Chemically treated titanium: early surface activity detected in vitro

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This study examined the early interaction of the acid and alkali-etched titanium surfaces with the simulated body fluid (SBF) and cultured cells. Machined commercially pure (CP) titanium was used as a reference material. After exposure to SBF samples were analyzed by X-ray photoelectron spectroscopy, X-ray diffraction and electron microanalysis. The results proved presence of adsorbed calcium and phosphate ions on the chemically treated (CT) surface after 2.5 minutes exposure to SBF. The adsorbate later transformed into crystalline apatite. The surface changes were in accord with those in the solution, showing an immediate decrease of calcium and phosphate concentrations. The rapid formation of the calcium phosphate on the surface could cause the bioactive properties of the (CT) surface. The significance of this finding was tested in an interaction with living cells in vitro. Machined CP titanium did not stimulate long lasting cells, ALP negative, did not discriminate between CT Ti or CP Ti or steel within first 2 days. Whereas over a period of 2 weeks it was proven that haptotaxis was a property of only the CT Ti. Chicken embryonic cells with an osteoblastic potential during 3 weeks in contact with the CT Ti surface attached themselves to it and showed increased alkaline phosphatase (ALP) activity. This therefore indicated its conceivable osteoinductive potential. This relationship between surface chemistry and bioactivity was revealed by an in vitro bioassay with living cells.

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