Effect of elastomeric ligatures on frictional forces between the archwire and orthodontic bracket

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Abstract

Aim: To evaluate the frictional force between the archwire and orthodontic bracket generated by elastomeric ligatures with polymer coating (Super slick, TP Orthodontics) and conventional ligatures (Morelli) using two types of insertion techniques. Methods: Forty elastomeric ligatures, 20 with polymer coating and 20 conventional, were evaluated. Each type of ligature was separated into two groups (n=10), according to the insertion mode: conventional or crossed (from mesial to distal region crossed in front). To analyze friction, 40 5-cm-long segments of stainless steel orthodontic archwires 0.018" x 0.025" (Morelli) and Edgewise brackets (slot 0.022" x 0.028"; Morelli) were used. Each set (bracket, wire and elastic) was submitted to frictional testing in a universal test machine (Instron 4411) at a crosshead speed of 5 mm/min. Each bracket was moved 5 mm on the wire, with maximum friction and mean friction being recorded for each cycle. Three readings were taken for each bracket. Data were submitted to two-way ANOVA and Tukey's test (p<0.05). Results: It was shown that for maximum and mean friction, the polymer-coated ligature did not differ statistically from the conventional type in a dry environment condition. Ligatures placed in crossed mode promoted significantly greater friction than those placed in conventional mode, irrespective of the type of elastomeric ligature. Conclusions: Friction depended on the insertion mode, but not on the type of elastomeric ligature.

Keywords: friction, elastomer, orthodontics.

Introduction

Sliding mechanics may be used in cases of tooth extraction, severe crowding, or for problems of discrepancy between the dental arches, involving movement of brackets along archwires. However, the disadvantage of using this type of mechanics is the friction generated between the bracket and wire during orthodontic movement, which the friction produced at the bracket-wire interface tends to prevent the desired movement.

According to Burrow and Charlotte (2009), friction is defined as the force of resistance exerted by the surfaces opposed to the movement. The area of contact is influenced by the roughness and force with which the surfaces are pressed against each other. There are two types of friction: static and kinetic. Static friction is opposed to any application of force, and its magnitude is exactly what it should be to prevent movement between two surfaces, up to the point when it is overcome and movement begins, that is, the force applied is not sufficient to move the object. On the other hand, kinetic friction is opposed to the direction of movement of the object and occurs when the bodies are in motion. Therefore, kinetic friction is irrelevant during the orthodontic movement of teeth, as continuous movement of...