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Evaluation of The Effect of Self- Ligating Bracket and Conventional Bracket Systems on The Arch Width And Buccal Corridor Changes (Clinical Comparative Study)

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ABSTRACT

Aim: To evaluate the effect of self-ligating and conventional bracket systems on buccal corridor widths and areas **Subjects and Methods**: 20 participants were recruited for each bracket system. Pretreatment and post treatment frontal photographs were transferred to Photoshop CC, standardized using inter-canthal width and linear and area measurements were performed with tools in Photoshop CC. Ratios was then calculated for statistical analysis. Relationships between arch widths and buccal corridors were also examined. **Results:** There were no significant differences in the posttreatment intercanine or intermolar widths either within or between the CG and SL groups. There were no significant differences in any buccal corridor width or area measurement either within or between the CG and SL groups. There were strong correlations with the intercanine width and the corresponding buccal corridor smile width measurements. There was an inverse correlation with the buccal corridor area in relation to the canine and the total smile width. **Conclusion:** It is likely that posttreatment increases in arch width can be seen in patients treated with either a conventional bracket system or the self-ligating system. It is highly unlikely that there is any significant difference in buccal corridor width or area in patients treated with the self-ligating system or a conventional bracket system.

KEYWORDS

Self-ligating, bracket, smile width, intercanine width , inter-canthal width

INTRODUCTION

In the past two decades, a paradigm has emerged in which frontal facial esthetics are paramount and, more important to orthodontists, how best to position the teeth (the maxillary incisors in particular) to maximize overall soft tissue facial esthetics.[1, 2] As part of evaluating frontal facial esthetics, terms such as smile arc, broadness of smile, and buccal corridors have become increasingly important.[3-7] Additionally, claims have been made that one bracket system produces a fuller, wider smile with enhanced facial balance and esthetics.[8]

Following the introduction of self-ligating system brackets, it was claimed that by using this system, the patient would benefit by

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improved facial esthetics. According to proponents of the self-ligating system brackets, considerable expansion can be achieved in the buccal segments, producing a broader arch form (with reduced buccal corridors) that is more in balance with the tongue and cheeks.[8]

Buccal corridors can be defined as that space between the facial surface of the last visible posterior teeth and the corners of the lips when the patient is smiling.[9] Buccal corridors can be influenced by the anteroposterior position of the maxilla, arch form, maxillary width, and facial pattern.[10-15] However, there is little to no supporting data that bracket systems influence buccal corridors. The purpose of this study was to retrospectively evaluate the effect of the Damon self-ligating bracket system and conventional edgewise brackets on buccal corridor widths and areas. Our null hypothesis is that there is no difference in buccal corridor widths or areas between patients in a general orthodontic population treated with self-ligating and conventional edgewise brackets.

MATERIALS AND METHODS

For this prospective study, 20 patients (mean age 20.6 years, minimum 11, maximum 30) were randomly divided into two groups: group I (n = 10 subjects using passive self-ligating brackets with a 0.022x 0.027-inch slot (EasyClip, Aditek, Cravinhos, SP, Brazil) and group II (n = 10 subjects using conventional preadjusted brackets with a 0.022x 0.030-inch slot (mini diamond ormoco).

All of the patients presented Angle Class I malocclusion, with anterior crowding ranging from 3 to 5 mm. Only patients with complete permanent dentition, except third molars, were accepted for the study. Patients who submitted to previous orthodontic treatment or with signs were excluded. Extraction of premolars and dental stripping were not included in the treatment proposed.

Informed consent was signed by all parents or guardians of the patients after they received detailed information about the planned clinical trial and their children's future orthodontic treatment. This trial was approved by the ethical committee of the University of alazhar .

For each patient in the conventional group, after the teeth were leveled and aligned with 0.014- to 0.018-inch NiTi arch wires, 0.018-to 0.018 3 0.025-inch stainless steel OrthoForm III Ovoid arch forms.

In the self-ligating group, 0.014- to .018 X 0.025-inch Ormco copper NiTi (Cu-NiTi) arch wires in the Damon arch form were used out of the box with no customization.

Each patient's pretreatment and post treatment photographs were taken in the standard location in the orthodontic department with ambient lighting Figure (1). The patients were asked for a relaxed smile with their head in a natural head position. The frontal smiling photographs were then transferred to Photoshop CC, wherein all photographic measurements were taken. The pretreatment and post treatment photographs were maximized to fill the computer screen (17-inch Dell 1707FP monitor; Dell, Inc, Round Rock, Tex).

