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Original Research Article

Comparative efficacy of orthodontic tooth movement using different bracket systems-A prospective clinical study

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Abstract

Objective: The aim of the study was to assess the treatment duration of self-ligating ceramic brackets and conventional ceramic brackets.
Methods and Materials: 20 patients aged 13-45 years visiting Sultan Qaboos University Hospital for orthodontic treatment, were selected for the study based on the inclusion and exclusion criteriae. Ormco Symetri clear brackets were bonded on one quadrant and Damon Clear 2 brackets were used in the other quadrant. The treatment duration between the two groups was compared using ANOVA and Tukey's post hoc test.
Results and Conclusion: No significant differences were found between the two groups. The overall interaction effect (groups vs time) was also not statistically significant between the groups (p-value =0.654).

Keywords: Damon, Ceramic, Conventional, Orthodontic movement, Self-ligating brackets

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1. Introduction

The duration of orthodontic treatment has a significant psychological influence on patient compliance during orthodontic treatment.[1-2] Newer modalities such as self-ligating brackets have been explored for reduction of chairside time as well as decreased overall duration of treatment. The self-ligating bracket systems have been developed with the purpose of reducing frictional resistance between the archwire and ligatures. In fact, some companies claim a shorter duration when using one type over the other [3-4] Various studies suggest that less friction in bracket systems significantly reduce treatment time during sliding mechanics.[4]

Ceramic brackets are widely being preferred by patients over metal brackets due to their aesthetic appearance.[5-6] Some studies have recorded the rate of space closure and found no significant difference between self-ligating and conventional brackets.[7-8] The first published prospective clinical trial compared a Smart-Clip self-ligating bracket with a conventional bracket in the mandibular arch and examined reduction in anterior crowding over the first 20 weeks of treatment. This study used identical wire sequences and found no difference between the two bracket types.[9]

Recent systematic reviews highlighted the variability and differences between the studies and recommending that further randomized clinical controlled trials are needed.[10] Due to the lack of clinical trials comparing different systems of ceramic brackets in the same patient, this study aims to assess the claim of shorter duration of self-ligation over the conventional ceramic bracket system in the maxillary arch over a period of six months.

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2. Materials and Methods

This study was conducted at the Dental and Maxillofacial department, Sultan Qaboos University, Muscat, Sultanate of Oman, with the Institutional Ethical Committee approval.

This study was conducted at the Dental and Maxillofacial Department, Sultan Qaboos University, Muscat, Sultanate of Oman, with approval from the Institutional Ethical Committee. The study was approved by the Ethics Committee of College of Medicine and Health Sciences, Sultan Qaboos University (REF. NO. SQU-EC/406/2021.)

The study design was a Randomized Control Trial employing the split-mouth technique with a 6-month trial duration. The patients selected for the study were active orthodontic cases requiring extractions as part of their treatment, which were performed one week prior to initiating treatment. The aim of the study was to measure the amount of space closure monthly between the two quadrants, with conventional orthodontic ceramic brackets on one quadrant and Damon Clear brackets on the other quadrant of the maxilla.

Measurements of the extraction space in both quadrants were recorded using digital calipers. The measurements were compared monthly between the canines and the second premolars to assess the rate of tooth movement. Patients and their parents signed the consent forms prior to the study, which were available in both Arabic and English languages. There was no marketing or advertising influence on the materials that could conflict with the study results.

The patients were selected for the study based on the following inclusion criteriae:

1. Aged 13 to 26 years.
2. Patients requiring first premolar extractions for orthodontic treatment.
3. Absence of any systemic disease or craniofacial syndromes.
4. No history of any permanent teeth extraction previously.
5. Not on any medication that could interfere with tooth movement, such as NSAIDS or doxycycline.
6. Presence of good oral hygiene with no periodontal disease or radiographic evidence of bone loss.
7. Agreement to sign the informed consent by the patient or their parents to participate in the study.

Exclusion criteria included patients who did not satisfy the above-mentioned inclusion criteria and who were alcoholics and smokers. Also, any patient with debonded brackets during the course of space closure and those who refused to sign the informed consent were excluded.

