



Comparison of bracket irregularities in 4 conventional ligation systems and 1 self-ligating system

Comparación de irregularidades en brackets de cuatro sistemas de ligado convencional y un sistema de autoligado

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ABSTRACT

Success in the orthodontic movement is directly related to the sliding ability of the arches in the brackets' and tubes' slot. The contact between the arch and the slot surface produces friction that is defined as a set of forces that act on the tooth opposing the tooth movement. **Objective:** To compare bracket and slot irregularities of four conventional ligation systems and one self-ligation system. **Material and methods:** Using a digital microscope 75 brackets, 15 of each commercial brand, were observed. An image capture was obtained and evaluated by 4 observers who registered the observed irregularities in the base and slot of each bracket, for later percentage comparison. **Results:** Self-ligating brackets showed the lower percentage of irregularities in the total number of their surfaces as well as in the slot.

Key words: Comparison, brackets, self-ligating, irregularities.

Palabras clave: Comparación, brackets, autoligados, irregularidades.

RESUMEN

El éxito en el movimiento de ortodoncia está directamente relacionado con la habilidad de deslizamiento de los arcos en el *slot* de los brackets y tubos. El contacto entre el arco y la superficie del *slot* nos produce una fricción la cual es definida como un conjunto de fuerzas que actúan sobre el diente oponiéndose al movimiento dentario. **Objetivo:** Comparar las irregularidades presentes en brackets y *slot* de cuatro sistemas de ligado convencional y de un sistema de autoligado. **Material y métodos:** Se realizó la observación con un microscopio digital de 75 brackets, 15 de cada casa comercial, se tomó una captura de la imagen observada, fueron evaluadas por 4 observadores, quienes registraron irregularidades observadas en base y *slot* de cada bracket, para su comparación porcentual. **Resultados:** Los brackets de autoligado presentan el porcentaje de irregularidades menor tanto en el total de sus superficies como en el *slot*.

INTRODUCTION

Brackets are passive, small, hygienic and aesthetic components that act as support in the union of active components (main archwire, elastics, springs, etc.) to transmit forces. Brackets may be adhered on the labial faces of the teeth or welded to bands.^{1,2}

Success in orthodontic movement is directly related to the ability of the archwires to slide within the brackets and tubes' slots. Contact between the archwire and the surface of the slot produces a friction that is defined as a set of forces that act on the tooth opposing dental movement. The intensity of this force is closely related to the characteristics of the surface as well as the properties of the materials involved.^{3,4}

Due to the friction present during orthodontic mechanics, understanding of biomechanical concepts is of utmost importance for the development of new orthodontic materials.⁵

Objectives

- To compare the irregularities present in brackets of four conventional ligation systems and one self-ligating system.

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- To compare the irregularities present in the slot of four conventional ligation systems and one self-ligating system.

MATERIAL AND METHODS

Observation was performed with a ScopeCapture digital microscope (100X zoom), of 75 new upper and lower canine brackets, 15 from each brand. An image capture of the observed brackets was obtained, standardizing the taking of all the images in the same position and the same amount and intensity of artificial light (Ringflash Kodak light level 2). The data were recorded in an Excel spreadsheet and only a number was given to the observers so that they had as little information as possible about the bracket they observed (double-blind); the 4 observers recorded separately in the Excel spreadsheet the irregularities observed in the base and slot of each bracket, to make a percentage comparison (Figures 1 and 2).

RESULTS

In the brackets of brand #1, surface irregularities were found in 61% of the sample; in brand #2, 76%; brand #3, 56% of irregularities were reported, while in brand #4, 63% of the total number of brackets were found to have an irregular surface.

During the assessment of the slot irregularities of four orthodontic bracket brands, the following results were found: brand #1 26.9% of the sample showed irregularities; brand #2, 26.5%; 33.7% of the total brackets from brand #3 presented irregularities in the slot and 34.9% of the brackets from brand #4.



Figure 1. Conventional ligation bracket.

In self-ligating brackets, 41% of irregularities were observed in their surfaces and 14% of these defects in the slot.

Self-ligating brackets showed the lowest percentage of irregularities both in their total surfaces and in the slot (Tables I and II).

DISCUSSION

Friction depends on the geometry of the slot and the wire-bracket contact, as well as on normal force



Figure 2. Self-ligating bracket.

Table I. Results for irregularities in the five bracket systems.

Bracket system	Percentage of total bracket irregularities
Conventional ligation brand #1	61
Self-ligation brand #1	41
Conventional ligation brand #2	76
Conventional ligation brand #3	56
Conventional ligation brand # 4	63

Table II. Mean of irregularities in the slot surface.

System	Mean of irregularities in the slot surface
Conventional ligation brand #1	26.9%
Self-ligation brand #1	14%
Conventional ligation brand #2	26.5%
Conventional ligation brand #3	33.7%
Conventional ligation brand #4	34.9%

and contact materials.⁶ There are currently few studies on the irregularities of brackets in both the slot and wings, and their potential for producing friction during tooth movement.

In order to achieve optimum sliding during mechanotherapy, friction plays an important role in the overall treatment, alignment and leveling times as well as in space closure, which cannot be avoided at present but can be reduced according to Segovia.⁷

Vicente-Gijón at the University of Oviedo presented data from a study that shows variables between brands and roughness with respect to the comparison of the roughness and wings variables. The overall behavior was 4.12% in the distal wings and 3.79% in the mesial. The brands evaluated for the same variables and with the highest percentage of wing irregularities were Masel with 10.09% in the distal wings and 9.16% in the mesial, followed by Orthoclassic with 9.06% in distal and 8% in mesial. The orthodontic bracket brands with the lowest percentage of wing irregularities were GAC with 1.1% in the distal wings and 1.24% in the mesial and RMO with 1.24% in distal and 0.82% in mesial.⁸

CONCLUSION

The orthodontic mechanics where the movements of retraction or mesialization of canines should take into account that the irregularities present in the fixed appliances may play a role for the achievement of the objectives in the treatment, generating inefficient

mechanics, alterations to the periodontium and alveolar bone, etc. Therefore, it is very important that the equipment we use complies the ideal characteristics for these mechanics, which is why this study provides us with greater knowledge regarding the manufacture and design of the slot in stainless steel brackets.

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