Tolerance in a 0.022" x 0.025" bracket slot from three commercial brands used in the Department of Orthodontics of the National Autonomous University of Mexico

Tolerancia en la ranura de brackets .022" x .025" de tres casas comerciales usados en el Postgrado de Ortodoncia de la UNAM

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ABSTRACT

The aim of this study was to determine the quality in the size of .022" x .025" slots in brackets of three commercial brands (3M Unitek, GAC, ORMCO) used in the Orthodontics Clinic at the Department of Postgraduate Studies and Research at the National University of Mexico. **Methods:** The sample was divided into three groups of 40 stainless steel upper right premolar brackets from three different commercial brands which were measured in three dimensions: depth, internal height and external height under a Profile Projector Microscope. Data was statistically analyzed using *Student's* t-test and ANOVA in which statistically significant differences (p < 0.05) were obtained between the three commercial brands in all three dimensions. The t-test showed that ORMCO was the closest to standards, GAC and 3M Unitek obtained statistically significant differences, thus separating from standards. All brackets were found to be larger than established.

Key words: Slot, tolerance.
Palabras clave: Ranura, tolerancia.

RESUMEN

El objetivo del estudio fue determinar la calidad en el tamaño de las ranuras .022 x .025 pulgadas en *brackets* de tres casas comerciales utilizados en la Clínica de Ortodoncia de la DEPeI de la UNAM (3M Unitek, GAC, ORMCO). **Métodos:** Se conformaron tres muestras de 40 *brackets* de acero inoxidable de tres casas comerciales diferentes para premolares superiores derechos que fueron medidos en tres dimensiones: profundidad, altura interna y altura externa en un Microscopio Proyector de Perfiles. Los datos fueron analizados estadísticamente con la prueba t de *Student* y ANOVA en las cuales se obtuvieron diferencias estadísticamente significativas (p < 0.05) entre las tres marcas en las tres dimensiones. La prueba t demostró que la casa ORMCO fue la que más se acercó a los estándares, GAC y 3M Unitek obtuvieron diferencias estadísticamente significativas, alejándose por lo tanto de la norma. Todos los *brackets* resultaron ser más grandes que lo establecido.

INTRODUCTION

Tri-dimensional orthodontic placement of the tooth occurs as a result of the interaction between arches and preadjusted brackets that are cemented to teeth within healthy support tissues. In a medical environment that strives for excellence in treatment results, it is disappointing to find that, in some cases, orthodontic appliances can be manufactured in an inaccurate way.

The effects in terms of anterior torque loss with bracket slots larger than they should be were illustrated by Siatkowski, who noted that maxillary and mandibular incisors can suffer an unexpected torque loss of 5-10°, and this is compared to 1.9 millimeters of lingual retrusion when retracting to close residual spaces.[1] Orthodontists should then be aware that preadjusted bracket systems and wires used

extensively in clinical practice may not produce the dimensional control required to produce an acceptable result. This may be particularly evident in cases that require incisor axial correction and the clinician should be aware that additional torsional force must

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be added to the arch in order to compensate for incorrectly manufactured bracket dimensions thus clearly reducing the simplicity and effectiveness in the use of a straight-wire preadjusted system and may encourage a clinician to return to the use of Edgewise brackets.[2]

Creekmore et al. obtained data about tolerance in slot height of the brackets from Unitek brand. It was showed in his results how torque varied between different wire sizes in the two slot dimensions: .018" and .022".[3]

Sebanc observed under a microscope the tolerances of the slots in .018" brackets and in .022" ones as well as the characteristics of the wall surfaces of the slots in both dimensions. All the slots were found to be larger than what was established by the manufacturer.[4]

Tolerance in the manufacturing process can affect the deflection angle and therefore torque. The orthodontic appliances manufacturers generally do not present their tolerances and do not inform us about the smoothness of the slot walls which has been scarcely studied.[5]

In this regard, Meling developed a method to measure effectively slot height in a bracket. He obtained that the variation in slot height was much larger than established.[6] Kusy and Whitley assessed 24 brackets from eight manufacturers and found three smaller bracket slots and 20 bracket slots larger than the dimensions indicated by their manufacturers. The larges 0.018 - inch slot measured 16% more than established and the largest 0.022 - inch slot measured 8% more than what was indicated.[7] Cash et al concluded that all slots in the measured brackets were larger than what was said by the manufacturers. They also found that there was variation in bracket geometry from one brand to another. In orthodontics, the placement of the maximum prescription wire in a preadjusted bracket produces three dimensional forces for dental movement. These forces are given as a result of an intimate union between the wire and the slot in the bracket and some game between these two components may lead to an alteration of the complete transmission of the bracket prescription.[2]

MATERIALS AND METHODS

The sample consisted of 120 stainless steel brackets randomly selected: 40 brackets from 3M Unitek, 40 brackets from ORMCO and 40 brackets from GAC. All the brackets were upper right premolar brackets. Each bracket was fixed on its left side, on top of a plastic surface (clay). They were placed under the lens of the Profile Projector Microscope (Nikon, V-16D 77507) which is located in the facilities of the Center for Applied Sciences and Technological Development of the National Autonomous University of Mexico (UNAM), in such a way that when observed from above the slot would be clearly seen without interference from slot walls. Slot dimensions were measured with an increase of 100x.

When the bracket was placed over the microscope slide, an image was projected on the projector screen divided by X and Y coordinates. The image was moved to the intersection of the coordinates by means of handles that the projector has for this specific purpose.

Three measurements were obtained for each slot: depth, internal height and external height *(Figure 1)*.

Each measurement was converted from millimeters to thousandths of an inch. A direct measurement was performed by the researcher. Data was analyzed using SPSS V13 and the tests t *(Student)* and ANOVA.

RESULTS

The results showed that there were statistically significant differences in terms of depth of bracket slots from the three commercial brands ($p < 0.05$), it was also found that there were statistically significant differences in the variables internal and external
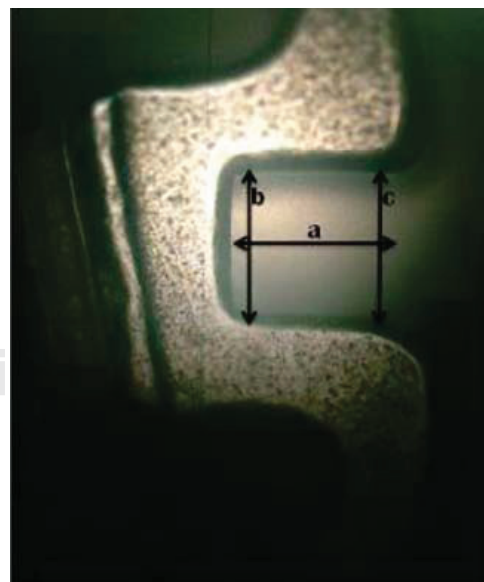

Figure 1. 0.022" Roth bracket from commercial Brand ORMCO. The figure shows the three determined dimensions: **a**) depth, **b**) internal height, **c**) external height.