



A Comparison of Three Commonly used self Ligating Bracket Systems - A Prospective Clinical study

KEYWORDS

Smart Clip, In-Ovation, Damon 2, ABO score

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ABSTRACT *Background & Objectives: Self-ligating brackets are becoming common in the marketplace with many manufacturers offering different forms. Various studies have evaluated the frictional characteristics of self ligating brackets with only few studies actually evaluating their treatment quality. This study compares effectiveness and efficiency of three contemporary self ligating bracket systems (Smart Clip, In-Ovation, Damon 2).*

Methods: This was a prospective in-vivo study in which a total of 24 patients were randomly divided into 3 groups treated with Smart Clip, In-Ovation, and Damon 2 bracket systems. The total treatment time and the number of appointments required to complete the treatment were recorded. As a measure of quality of treatment, the ABO scores were measured at the end of treatment.

Results: The average time for the completion of treatment in Smart Clip, In-Ovation, and Damon 2 group was 15.6 ± 2.7 , 16.2 ± 3.5 , and 17.0 ± 3.5 months respectively. The total number of appointments required for the completion of treatment in Smart Clip, In-Ovation, and Damon 2 group were 16.7 ± 2.5 , 17.5 ± 3.2 , and 19.3 ± 2.7 respectively. The mean ABO score in Smart Clip, In-Ovation, and Damon 2 group were 24.1 ± 1.3 , 26.5 ± 2.6 , and 25.6 ± 1.9 respectively.

Conclusion: There was no statistically significant difference in the treatment time, number of appointments and quality of treatment outcome between the three bracket systems.

INTRODUCTION

Orthodontic mechanotherapy is primarily dependent upon the material science and design. Bracket designs and archwires greatly affect the efficiency of treatment.

The last few years saw a revival of self ligating brackets of different types sparking off controversies on the efficiency of bracket design and treatment efficiency. Two types of self ligating brackets have been developed: those with a spring clip that presses against the archwire ('active' SLBs) and those with a clip that does not press against the archwire ('passive' SLBs).¹

Various studies¹⁻¹⁷ have been undertaken to compare the self ligating brackets with conventional brackets, however, there is a lack of studies which have actually compared the clinical efficiency of the different type of self-ligating brackets designs.

This study aims to compare 3 commonly used self ligating bracket systems with regard to final finishing, treatment time and number of patient appointments.

The objectives of this study were

To compare the efficiency of three contemporary self ligating bracket systems and evaluate whether there are any differences in treatment time and number of appointments required to complete the treatment.

To evaluate the quality of treatment outcome by measuring post treatment study models and radiographs using the grading criteria for certification as set by the American Board of Orthodontics (ABO).¹⁸

METHODOLOGY

24 patients were selected from the patients seeking orthodontic treatment. The selection of patients in the sample was such that there was a requirement of premolar extraction.

Inclusion criteria:

- Patients with full complement of permanent teeth for that particular age.
- Patients within the age range of 16-25years.
- Patients requiring premolar extraction.

Exclusion criteria:

- Patients having poor oral hygiene.
- Periodontally compromised patients.
- Patients requiring surgical line of treatment.
- Patients with impacted teeth.
- Non cooperative patients.

Three self ligating brackets were investigated in this study:

- Smart Clip (3M Unitek) (Fig 1)
- In-Ovation (GAC International) (Fig 2)
- Damon 2 (Ormco) (Fig 3)



Fig. 1 SMART CLIP



Fig. 2 IN-OVATION



Fig. 3 DAMON 2

The patients included in the study were equally divided into 3 groups of 8 patients each:

- Group 1 : Patients treated with Smart-Clip self ligating bracket system
- Group 2 : Patients treated with In-Ovation self ligating bracket system
- Group 3 : Patients treated with Damon 2 self ligating bracket system

The treatment was carried out as per the guidelines given by MBT.¹⁹

These three groups of patients were compared for treatment efficiency and effectiveness.

The two principal measures of treatment efficiency were:

The treatment time in months from 1st placement of fixed appliances to their removal and,

The number of appointments during this time

The records of number of visits were maintained for each visit the patient made for treatment, in all the three groups.

As a measure of effectiveness (quality) of treatment, the ABO scores were measured at the end of treatment from the post treatment dental casts and OPG.

STATISTICAL ANALYSIS

Results were expressed as Mean ± SD and Range values. One way ANOVA was used for multiple group compari-

sons followed by Post hoc Tukey's test for group wise comparisons. A P value of 0.05 or less was considered for statistical significance.

