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SURFACE MODIFICATION OF TITANIUM AND TITANIUM ALLOYS TO ENHANCE BONE HEALING

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Abstract: Titanium and Its alloys have been used for many years as the material of choice for fabrication of dental , orthopaedic and maxillofacial implants, due to their excellent mechanical properties, biocompatibility, and the ability to osseointegrate with the surrounding bone. In order to improve the bioactivity and osseointegration of titanium implants, especially in compromised bone, surface modification of the implant surface and surface coatings have been introduced. There are different kinds of surface modification, such as, grinding, plasma spraying, sputter coatings, and alkaline treatment. More significantly, immobilization of drugs, such as, bisphosphonates, played an important role in enhancing the bone healing process. The main aim of the study is to develop and identify a facile surface modification method of immobilizing bisphosphonate molecules on commercially pure titanium and its alloy. 10 mm discs of CpTi and Ti-6Al-4V alloy were subjected to different surface treatments experiments; 1) the CpTi and Ti64 alloy surfaces were invested in phosphate bonded investment (Deguvest) and heated up to 900?C simulating superplastic forming process (SPF) creating an interaction layer on the surface upon which they were subjected to immersion in simulated body fluid (SBF) for 7 and 10 days, 2) the titanium surfaces were subjected to alkali treatment with 5M NaOH at 60?C for 24 hours, further more immersed in SBF solution for 7 and 10 days, 3) immobilization of sodium alendronate bisphosphonate on the pre treated titanium surfaces using microseeding method, and 4) tethering of bioglass and sodium alendronate bisphosphonate on the titanium surfaces using the electrohydrodynamic sparying method. The surface characterization of the treated surfaces was assessed using scanning electron microscopy (SEM/EDAX), Raman spectroscopy, surface roughness profilometer, and atomic force microscopy (AFM). In vitro cellular bioactivity and cytotoxicity were evaluated on the treated surf