THE INFLUENCE OF FLUORIDE IONS ON THE CORROSION RESISTANCE OF TITANIUM AND NITI IN AN ARTIFICIAL SALIVA AND A MOUTHWASH

N.Schiff [1], B.Grosgogeat[1], M.Lissac[1], F.Dalard[2]

[1] *School of dentistry, Lyon,France.*

[2] *LEPMI, polytechnic institut of Grenoble, Saint Martin d'Hères, France*

INTRODUCTION: Nowadays, in oral implantology, Titanium is the best material. In dental orthopedic procedures, Nickel-Titanium alloys are frequently used. At the same time, fluoride mouthwashes are more and more prescribed by practitioners.

The aim of this work is to study the corrosion resistance of pure Titanium and NiTi alloy, in a reference medium and a mouthwash.

METHODS: The materials chosen are already prepared for clinical used, implantology for Titanium and orthodontic treatments for NiTi. The samples were shaped into a cylindrical form, in order to constitute the cap of rotating disk electrode. They were mechanically cleaned with abrasive strips and tested in three media : Fusayama Meyer artificial saliva [1], fluorided and acidified Fusayama Meyer artificial saliva and Acorea® ready to use mouthwash.

The electrochemical setting employed is a glass electrochemical cell with a calomel saturated electrode, a platinium cunter electrode and a working rotating disk electrode in a Faraday cage, all connected to a potentiostat with a specific software, obtaining potentiometric and polarization curves.

The corrosion resistance is studied by getting different values : corrosion potential, density of corrosion current and polarization resistance.

Afterwards, by a chronoamperometric study we get samples to be analyzed at the S.E.M.

RESULTS: The values obtained show a clear decreasing of the corrosion resistance of the two tested materials when used in the acidified and fluorided environment. In the Acorea® mouthwash we also observed a decrease in electrochemical properties of these two materials and the S.E.M. shows a deterioration of the surface of specimens[2] (table 1).

Table 1.Corrosion potentials and polarization resistance of NiTi alloy.

NiTi	Fusayama Meyer Artificial saliva	Acorea ® Mouthwash
Corrosion potential	-150 mV/SCE	-380 mV/SCE
Polarization Resistance	120 KÙ.cm²	40 KÙ.cm²

DISCUSSION & CONCLUSIONS: It is clearly experimented that the corrosion resistance of the two specimens decreases in the presence of fluoride in an acid environment [3, 4]. Fluoride dissolve the protective oxide layer of the materials. In artificial saliva, a chemical attack is visible at SEM, characterized by localized pitting. The Acorea® mouthwash , with a pH=5 and a fluoride concentration of 65ppm, has the same effect that fluorided and acidified artificial saliva but is less aggressive. The two materials have also a deterioration of the passive layer, visible at S.E.M. as generalized corrosion.

So, it seems wiser not to use certain fluorided mouthwashes especially during long terms orthodontic procedures, to avoid the risk of loosing physical and electrochemical characteristics of used materials. Moreover, in the presence of fluoride ions, there could be nickel ions release which are known to cause toxic and allergic reactions in the body.

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