ACEX093
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A Research on Material Design And Application: High Cycle Loading Analysis of Zirconia Ceramic Dental Implant by Finite Element Analysis And Tentative Study

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This research focuses on the biocompatible zirconia ceramic (ZrO2) material and load behaviour causing fatigue on the surface of the dental implant. Fatigue fracture and wear have been identified as some of the major problems associated with implant loosening, stress-shielding and ultimate implant failure. A static and cyclic fatigue testing of ceramic dental implant in laboratory conditions for this investigation were carried out according to the ISO protocol 14801 under worst-case conditions. A finite element analysis (FEA) of dental implant with accurate geometry and material properties were developed to make realistic investigations on biocompatibility of the implant biomaterial properties and mechanical fatigue behavior of new dental implant comparing Von-Mises criteria and maximum stress levels. The comparison of calculated fatigue life simulation data of and experimental data for the biocompatible zirconia ceramic dental implants is presented. As a conclusion zirconium implant exceeded the established values for maximum incisal bite forces reported in the literature and and also shows better performance than titanium implant material. The results of fatigue of biocompatible zirconia analysis are helpful for implant biomaterial selection and design for clinical interest.

Keywords: Zirconia ceramic (ZrO2), dental implant, fatigue, material stress-strain relations, biocompatibility,

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Evaluation of Biomimetic Recovering on the Alumina and Alumina-Zirconia Submitted to Surface Treatment by Femtosecond Laser

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The material bioactivity can be evaluated by the apatite formation on its surface in simulated solution of corporeal fluids. The adhesion of hydroxyapatite is essential for interaction with the substrate and depends on the surface properties of the material. The quality of the adhesion will influence their morphology and the future ability of osseointegration. Previous studies have shown that these surface characteristics depend on the chemical composition, energy and topography of the surface. Additionally, the adhesion and growth of deposited apatite is a function of surface roughness. The femtosecond laser surface treatment generally improves the adhesion of apatite obtained by biomimetic coating on the surfaces of materials. Based on this, the aim of this work is to study the effect of texturization on the surface of alumina and composite of zirconia-alumina-yttria stabilized utilizing femtosecond laser. The

efficiency of the adhesion and growth of hydroxyapatite were evaluated by roughness, wettability and microstructure of the samples. The results have shown that the samples textured with femtosecond laser and then immersed in 1.5 SBF for 6 and 15 days presented layers of apatite strongly bonded to the substrate on their surfaces, showing that this biomimetic method can make these ceramics bioactive. The formation of apatite on the samples without laser treatment was also observed, but the thickness of the apatite layer was higher in the samples submitted to surface texturization with femtosecond laser. The microstructural characterization showed grains in nanometric scale on the samples performed by the femtosecond laser. The use of femtosecond laser also changed the alumina morphology from a-Al2O3 to g-Al2O3. Finally, the effects of texturing surface for the different ceramics and the influence of immersion time in SBF 1.5 were discussed in order to determine the optimal conditions to promote the deposition and the adhesion of the apatite on the surface of the material.

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Growth of Blood Vessel Cells on the Internal Surface of a Silk Tubular Scaffold

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Regeneration silk fibroin (SF) scaffolds have been considered for fabrication of artificial blood vessels owing to its excellent biocompatibility and biodegradability. As a replacement of blood vessels, it should have suitable internal surface for the adherence and proliferation of vascular cells, especially for human vascular endothelial cells. Microporous structure of internal surface was an important factor. In this article, different silk fibroin concentration, crosslinker content and freezing temperature were investigated for the internal surface microporous forming of a silk fabric tubular scaffolds (SFTS). The SFTSs were crosslinked by poly(ethylene glycol) diglycidyl ether (PEG-DE). Cytotoxicity of SFTSs was evaluated by seeding L929 cells. Adhesion and proliferation of human umbilical vein endothelial cells (HUVECs) on the SFTS internal surface were studied by MTT and cell fluorescence imaging. Results indicated that: cells grew well on the SFTSs and showed high proliferation ability. The suitably microporous and rough interface structure of the silk fabric tubular scaffolds was conducive to HUVECs adhesion and could prevent cells from leaking into the media.

[1] J. N. Wang, Y. L. Wei, H. G. Yi, Z. W. Liu, D. Sun and H. R. Zhao, Mater. Sci. Eng. C, 34, 429 (2014).

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Interaction Mechanism between Reinforced Chitosan and Biological Solvent

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