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Original Articles

Type of Archwire and Level of Acidity: Effects on the Release of Metal Ions from Orthodontic Appliances

Maja Kuhta^a, Dubravko Pavlin^b, Martina Slaj^c, Suzana Varga^d, Marina Lapter-Varga^e, and Mladen Slaj^f

Abstract

Objective: To examine the effects of three different parameters—pH value, type of archwire, and length of immersion—on release of metal ions from orthodontic appliances.

Materials and Methods: Simulated fixed orthodontic appliances that corresponded to one-half of the maxillary arch were immersed in artificial saliva of different pH values (6.75 ± 0.15 and 3.5 ± 0.15) during a 28-day period. Three types of archwires were used: stainless steel (SS), nickel-titanium (NiTi), and thermo NiTi. The quantity of metal ions was determined with the use of a high-resolution mass spectrophotometer (HR-ICP/MS).

Results: The release of six different metal ions was observed: titanium (Ti), chromium (Cr), nickel (Ni), iron (Fe), copper (Cu), and zinc (Zn). Repeated measures statistical analysis of variance (ANOVA) was used. Results showed that (1) the appliances released measurable quantities of all ions examined; (2) the change in pH had a very strong effect (up to 100-fold) on the release of ions; and (3) the release of ions was dependent on wire composition, but it was not proportional to the content of metal in the wire. The largest number of ions was released during the first week of appliance immersion.

Conclusion: Levels of released ions are sufficient to cause delayed allergic reactions. This must be taken into account when type of archwire is selected, especially in patients with hypersensitivity or compromised oral hygiene.

Keywords: [Metal ions](#), [Orthodontic appliances](#), [Level of acidity](#)

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^a Private Practice, Zagreb, Croatia

^b Associate Professor, Department of Orthodontics, School of Dentistry, University Health Science Center at San Antonio, San Antonio, Texas

^c Assistant Professor, Department of Orthodontics, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

^d Resident, Department of Orthodontics, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

^e Professor, Department of Orthodontics, School of Dental Medicine, University of Zagreb, Zagreb, Croatia

^f Professor and Head, Department of Orthodontics, School of Dental Medicine, University of Zagreb, Zagreb, Croatia



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