THE RESEARCH OF GLASS-CERAMICS IMPLANTS USED FOR BONE PITCHES TO EXAMINE BACTERIA ADHESION OCCURRING IN HUMAN BODY

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Abstract

Every day human body is endangered by various injuries and diseases. The consequence may be constant disability or the risk of limited ability and even death. The fractions and resections of bones threaten not only elderly people suffering from ostheoporosis, but more and more frequently young people, who experience some body harms resulting from accidents or diseases. In case of complicated fractures surgical intervention and using implant is necessary. A special implant is also needed in case of the resection of bone, which has big lack of tissues and must be filled in with the material, which has all the properties typical of bone implants. The glass-ceramics implants were already used in the XXth century. They have big future before them owing to their bioactivity, as well as morphological similarity to bone tissue.

The paper deals with the research concerning the bacteria adhesion on bioactive glass-ceramics materials.

Keywords: *glass-ceramics implants, bacteria, human body*

[Engineering of Biomaterials, 122-123, (2013), 3-4]

Introduction

Implants are used to join parts of bones or to replace the missing ones. To make the whole structure capable of working, an implant must have suitable properties. Every implant is chosen for a patient according to their age, bone structure, sex, weight and height.

Biologically best reconstruction material comes from the patient`s own bone. A steady or partial transplant can be used to fill in the missing element. The acceptance of the transplant by body needs the proper blood delivery to the place of inserting implant [1]. To choose the best implant the biocompatibility and biotolerance are taken into consideration. The biotolerance and biocompatibility make the material non toxic and at the same time they don`t affect immunological system. The materials designed for transplantation should be biofunctional, as well as be in agreement with the body. They shouldn`t cause side effects such as formation of coagulations or allergies [1-3].

The ceramic and bio-ceramic materials provide long-lasting joining of tissue and implant. The glass-ceramic is resistant to corrosion and its degradation products are not responsible for any toxic and allergic reactions. The chemical compounds of bioceramic, especially hydroxyapatite is identical with human bones compounds. In addition to that, the hydroxyapatite bioceramic possesses similar density and friction factor [3,4].

Materials and methods

The material undergoing examination was bioactive glass-ceramic deeped in bacteria liquid for the duration of 6 months.

Implant is an alien body and it should be remembered, that in its environment may occur bacteria. For that reason all inflammation focuses should be destroyed [5]. The most frequent bacteria, which appear in human body are [6]: Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecalis, Klebsiellaoxytoca, Pseudomonas aeruginosa. The examination of the behavior of microporosity glass-ceramics in bacteria environment a special liquid made of five bacteria was prepared to put the specimens in. The TABLE 1 presents the compounds of Tryptic Soy Boulion.

TABLE 1. The compounds of the liquid

Compounds	*Contents [g/l distilled water]*
casein pepton	17,0
pepton S	3,0
NaCl	5,0
K_2HPO_4	2,5
glucose	2,5
Bacteria [1 µl]	
Staphylococcus aureus, Staphylococcus epidermidis, Enterococcus faecalis, Klebsiellaoxytoca, Pseudomonasaeruginosa	

The liquid compounds enabled proper conditions for bacteria to survive.

After the duration of six months, the specimens were taken out of the bacteria liquid and their surfaces were examined with the Scanning Electron Microscope Philips XL30.

In small enlargement (44x) no changes could be observed on the surface (FIG.1).

Whereas in 250x enlargement remains of biofilm are clearly visible (FIG.2).

The material watched by means of microscope in 1000x enlargement presents a very clear design of microporosity surface containing bacteria (FIG.3).

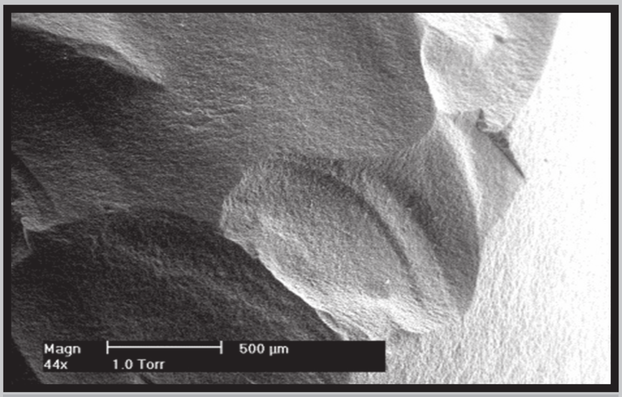

FIG.1. The view of the surface (44x)

