

ANALYSIS OF METALLIC-CERAMIC INTERFACE IN DENTAL PROSTHESIS AND CONSIDERATIONS ABOUT THE POTENTIAL IMPROVEMENTS OF THE BOND STRENGTH

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Introduction

The aim of the paper is to present a complex analysis of metallic-ceramic interfaces in case of dental prosthesis using advanced microscopically technique. We present the results of microstructural investigations on some experimental samples made by Co-Cr dental alloys and consideration about the influence of casting aspects on the microstructure [1] and how affect this the metallic-ceramic interface. Also, in this paper is shown the main possibilities of different microscopy techniques for investigation of the metallic-ceramic interface.

Methods

We were casting some samples from Ni-Cr and Co-Cr dental alloys into similar shapes. The metallographic samples taken from the casting profile have been submitted to the following tests: quantitative optical microscopy (inclusions study), qualitative (metallographic analyses) and scanning electron microscopy coupled with EDS spectrometry. In order to be prepared for optical microscopy examination, the samples were cut, polish, immerse, and dry polish and electrochemical attack with 90 ml water and 10 ml hydrochloric acid and maintaining at 5-10 V for 1-2 minutes. For finding about the nature of our inclusions, we used the scanning electron microscopy and we study the microstructure morphology of some inclusions [1].

In order to analyse the interface between metallic dental alloys and different ceramics for non-noble alloys we prepare some experimental sample according the standards used in dental laboratories and the processing recommendation given by the suppliers. We use scanning electron microscopy coupled with EDS spectrometry using a microscope XL-30 – ESEM TMP in order to analyse the interface, the diffusion of different elements and qualitative appreciation of the adhesion.

Results

The results of the optical microscopy are presented in figure 1. According this, the alloys fit the international standards.

Qualitative analysis relived that the alloy has a dendritically structure.

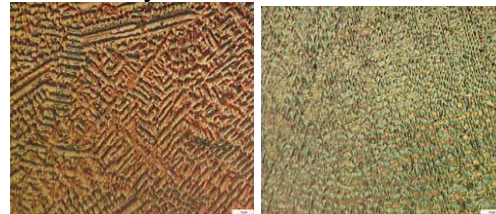


Fig. 1: The optical microscopy images for the Co-Cr samples

Over the surfaces there has been performed EDS quantitative analysis of the composition and also analyses concerning the distribution of the elements on inclusions. In some cases, we find some non-metallic inclusions, according to the distribution of the elements obtained by EDS quantitative analyses, who affect the adhesion between dental alloys and ceramics.

Discussion

By optical microscopy more structural aspects may be put in evidence, like the presence of carbides with discontinuous precipitation in metallic matrix or the dendritic structure, but better characterization is possible using the scanning electron microscopy. Freedom from non-metallic inclusions is a critical aspect of the castability of the cobalt-chromium dental alloys. The data obtained from microscopically analyses is critical to define factors and/or mechanisms that lead to premature breakdown of materials during clinical function, not just to analyze the interface between dental materials and tissue. In the light of these changing paradigms and new developments, the modern microscope technique appear as a powerful research tool for dental material research.

Acknowledgments

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References

- [1] Saldivar-Garcia AJ, Lopez HF. (2005) Microstructural effects on the wear resistance of wrought and as-cast Co-Cr-Mo-C implant alloys, J Biomed Mater Res A. 2005 Aug 1;74(2):269-74.