The Angle Orthodontist: **Vol. 69, No. 5, pp. 433–440.**

An investigation into the effects of polishing on surface hardness and corrosion of orthodontic archwires

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ABSTRACT

The purpose of this study was to investigate the effect of surface roughness on the relative corrosion rates of wires of four alloys—stainless steel, nickel titanium, cobalt chromium, and beta titanium. Batches of wire were divided into two groups. Wires in one group were industrially polished to provide a uniform surface finish; wires in the other group were left for comparison “as received.” Wire diameter, hardness, and relative corrosion rates were compared within groups before and after polishing. Comparisons were also made across the four groups of alloys. The samples of as-received wires showed variations in surface finish, with beta titanium having the roughest appearance and cobalt chromium the smoothest. Nickel titanium and stainless steel surfaces were similar. Polishing provided a more uniform finish, but significantly reduced the diameter of the wires. Microhardness testing of wire surfaces of each alloy indicated that no significant work-hardening occurred as a result of polishing. The relative corrosion rates (expressed in terms of corrosion current density) in a 0.9% sodium chloride solution were estimated using the electrochemical technique of polarization resistance. Nickel titanium wires exhibited the greatest corrosion current density in the as-received state. Polishing significantly reduced the corrosion rate of nickel titanium, such that comparison between the four alloys in the polished state revealed no significant difference in their relative corrosion rate / corrosion current density.

KEY WORDS: Orthodontic alloys, Polishing, Corrosion.

Submitted: May 1998
Accepted: September 1998.