RESULTS

TREATMENT TIME (Table 1 & 2)

Average treatment time to complete treatment with Smart Clip self- ligating brackets was 15.6 ± 2.7 months, with In-Ovation it was 16.2 ± 3.5 months whereas with Damon 2 brackets it was 17.0 ± 3.5 months. The mean difference in treatment time between Smart Clip and In-Ovation self-ligating brackets was 0.6 months, between Smart Clip and Damon 2 it was 1.4 months and the difference between Damon 2 and In-Ovation was 0.8 months. This showed that Smart Clip brackets reduced the treatment time by 0.6 months when compared with In-Ovation brackets and by 1.4 months when compared with Damon 2 brackets. Damon 2 brackets took 0.8 months more as compared to In-Ovation brackets. The differences in mean treatment time between the 3 groups were not statistically significant.

NO. OF APPOINTMENTS (Table 1 & 2)

The mean number of appointments required to complete treatment with Smart Clip self- ligating brackets was 16.7 ± 2.5, with In-Ovation brackets, it was 17.5 ± 3.2 while with Damon 2 brackets, it was 19.3 ± 2.7. This showed that patients in Smart Clip appliance group required 2.6 appointments less to get their treatment completed as compared to Damon 2 brackets and 0.8 appointments less as compared to In-Ovation brackets. Patients in Damon 2 group required 1.8 appointments more to get their treatment completed as compared to In-Ovation brackets. The differences in mean number of appointments between the 3 groups were not statistically significant.

ABO scores (Table 1, 2 & 3)

The parameters that were used to evaluate the final ABO scores of the patients in the 3 groups were Alignment, Marginal Ridges, Bucco-Lingual Inclination, Occlusal Relationship, Occlusal Contacts, Interproximal Contacts, Overjet, and Root Angulation.

The mean of total ABO score for Smart Clip self-ligating brackets was 24.1 ±1.3, for In-Ovation, it was 26.5 ± 2.6 and for Damon 2 it was 25.6 ± 1.9. The mean difference in ABO score of Smart Clip and Damon 2 was 1.5, between Damon 2 and In-Ovation it was 0.9 and between In-Ovation and Smart Clip 2.4. The difference in mean ABO scores between Smart Clip and In-Ovation was found to be statistically significant. (Table 1 & 2)

TABLE 1 DESCRIPTIVE STATISTICS FOR DIFFERENCES IN TREATMENT TIME, NUMBER OF APPOINTMENTS AND ABO SCORE BASED ON BRACKET TYPES

Measurement	SMART CLIP		IN-OVATION		DAMON 2		ANOVA	
	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD	RANGE	F*	P
Time taken (months)	15.6 ± 2.7	14-18	16.2 ± 3.5	15-18	17.0 ± 3.5	13-20	1.39	0.27,NS
Appointments (number)	16.7 ± 2.5	15-19	17.5 ± 3.2	16-21	19.3 ± 2.7	15-23	2.06	0.16,NS
ABO score (Index/line)	24.1 ± 1.3	22-28	26.5 ± 2.6	23-29	25.6 ± 1.9	23-29	1.61	0.23,NS

* One way ANOVA

TABLE 2: DESCRIPTIVE STATISTICS FOR GROUP WISE COMPARISON BETWEEN THE 3 BRACKET SYSTEMS

Measurement	SMART CLIP VS. IN-OVATION		SMART CLIP VS. DAMON 2		DAMON 2 VS. IN-OVATION	
	Mean difference	p=	Mean difference	p=	Mean difference	p=
Time taken (months)	0.6	0.42, NS	1.4	0.36, NS	0.8	0.56, NS
Appointments (number)	0.8	0.57, NS	2.6	0.13, NS	1.8	0.21, NS
ABO score (deductions)	2.4	0.04, S	1.5	0.19, NS	0.9	0.37, NS

** Post hoc Tukey's test

TABLE 3: DESCRIPTIVE STATISTICS FOR INDIVIDUAL ABO SCORES OF THE 3 BRACKET SYSTEMS

	Alignment	Marginal ridges	Inter-lingual notches	Occlusal ridges	Occlusal contacts	Interproximal contacts	Overjet	Root angulation	
SMART CLIP	3.6±0.6	4.2±0.6	2.7±0.8	3.6±0.6	3.6±0.7	3.6±0.7	3.2±0.8	2.3±0.3	
IN-OVATION	6.1±0.4	4.0±0.4	3.5±0.6	3.5±0.8	3.6±0.7	3.6±0.7	3.6±0.8	2.6±0.6	
DAMON2	4.7±0.5	4.1±0.5	3.8±0.3	4.6±0.8	3.6±0.8	3.6±0.5	2.3±0.6	2.9±0.8	
ANOVA	F*	17.3	0.08	0.08	0.22	0.37	0.18	1.58	1.48
	P	<0.02, S	0.88, NS	0.78, NS	0.78, NS	0.92, NS	0.64, NS	0.21, NS	0.29, NS
SMART CLIP vs DAMON2 **		0.54, NS	0.90, NS	0.76, NS	0.74, NS	0.94, NS	0.42, NS	0.88, NS	0.67, NS
SMART CLIP vs IN-OVATION **		<0.01, S	0.97, NS	0.94, NS	1.00, NS	0.91, NS	0.92, NS	0.69, NS	0.91, NS
DAMON2 vs INOVATION **		<0.01, S	0.90, NS	0.94, NS	0.91, NS	1.00, NS	0.97, NS	0.58, NS	0.98, NS

