BEHAVIOR CORROSION OF TITANIUM ORTHODONTIC ARCHWIRE

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ABSTRACT

Various type of metallic orthodontic wire and brackets stainless steel, cobalt-chromium-nickel alloy, nickel-titanium alloys, beta-titanium alloy are use in treatment of malocclusion. For correct of orthodontic case one must have a thorought knowledge of the material from wich these appliance are made. The mechanical and physical properties of these materials change greatly under variying condition of manipulation. These metals undergo chemical or electrochemical reaction with the oral enviroment resulting in dissolution or formation of chemical compounds. Under several situations the oral environment is highly aggresive anf leds to corrosion. The aim of this study to determine the corrosion rate of orthodontic titanium archwire with immersion in artificial saliva. The rectangular 0.017 x 0.025 Beta Ti (3M United) and CNA (Ortho Organizer) were used in this study. To measure the corrosion rate the weight loss and planed interval test (t1=7 days; t2=14 days;t3=21 days;t4=28 days) methode has been usued. The X-Ray Fluorecent Spectroscopy was used to identity the elemental composition of wire and was to investigated decreasing of element composition, before and after corrosion process by immersion in artificial saliva. Data was tasted and analized using Between Subjects Effectc and Multiple Comparation Test. The result show corrotion rates of CNA was higher than Beta III Ti. Presentage content of alloy is very influential on the characteristics an orthodontic material.

Key words : Orthodontic wire, Titanium Alloy, Corrosion rate, Artificial saliva.

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INTRODUCTION

The corrosion behavior of orthodontic wires shows high corrosion resistance in various solutions, such as Ringers solution, artificial saliva, and sodium chloride solution.

Factors such as temperature, quantity and quality of saliva plaque, pH, protein, physical and chemical properties and ralheait conditions may influence corrosion

De Waard and Milliams state that corrosion or chemical corrosion is a phenomenon in metallic materials. The reaction is the reaction solution elements on the surface of the metal by contact with an environment containing water and oxygen. In the corrosion process, the metal will be the contact with the anode while hydrogen ions (acid soluble metals).

Fixed orthodontic wire used is a titanium alloy or some type of metal alloy. In general, the alloy used is molybdenum, chromium, vanadium, zirconium and tin, with a certain percentage depending on the brand on the market. Some metal alloys is intended to change the mechanical properties of a metal to fit the needs. However, the structural changes that occur will result in a potential difference that can change the behavior of the metal corrosion

The purpose of this study was to evaluate the corrosion behavior of orthodontic wires made of titanium

MATERIAL AND METHODE

The TMA orthodontic wire Beta III Ti (ORMCO) and CNA (Ortho Organizer) used in this study.
Six orthodontic wires of each type were suspended in artificial saliva (pH 6.25) over an extended time interval (t_1=7 days, t_2=14 days, t_3=21days and t_4= 28 days) at 37°C.

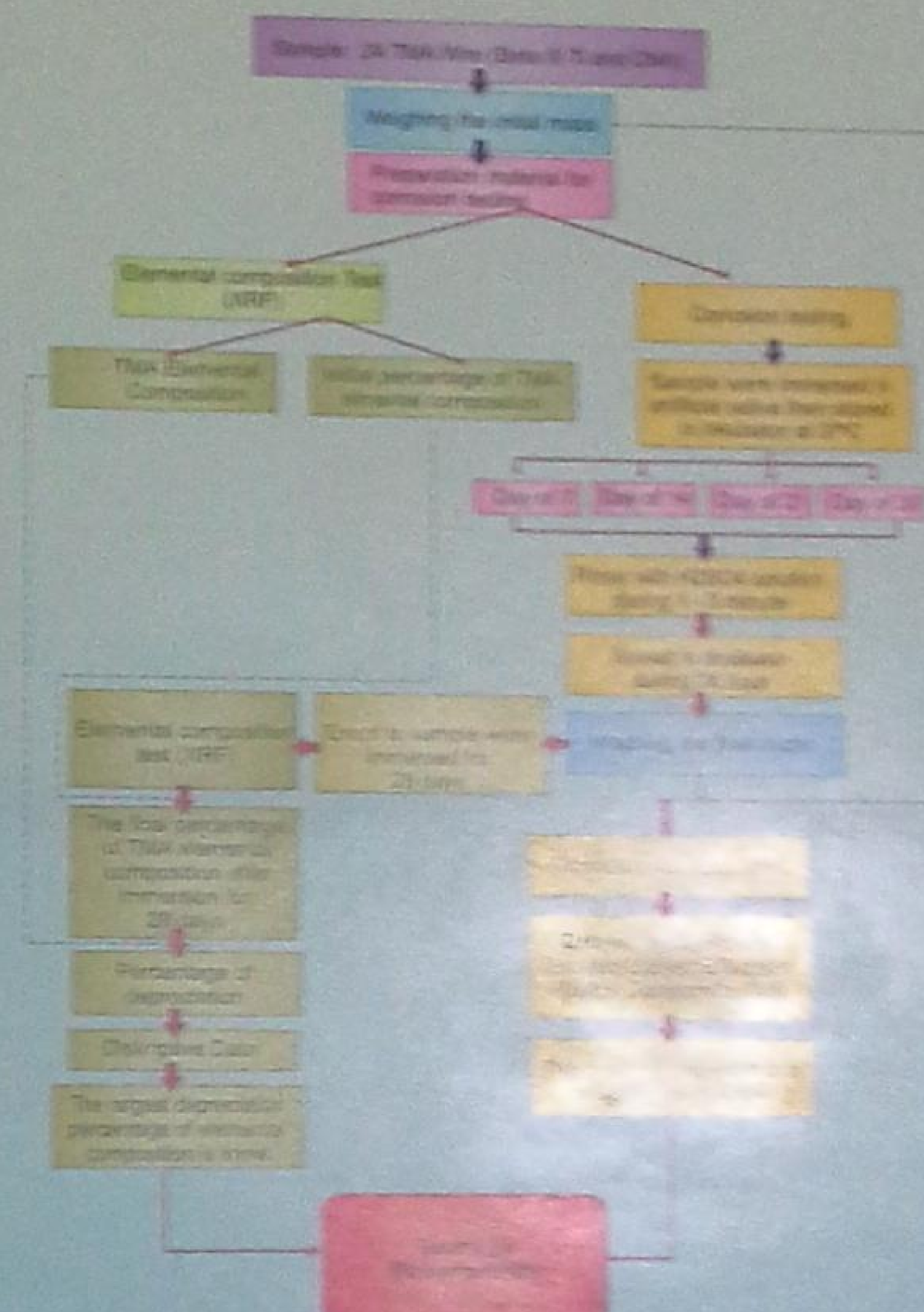
Sample were immersed in artificial modified Fusayama saliva in static conditions (as the corrosion test electrolyte), which consisted of NaCl (400 mg/L), KCl (400 mg/L),$CaCl_2 \cdot 2H_2O$ (795 mg/L), $NaH_2PO_4 \cdot H_2O$ (690 mg/L), KSCN (300 mg/L), $Na_2S \cdot 9H_2O$ (5 mg/L), and urea (1000 mg/L). The electrolyte had a pH of 6.25 and was maintained at 37 ± 0.2 °C.

