL) and a brush + argon /1% O₂ plasma treated (BR+PL) surface was investigated. Subsequently human osteoblastic cells (MG-63) were seeded (22.700 cells/cm²) onto the specimens and cultivated for 60 min and 24 h in DMEM at 37°C and 5% CO₂. Cell area as well as morphology of cells was investigated by using scanning electron microscopy (SEM).

Preliminary results indicated that cells on BIO (354 ± 97 μm²), AUTO (401 ± 127 μm²) and BR (329 ± 116 μm²) are significantly smaller after 60 min of cultivation in comparison to PL (525 ± 160 μm²) and BR+PL (668 ± 181 μm²). Interestingly the combined treatment with brush and plasma (BR+PL) resulted in even larger cells compared to PL (P < 0,05). In relation to the cell area MG-63 on plasma treated specimens showed a more spread appearance. Our investigations revealed that plasma treatment not only inhibits the bacterial deposits. On PL as well on BR+PL the biofilm was removed.

Obviously removing the biofilm with brush and subsequent plasma treatment have synergistic effects. Earlier investigations showed improved cell reaction in consequence of plasma treatment on pure Ti without bacterial deposits. The AUTO surface indicates that it is of great importance for growth of cells if there are bacterial remnants - indeed destroyed - on the surface.

References

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