Copper-Nickel-Titanium Wires: Ormco vs. RMO
By: Leon Laub, September 3, 2014.

Just published – August 2014:
Pompei-Reynolds RC, Kanavakis G. Interlot variations of transition temperature range and force delivery in copper-nickel-titanium orthodontic wires. Am J Orthod Dentofacial Orthop 2014;146:215-26.

- Don't know the differences between FLI Copper Nickel Titanium and Ormco Copper NiTi?
- How come those numbers: 27, 35, 40 on FLI Copper Nickel Titanium don't say °C?
- Don't know how to sell FLI Copper Nickel Titanium against Ormco Copper NiTi?
- Want to jump start your wire sales?
- Now we have the scientific evidence to make claims for superiority of FLI Copper-Nickel-Titanium!

A Tufts University study just published, August 2014, in the most respected refereed (this means that several doctors evaluate the study before the journal will publish it) orthodontic journal – American Journal of Orthodontics and Dentofacial Orthopedics, and is precisely what we needed to independently prove to your doctors that RMO Copper-Nickel-Titanium wires are superior in clinical properties of tooth-moving forces and consistent Transformation Temperatures than Ormco Copper NiTi. The study is a head-on, no holds barred, comparison of RMO vs. Ormco CuNiTi wires. And, the results show a more consistent and predictable product from RMO. Doctors are not in the guessing mode – they expect a wire to work the same way every time, and that is what RMO's wires show!

Make copies of the attached article, read it, talk about it, and give your doctors a copy.

There is an international standard for orthodontic wires (ISO 15841) that is identical to the U.S. American Dental Association standard (ANSI/ADA Specification No. 32). Two tests are used as the major comparison between NiTi wire brands: Transformation Temperature or Austenite finish temperature, A_f, and Force. This study, done at Tufts Department of Orthodontics in Boston, measured both these factors to look at the consistency among several production lots of these wires. From a doctor's perspective, he/she want wires that work the same way every time so the doctor can predict the clinical outcomes. No surprises wanted! Results from this study show a large variability in results for Ormco wires; much smaller differences for RMO wires. Combine these results with lower pricing from RMO and you have a very persuasive reason for the doctor to switch brands!

If you are a little "rusty" on terminology, look at the article I wrote on understanding NiTi wires in the 2013 RMO Clinical Review –also attached.

Ormco had a patent on Copper NiTi wires that expired a few years ago – they had the entire market for 20 years and did such a good job of branding that some doctors do not want to change. For RMO to enter the market, we had to do something better! From internal testing, we knew that there was a lot of inconsistencies in forces developed by Ormco wires, and we set out to improve that. Our focus was to make wires that all had identical forces within one package, and among production lots– so a wire that the doctor uses today will deliver the same force as the same size wire that the doctor uses in 6 months, 1 year, 10 years! The Clinical Review article goes into the details of how RMO achieved this by focusing on wire production that gave consistent forces, rather than Ormco's focus on producing a consistent Transformation Temperature – or Austenite finish temperature, A_f .

Ormco calls its wires: Copper NiTi 27°C, Copper NiTi 35°C, Copper NiTi 40°C. The temperatures are Austenite finish temperatures, A_f , that are measured according to the method in the standard. What we found is if the manufacturing focus is to get consistent A_f values, a significant consequence is that the tooth-moving forces will have a large variation.

Doctors are more concerned that the wire forces are consistent than A_f . So, when we set out to make an RMO brand of Copper-Nickel-Titanium wires, we focused on manufacturing consistent force wires! What a concept! The independent Tufts University study shows that RMO has very successfully achieved that goal.

Since RMO focused on producing consistent forces, we were not concerned to match the same Austenite finish temperatures, A_f , that Ormco advertises. That's why we just use the numbers: 27, 35, 40; they are not actual A_f values. Use these numbers to convert a doctor from the Ormco wires used. The equivalent wires for: Copper NiTi 27°C, Copper NiTi 35°C, Copper NiTi 40°C, are FLI CuNiTi ^{27}, FLI CuNiTi ^{35}, FLI CuNiTi ^{40} , respectively.

Take a look at the Reynolds & Kanavakis publication. One size round wire, 0.016," and one size rectangular wire, .016" x .022," for each of the three A_f values were tested. Figure 1 is a photo of the equipment used to measure A_f , and Figure 3 is a sample output graph from a test run. The lower part of the curve is for heating the wire samples from a low temperature and the upper part of the curve is for cooling from a higher temperature, than mouth temperature. Notice that there are 2 peaks in the curve; the lower is for the change in lattice structure from martensite to austenite, the upper is for the change in lattice structure from austenite to martensite. Note where the readings are made for the austenite start, A_s , and austenite finish, A_f temperatures. This test is repeated for samples from each manufacturing lot and the results for all lots of the same wire temperature designation and size are superimposed in Figures 4 and Fig. 4 (continued). Ormco

wire results are shown in the left side and RMO on the right side of each pair of same-size wires. A visual comparison shows a much greater manufacturing lot variation in Ormco wires that the equivalent size RMO wires.

Figure 2 shows the set-up for a 3-point bend test according to the ISO standard. This test is discussed in detail, including how the graphical data is interpreted, in the Clinical Review article. Tooth moving force results are shown in Figure 5 and Fig. 5 (continued). Respective Ormco and RMO wires are compared in pairs. The left side of the Figure shows Ormco results, and the right side, RMO results for each of three A_f temperatures. Each graph in a composite Figure is from one manufacturing lot of the wire. A visual comparison shows a much greater manufacturing lot variation in Ormco wires that the equivalent size RMO wires.

The investigators point out several limitations to their study. The sample size for each lot was small due to limited available of wires from each lot. However, they suggest that manufacturing processes should be in-control so that within one production lot there would be good reproducibility of test results. They also note statistically significant differences in force for the same wire type and size.

Conclusions are:

- "Wires of the same materials, dimensions, and manufacturer but from different production lots do not always have similar mechanical properties.
- Differences in interlot variations exist between manufacturers of CuNiTi archwires."

The conclusions are very "understated." The data on Transformation Temperature and Tooth-moving Forces show SIGNIFICANT DIFFERENCES between Ormco and RMO Copper-Nickel-Titanium wires. The data clearly show that RMO wires are more consistent from lot to lot in both ($A_f - A_s$) and tooth-moving forces. This makes RMO wires more clinically predictable for the doctor.