To measure the corrosion rates, the weight loss method has been used.

$$CR = \frac{534\ W\ (mg)}{\rho\ (gr/cm^3).\ A\ (cm^2).\ t\ (hour)}$$

The X-ray Fluorescent spectroscopy was used to identify the elemental composition TMA wire and was to investigate decreasing of elemental composition before and after corrosion process by immersion in artificial saliva

RESEARCH PROCEDURE



RESULT

The results were statistically analyzed with analysis of variance and Least Significant Difference test at the 0.05 level of significance

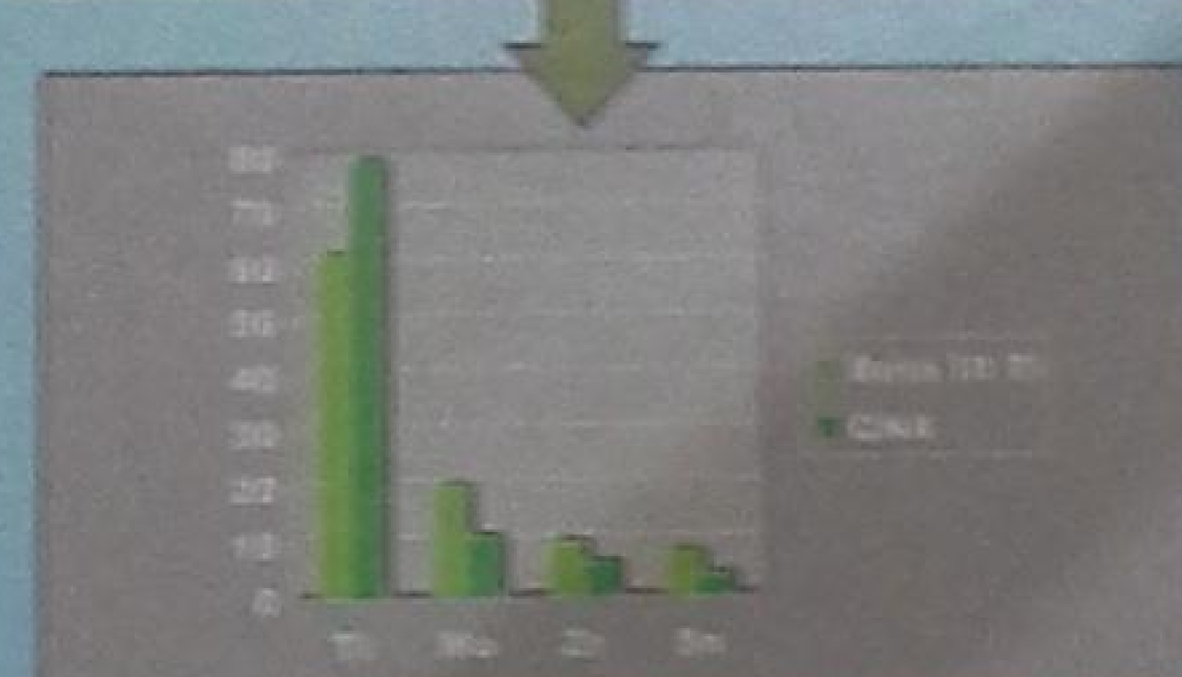


Figure 1. Elemental Composition (wt%) of Alloys as Determined by XRF

Figure 2. Weight loss of TMA Wire after depending on immersion time

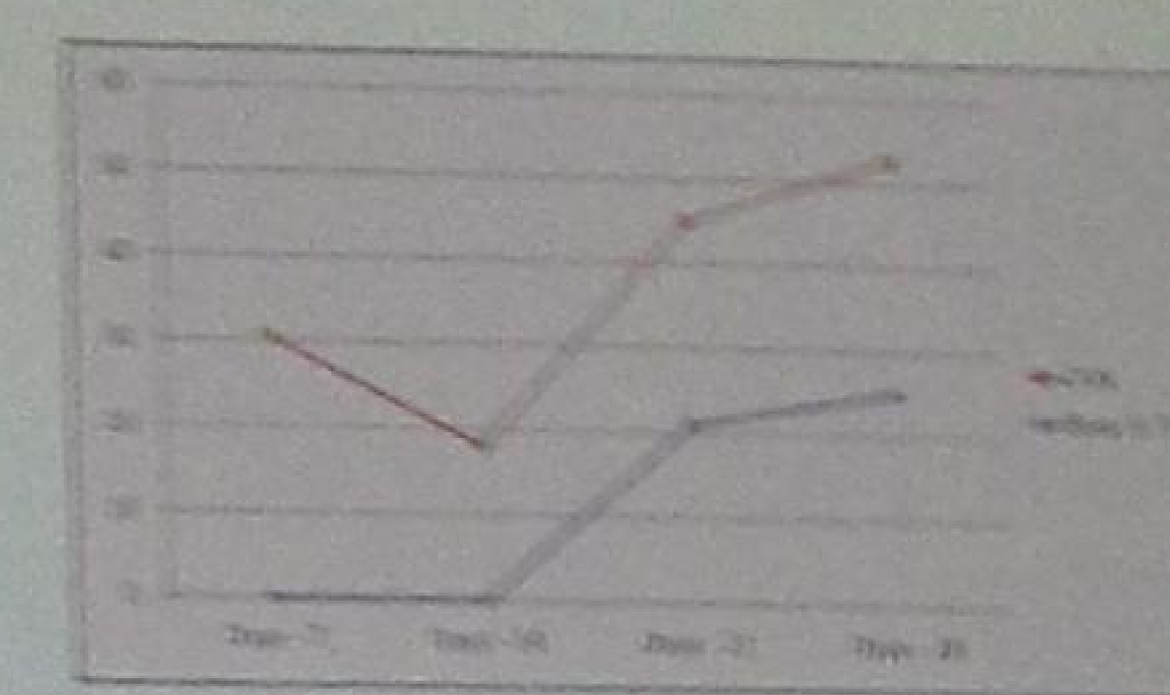


Figure 3. Corrosion rate TMA Wire after depending on immersion time

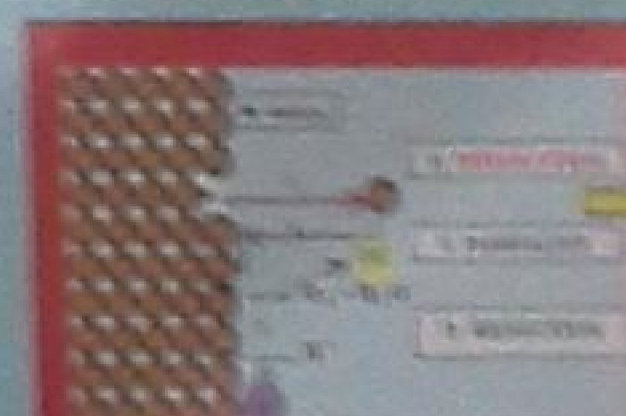
Figure 4. View of Beta III Ti and CNA with 1000x

DISCUSSION

Some corrosion of orthodontic alloy, regardless of their metallurgical structure, occours in the oral environmental. the inevitable surface defects from wire manufacturing are assumed to accelerate this process

The corrosive status of the experimental wires was created through electrochemical means and was intended to increase corrosion speed compared to traditional immersive corrosion methods

Orthodontic wire products from different manufacturers would have different corrosion resistance. We assayed the corrosion resistance, in terms of ion release, of different orthodontic wires in artificial saliva with various acidities



The stability of TMA wire in the physiological environment is dependent primarily on the properties of the mostly TiO2 oxide layer that is present on the surface.

The later proses involves the reaction of O2 which in turn reach with an oxidative trace metal and generation of O2, wgich in turn reach with hydroxy peroxide to form the hydroxy radical and OH.

CONCLUSION

Corrosion behavior of wire CNA higher than in TMA wire

The composition of the alloy content of material will greatly influence the behavior of corrosion on the wire orthodonti

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