Proliferation of Osteoblastic Cells Cultured on Nanostructural Ti Alloy Surface for Dental Implant Use

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Abstract: The interactions between cells and nanotopographies are increasingly interested as nanotopographies that may be more efficient in promoting cell functions and, titanium nanotubes have attracted much attention. Titanium nanotube can be fabricated easily with precisely controlled diameters and lengths. Titanium nanotubes with the suitable tube dimensions have been observed to enhance bone cell functions, whereas, there is still some controversy. These nanotubes can also serve as carriers for drugs such as growth factors, antibacterial agents and other drugs and show promise in bone implant applications.

1. Introduction

Bone cells attach to titanium surfaces through both chemical and mechanical bonds. The first one includes ionic and covalent bonding between the biological environment and the adapted exposed surface. The mechanical attachment is the physical interlocking of the strong mature bone matrix in the implant surface structure involving the presence of an appropriate implant surface topography. Fluoride-modification of titanium dental implants has a documented potential for promoting implant attachment and improve bone response, reducing the healing time needed before loading, as well as significantly improve the bone to implant contact, and stimulating osteoblast gene expression at the implant surface.

In this study, proliferation of osteoblastic cells cultured on nanostructural Ti alloy surface for dental implant use was studied with various experimental instruments.

2. Experimental

In this paper, Ti-30Ta-xZr(3, 7 and 15 wt %) alloys were prepared by arc melting, followed by followed by homogenization for 24 hr at 1000 °C in argon atmosphere. The murine osteoblast cell line MC3T3-E1 was used as in vitro model. Cells were routinely cultured at 37 °C in a humidified atmosphere of 5% CO_2, and maintained in alpha-MEM supplemented with 10% fetal calf serum. Cells were sub-cultured 1:4 before reaching confluence using PBS and trypsin/EDTA. The same number of cells was cultured in parallel in plastic in all experiments. Microstructures of the alloys were examined by optical microscopy (OM) and x-ray diffractometry (XRD). A field emission scanning electron microscope (FE-SEM) analyses were performed to study the morphology of MC3T3-E1 cells. Cell growth and size increased and more cytoplasmic prolongations were observed at nanotube surfaces.

3. Conclusions

MC3T3-E1 cells cultured on the Ti-30Ta-xZr alloy was a round shpae. In the case of anodized and crystallized sample, cells were well cultured on the surface of Ti-30Ta-xZr alloy in compared with polished alloy. Cell growth and size increased and more cytoplasmic prolongations were observed at nanotube surfaces.(hcchoe@chosun.ac.kr)

Reference

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