A comparative study on time efficiency management of self ligating brackets with conventional ligating brackets on orthodontic subjects in North Karnataka

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Abstract: *Background:* Self-Ligating brackets were originally designed with the intention to reduce the time needed to change wires compared with the use of wire ligatures. However, the advent of elastomeric ligatures meant that this perceived advantage was diminished. *Objective:* To compare aligning efficiency, rate of retraction and torque expression of Self Ligating bracket (SLB) system with Conventional Pre adjusted Edgewise bracket (CLB) system. *Materials and Methods:* Twelve patients were selected and divided into two groups treated with self ligating brackets (SLB, n=6) and conventional ligating brackets (CLB, n=6). The brackets used were 0.22 slot McLaughlin Bennet Trevesi (MBT) prescription. Aligning was evaluated with 0.14 Niti followed by 19X25 Heat Activated Ni Ti and then 19X25 stainless steel wires for retraction within 4 months. The rate of retraction was evaluated per month and torque loss after space closure was also estimated. *Results:* Alignment Efficiency shows significant changes with SLB compared to CLB and also save more than 30% of chair side time during wire adjustments while rate of en masse retraction in SLB shows statistically non significance as compared to CLB system. In case of upper incisor changes when compared between two groups showed less torque loss in SLB than CLB although which was statistically no significant but % difference show SLB have better improvement result than CLB.

Keywords: Damon brackets, self-ligation, treatment efficiency

Introduction

Leveling, aligning constitutes the first phase of fixed orthodontic therapy. In the recent years through newer techniques such as MBT (McLaughlin Bennet Trevesi) have been able to solve the purpose of perfection in leveling, aligning. With the advent of invention of newer Self Ligating Brackets, the efficiency of these new brackets with the conventional brackets and their ligating techniques were reported earlier [1]. The first self-Ligating bracket, the Russell attachment, was introduced by Dr. Jacob Stolzenberg in the early 1930s [2].

In recent years, various SLBs have been developed: 1) those that have a spring clip that presses against the arch wire ("active" or "interactive" SLBs), such as SPEED, In-Ovation, Quick and Time2 brackets; and 2) those in which the self Ligating clip does not press against the arch wire (passive SLBs) such as Damon, Smart clip, Carriere and Opal.

The Smart clip SL3 (Intelligent clip), with no moving latches or doors, the familiar twin design allows for selective engagement, giving the Orthodontist added control while treatment have shown consistently less friction during sliding mechanics than active SLBs [2-3]. Hence, the present study was undertaken to compare the aligning efficiency, rate of retraction and torque expression which are the part of efficiency of time management by using Self Ligating brackets with Conventional Ligating bracket systems.

Material and Methods

Twelve patients from the department of Orthodontic and Dentofacial Orthopaedics were selected and divided into two groups having six patients in each group. Group I was treated with Self Ligating brackets (Figs 1 to 2) and group II was treated with Conventional brackets (Figs. 3 to 4). The brackets used were 0.22 slot MBT prescription. The wire sequence for both groups were 0.14 Niti as

initial wire and aligning efficiency was evaluated within 4 months. Aligning was followed by 19 X 25 HANT and then 19 X 25 SS for retraction. The rate of retraction was evaluated per month and torque loss after space closure was also evaluated.

Fig-1: Pretreatment Photographs with SLB

Fig-2: With Retraction Archwire 19X25 SS

Fig-3: Pretreatment Photographs with CLB

Fig-4: With Retraction Archwire 19X25 SS

Determination of Alignment efficiency: Upper alginate impressions were taken as the baseline impression (T0) just before bonding of the bracket systems. A 0.014 inch dimension circular cross-sectional NiTi arch wire was used as the initial aligning arch wire and patients were recalled at monthly interval for 4 months and an upper impression was taken at each visit as (T1,

T2, T3, and T4). Little's irregularity index was used to assess the overall changes in alignment. All measurements were made on the study models taken at T0 and during alignment and leveling (T1, T2, T3, and T4). These measurements were carried out using calipers. Assessment of the effect of the brackets on tooth movement was determined by subtracting the current reading from the previous reading [4].

