

LETTERS FROM OUR READERS

To: Editor, *The Angle Orthodontist*

Re: Kaneko K, et al. Degradation in Performance of Orthodontic Wires Caused by Hydrogen Absorption During Short-term Immersion in 2.0% Acidulated Phosphate Fluoride Solution. *Angle Orthod.* 2004;74:487–495.

I read with interest the recent publication of Kaneko and coworkers in *The Angle Orthodontist* reporting on the degradation in performance of four major alloys of orthodontic wires, namely nickel-titanium, beta titanium, stainless steel, and cobalt-chromium-nickel, caused by hydrogen absorption during short-term immersion in an acid fluoride solution.

This was a carefully done study, and the information reported does contribute to our body of knowledge. However, the title says “Short-term Immersion” in 2% APF and later in the text they report their findings based on events occurring after they had immersed the wires for 60 minutes! That’s not my definition of short-term immersion of wire in 2% APF.

If their definition of short term creates a reservation in any reader on the propriety of fluoride treatments for patients wearing orthodontic appliances, it would be very unfortunate.

The recommended time for an APF application is at most four minutes. It is well known that hydrofluoric acid will attack titanium, it is about the only thing that will. But to create a test environment that is supercritical, more than 10 times any expected exposure and then draw any clinical implications is quite a stretch.

Michael L. Swartz, DDS

Director, Clinical Affairs
Ormco, Sybron Dental Specialties
mike.swartz@sybronDental.com

Re: Response from Dr. Yokoyama

We would like to thank Dr Swartz for his contribution and comments concerning our article. In this article, we used the word “short-term” unlike in our previous reports,^{1,2} in which hydrogen embrittlement of titanium alloys in APF solutions was investigated by immersion tests from a few to 1000 hours. The immersion for 60 minutes was not necessarily performed under usual clinical conditions. Nevertheless, the result of this study indicates that hydrogen absorption occurs for a few minutes. This immersion test was conducted at pH 5.0 without applied stress. The use of a low pH or an applied stress larger than the critical stress for martensite transformation markedly enhanced hydrogen absorption.³ Hydrogen embrittlement prevention must be studied. Dentists should use fluoride in treatment always bearing hydrogen embrittlement in mind.

Ken'ichi Yokoyama, PhD

Department of Biomaterials and Bioengineering
Institute of Health Biosciences
The University of Tokushima Graduate School
Tokushima, Japan
yokken@dent.tokushima-u.ac.jp

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2. Kaneko K, Yokoyama K, Moriyama K, Asaoka K, Sakai J, Nagumo M. Delayed fracture of beta titanium orthodontic wire in fluoride aqueous solutions. *Biomaterials.* 2003;24:2113–2120.
3. Yokoyama K, Kaneko K, Moriyama K, Asaoka K, Sakai J, Nagumo M. Delayed fracture of Ni-Ti superelastic alloys in acidic and neutral fluoride solutions. *J Biomed Mater Res.* 2004;69A:105–113.

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