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Biocompatibility of Titanium FEREYDOON NAMAVAR, University of Nebraska Medical Center, RENAT SABIRIANOV, University of Nebraska at Omaha, DENES MARTON, UTHSCSA, ALEXANDER RUBINSTEIN, University of Nebraska at Omaha, KEVIN GARVIN, University of Nebraska Medical Center — Titanium is the material of choice for orthopaedic applications because of its known biocompatibility. In order to enhance osteogenic properties of the Ti implants, it is necessary to understand the origin of its biocompatibility. We addresses the origin of Ti biocompatibility through (1) theoretical modeling, (2) the precise determination of Ti surface chemistry by X-ray photoelectron spectroscopy (XPS), (3) and the study of fibronectin adsorption as a function of Ti (near) surface chemistry by Enzyme-linked immunosorbent assay (ELISA). We compare the protein adsorption on Ti with the native oxide layer and the one coated by TiO2 in anatase phase using ion beam assisted deposition (IBAD). We show that the thin native sub-stoichiometric titanium oxide layer is crucial for biocompatibility of Ti surface. This is due to the enhancement of the non-specific adsorption of proteins which mediate cell adhesion. Improving the surface oxide quality, i.e. fabricating stoichiometric TiO2 (using IBAD) as well as nanoengineering the surface topology that matches its dimensions to that of adhesive proteins, is crucial for increased protein adsorption and, as a result, further increases biocompatibility of Ti implant materials.

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