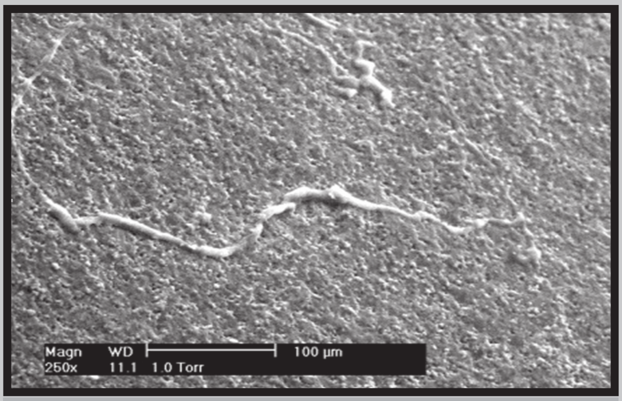

FIG.2. The view of the surface (250x)

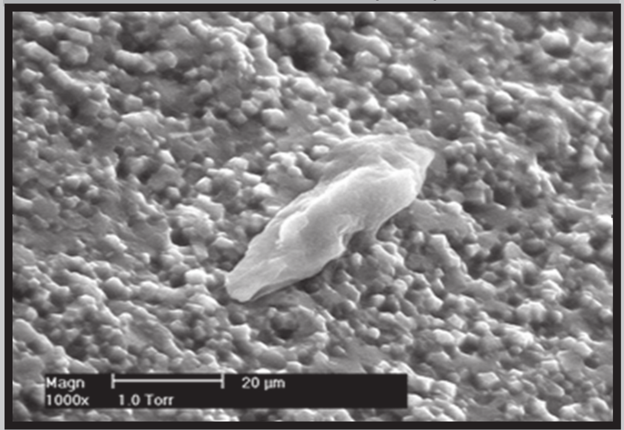

FIG.3. The view of the surface with biofilm (1000x)

Conclussions

The contemporary medicine takes interest in the materials, which have the most similar properties to natural substances. Therefore the material, which apart from bioactive properties has suitable porosity enables proper joining of tissue and implant, as well as it makes it possible to cover implants with drugs or maternal cells, which in turn allows concentration of antibiotic in the place of implantation, without affecting the whole body [7].

Biomaterials can have different impact on the body. In case of a person, who has underwent implantation, that impact may carry dangerous results for the patient`s body and the success of the implantation.

After six months` stay of the specimens in bacteria liquid the biofilm could be observed on the microporosity glass-ceramics surface.

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ELECTROCHEMICAL OXIDATIONAND CORROSION RESISTANCE OF THE Ti13Nb13Zr ALLOY

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Summary

This paper presents the results of oxidation andcorrosion tests carried out on titanium alloy Ti13Nb13Zr. The oxide film was prepared by electrochemical environment 2MH_3PO_4 for 30 min and 1h, at a constant voltage 40 V. The tests of corrosion resistance were performed by potentiostatic method in Ringer's solution at different pH values: 7, 5 and 3. The change in an appearance of surface and the increase in corrosion resistance even in an acidic environment is an evidence that the electrochemical treatment of theTi13Nb13Zr alloy results in formation of dense, compact and likely amorphous oxide layer.

***Keywords**: titanium alloys, electrochemical oxidation, corrosion resistance*

[Engineering of Biomaterials, 122-123, (2013), 4-5]

Introduction

Titanium alloys are a group of metallic biomaterials that due to the high biocompatibility, lack of mutagenic and carcinogenic effects, good corrosion resistance and high strength/density ratio, are widely use as load-bearing implants [1-3]. Almost 40 titanium alloys proposed so far to use as the load-bearing implants but only the Ti6Al4V, Ti6Al7Nb and Ti13Zr13Nb alloys have been certified and applied[1]. An important factor in the use of titanium alloys is their long term stability in the human body.It is estimated that the average life-time of implants is not over 15 yrs., and in order to extend this period, a number of new technologies, based on modification of chemical composition of an alloy, modification of the surface layer of a base metal or application of coatings possessing superior physical, chemical and biological properties have been investigated [3,4]. Among them, the formation of titanium oxide film is the most plausible as concerns the increase in corrosion resistance, and well developed by electrochemical oxidation [5-12], and chemical, gaseous and CVD method [3]. The aim of this work was to determine the effects of anodic oxidation of the Ti13Zr13Nb alloy on corrosion resistance of the Ti13Zr13Nb alloy in neutral and acidic environments, for which such research has not been extensive and some data are lacking.

Experimental methods

The study was conducted on a two-phase titanium alloy Ti13Nb13Zr which chemical compositions is shown in FIG.1.