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Mechanical Behavior of Cobalt-Chromium Odontological Alloys after Successive Recasting

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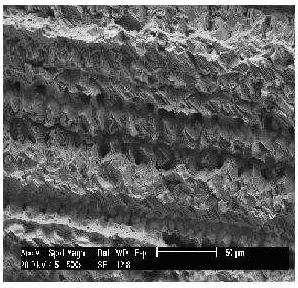
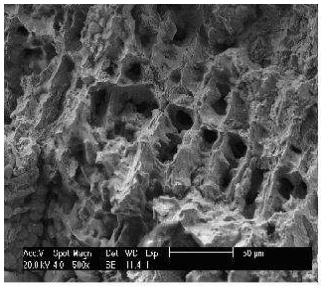
Abstract – Cr-Co alloys can replace noble metals in the manufacture of removable partial dentures. Since these devices are cast in small laboratories, remnants from previous castings are often reused in new devices. The present study aimed at evaluating the changes in the mechanical behavior of Cr-Co odontological alloys after successive recasting. The results revealed that to preserve the mechanical properties of the material, Cr-Co alloys should not be cast more than two times.

Regardless of the continuous advances of the last few decades on the development of new odontological materials, both technological and economical challenges still remain. Only mechanically reliable and cost-efficient materials will be able to reach economically challenged social classes. This situation applies especially to materials for implants and removable partial dentures. In the latter case, one of the latest advances concerns the replacement of noble metals such as Au and Ag by Cr-Co alloys. Removable partial dentures are commonly cast in small laboratories. In an attempt to optimize costs, remnants from previous castings are often mixed to fresh metal and reused in the manufacture of new devices. However, little is known about the deleterious effects caused by such practice on the mechanical behavior of prosthetic devices. It should also be pointed out that removable dentures are submitted to fatigue stresses that can shorten their service life. Therefore, the present study aimed at evaluating the changes in the mechanical behavior of Cr-Co odontological alloys after successive recasting. Seven groups of samples were prepared by varying the amount of recast material in their composition. 50% of the material from previous casting was added to each new group of samples. No significant statistical differences were observed considering the tensile strength of the material. On the other hand, the results showed significant differences in the modulus of elasticity and reduction of the fracture energy by increasing the amount of recast material. Deficient cast and clear signs of increased porosity can be seen on the fracture surface of the successive groups of samples (Figure 1 a to c). Therefore, it could be established that the production of metallic Cr-Co removable partial dentures should not use material that exceed two recasting steps in order to preserve the mechanical properties of the device.



(a)

(b)



(c)

Figure 1: Fracture surface of Cr-Co alloys after successive casting. Samples for (a) Group 1, (b) Group 4 and (c) Group 6.

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