Fig. (1) Figure (1) Standardized frontal posed smile

Linear and area ratios were determined as follows: inter canine distance to smile width (IC: SW); inter last visible maxillary tooth distance

to smile width (IL: SW); buccal corridor area in relation to the canine to total smile area (BCC: TSA); buccal corridor area in relation to the last visible maxillary tooth to total smile area (BCL: TSA). Ratios were calculated according to the methods of Hulsey,[16] Johnson and Smith,[12] and Ritter et al.[17]. The linear measurement tool was used for linear measurements (0.01 mm). The magnetic lasso tool was used for area measurements to select the smile area according to the methods described by Yang et al.[13] The area was recorded as the number of pixels.

Pretreatment and post treatment maxillary arch digital models (Orthocad Version 3.5, San Jose, Calif) were measured using the arch measurement tool, rather than the traditional method of digital calipers and plaster models, as the measurements have been shown to be equally as accurate.19,20 To minimize any effects of tipping the teeth buccally, measurements were made using the minimum distance between the linguogingival surface of the maxillary canines and molars and recorded to the nearest 0.1 mm

Statistical Analysis

Power analysis showed that a sample size of at least 20 patients would give an 80% probability of detecting a real difference of 0.4 mm between groups at a statistically significant level of 5%.

The mean and standard deviation values were calculated for each group in each test. Data were explored for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests, data showed parametric (normal) distribution Paired sample t-test was used to compare between two groups in related samples. Independent sample t-test was used to compare between two groups in non-related samples.

The significance level was set at $P \leq 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows.

RESULTS

For between-group buccal corridor outcomes (Table 1), there were no significant differences between any pretreatment or posttreatment measurements of either the conventional edgewise bracket group or the Damon self-ligating bracket group. Interestingly, from pretreatment to posttreatment, the IL: SW ratio increased 3.1% in the conventional group and 3.7% in the Damon group with a corresponding decrease in the BCL: TSA ratio of 2.3% and 2.7%, respectively.

For the within-treatment group outcomes, the mean inter canine pretreatment and post treatment widths were not significantly different in either the conventional group (0.29 mm) or the Damon self-ligating group (0.10 mm). Similarly, there was a measurable (0.42 mm) but not significant inter canine width difference between the pretreatment conventional and Damon group and essentially no difference between the post treatment conventional and Damon group table 1; however there was an absolute mean difference of 0.32 mm between groups.

Outcomes for the within-treatment inter molar group showed positive width increases of 0.53 mm within the Damon self-ligating group and 0.86 mm within the conventional group; however, neither was statistically significant. Similarly, in the between-treatment group, there were measurable increases in inter molar width between the Damon and the conventional group (0.64mm), but not statistical significance (Table 2). We checked for correlations between arch widths and buccal corridors. In the pretreatment group, a strong correlation (0.460, P, .0001) was found between intercanine width and the IL: SW ratio, whereas a moderate inverse correlation (20.350, P , .001) was shown between the inter canine width and the BCC:TSA ratio. A significant positive finding was seen between the inter molar width and the IL: SW ratio and a significant negative finding with the BCL: TSA ratio. In the post treatment group, a significant

inverse relationship was found between the inter canine width and the ratio between the buccal corridor area in relation to the canines and the total smile area (BCC: TSA). None of the others reached statistical significance.

Table (1) *The mean, standard deviation (SD) values of IC: SW of different groups*.

Variables	IC:SW				
	Group I (Conventional)		Group II (Self-ligating)		p-value
	Mean	SD	Mean	SD	
Pre-treatment	63.08	5.16	62.82	3.94	**0.931ns**
Post-treatment	62.76	5.19	62.40	3.85	**0.904ns**
p-value	**0.005***		**0.022***		

**; significant (p<0.05) ns; non-significant (p>0.05)*

Table (2) *The mean, standard deviation (SD) values of Inter-molar width of different groups*.

