鈦金屬植體表面經電漿清潔及聚合反應之研究

Effect of Plasma Cleaning and Plasma Polymerization on Titanium Surfaces

中文摘要

植入性生物材料的表面不僅與宿主組織直接接觸，且於生物相容性扮演關鍵性角色，爲改善植體與組織的整合性進而控制植體界面反應，減少非特定蛋白質的吸附，近年來已發展出利用低溫電漿來活化鈦金屬表面以連接特定蛋白的植體表面處理技術。影響電漿處理之因素包含:處理的時間、輸出功率、工作壓力。低溫電漿處理包含氬氣電漿處理以及丙烯胺(allylamine)電漿處理兩個部份。經電漿處理後的鈦金屬表面會附著上胺基(-NH2)官能基，再以交鏈劑戊二醛(glutaraldehyde)固定白蛋白於低溫電漿處理後的鈦金屬表面。經氬氣電漿處理後的鈦金屬表面分別以掃描式電子顯微鏡(SEM)及原子力顯微鏡(AFM)進行鈦金屬表面粗糙度分析;以 X 光光電子能階術(XPS)分析白蛋白吸附於鈦金屬後其化學鍵結的改變;爲探討經低溫電漿處理的鈦金屬植體表面對固定白蛋白的影響，故以低掠角 X 光繞射儀(GIXRD)進行電漿與無電漿處理鈦金屬的結構分析;再以 AFM 觀察奈米金粒子的分佈情形，並將金屬植體接著一系列的反應以 SEM 進行表面觀察。本研究主要目的在探討鈦金屬牙科植體表面經由低溫電漿來活化鈦金屬表面以連接生物活化性白蛋白(albumin)。將鈦金屬表面以電漿處理和膠原蛋白進行表面改質並配合儀器分析，找出適當的表面處理條件，希望能提出一個穩定可靠的表面改質方法，而其結果可對縮短種植於骨內的植體，如牙科植體的骨整合癒合時間而有所助益。

英文摘要

The surface of implantable biomaterials is in direct contact with the host tissue and plays a critical role in determining biocompatibility. In order to improve implant integration, it is desirable to control interfacial reactions such that nonspecific adsorption of proteins is minimized and tissue-healing phenomena can be controlled. The purpose of this study was to develop a new method to functionalize titanium surfaces by plasma treatment. The covalent immobilization of bioactive organic molecules and the in vitro bioactivity were evaluated by x-ray diffraction (XRD), atomic force spectroscopy (AFM), x-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), and MTT assay. Argon plasma removes all adsorbed contaminates and impurities. Plasma-cleaned titanium surfaces showed better bioactive performances than did untreated titanium surfaces. Our results reveal that plasma-cleaned titanium surfaces provide a clean and reproducible starting condition for further plasma treatments to form well-controlled surface layers. Allylamine was

ionized by the plasma treatment process, and dangling bonds acted as a medium to link albumin. Cells had spread well, and good attachment was attained on the albumin/allylamine/TiO2/Ti surface. It was revealed that attachment and growth of cells are influenced by the surface properties. The plasma treatment process plays an important role in facilitating tissue healing. This process not only provides a clean titanium surface, but also produces surface amination on plasma-treated titanium surfaces. Surface cleaning by ion bombardment and surface modification by chemical polymerization of plasma treatments are believed to remove contamination on titanium surfaces and hence promote tissue healing.