Galvanic Corrosion of Ti6Al4V Coupled With NiCr as a Dental Implant Alloy in Fluoride Solutions

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The aim of this study is to investigate the galvanic effect of NiCr on Ti6Al4V in fluoride solutions used on dental implants rehabilitations. The alloys were evaluated in solutions with different contents of fluoride and pH in similar conditions founded in oral environment. The electrochemical measurements were performed on two steps. On the first step, analysis of the open circuit potential of each alloy in combination with various fluoride concentrations and pH values were carried out. In the second step, galvanic measurements were performed between the coupled alloys using precision multimeters. Data were evaluated by one-way ANOVA tests ($\alpha=0.05$). Ti6Al4V presented a decreasing corrosion resistance with increasing fluoride concentration and decreasing pH, being in a thermodynamic corrosion domain for all evaluated solution combinations except 227 ppm F⁻ at pH 5.5. Despite this, an important result was obtained from the galvanic measurements. When coupled with NiCr, Ti6Al4V was

able to achieve passivity and did not exhibit adverse galvanic effects with the different fluoride combinations tested. The possible galvanic effect in our study was an improvement in the Ti6Al4V corrosion resistance in the presence of fluoride content when it was coupled with NiCr. This study provides a new important result for the safe use of Ti6Al4V with a possible fluoride presence in the oral environment since they are associated with NiCr-based prostheses and implant connections.

Keywords: galvanic corrosion, titanium, fluoride, implant, NiCr

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