

Microstructural and cytotoxicity evaluation for different surface treatments of TA6V4 alloy

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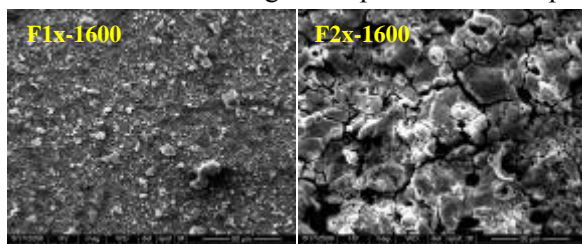
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INTRODUCTION: Titanium, the currently material used for dental implants manufacturing presents proper osteointegration characteristics, but from physiological point of view is practical bioinert. Today, there are a permanent preoccupation for improving the osteointegration characteristics of the dental implantable devices. The biomaterial surface is the only face which is in directly contact with the biological medium, so that it play a decisive role in the biological interactions. The performed researches showed that the preparation methods of the implants surface is able to have significantly impinge upon the resulting properties of the surfaces and implicitly the biological responses which take place on the surface. In this study it was evaluated the microstructure and the cytotoxicity of the titanium alloys with different surface treatments.

METHODS: The oxide layers on experimental alloy samples TA6V4 (F1, F2, AF4, AF5 and TEG) were realized at normal temperature by electrochemical proceedings and specific thermal treatments. The preparation of the surfaces was realized by abrasive cleaning (sandblast) with Al₂O₃ 240 μ ; polishing with metallographic paper 150-400 followed by degreasing and washing; warm air dries and acid pickling HF (6%)+HNO₃ (26%). For all samples, the oxide layer was depositing by anodization in different conditions; for F1 and F2 samples were applied a thermal treatment at 700°C, 60'. The structural and morphological aspects of superficial layers of titanium alloy were investigated through optical microscopy in polarized light (Axio Imager A1m, Carl Zeiss) and SEM (FEI system). The cytotoxicity test, according to ISO 10993 standards, was effectuated after the electrochemical deposition samples, in vitro, on fibroblast culture. The samples used for cytotoxicity test (2x2x8 mm) were sterilized by UV radiation exposed and put directly in contact with normal human fibroblasts, in culture medium for 72 hours. The adherent cells on the surface of culture were count, used a Neubauer counted camera. The viability was appreciated using trepan blue coloration.

RESULTS: The accomplished surface treatments have lead to the obtaining of the titanium oxide layers with different morphology. Certain electrochemical treatments assure the obtaining of some proper microstructure for penetration and attachment of the biological cells to the implant surface in the biointegration process. The aspects



of the obtained samples are showed in below figures.

The SEM micrographs of the studied implantable systems was compared with the images obtained in polarized light using an optically microscope. It was determinates thickness of oxide layers greater than 1 μ . For the TEG sample, the TiO₂ thickness was about 22,5 μ . The cytotoxicity test results, respectively the values obtained for the human fibroblasts viability in 24 hours and 48 hours are showed in figure 1.

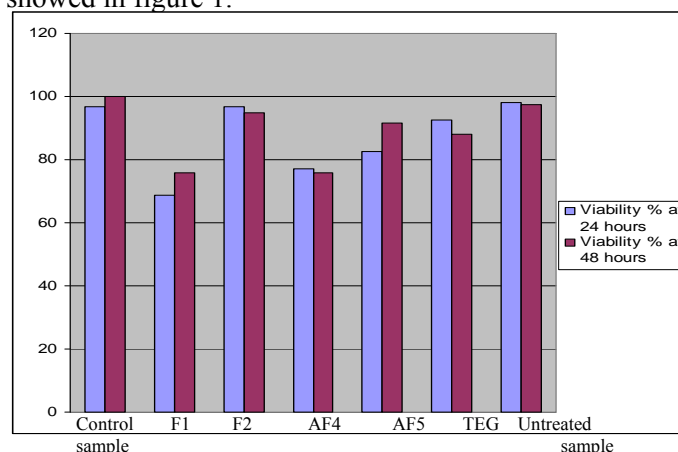


Figure 1. The human fibroblasts viability after 24 hours and 48 hours

DISCUSSION&CONCLUSIONS: The microstructure analysis through SEM and microanalysis proved the presence of a compact, uniform and adherent layer of titanium oxide, with lower conductivity properties from electrical point of view. The oxide layer has a scaliness aspect, in our opinion, that thing contribute at the better tissue grown on the implant and anchorage of them. We established methods for treatment of implant surfaces TA6V4 to improve the biocorrosion strength, to create diffusion barrier to obstruct the release of the toxic ion in organism and to favor the growing and interaction between bone tissues and implant alloy.

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