



A Comparative Evaluation of Space Closure Rate Between Newer Generation Ceramic Brackets and Conventional Straight Wire Appliances

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Abstract

Background: With the emerging concept of aesthetics in orthodontics, ceramic brackets play a major role especially in the anterior region of the dental arch. However, the duration of the orthodontic treatment is one of the most important issues in treating patients with ceramic brackets.

Objectives: This study is conducted to compare space closing rate between conventional MBT and Symetri Clear™ bracket systems.

Methods: This study is comprised of 18 subjects who were equally separated into two groups. The first group was treated with conventional MBT pre-adjusted bracket and the second group with Symetri Clear™ brackets. Space closure was performed via 0.019 × 0.025 inch stainless steel wires using 9-mm nickel-titanium Sentalloy coil springs with a constant force of 150 g. The distance between the distal of the first molar buccal tube and the mesial of the canine bracket was measured by a digital caliper. The difference of the first and last values was determined to assess the sheer quantity of space closure. The value was then divided by the number of months during which the space closure was carried out to examine the ratio of space closure in mm per month. For the statistical analysis we used paired *t* test as well as independent *t* test and the P-value > 0.05 was deemed significant.

Results: The MBT group showed a 0.85 mm/appointment retraction rate while the Symetri Clear™ bracket group had a 0.83 mm/appointment retraction rate. The difference in space closing between MBT and Symetri Clear™ groups was not statistically and clinically significant (P-value > 0.05).

Conclusions: As the rate of space closure was almost similar in the two types of brackets, we can use Symetri Clear™ brackets instead of MBT brackets without any concern about the duration of treatment and use the esthetic benefits of these brackets simultaneously.

Keywords: Space Closure Rate, Brackets, Steel, Ceramic

1. Background

The combination of acceptable aesthetics and optimal technical performance is required when it comes to fixed orthodontic appliances (1). The desire for the optimum cosmetic appearance of orthodontic appliances has increased recently due to the great number of adults who are concerned about aesthetics during their treatment process (2). Ceramic brackets have thus become an important part of clinical work and have gained popularity since their introduction (1, 2).

Ceramic brackets contribute to better strength, more resistance to wear and deformation, superior color stability and higher aesthetics. Despite these advantages,

they pose certain disadvantages such as bracket breakage, higher frictional resistance and iatrogenic destructive enamel changes (2).

While manufacturers have continued to improve the properties of their ceramic brackets, invisible clear brackets like Symetri Clear™ were introduced by Ormco™ (3).

2. Objectives

The purpose of the present study was to evaluate and compare the rate of space closure among Symetri Clear™ and conventional straight wire appliances.

3. Methods

In this preliminary study, eighteen subjects were chosen from patients referred to the Department of Orthodontics and Dentofacial Orthopedics, Coorg Institute of Dental Sciences, Virajpet, Karnataka (India). The Formula used to calculate the sample size was:

$$N = \frac{(Z_{\alpha} + Z_{\beta})^2 \times 2 \times \sigma^2}{d^2}$$

Z alpha was 1.96 at 95% confidence interval and Z beta was 0.67 at 75% power of the study. Mean difference was calculated to be 1.1 and variance was 0.7673. Sample size was calculated to be 9 per group.

The patients were divided into two equal groups: (1) group A included 9 patients (5 male and 4 female patients) who were treated with Symetri Clear™ (Ormco Corporation, Orange, California, USA) brackets; (2) group B included 9 patients (5 male and 4 female patients) who underwent treatment with Conventional MBT Brackets (Garmy, Kerala, India).

Inclusion criteria: (1) patients requiring extraction of first premolars as part of their orthodontic treatment; (2) between 18 to 25 years of age; (3) patients without missing teeth except the third molars; (4) patients who did not require asymmetric elastic wear or any asymmetric mechanics in the space closure phase; (5) patients who had class I malocclusion in addition to bi-alveolar protrusion of teeth or class II canine and molar relationship; (6) using conventional first molar anchorage; (7) no prior orthodontic or orthognathic surgery.

Exclusion criteria: (1) patients requiring extraction of second premolars for their orthodontic treatment; (2) missing permanent teeth (other than third molars); (3) patients with periodontal diseases or any medications that could affect tooth movement; (4) using supplementary anchorage (mini-implant, head gear, trans-palatal arch, intermaxillary elastic, pendulum, lingual arch, twin block, Nance appliance or removable appliances in their treatment); (5) patients with previous history of facial trauma or cleft lip and palate.

The purpose of the study was explained to each of the selected patients and their written consent was obtained prior to the commencement of the study.

