Effects of Ordered Texture Surface with Nanometric Scale Roughness on Biological Responses for Titanium Implants

Abstract:
Implants made of titanium and its alloys are widely used in dental and orthopedic fields due to their excellent properties, including high strength-to-weight ratio, low toxicity, and favorable mechanical properties compared to other metals such as stainless steel. However, pure titanium (Ti) and titanium alloys are considered as bio-inert materials in clinical use. Surface modifications of metal are often used to control tissue reactions and shorten bone healing period. The anodization is an effective technique to modify titanium metal. The anodizing technique is an effective method to modify surface of titanium. This study aimed to investigate the ordered texture surface with nanometric scale roughness on biological responses for titanium implants. The thin film-XRD results indicated that phase of surface was only titanium peak. The titanium peak was detected by EDX. Using the SEM, the surface morphology exhibited uniform ordered texture. The roughness showed the nanometric scale roughness by AFM. Cell culture experiments demonstrate that nanometric scale roughness of ordered texture surface would alter initial cell morphology and 7-day and 14-day cell numbers. The cell proliferation of N65 specimen at 14-day culture was higher than others. Cell morphology was significant influence with ordered texture surface with nanometric roughness. Consequently, this study indicates that ordered texture surface with nanometric roughness did not change the physicochemical characteristics but exhibited an effect on biological responses.