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ANALYSIS, RESEARCHES AND SOLUTIONS CONCERNING OF DENTAL PROSTHESIS MATERIALS

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Abstract: *Prosthetic works upon implant may replace from a single tooth to an entire arcade. They can be made of various materials: metal-acrylate or metal-ceramics. Metal-ceramics works (with porcelain antagonists) are preferred today for their structure rigidity. Acrylic works present the benefit of shocks damping, but they are not resistant enough. The abutment applied on the implant represents the trans-mucous component and the implant package is covered in order to rebuild the aspect of a natural tooth.*
Keywords: *finite element, dental prosthetics, stress.*

1. INTRODUCTION IN DENTAL PROSTHETICS

Over time, there were a multitude of researches and solutions concerning dental prosthetics, 9 which was in its turn subjected to a major revolution at the time of a new procedure emergence, namely oral implantology. Today, millions of dental implants are used as oral implantology providing the possibility of using additional pillars that may be inserted wherever needed. Thus, a wide range of edentations that not long ago were benefiting only of mobilizable or mobile solutions can be approached today by fixed prosthetic restorations.
From the point of view of a simple classification the prosthetic parts can be attached exclusively upon implants (pure implanter) or can be mixed (dental-implanter).
The hexagonal shape of the implant's end prevents the abutment rotation and the contact surface between this and the implant is especially important especially in the process of occlusion with upper arcade. The dentist may reshape some part of the abutments used in implantology today, while the micro prostheses edges may be placed sub gingival without being followed by complications.
Also, upon an implanter support we can create the so called prosthesis upon implant, which is a mobilizable prosthetic device. On a small number of implants, the prosthesis with special aggregation systems can be manufactured, systems that confer much higher stiffness and support to the prosthesis on implant than to the usual prosthesis.

2. BIOCOMPATIBILITY ISSUES OF DENTAL PROSTHESIS

According to a more general and officially approved definition (Williams, 1987), a material with an optimal biocompatibility is the one that do not determine any tissue adverse reaction. Also, the implanted material is expected to withstand any physiological strain without showing any substantial dimensional change, shape alteration or any other catastrophic event. The implants should resist to any degradation or corrosive attack of the physiological or nutritional fluids. Their constituent materials must be resistant to oppose any force applied to them during their designed life cycle.
A great importance for the human tissues is presented by the development of electrochemical corrosion processes in blood serum at 37oC temperatures. When the material is introduced inside the body we should consider two aspects. One is the influence of the physiological environment that may change the material nature and properties. The other is the effect of the implant material and of each of its degradation products upon the physiological fluids and tissues.

We must highlight the fact that the chemical action of the physiological fluids does not involve just some chemical reactions of ionic exchange or oxidation-reduction reactions with the consisting molecules of a given biomaterial, but above all these the interaction of an impressive number of food substances, still unknown, that operate at the level of complex substances and are able to selectively attract specific ions, creating a physical-chemical unbalance state inside the material. Thus the material may sustain various chemical or physical degradations.
In order to determine the biocompatibility of the materials used in dental prosthetics a questionnaire was conceived, which was filled in by a human subjects' sample with prosthetic works made of the same type of acrylic material.

3. MATERIALS DENTAL PROSTHESIS – MICROSCOPIC ANALYSES

3.1 Description microscope

The experimental setup used for the microscopic analysis of the polymerization dental materials samples consists of a digital microscope Keyence VHX-600 type, with objective magnification between 500x and 5000x, an object field of 0, 25 mm2 and software suitable for the assessment studies and surface quality measurements, roughness, 3D representations. The used samples were manufactured in the same conditions and assessed according to the same procedures.

Figure 1: Keyence VHX-600 digital microscope (first two pictures) and mechanical testing system for dental samples

Most of the restoration materials should withstand forces during manufacturing 1 ing or mastication, so the mechanical properties are important in understanding and predicting the material behavior under load. Because a single mechanical property cannot represent a quality measure, the application of the involved principles in a range of mechanical properties is essential, especially considering the human factor implication.

3.2 The materials analyzed

Fixed metal-ceramic prostheses consist of a metal component that confers resistance and a ceramic component denture physiognomy.
The first non-noble alloys that have been used in the art of metal-ceramic had the composition of chemical elements such as cobalt, chromium, iron, nickel and other metals. Non-noble alloys show a lower resistance to corrosion than noble alloys, but have a higher hardness and elastic modulus greater fluidity is reduced and machining is difficult.
Alloys of Co-Cr has advantages over the alloys Ni-Cr due to their biocompatibility and the lack of allergic reactions that can develop the latter. Also, Co Cr-based alloys are highly resistant to corrosion due to chromium, which forms a protective oxide film on the alloy surface.
Corrosion is the deterioration of a material under the action of chemical or electrochemical environment in which it is located. The main causes of failure of metal ceramic restorations are the corrosion degradation of metals and alloys, mechanical wear and tear fatigue.
Studies have shown that the corrosion products from dental alloys solubilized in adjacent gingival tissue restoration depends on the component which influences the corrosion resistance of the alloy structure turnării166 formed during the combustion and subsequent protocols.