Determining rate of retraction: The rate of retraction was defined as the distance travelled, divided by the time required to complete space closure. This was recorded in millimeters per interval. An interval was defined as a 4 week period. The widths of the extraction spaces were measured, and space closure and time of retraction were recorded. Measurements were performed by direct-technique from stone casts obtained before and at the end of each interval from distal of canine to mesial of premolar with the help of Vernier caliper [5].

Determination of upper anterior changes after space closure: Pre treatment and post space closure alginate impressions were taken and stone cast were poured. Then, these pretreatment stone casts were placed on the Tooth Inclination Protractor (TIP custom made) for the measurement of torque. Then the same method was repeated for the post space closure cast and the differences were calculated, which were upper incisor torque change [6].

The experimental protocol was approved by Institutional Ethical Committee as per the guidelines of ICMR (2006) [7]. The mean ± SD values were calculated for each group. For determining the significance of inter-group differences, each parameter was analyzed separately by using student's unpaired 't' test and the level of significance fixed at $p < 0.05$.

Results

Twelve patients were divided in two groups, the Self Ligating brackets (group I) and Conventional brackets (group II) respectively and comparison done between these bracket systems based on the changes observed.

Table-1: Comparison between the SLB and CLB in the Little irregularity index scores at the four treatment intervals: T0 = pre-treatment and at the first (T1), second (T2), third (T3), and fourth (T4) & IQR interquartile range

Bracket Types	SLB	CLB	Comparison between SLB* & CLB**	
			t-value	P-value
$T_0 - T_1$ Median (IQR)	5.3 (1.2)	5.4 (1.8)	0.113	0.916
$T_1 - T_2$ Median (IQR)	3.9 (1.4)	4.2 (1.1)	0.413	0.686
$T_2 - T_3$ Median (IQR)	1.8 (1.9)	3 (1.9)	1.094	0.278
$T_3 - T_4$ Median (IQR)	0.8 (1.2)	1.1 (1.1)	0.451	0.656
*SLB- Self ligating bracket **CLB-Conventional ligating bracket				

Table-2: Little's irregularity index scores between before alignment (T0), after alignment (T4), and percentage of improvement for Self Ligating, Conventional system during the leveling and aligning stage

Bracket Types	N	Mean T_0 (mm)	Mean T_4 (mm)	Mean T_0-T_4 (mm)	Mean %
SLB	6	5.97 (0.48)	0.23 (0.37)	5.74	96.14
CLB	6	6.17 (0.45)	0.50 (0.55)	5.67	91.89

Alignment efficiency: Comparison of the difference in overall tooth alignment with the Little's Irregularity Index(LII) score between T0 and T4 showed faster changes with the SLB compared with CLB over the 4 month of treatment [Table 1]. The average percentage alleviation of crowding was higher with SLB (96.14 per cent) as compared with CLB (91.89 per cent) [Table 2].

Rate of retraction: Table 3 depicts the mean rate of en masse retraction per month in the SLB and CLB in maxillary arch which show statistical non significance.

Table-3: Comparision of rate of retraction between Self ligating and Conventional   brackets in maxilla per month

Months	SLB	CLB	Comparison between SLB & CLB	
			t-value	P-Value
M1	1.0	1.07	--	--
M2	1.05	1.02	--	--
M3	1.05	1.05	--	--
M4	1.07	1.05	--	--
M5	1.12	1.08	--	--
M6	1.05	1.03	--	--
Mean ± SD	1.05667± 0.038	1.05 ± 0.023	0.3627	0.36218

Torque expression: The results for upper incisor torque changes were as follows.