* ONE WAY ANOVA **POSTHOC TUKEY'S TEST

DISCUSSION

Numerous studies²⁰⁻²⁶ have demonstrated a dramatic decrease in friction for SLBs, compared to conventional bracket designs. Such a reduction in friction can help shorten overall treatment time, especially in extraction cases where tooth translation is achieved by sliding mechanics.

Though a number of studies have been undertaken to compare the self ligating brackets with conventional brackets, there have been no studies which have compared the clinical efficiency of the different types of self-ligating brackets.

The purpose of our study was to evaluate and compare the efficiency and effectiveness of 3 contemporary self-ligating brackets with different methods of engagement of the archwire for any difference in the treatment time and in the number of appointments required to complete the treatment and finishing quality of treatment.

Three bracket systems with different self ligation mechanisms were included in our study - Smart Clip, In-Ovation and Damon2 self ligating brackets. The In-Ovation bracket is an active twin self ligating bracket with a sliding spring clip made of stainless steel which encroaches on the slot from the labial aspect, potentially placing an active force on the archwire. The Damon 2 bracket is a passive single wing self ligating bracket with a single slide to entrap the archwire which creates a passive labial surface to the slot with no intention or ability to invade the slot or store force by deflection of the metal clip. The Smart Clip bracket is a passive twin self ligating bracket which engages the wire by NiTi clips adjacent to the wings and contains no moving door or latch. It has a familiar tie-wing design which allows for the use of traditional ligation as an option to the clinician. This design also facilitates simple and easy use of chain ligatures when needed for space closure.

The Smart Clip patients required the least amount of treatment time 15.6 ± 2.7 months, followed by the In-ovation

group 16.2± 3.5 months. The Damon 2 patients required the maximum amount of time 17.0 ± 3.5 months. However, this difference in treatment time between the 3 groups was not statistically significant. A mean reduction of 0.6 months noted between Smart Clip and In-ovation brackets was not statistically significant. Similarly, the mean reduction of 1.4 months noted between Smart Clip brackets and Damon 2 brackets was also not statistically significant but this difference in treatment time is of clinical significance and does favour the choice of Smart Clip brackets in the clinical practice. The mean reduction of 0.8 months noted between Damon 2 and In-Ovation brackets was also not statistically significant.

The mean ABO score for Smart Clip self-ligating brackets was 24.1 ± 1.3 for In-Ovation, 26.5±2.6 and for Damon 2 it was 25.6 ± 1.9. The difference in mean ABO score of Smart Clip and In-ovation was 2.4, between Smart Clip and Damon 2 was 1.5 and between Damon 2 and In- Ovation was 0.9. The differences in mean ABO scores between the Smart Clip and In-ovation groups was statistically significant whereas statistically no significant difference was found in the remaining other two groups.

Significant differences were found in the scores for alignment between the In-Ovation group as compared to both Smart Clip and Damon 2. The In-Ovation group had significantly poor ABO score for alignment than the other 2 groups. The reason for this may be explained by the fact that the In-Ovation bracket is an active SLB producing more amount of friction.

CONCLUSION

The present study evaluated and compared the treatment time, number of appointments and the final orthodontic treatment outcome (ABO scores) for the three bracket systems.

The results showed a clinically significant reduction in treatment time and number of appointments with Smart Clip as compared to In-Ovation self ligating brackets. The result was however, not statistically significant.

There was no clinical and statistically significant difference in treatment time and number of appointments with Smart Clip and Damon 2 self ligating bracket systems.

There was a reduction in treatment time and number of appointments with In-Ovation as compared with Damon 2 self ligating bracket system but the difference was not statistically significant.

All the 3 bracket systems showed almost similar quality of orthodontic treatment outcome. The differences in mean ABO scores between the Smart Clip and In-ovation groups was statistically significant whereas the statistically no significant difference was found in the remaining other two groups..

Thus, it can be concluded that Smart Clip and In-Ovation self ligating brackets were more efficient in reducing the treatment time and number of appointments than the Damon 2 self ligating brackets, but the difference was not statistically significant and the quality of orthodontic treatment outcome was better for Smart Clip than In-ovation group.

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