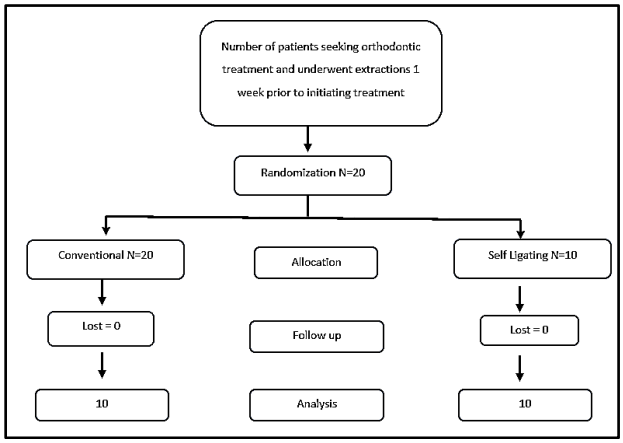
The study involved 20 patients (15 females and 5 males) with Angle's class II division 1 malocclusion. The participants were randomly divided into two groups, each consisting of 10 subjects. After oral prophylaxis, Transbond Plus Self-Etching Primer was applied to the enamel for 5 seconds, followed by the application of a thin layer of Transbond XT orthodontic adhesive on the bracket base. The adhesive was cured for 20 seconds with a diode polymerization light.

On random allocation, conventional orthodontic ceramic brackets (0.22" slot MBT Ormco) were bonded in the right quadrant and Damon Clear (0.22" slot MBT Ormco self ligating) brackets in the left quadrant of the maxilla for 10 patients and vice versa for the other 10 patients. All the brackets were bonded by the same operator. Identical bands and archwires were used for retraction in both quadrants. Patients were instructed on oral hygiene measures during the course of the treatment.

Mini implants (8 mm, 3M Unitek, Germany) were placed between the second premolar and the first maxillary molar bilaterally, and periapical radiographs were taken to assess the location of the implants. Bilateral first premolars were extracted one week before bonding by the same operator to eliminate bias.

During the first 12 months of active treatment, the amount of extraction space was recorded at every appointment, and the space was measured from the day of extraction till the end of the study.

Enrollment of the sample in the two groups.



2.1. Statistical analysis

Statistical analysis was performed to compare the rate of space closure between the right and left quadrants using a paired non-parametric test (one-way ANOVA).

Descriptive statistics included analysis of variance (ANOVA) for mean difference and Tukey's posthoc test was used for multiple comparisons between the parameters. The p-value was set at 0.05.

3. Results

20 patients were enrolled in the study (15 females and 5 males). The split-mouth technique was employed for the maxillary arch, resulting in a total of 40 quadrants. Assessment of the rates of orthodontic movement, as shown in Table 1, was conducted between the conventional and self-ligating Damon bracket systems.

Repeated Measures ANOVA was used to check for differences within the sample over the stipulated time period, and a p-value less than 0.05 indicated a statistically significant difference between the time periods. Pairwise comparisons followed by post-hoc Tukey's test showed that all the groups were statistically significantly different from each other. Comparisons between the two groups did not reveal any significant difference between the conventional and self-ligating groups. All horizontal p-values were not significant at the 0.05 level. The overall interaction effect (groups vs. time) was also not statistically significant between the groups (p-value = 0.654).

Table 1:

Time period	Extraction space (in mm) present with Conventional ceramic brackets.	Extraction space (in mm) present with Self ligating ceramic brackets.	P-value
at extraction	7.14±0.543	7.31±0.664	0.351
End of 1st month	6.46±0.903	6.67±0.664	0.436
End of 2nd month	5.83±0.768	6.15±0.662	0.195
End of 3rd month	5.29±1.037	5.43±1.241	0.779
End of 4th month	4.83±1.087	4.91±1.23	0.824
End of 5th month	4.28±1.259	4.42±1.317	0.749
End of 6th month	3.47±1.292	3.7±1.382	0.612
p-value	0.0001*	0.0001*	

*Statistically significant at 0.05

4. Discussion

Orthodontic treatment duration significantly influences patient compliance and satisfaction. Various bracket systems, including self-ligating brackets, have been explored for their potential to reduce treatment time.[11-12] This study aimed to evaluate whether self-ligating ceramic brackets demonstrate a shorter duration of treatment compared to conventional ceramic brackets in the maxillary arch over a six-month period.

The findings of this study did not demonstrate a significant difference in treatment duration between the two bracket systems. Both the conventional ceramic brackets and the Damon Clear self-ligating brackets exhibited similar rates of space closure over the six-month period. These results are consistent with previous studies[12-13] that have shown comparable efficacy between self-ligating and conventional brackets in terms of treatment duration.

The lack of significant difference in treatment duration between the two bracket systems contradicts claims made by some manufacturers regarding the superior efficiency of self-ligating brackets. This suggests that factors other than the type of bracket system may influence treatment duration, such as patient characteristics, treatment protocols, and orthodontic mechanics.

One possible explanation for the comparable treatment durations observed in this study is the similarity in frictional resistance between the two bracket systems. While self-ligating brackets are designed to reduce friction by eliminating the need for ligatures, studies have shown that the clinical significance of this reduction in friction may be limited.

