Importance of endooseous implant surface in clinical dentistry

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Now dental implantology is in the process accumulation of information derived from fundamental investigations and clinical experience as well. As a result, a new direction appeared in modern dentistry - The Oral Implantology alias Prosthetic Implantology. According to *D. Bratu et al. (1996)*, it appeared to be a revolution in dentistry in general and mainly in dental prosthetics.

One of the advantages that oral implantology offers is the formation of new/or additional support points, in order to close the spaces in the dental arch; implants play a particularly important role in terminal defects, which can be transformed into intercalated, with the replacement of dental functions.

For the time being, prosthetic approach to a great number of cases to resolve includes the use of implants, especially their endoosseous alogene type. They are known for their longtime durability and not only *(I. Septelici et al., 1993; P. Schnitman, 1993; M. Augustin et al.; A.A. Dolgalev, 1999).*

As a necessary component in the process of implant making, titanium and its alloys with the other metals is used more and more often. Ti is a metal, it belongs to the group IV in the periodical table of elements, its atomic number is 2.2 and anatomic weight 47.9, specific density - 4.51.

Thus, Ti is considered to be the number one biomaterial possessing the necessary properties to achieve osteogenesis, osteointegration and ensure longtime durability *(M. Augustin et al., 1995).*

Ti, being a modern material for implants, compared to the other materials, possesses no magnetic effect that would have produced functional cell disorders in the periapical zone. Ti proves to have a regenerative effect; it shows low thermal conductibility and at the same time its electrical resistance is higher, as compared to other metals.

What is characteristic of Ti, as was shown in multiple investigations, including our clinical experience, is its reactivity - special ability of oxide formation that invests it with many properties, including pronounced anticorrosion. They also determine the inert character of implants in the live tissue. Another titanium advantage is considered to be its firmness - high resistance to any mechanical influences and at the same time malleability. Worth mentioning is the very tight contact between titanium and periimplant bed, or the formation of anchilosal grapple, also named osteointegration *(N. Ganuta et al., 1996; O. N. Surov, 1998).* The layer of TiO_2 formed on the surface of the implant, induces a bivalent connection at the molecular level with the structural components of surrounding tissue. All mentioned above make possible the process of osteointegration in endooseous implantology. Implants of Ti, through their cathode effect and appearance of electric potential, attract Ca^{++} from hydroxylapatite covering, favoring osteogenesis.

Biological compatibility of Ti increases markedly when it is covered with plasma, or by means of other methods we use, which provide it guided rough surface. The last one improves the anchoration of the implant in the tissue, especially after covering the surface of the implant with a layer of phosphate, silicate substances. Thus, at the moment of interaction with the surrounding tissue, the bioactivity of the implant rises a lot *(A.I. Volojin et al., 1996; A.M. Kovalevskii et al., 1997; I.M. Zelenskaia, 1999; S.G. Kalaganova et al., 1999; M.D. Petrova, 2000; A. Caraiane et al., 2002).*

For the time being plasma implants are widely spread. Dispersing material, especially titanium, contributes to achieving high quality implants. Thus, on its surface a cover with an unpredictable level of roughness is formed. Lately, the question of the implant surface roughness is becoming more often a point of discussion in professional literature. We can distinguish two values of roughness of the implant surface:

1. Measures of the roughness are bigger then those of an atom or a molecule;
2. Measures of the roughness are about the same size with those of an atom or molecule.

It is evident that in the first case formation of the chemical connection is more difficult than in the other case - the roughness can influence qualitatively and quantitatively not only the formation of the chemical connection, but also the formation of the Van der Vaals connections, contributing to intensification of the electromagnetic field on the surface.

This way, the growth of the implant surface by means of increasing its roughness leads to sufficient osteointegration, but at the same time it increases metal ion concentration in the human body, in other words, it increases the degree of superficial layer dissolution. This corrosion becomes more intensive, when alloy-free titanium is coupled with some other alloys, being demonstrated in the electrochemical corrosion phenomenon.

In order to reduce this dissolution and increase the integration capacity we widely use the "super passivity" of the implant surface.

We used different methods of the implant surface processing:

1. Anode oxidation - an electrochemical method, based upon the ionic transportation, which produces an implant surface inert to chemical substances.
2. Microplasmatic action of different currents with different intensity, frequency and pressure, as TiO_2 formation factors.

Under our supervision for 7 years we had a group of 68 patients, mostly mature and geriatric, that were submitted successively to 93 two-stage implantations.

We have switched to a prosthetic resolving of different types of the missing teeth situations, by the use of cylindrical and screw type Ti-made implants. Their surface was machined according to the methods developed by us.

In conclusion, it can be mentioned that for the time being titanium endoosseous implants with an adequate processed surface provide a high percentage of structural and functional rehabilitation for the dentomaxillary complex, leading to a confirmed qualitative osteointegration as well as to long life implants and dental bridges.

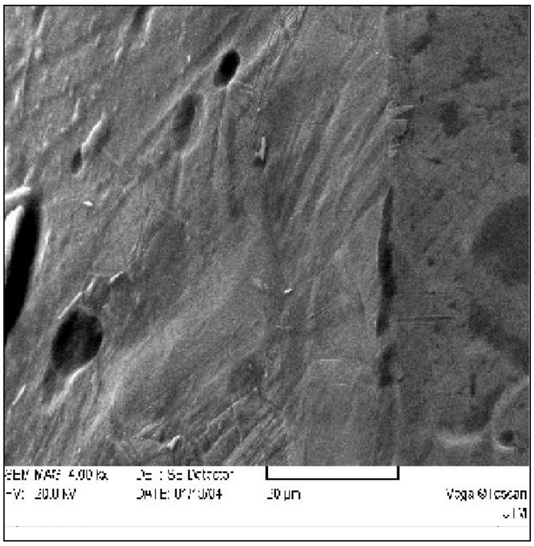

Figure 1. Unprocessed Ti surface

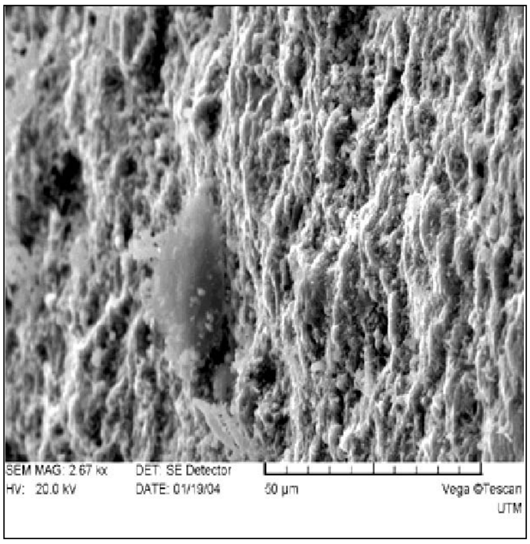

Figure 2. Surface processed by anode oxidation

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