電化學方式形成不同氧化膜層厚度及孔徑大小於?金屬表面對類骨母細胞之影響

林哲堂;薛文景;楊政峰;歐耿良;周幸華;施永勳;鄧乃嘉;曲國田;李勝揚

Abstract

Many literatures have shown that titanium with excellent biocompatibility is due to its passive oxide film. The surface characteristics of titanium implant (pore sizes/roughness) are related to initial cell behaviors or osseointegration, however, the optimal surface design of dental implant for enhancing the rate and result of osseointegration remains unknown. The purpose of this study is to investigate the effects of the varied thicknesses of the titanium oxide and pore sizes/ roughness (micrometer range) on the initial attachment and proliferation of the osteoblast-like cell (MG-63) to the implant surfaces in vitro. The experiment is designed in two catagories: A) thicknesses of the titanium oxide and B) pore sizes/roughness. The Grade II titanium discs (10x10x3mm) are formed in varied textures and topography on their surface electrochemically. Different current densities, voltages and times to control the thickness of the titanium oxide and to creat different pore sizes on titanium discs are studied. Mechanical stylus (2D) combined with scanning electric microscope to measure the surface topography, and SIMS to detect the thickness of titanium oxide are also employed. Cell cultures are performed on the titanium discs with different conditions after materials are prepared and cleaned. The MTT test is used to investigate the cell attachment, proliferation at different time periods (4 hr,1 day,2 day,4 day, 6 day, 8 day, 12 day). The machine surfaces (rough, smooth) are used as for comparisions. The results show that the anodizing oxide layer contained TiO_2 in different phases (anatase, rutile or brookite) and with Ti_3O_5 on 120 nm thick oxide. The optical density from MTT test show that cells have significant proliferation on titanium samples except with 50 μm, 100 μm pore size after 48 hours. Titanium oxide with thickness of 40 and 80 nm show higher level of the cell proliferation with statistical significant difference at 8th, 12th day. The titanium discs having 100 μm pore size show the greatest optical density at initial cell attachment and with statistical significant difference compared with that of 10 μm pore size. Smaller pore-sizes and smooth surface present more proliferation than larger ones but no statistical significant difference is shown at 8th and 12th day. Surface roughness to increased surface areas is considered, when the relationship between contact angle and cell attachment level is investigated in this work.