Influence of Fluoride and/or Bovine Albumin on Electrochemical Properties of Bare and ionic liquid- Coated Ni₄₇Ti₄₉Co₄ Orthodontic archwires in artificial saliva solution

Rasha A. Ahmed^{1,*}, R. A. Farghali², Wafa A. Alshahrani³

¹ Forensic Chemistry Laboratories, Medico Legal Department, Ministry of Justice, Cairo, Egypt

² Chemistry Department, Faculty of Science, Cairo University, Giza 12613, Egypt.

³ Department of Chemistry, College of Science, University of Bisha, Bisha, Saudi 61922, Arabia.

*E-mail: rashaauf@yahoo.com

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Drawn biodegradable metallic wires are expected to degrade or to be resorbed within the body. Subjected to inorganic ions as fluoride corrosive ions and organic compound as proteins can affects corrosion and induce health complications. Accordingly, Surface modification materials are presently used as dental, orthopedic and cardiovascular applications. In this perspective, Ni₄₇Ti₄₉Co₄ orthodontic brackets and archwires were firstly coated with ionic liquid (IL) and then immersed in fluoride and/or bovine albumin containing simulated saliva solution; the corrosion behavior was examined and compared with bare Ni₄₇Ti₄₉Co₄ orthodontic archwires. The surface morphology before and after the immersion tests were analyzed while using scanning electron microscopy (SEM). The observations showed significant morphological changes with ionic liquid coat of the archwires surface. In addition, conventional electrochemical measurement methods, including cyclic voltammetry, corrosion potential and potentiodynamic measurements were also used to elucidate the effects of ions concentration, immersion time and coat stability on Ni₄₇Ti₄₉Co₄. The results showed that either the NaF(0–0.1%) and/or the presence of albumin (0–0.05%) in simulated saliva solution had a considerable impact on the corrosion potential (E_{corr}), corrosion rate (I_{corr}), and polarization resistance (R_p). The I_{corr} values increased with increasing the NaF concentration, but decreased with albumin addition in NaF-containing saliva solution. Furthermore, the presence of ionic liquid coat, irrespective of the testing media, greatly enhances the corrosion resistance of the Ni₄₇Ti₄₉Co₄ archwires.

Keywords: Ni₄₇Ti₄₉Co₄; Electrochemical impedance; coating; corrosion; fluoride.

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