

Cell Growth on Activated Titanium Surfaces

Background / Objectives:

Titanium and other metals for medical implants are not osteoconductive, i.e. they don't stimulate the cell adherence and the integration in bone. Usually an improvement is achieved by a deposition or precipitation of hydroxyapatite (HA) on the implant surface.

HA-Deposition by Plasma Spray:

- Mineral component of the bone
- **Disadvantage:** Thick layer, low bonding strength, no repair of damages

Alternative Possibilities for HA precipitation from a solution:

(1) Treatment in hot concentrated NaOH

(2) Ion implantation of Na ions

Intended Advantages:

- Stimulation of the HA precipitation in the patient
- Spontaneous calcium phosphate precipitation in a solution

Objective:

Growth of bone forming cells on ion implanted titanium compared with NaOH etched titanium.

Method:

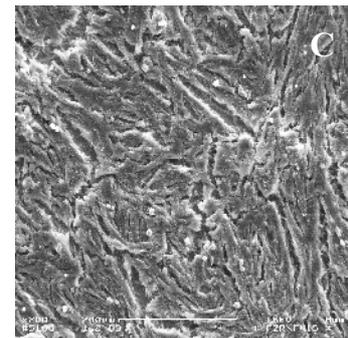
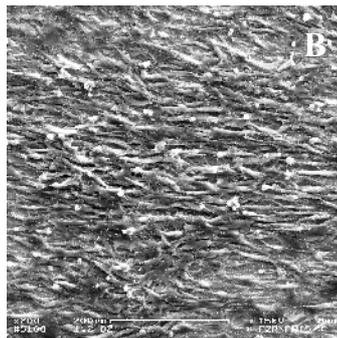
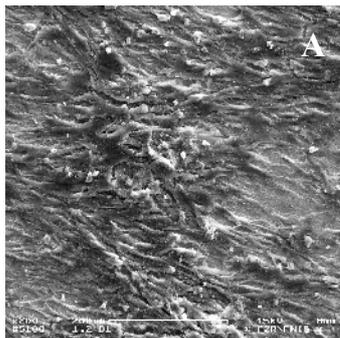
The osteosarcoma line SAOS-2 was seeded out on untreated, Na implanted and NaOH etched titanium and cultivated in a medium containing ascorbic acid and β -glycerophosphate.

Results:

On Na implanted samples the cells grew to the highest density, but the morphology was most typical for this cell line on the untreated samples.

The EDX spectra of the untreated and the Na implanted samples showed only a very limited calcium accumulation, whereas on NaOH etched samples the Ca content was higher (Ca : P = 1.7), indicating the formation of HA.

The activity of alkaline phosphatase, the key enzyme of biomineralisation, was not significantly different on the different samples.



SEM pictures of SAOS-2 cells after a culture period of 2 weeks. On untreated titanium (A) there was a regular, good cell growth, on Na implanted Ti (B) there was a high cell density with very elongated cells, on NaOH treated Ti (C) the cell growth and cell adherence was reduced.

Conclusion:

Growth and function of bone forming cells can be modified by ion implantation in titanium. By the treatment up to now the activation of the surface is too high. The calcium phosphate precipitation from a simulated body fluid before cell culture should improve the biocompatibility of the surface.