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Paper Title: Investigating the Influence of Titanium-Tantalum (Ti-Ta) Thin Film on Alveolar Bone Cell Response

Authors: Chawan Manaspon (Chiang Mai University, Thailand)

Email: chawan.m@cmu.ac.th

Abstract

Titanium alloy stands as the leading implantable material in dental applications, renowned for its favorable biocompatibility and exceptional mechanical properties. Surface modification has emerged as a pivotal strategy for enhancing material properties and eliciting desirable biological responses. In this study, a promising titanium-tantalum (Ti-Ta) coating was deposited on a Si (100) wafer using a magnetron sputtering technique. The Atomic Force Microscope (AFM) image revealed that the Ti-Ta surface provided Root Mean Square (RMS) roughness of 3.22 ± 0.05 nm, representing a smooth surface. The proliferation of human alveolar bone (hAB) cells on the Ti-Ta surface increased significantly up to 4 times that of the control. The Ti-Ta surface demonstrated an early attachment of hAB cells within 6 hours. However, the accumulation of calcium by hAB cells was absent, as indicated by the lack of Alizarin Red S staining. Regarding the expression of marker genes (ALP, BMP2, and RUNX2), the upregulation of the marker was a notable enhancement during the early cell adhesion. Indeed, the application of the magnetron sputtering technique to create a Ti-Ta thin film appears promising as a surface modification process suitable for cell biocompatibility but not in mineralization. Further investigations and evaluations are warranted to fully assess its potential benefits and suitability in enhancing dental implant materials.