Variables	Inter-molar width				
	Group I (Conventional)		Group II (Self Ligating)		p-value
	Mean	SD	Mean	SD	
Pre-treatment	33.04	2.01	32.82	1.66	**0.855ns**
Post-treatment	33.54	2.02	33.42	1.64	**0.921ns**
p-value	**0.043***		**0.006***		

**; significant (p<0.05) ns; non-significant (p>0.05)*

DISCUSSION

In contrast to our findings, both Pandis et al.[18] and Vajaria et al.[19] found a greater inter molar arch width increase in patients treated with the Damon system than in the conventional edgewise group. This difference might be partly explained in the Pandis et al. article by the use of rectangular Cu-NiTi arch wires in the Damon group, while using only round NiTi in the conventional group.

In Vajaria et al., significantly larger finishing arch wires in the Damon group coupled with a smaller slot size for the conventional group might explain the greater arch width increase in the Damon group vs the conventional group.

The average Damon treatment time was approximately 5 months less than the conventional group treatment time. However, given that the average age of our test subjects was 15 years of age and that we standardized the photographs using the intercanthal width, this shorter treatment time should affect neither the buccal corridor linear nor area measurements. Ideally, the same manufacturer and slot size should be used when comparing conventional and self-ligating bracket systems. In our study, the same slot size was used in both treatment systems to remove slot size as a variable, but the brackets were manufactured by different companies. Additionally, the type of NiTi for leveling and aligning was different between the groups (standard NiTi in the conventional group and Damon Cu-NiTi in the Damon group). Again, no statistical differences in any measurements were apparent. Some interesting correlations were shown between pretreatment Orthocad arch width and corresponding intercanine and intermolar ratios (Table 4). In our study, the strongest positive correlation was between the pretreatment intercanine width and the IC:SW. This is in contrast to the findings of Meyer et al.,[10] who found a correlation in posttreatment widths. These authors[10] noted that several pretreatment measurements were based on a best parallel estimate, so this may have produced an unreliable correlation between arch width and buccal corridor. Posttreatment arches were well aligned, so the measurements were less likely to be skewed. This may be partly explained by fewer ectopically displaced canines in our sample, allowing our pretreatment width to better correlate with smile width. It can be seen from the standard deviations in Table 2 that there were considerable individual variations in all the linear and area measurements. Consequently, it would not be possible by simply

looking at the arch width changes to distinguish that a particular patient was treated with either the Damon system or conventional brackets.

CONCLUSIONS

1. Post treatment arch width increase is likely to be seen in patients treated by either conventional or Damon self-ligating brackets.
2. It is highly unlikely that there is any significant difference in buccal corridor width between patients treated with the Damon system or conventional brackets.

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تقييم تأثير عوالق الربط الذاتي وأنظمة العوالق التقليدية على عرض الفك وتغييرات الممر الشدقى (دراسة مقارنة سريرية)

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الملخص :

الهدف: تقييم تأثير الترابط الذاتي وأنظمة الأقواس التقليدية على مساحات ومساحات الممر الشدق.

المواد والاساليب: تماخضاع 20 مشاركًا لكل نظام قوس. تم نقل الصور الأمامية للمعالجة المسبقة وبعد المعالجة إلى برنامج الفوتوشوب ، وتم توحيدها باستخدام العرض الداخلي والقياسات الخطية والمساحة التي تم إجراؤها باستخدام أدوات في برنامج الفوتوشوب. ثم تم حساب النسب للتحليل الإحصائي. كما تم فحص العلاقات بين عروض القوس والممرات الشدقية.

النتائج: لم تكن هناك فروق ذات دلالة إحصائية في عرض مابين الانياب أومابين الضروسR بعد المعالجة سواء داخل أو بين مجموعات CG و SL. لم تكن هناك فروق ذات دلالة إحصائية في أي عرض ممر الشدق أو قياس المساحة سواء داخل أو بين مجموعات CG و SL. كانت هناك ارتباطات قوية مع عرض البراكين وقياسات عرض ابتسامة الممر الشدق المقابل. كان هناك ارتباط عكسي مع منطقة الممر الشدق بالنسبة للكلاب وإجمالي عرض الابتسامة.

الخلاصة: من المحتمل أن تظهر زيادات ما بعد المعالجة في عرض القوس في المرضى الذين عولجوا إما بنظام قوس تقليدي أو نظام ربط ذاتي. من المستبعد جدًا وجود أي اختلاف كبير في عرض أو منطقة ممر الشدق في المرضى الذين عولجوا بنظام الربط الذاتي أو نظام القوس التقليدي.

الكلمات المفتاحية : الربط الذاتي ، القوس ، عرض الابتسامة ، العرض ما بين الانياب، العرض بين الكانتال