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Assessment of Metal Ions Release and Corrosion Behavior of Orthodontic Mini-Implants In Fluoridated Mouthwashes (An in Vitro Study)

A Thesis

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Abstract

Orthodontic mini-implants are considered to be one of potential sources of orthodontic patient exposure to metallic ions due to different elements used in manufacturing of these devices and because of the corrosion of titanium and stainless steel alloys in the body fluids. Accordingly, the current in vitro study was performed to evaluate the effect of fluoridated mouthwashes and immersion time on the corrosion behavior, amount of metal ions release and microscopical surface of two different types of orthodontic mini-implants (titanium and stainless steel).

Thirty orthodontic mini-implants (15 titanium and 15 stainless steel) were used, each group subdivided equally into 3 subgroups which were immersed separately in (Artificial saliva, Lacalut white and Kin B5 mouthwashes) for 28 days as following immersion intervals (1-7), (8-14) and (15-28) days. All mini-implants were used in as-received condition without any additional treatment.

The assessment of the amounts of released ions (titanium, aluminum, vanadium, nickel, iron, manganese and chromium) was achieved using the atomic absorption spectrophotometer, and the statistical analysis was performed using one-way ANOVA and Tukey's (HSD) test ($P \leq 0.05$).

The results revealed that the highest amounts of ions were released in Lacalut-White followed by Kin-B5 mouthwashes and finally in artificial saliva for both (titanium and stainless steel) mini-implants. The amounts of iron ion released were higher than that of nickel, manganese and chromium ions in all groups for stainless steel mini-implants with the highest ions released were at the end of 28 days. On the other hand, the amounts of aluminum released were higher than titanium and vanadium ions for titanium mini-implants with different patterns of release along the immersion intervals.

The results of scanning electron microscopy (SEM) showed that the signs of pitting and crevice corrosion were obvious in different regions of the examined

samples, being greater in titanium than stainless steel mini-implants, and more evident in both fluoridated mouthwashes than artificial saliva.

The results of weight analysis revealed a reduction in the weight of all mini-implants measured after immersion in different storage media when compared to that measured before immersion.

In conclusion, the occurrence of corrosion in various amounts indicates the release of quantities of metal ions from titanium and stainless steel orthodontic mini-implants in different pattern and amounts due to several influencing factors. Additionally, it can be recommended to use fluoridated Kin-B5 mouthwash in orthodontic patient and avoid prolonged use of fluoridated Lacalut-White mouthwash.