Additionally, the study design employed a split-mouth technique, which allowed for direct comparison within the same patient, minimizing potential confounding variables such as, age, endocrine factors, systemic diseases, medication, bone density, type of material, size, shape and angle of the wire interface/slot, humidity and bond strength.[14-15] However, the sample size of 20 patients may have limited the statistical power of the study. Larger sample sizes could provide more robust evidence regarding the comparative efficacy of different bracket systems.

Another consideration is the duration of the study. While a six-month follow-up period was sufficient to assess short-term changes in space closure, longer follow-up periods are needed to evaluate the stability of treatment outcomes and the potential for relapse.

In conclusion, this study did not find a significant difference in treatment duration between conventional ceramic brackets and self-ligating Damon Clear brackets in the maxillary arch over a six-month period. The findings of this study contribute to the growing body of literature on the efficacy of different orthodontic bracket systems.

In conclusion, this study did not find a significant difference in treatment duration between conventional ceramic brackets and self-ligating Damon Clear brackets in the maxillary arch over a six-month period. Further research with larger sample sizes and longer follow-up periods is warranted to confirm these findings and provide more comprehensive insights into the comparative efficacy of different bracket systems in orthodontic treatment.

5. Conclusion

The present study did not find a significant difference in treatment duration between conventional ceramic brackets and self-ligating Damon Clear brackets in the maxillary arch over a six-month period. Further research with larger sample sizes and longer follow-up periods is warranted to confirm these findings and provide more comprehensive insights into the comparative efficacy of different bracket systems in orthodontic treatment.

5.1. Data availability

The data used to support the findings of this study are included within the article.

6. Conflicts of Interest

The authors declare that there are no conflicts of interest.

7. Acknowledgments

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8. Source of Funding

None.

9. Conflict of Interest

None.

Reference

1. Eberting JJ, Straja SR, Tuncay OC. Treatment time, outcome, and patient sa-tisfaction comparisons of Damon and con-ventional brackets. *Clin Orthod Res*. 2001;4(4):228–34.
2. Samuels RHA, Orth M, Rudge SJ, Mair LH. A comparison of the rate of space closure using a nickel-titanium spring and an elastic module: A clinical study. *Am J Orthod Dentofac Orthop*. 1993;103(5):464-7
3. Al-Sayagh N, Ismael A. Evaluation of space closure rate during canine retraction with nickel titanium closed coil spring and elastomeric chain. *Al-Rafidain Dent J*. 2011;11(1):146-53.
4. Cacciafesta. Evaluation of friction of stainless steel and esth.pdf. Accessed February 3, 2023. http://www-2.unipv.it/compmech/publications/2003_3.pdf
5. Songra G, Clover M, Atack NE. Comparative assessment of alignment efficiency and space closure of active and passive self-ligating vs conventional appliances in adolescents: A single-center randomized controlled trial. *Am J Orthod Dentofac Orthop*. 2014;145(5):569-78.
6. Miles PG. Self-ligating vs conventional twin brackets during en-masse space closure with sliding mechanics. *Am J Orthod Dentofac Orthop*. 2007;132(2):223-5.
7. Ong E, McCallum H, Griffin MP, Ho C. Efficiency of self-ligating vs conventionally ligated brackets during initial alignment. *Am J Orthod Dentofac Orthop*. 2010;138(2):138.e1-7.
8. Miles P. SmartClip versus conventional twin brackets for initial alignment: is there a difference? *Aust Orthod J*. 2005;21(2):123-7.
9. Fleming PS, Johal A. Self-Ligating Brackets in Orthodontics: A Systematic Review. *Angle Orthod.* 2010;80(3):575-84.
10. Pizzoni L, Raunholt G, Melsen B. Frictional forces related to self-ligating brackets. *Eur J Orthod*. 1998;20(3):283-91.
11. Sims AP, Waters NE, Birnie DJ, Pethybridge RJ. A comparison of the forces required to produce tooth movement in vitro using two self-ligating brackets and a pre-adjusted bracket employing two types of ligation. *Eur J Orthod*. 1993;15:377-85.
12. Pandis N, Polychronopoulou A, Eliades T. Self-ligating vs conventional brackets in the treatment of mandibular crowding: A prospective clinical trial of treatment duration and dental effects. *Am J Orthod Dentofac Orthop.* 2007;132(2):208-15.
13. Miles PG, Weyant RJ, Rustveld L. A Clinical Trial of Damon 2Y Vs Conventional Twin Brackets during initial alignment. *Angle Orthod*. 2006;76(3):480-5.
14. Zachrisson BU. Use of self-ligating brackets, superelastic wires, expansion/proclination, and permanent retention - a word of caution. *World J Orthod*. 2006;7(2):198-206.
15. Turnbull NR, Birnie DJ. Treatment efficiency of conventional vs self-ligating brackets: effects of archwire size and material. *Am J Orthod Dentofac Orthop*. 2007;131(3):395-9.

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