Analyzing the benefits of composite materials based upon resins, used as dental materials, we may find the following: they do not include Hg; due to a suitable edge adjusting and a volume constant in time they do not allow deposits in the contact area between the two materials (root and tooth); there is a biocompatibility with the human organism.

Among the disadvantages of using composite materials as dental materials we may list the following: situation when the hardening agent is not entirely consumed in the polymerization reaction and it may become toxic to the human body, triggering local inflammation; composite materials may sustain some mechanical damage due to forces occurred during mastication or due to important temperature changes, and if it is used in visible areas, it may present the fluorescence phenomenon when using a certain type of light radiation.

It was examined microscopically three prostheses used for a long time: ceramic hard chromium (Fig. 2), Graudent (fig. 3), chrome + duracryl (fig. 4), finding various deposits on the material, degradation and substantial changes to material.

Figure 2: Ceramic backed chrome

Figure 3: Graudent

Figure 4: Chrome + duracryl

3.3 Results obtained from microscopic analysis

Figure 5: Ceramic backed chrome prosthesis magnified 200 times the lack of material back 3D plan

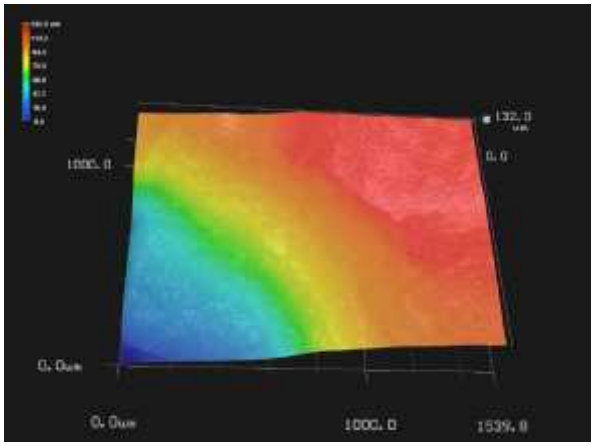

Figure 6: Chrome ceramic prosthesis magnified 200 times the lack of material sided 3D color

Making microscopic research has led to a detailed analysis of the material, degradation, damage occurring in material where it was observed that may occur cracks both in the crown, related to color, scale and at the level of the tooth, blunt, coloring cracks.

View detail was achieved with a powerful microscope that can increase the area studied by 500 times to 2,000 times, and the images were as clear and even to the depth of the material. The results obtained with the microscope were both 2D and 3D, while also noting how changed the whole structure of these materials.

Figure 7: Gaudent hearing increased 100 times 3D plan

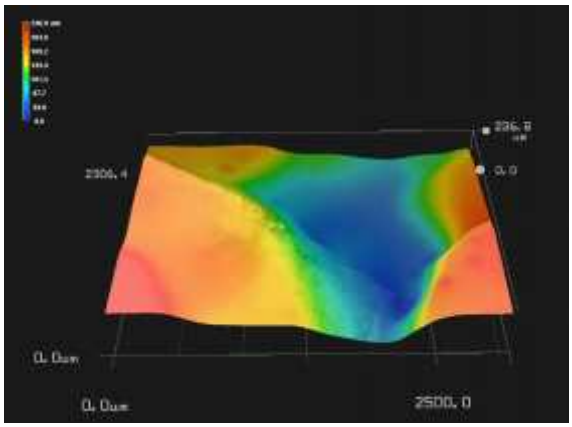

Figure 8: Gaudent hearing increased 100 times 3D color

Figure 9: Chrome + duracryl prosthesis 100 times increased 3D layer section plan

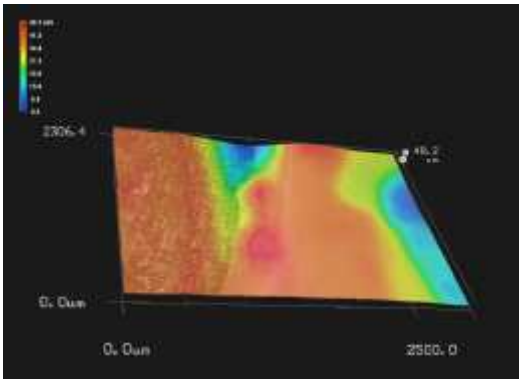

Figure 10: Chrome + duracryl prosthesis 100 times increased 3D layer section color

3. CONCLUSION

Extreme complexity of products, the continued emergence of new scientific models and theories that changes the approach to technological measure itself makes any work requiring great concentration of forces and conceptual material.

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