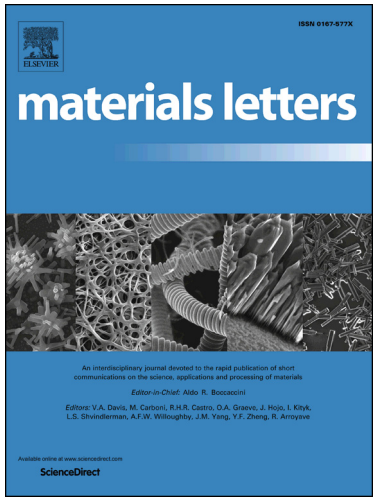

Fabrication of an orderly micro/nanostructure on titanium surface and its effect on cell proliferation

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Fabrication of an orderly micro/nanostructure on titanium surface and its effect on cell proliferation

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Abstract

The hierarchical micro/nanostructure has been fabricated on the surface of titanium by various surface modification methods for improving the biocompatibility of implants. However, it is still a challenge to construct a regular micro- and nanostructure on the surface of titanium. In this study, an orderly micro/nanostructure was produced on titanium surface by micro-milling and anodic oxidation. Compared to polished titanium, micro/nanostructured titanium presented increased roughness and enhanced hydrophilicity. More importantly, the proliferation of osteoblasts was significantly improved on the surface of micro/nanostructured titanium. This study provides a promising strategy to fabricate an orderly micro/nanostructure on the surface of titanium for improving cell proliferation.

Keywords: Biomaterials; Structural; Surfaces; Cell proliferation

1. Introduction

Titanium (Ti) and its alloys are considered as reliable biomaterials to produce dental implants and artificial joints, due to their good biocompatibility and mechanical properties [1]. Although the survival rates of Ti-based implants have achieved a high level, implant failures ascribed to poor osseointegration still frequently happen in the clinic [2]. It is well known that the interactions between an implant and its surrounding tissue mainly occur on their interfaces because of the non-degradability of Ti-based materials. Hence, the properties of Ti surface play an important role in regulating cells or tissues interactions with the implants. To achieve good osseointegration, various methods have been developed to modify the surface characteristics of implants, including sandblasting/acid etching, micro-arc oxidation and anodic oxidation [3-5].

Natural bone tissues consist of nanostructures including fibrillar collagen and hydroxyapatite crystals, microstructures such as Haversian systems, and macro-structures including cortical bones [6]. Therefore, the hierarchical micro/nanostructured surface would be favourable to enhance cell functions by