Titanium Surfaces Modified With Zinc

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Objectives :

The therapy of peri-implant infections is still a challenge in dentistry. One new approach could be the use of antibacterial surfaces in the infected implant site. The aim of the study was to evaluate the viability of cells on antibacterial, cytocompatible zinc surfaces over time.

Material and Method:

Discs (∅ 15mm) with smooth (machined, Camlog) and rough (promote®, Camlog) surfaces were treated with zinc and fibronectin with two different coatings (2000 nm; 540 nm) of zinc. The control group of discs were not treated. Human fibroblasts (HFIB) and human osteoblasts (HOB) were incubated on the surfaces. Cell viability was measured at 24 hours, 72 hours and 7 days using a two-colour assay (LIVE/DEAD®Viability/Cytotoxicity Kit, invitrogen live science).

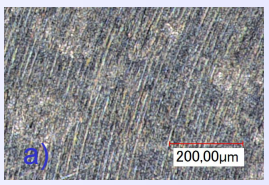

Abb. 1a/b: smooth and rough surfaces, 200 times amplified

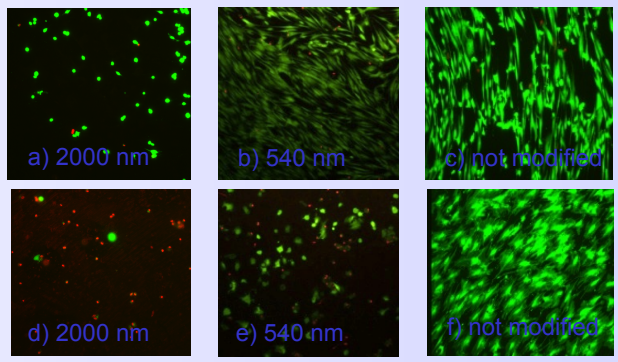

Abb. 2: examples of HFIBs (a/b/c) and HOBs (d/e/f) on the smooth surface modified with zinc layers (2000 nm and 540 nm) after 72 hours. The live/dead staining with fluorescence labelled cells shows living cells green, dead cells stained red.

Results:

Human fibroblasts

Figure. 2a: HFIBs tested with the differend zinc layers and the smooth surface.
(green =living cells, blue dead cells)

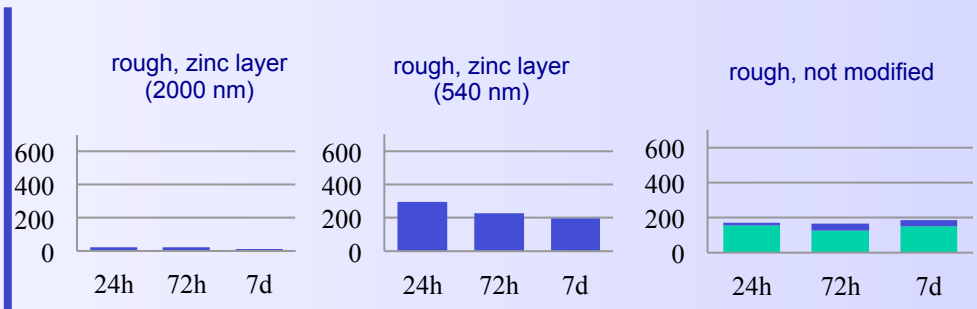

Figure. 2b: HFIBs tested with the two differend zinc layers and the rough surface.
(green =living cells, blue dead cells)

Human osteoblasts

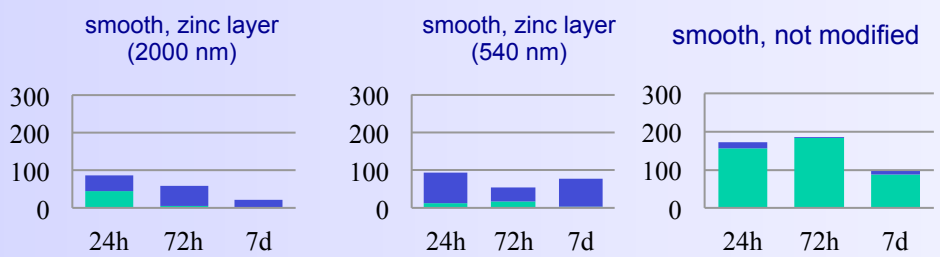

Figure. 3a: HOBs tested with the differend zinc layers and the smooth surface.
(green =living cells, blue dead cells)

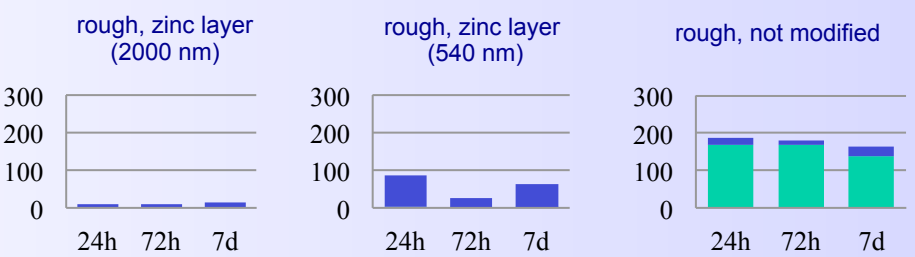

Figure. 3b: HOBs tested with the differend zinc layers and rough surface.
(green =living cells, blue dead cells)

The HFIBs and HOBs had an enhanced cytotoxic reaction to the zinc surfaces with the thicker zinc coating (2000 nm) in comparison with the thinner zinc coating (540 nm) independent of the surface roughness. More living HFIBs and HOBs could be found at the smooth surface than on the rough surface, with an increase of cytotoxicity over time. Comparing the growth of HFIBs and HOBs on the control disks, both cell types covered a greater surface area on the smooth surface.

Conclusion:

The cytocompatibility of the zinc and fibronectin layer was dependent of the thickness of the layer. Further tests using a thinner zinc layer and thicker fibronectin layer are being conducted.

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