

Comparative analysis of load/deflection ratios of conventional and heat-activated rectangular NiTi wires

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Objective: This study compared the load-deflection ratios between 0.019 x 0.025-in rectangular orthodontic wires using 5 conventional preformed nickel-titanium (NiTi) and 5 heat-activated NiTi archwires from four different manufacturers (Abzil, Morelli, 3M Unitek and Ormco), totaling 40 archwires. The archwires were placed in typodonts without tooth # 11 and tested using a universal testing machine connected to a computer.

Results: The comparisons of mean load-deflection values of conventional NiTi wires revealed that the lowest mean-deflection ratio was found for 3M Unitek, followed by Ormco, Morelli and Abzil. Regarding the heat-activated wires, the lowest load-deflection ratio was found for Ormco, followed by 3M Unitek, Abzil, and Morelli.

Conclusion: The comparison of mean load-deflection ratios revealed that the heat-activated wires had lowest mean load-deflection ratios, and this trend was seen during all the study. However, at 2-mm deflection, mean load-deflection ratios for heat-activated Morelli and conventional 3M Unitek wires were very similar, and this difference was not statistically significant.

Keywords: Orthodontics. Orthodontic wires. Qualitative analysis.

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Editor's abstract

The nickel-titanium wires have been widely used in orthodontic practice, mainly due to the release of low and continuous forces, very useful for dental aligning and leveling. So, with the advent of low elasticity modulus wire (nickel-titanium and TMA), a trend is observed during orthodontic treatment, the variation in alloys used according to the wire caliber, leading to a possible better root torque control. However, there are few studies evaluating the force released by nickel-titanium wires of rectangular section, with the purpose of its usage for the initial dental aligning and leveling. Therefore, the objective of this study consisted in comparing the released force in different deflections by four brands of conventional and heat-activated nickel-titanium wires, with rectangular cross-section 0.019 x 0.025-in. Five upper pre-contoured conventional nickel-titanium orthodontic archwires and five heat-activated were analyzed for all the following brands: Morelli (Sorocaba, Brazil), Abzil (São José do Rio Preto, Brazil), Ormco (Orange, USA) and 3M-Unitek (Saint Paul, USA). These arches were preconditioned in environment with relative humidity of 50%, at 25 °C for 72 hours and then placed in suitable brackets in orthodontic typodonts. With a steel tip, a force of 50 N was applied in the maxillary central incisor region, buccolingual direction, using a universal testing machine (Emic-10000-003-MY). The forces released by wires were recorded in the deflections of 3 to 1 mm, in intervals of 0.5 mm. Data were recorded on the Tesc Software, version 2.0, and subjected to the

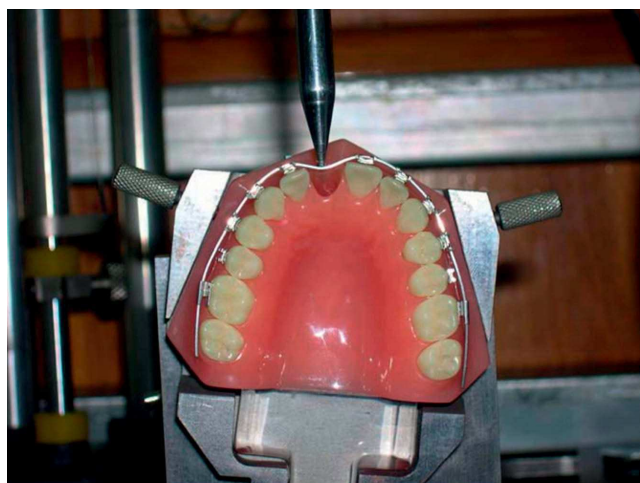


Figure 1 - Steel tip applying force in the buccolingual direction, on the upper central incisor region of the typodont.

Student's t test ($p < 0.05$). Results indicated that the heat-activated nickel-titanium wires released a minor force compared to the conventional ones, in all deflections. In comparison between brands, it was verified that there is a lower load / deflection ratio for the conventional wires for Ormco, followed by 3M-Unitek, Morelli and Abzil. Also for the heat-activated wires, a minor force was released in the different deflections for Ormco, followed by 3M-Unitek, but with the lowest scores for Abzil in relation to Morelli. The authors concluded that, in spite of the heat-activated nickel-titanium wires presenting a minor load/deflection ratio than the conventional wires, they release forces clinically non-acceptable, even in low deflections. This fact prevents the use of the rectangular nickel-titanium wires in the initial phase of dental aligning and leveling.