„GEORGE EMIL PALADE" UNIVERSITY OF MEDICINE, PHARMACY, SCIENCE AND TECHNOLOGY OF TARGU MURES

SCHOOL OF DOCTORAL STUDIES

PhD THESIS
-SUMMARY-

Influence of salivary pH on the properties of indirect restorative materials in patients with Gastroesophageal Reflux Disease

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Introduction

Biocompatibility is defined as the ability of a material to promote an appropriate response from the host, in a specific situation, to optimize the clinically relevant performance of the therapy. The contact of dental biomaterials with the biological environment has a decisive and specific role in the performance of the material used, through possible changes in the structure and functions of the oro-facial system, but also through transformations that can be induced to the characteristics and properties of the biomaterial.

The structure of the doctoral thesis

The general part of the doctoral thesis comprises 4 chapters. The first chapter presents general notions regarding gastroesophageal reflux disease (GERD), and the second chapter describes its effects on the oral environment. The third chapter presents the effects that metallic elements have on oral tissues and the alternative to their use, and the last chapter describes the use of CAD / CAM systems in dentistry. The personal contribution includes a clinical study and two experimental studies.

Obiectives

As the prevalence of GERD is constantly increasing, the aim of the first study was to comparatively evaluate the values of salivary pH, salivary buffer capacity and salivary flow in patients with and without GERD and the correlation between these parameters.

The objective of the second study was to evaluate the corrosion behavior in artificial saliva with different pH values, determined in the first study, of two Co-Cr dental alloys, made by casting, respectively by the subtractive method CAD / CAM .

The aim of the third study was to evaluate the behavior of two high performance fiber-reinforced CAD / CAM dental composites (Trinia™ and Trilor) in artificial saliva immersion tests and to determine if changes in mass or structure occur at variable pH values, specific to patients affected by GERD.

Study 1: Values of salivary parameters in patients with gastroesophageal reflux disease and patients without gastrointestinal pathology

A number of 80 patients were selected according to specific inclusion and exclusion criteria and were divided into a study group (patients diagnosed with GERD) and a control group, each containing 40 patients. The Saliva-Check Buffer kit (GC, Tokyo, Japan) was used to determine salivary variables. Statistical analysis was performed in the software dedicated to statistical processing, SPSS24, and revealed statistically significant differences ($p < 0.05$) between the salivary parameters of the two groups of patients. The amount of saliva at 5 minutes was lower in patients with GERD. The salivary pH of these patients changed to acidic values compared to the salivary pH of the controls, where the values were in the normal range. In patients with GERD, the determined salivary buffer capacity was low or very low. Medium and strong correlations were found between the parameters studied in both groups of patients.

Study 2: Experimental study of the behavior at different pH values of two types of Co-Cr alloys used for prosthetic restorations

Corrosion resistance of two commercial Co-Cr dental alloys, used for the manufacture of prosthetic restorations, by two different technologies, namely by casting and milling using CAD / CAM technology, was determined by the polarization resistance technique. The tests were carried out at human body temperature (37 ± 1 ° C), using Carter Brugirard artificial saliva with three different pH values, respectively 3, 5.7 and 7.6 as electrolyte. The morphology and elemental composition of the two Co-Cr alloys were analyzed with a scanning electron microscope (SEM), equipped with an X-ray energy dispersive spectrometer (EDS). Corrosion resistance tests were performed with a PARSTAT 4000 Potentiostat / Galvanostat. Electrochemical tests were performed according to ASTM G5–94 (2011) using the linear polarization technique. After calculating the electrochemical parameters, it can be stated that both cast and milled Co-Cr alloys, have the lowest corrosion current density, the highest polarization resistance and the lowest corrosion rate in artificial saliva with pH = 7.6. However, in the case of milled Co-Cr alloy tested in artificial saliva with pH = 5.7, the most

electropositive values of open circuit potential and corrosion potential were recorded. After corrosion tests, it was observed that the surface of the samples exposed to the electrolyte is colored, and by increasing the pH of the electrolyte, the color of the exposed surface changes to darker shades, suggesting a dependence between protective layer thickness and electrolyte pH. SEM investigations of Co-Cr alloy surfaces after corrosion tests did not show any signs of corrosion, indicating that the oxide layer formed on the surface is stable.

Study 3: Assessment of Immersion Testing of Two CAD / CAM Fiber-Reinforced Composite Dental Materials

After investigating the elemental composition and surface morphology, the specimens were immersed in Carter Brugirard artificial saliva for 21 days at different pH values: 5.7, 7.6 and varying pH (5.7-3), at a constant temperature of 37 ± 0.1 ° C using a Memmert IF55 incubator. Weight loss or gain was monitored at various intervals (3, 7, 14 and 21 days) using a Kern ALT 100–5 am balance with an accuracy of 0.01 mg. The samples were morphologically analyzed with a scanning electron microscope (SEM) to determine if the pH value had an impact on the morphology of the materials. The results suggested that both composite materials studied showed a similar mass variation regardless of the pH of the artificial saliva used as a test medium. Thus, after 3 and 7 days, the sample mass tends to decrease, and starting with the 14th day it starts to increase, reaching the highest growth value after 21 days. It should be noted, however, that the variation in recorded mass is not very large, ranging from −1,11 (±0,02) to 1.82 (± 0.02) mg, which suggests their stability in contact with artificial saliva, aspect that was also highlighted by the SEM analysis of the investigated areas.

General conclusions

The use of the Saliva-Check Buffer kit (GC, Tokyo, Japan) is a simple, easy, non-invasive and patient-accepted way, that can be used in the dentist's office to assess he saliva buffer capacity and pH.

Following clinical determinations of salivary parameters, it was observed that the salivary pH of patients suffering from gastroesophageal reflux disease turns to acidic values, and this aspect is of major importance for performing restorations made of biocompatible materials, with a reduced degree of corrosion or biodegradation.

Although according to the obtained results, it was observed that in artificial saliva with a more acidic pH value, the Co-Cr alloy investigated, regardless of the manufacturing technique (cast or milled), showed a lower corrosion resistance, it is worth noting that there was an improvement in the corrosion behavior of milled Co-Cr alloy compared to cast Co-Cr alloy, which is why it can be stated that this type of alloy is a better option for the prosthetic treatment of patients suffering from GERD.

Within the limits of this in vitro study, it can be concluded that the new composite biomaterials obtained by CAD / CAM technology may be a suitable alternative to the metal alloys used for the metal components of prosthetic restorations and they represent a viable option of dental materials for the oral rehabilitation of patients suffering from GERD.

For a correct dental rehabilitation treatment of patients affected by GERD, a multi- and interdisciplinary approach is required, by creating an integrated team of specialists / professionals, on account of general conditions that can affect the results of dental treatments, due to the specificity of the oral environment of these patients with acidic pH.

Originality

The PhD thesis covers an interdisciplinary subject, with obvious practical applications, quantifying the effects of salivary pH on various types of materials used in prosthetic restorations in adult patients with gastroesophageal reflux disease.

In this context, planning an oral rehabilitation treatment for GERD patients with biocompatible and resistant biomaterials in a more acidic salivary environment represents an effective method that reflects the need for multidisciplinary collaboration between dental prosthetics and gastroenterology.