Interaction of acid and alkali treated titanium with dynamic simulated body environment

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J. Therm. Anal. Cal., Vol.76, 2004

The objective of this study was to employ a dynamic arrangement for investigation of early interaction of acid and acid plus alkali treated titanium samples with simulated body fluid, and to discuss the possible effect of the surface treatments on implant healing. In the case of alkali treated titanium, the dynamic arrangement of the test allowed for simple detection of the three main phases of interaction (adsorption, induction time and later crystal growth) from the output solution. The induction time for crystal growth was 24.2±0.3 hours. On acid-only treated titanium no crystal growth was detected. The calcium phosphate adsorption layer formed on the acid treated samples was detectable by XPS only, however it differed from that formed on the acid plus alkali treated samples. The adsorption layer formed on the acid plus alkali treated samples contained by larger amount of calcium, especially in the shortest exposure times. Charging of the apatite crystallites during the XPS measurement enabled determination of their Ca/P ratio separately from Ca/P ratio of the adsorption layers. XPS and EDS analyses indicated that the spheroid crystallites consisted of carbonated hydroxyapatite with the Ca/P ratio close to that one of the stoichiometric hydroxyapatite. It is proposed that the adsorption layer formed spontaneously and immediately on the acid+alkali treated titanium can provide an ideal interface between the metal implant and the apatite cement line - the first structure formed by osteoblast cells during the formation of the new bone on foreign surfaces.

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