

Republic of Iraq
Ministry of Higher Education
and Scientific Research
University of Baghdad
College of Dentistry



Assessment of load-deflection and surface roughness of copper nickel titanium archwire after artificial aging.

A Thesis Submitted to The Council of the College of Dentistry at
the University of Baghdad, in Partial Fulfillment for the
Requirements of Master of Science Degree in Orthodontics

By
Mostafa Kareem Sofar
B.D.S.

Supervised by:
Assistant Professor
Reem Atta Rafeeq
B.D.S, M.Sc., (Orthodontics)
Baghdad-Iraq

2021 A.D.

1442 A.H.

Abstract

Basically, the initial alignment stage of comprehensive orthodontic treatment requires an archwires that have excellent strength, excellent springiness and a long range of action. These archwires, along with other parts of fixed orthodontic appliances, are prone to degradation or corrosion inside the oral cavity due to several factors which could affect their performance; therefore, the objectives of this *in vitro* study were designed to compare conventional superelastic nickel titanium (NiTi) with copper nickel titanium (CuNiTi) archwires in terms of their surface roughness and load deflection behaviors in as received and after artificial aging. Also, to assess the effects of different aging procedures on these properties for each archwires type.

A total sample of 48 pieces of 0.016 inch round preformed NiTi and CuNiTi archwires (24 pieces for each type) were used in the current study. From each archwire piece, two straight segments (30mm) were obtained from the straight distal end. Twelve segments from each archwire types were tested in as received condition to provide baseline information, while the remaining segments were kept under static bending for two months, and were divided into the following subgroups: static bending, thermo-cycling and acid challenge (12 segments per each subgroups). Half of the samples were undergoing a surface roughness assessment using atomic force microscopy, while the others were subjected to a modified bending test using a universal testing machine for evaluation of load deflection behavior. Independent t-test was used to evaluate the significant differences between NiTi and CuNiTi archwires in as received and artificial aging conditions, while one-way ANOVA and Tukey HSD post hoc tests

Abstract

each archwire. The level of significance was set at 0.05.

The results of independent t-test showed that there was a statistically significant difference between NiTi and CuNiTi archwires in terms of surface roughness and load deflection behaviors, except the hysteresis percentage after acid challenge experiment in which there was non-significant difference. While ANOVA and Tukey HSD post hoc tests show that only acid challenge experiment had significant effect on surface roughness of both archwires. However, *in vitro* aging did not exhibit any significant effects on load deflection behaviors of NiTi in contrast to CuNiTi archwires.

In conclusion, CuNiTi archwires had a rougher surface than NiTi archwires in as received and even after *in vitro* aging. Furthermore, CuNiTi archwires also provided more constant and light force compared to NiTi archwires of the same size; therefore, their indications are different according to the clinical situations. However, NiTi archwires were more resistant to *in vitro* aging, while thermocycling reduced the hysteresis percentage and acid challenge increased it for CuNiTi archwires.



جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة بغداد
كلية طب الأسنان

تقييم انحراف التحميل وخشونة السطح لأسلاك النحاس والنيكل تيتانيوم بعد التهريم الاصطناعي.

رسالة مقدمة الى مجلس كلية طب الأسنان – جامعة بغداد
كجزء من متطلبات نيل درجة الماجستير في علوم تقويم الأسنان

من قبل
مصطفى كريم صفر
بكالوريوس طب وجراحة الفم والأسنان

بإشراف
الأستاذ المساعد
ريم عطا رفيق
بكالوريوس طب وجراحة الفم والأسنان
ماجستير تقويم الأسنان