After the first alignment and levelling, a 0.019 × 0.025 inch SS arch wire was used with a soldered hook in the mesial of the canines and was placed for five weeks. After five weeks, a 9 mm Ni-Ti medium Sentalloy coil spring (Libral Traders, New Delhi, India) with a 150 g force that was

checked by a measuring gauge (Morelli Ortodontia) was inserted in the extraction are from the tube hook of the first molar to the hook in the mesial of the canine.

The spring was activated between 6mm to 9mm and it was then ligated with a stainless steel ligature. The space between the mesial of the canine bracket and the distal of the first molar buccal tube was calculated by a digital caliper (150 mm Work Zone Digital caliper) to the nearest 0.01 mm.

Two measurements were performed; one at the beginning of retraction and one after the extraction space was closed on one side. Three measurements were taken at each time, and in case of any discrepancy, the two closest measurements were recorded and mean average was taken. The patients were visited every five weeks and the wire was cut distal to the molar tubes. The springs were examined for 6 to 9 mm activation and the spaces were measured until one extraction site had closed (Figures 1 and 2).

The difference of the first and last values was assessed in order to obtain the amount of space closure and then it was divided by the number of appointments to assess the rate of space closure in mm per month.

The data was collected and analyzed using SPSS (IBM version 23) software for statistical analysis. The descriptive statistics includes mean and standard deviation. The data was found to be normally distributed, therefore parametric tests of paired *t* test and independent *t* test were used for the comparison of the data. The P-value > 0.05 was deemed significant.

4. Results

This study revealed that there was no significant difference between the two groups for canine to molar distance at the beginning of the investigation (P = 0.632). In contrast, the distance was different at end of the treatment (P = 0.049).

Furthermore, there were no significant differences regarding the mean difference of space closure, as well as the retraction rate between Symetri Clear™ and MBT groups (Table 1).

The overall mean rate of space closure was 0.83 (± 0.07) mm/appointment for Symetri Clear™ and 0.85 (± 0.13) mm/appointment for conventional MBT brackets. When comparing the retraction rate of Symetri Clear™ and MBT groups, no statistically (P = 0.692) and clinically significant difference was observed (Table 1).



Figure 1. Intra-oral and occlusal photographs at the start and the end of space closure with Symetri

5. Discussion

In the present study, the space closure rate between Symetri Clear™ and conventional MBT brackets were compared.

Regarding ceramic brackets with metal slots such as Symetri Clear™, some in-vitro studies proved less fric-

tion than other ceramic brackets but showed significantly higher amount of friction compared to the conventional metal brackets (4-6).

Nevertheless, this difference in friction did not affect the space closing rate in our study. The reason for this could be the new polycrystalline alumina structure of the Symetri Clear™ brackets which has been shown to have



Figure 2. Intra-oral and occlusal photographs at the start and the end of space closure with MBT

a lower amount of friction compared to monocrystalline brackets (7). In this regard, Burrow et al. (8) showed that the friction characteristics of wires and different bracket systems could play a slight role in clinical settings because of the unbinding effects of masticatory forces and differences in the in vitro and in vivo environmental traits like changes in saliva and dental plaques.

5.1. Conclusion

As the space closure rate was almost similar in the two types of brackets, we can use Symetri Clear™ brackets instead of MBT brackets without any concern about the duration of treatment and use the esthetic benefits of these brackets simultaneously.

Footnotes

Authors' Contribution: Dr. John, the principal study investigator; Dr. Goutham B., the chief investigator; Dr. Anmol Kala, idea designer; Dr. Sunil Mmuddaiah, methodology designer; Dr. Sanju Somaiah, statistics designer; Dr. Bk Shetty, investigator.

Conflict of Interests: There was no conflict of interest.

Ethical Approval: IRB/CIDS/220/2018

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Informed Consent: Written consent was obtained prior to the commencement of the study.

Table 1. Comparison of Mean \pm SD of Distance Between Canine and Molar Teeth Before and After Space Closing as Well as Mean Difference \pm SD and Space Closure Rate in Symetri and MBT^{a, b}

Bracket Type	Mean \pm SD	t	Significant
Beginning			0.632 (N.S)
Symetri Clear™	18.3244 \pm (1.80299)	0.488	
MBT	17.8544 \pm (2.25924)		
End			0.049 (S)
Symetri Clear™	11.7833 \pm (1.26765)	0.273	
MBT	11.6400 \pm (0.93899)		
Mean difference of space closing (Post - Pre)			0.998 (N.S)
Symetri Clear™	6.5411 \pm (1.79994)	0.380	
MBT	6.2144 \pm (1.84243)		
space closure rate			0.692 (N.S)
Symetri Clear™	0.8311 \pm (0.07167)	-0.404	
MBT	0.8522 \pm (0.13962)		

^a Values are expressed as mean \pm SD unless otherwise indicated.

^b P > 0.05; NS, non significant.

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