U1 to ANS-PNS: Table no 4 depicts the significant result with the pre treatment and post treatment values of upper incisor changes in both SLB and CLB while doing it on cephalometric method, but when we considered %change difference we have noticed 11.65% change of

SLB in comparison to 9.18% change in CLB which clearly reflects a superior qualitative improvement in upper incisor changes of SLB against CLB.

Tooth Inclination Protractor: Table no 5 depicts the significant result with the pre treatment and post treatment values of upper incisor changes iin both SLB and CLB while

using it on cast method but when we considered %change difference we have noticed -8.58% change of SLB in comparison to -8.23% change

in CLB which clearly reflects a almost similar qualitative improvement in upper incisor changes of SLB against CLB.

Table-4: U1* to ANS-PNS** of SLB and CLB					
	MEAN	S.D.	T	P	% change (Pre vs Post)
SLB: Pre-treatment	123.33	9.58	2.693	<0.004	11.65%
SLB: Post-space closures	109.17	8.61			
CLB: Pre-treatment	125.17	10.83	2.224	<0.026	9.18%
CLB: Post-space closures	113.67	6.56			
*U1- upper insior *ANS-PNS- Anterior nasal spine to posterior nasal spine					

Table-5: Upper Incisor changes with TIP* of SLB and CLB					
	MEAN	S.D.	T	P	% change (Pre vs Post)
SLB:Pre-treatment	118.50	6.06	2.981	< 0.002	-8.58%
SLB:Post-space closures	108.33	5.75			
CLB:Pre-treatment	119.33	3.88	4.050	< 0.0001	-8.23%
CLB:Post-space closures	109.50	4.51			
*TIP-tooth inclination protractor					

Table-6: Comparison Between Cephalometric Method And Tip (Cast Method) In SLB And CLB System					
Post-space closures	Mean	SD	T-Value	P-Value	% change
SLB: U1 - ANS-PNS	109.17	8.61	1.283	< 0.202	0.76%
SLB: TIP	108.33	5.75			
CLB: U1 - ANS-PNS	113.67	6.56	0.199	< 0.854	3.66%
CLB: TIP	109.50	4.51			

While comparing TIP (cast method) with ANS-PNS (cephalometric method) of U1 it has been observed that there were no statistical significant improvement between the two but % change differences show an improvement of 0.76% of SLB against 3.66% of CLB shown in Table 6.

Discussion

The primary purpose of this study was to compare treatment data from patients treated with two different types of brackets; the Self-Ligating bracket and Conventionally-ligated bracket. We hypothesized that, on average, patients treated with self-Ligating bracket would have significant result in aligning efficiency, rate of retraction and torque expression than cases treated with conventional bracket systems. In recent years, various SLBs have been developed like a spring clip that presses against the arch wire ("active" or

"interactive" SLBs) or those in which the self Ligating clip does not press against the arch wire (passive SLBs) [3].

Passive self-Ligating brackets usually have a slide that can be closed which does not encroach on the slot lumen, thus exerting no active force on the arch wire. The Smart clip SL3 (Intelligent clip as claimed by company), with no moving latches or doors, the familiar twin design allows for selective engagement, giving the Orthodontist added control during treatment [2]. Compared to earlier Smart Clip™ Appliance versions, the advanced SL3 smart clip significantly reduces wire insertion forces and removal forces required for large wires. The clips have more room to flex, making them more forgiving to wire misalignment, thereby helping to minimize patient discomfort. The Smart Clip bracket's

self-Ligating mechanism consists of two nickel titanium (Nitinol) clips that open and closes through elastic deformation of the material when the arch wire exerts a force on the clip. The bracket contains no moving door or latch [8].

In the study by Rohaya Abdul, it is seen that CLBs aligned teeth at a statistically faster than SLBs but only during T_1-T_2. There was no statistically significant difference between the CLB and SLB during T_2-T_3 and T_3-T_4 [4]. Our study reveals that SL3 appliances drastically reduce chair side time when compared to the conventional brackets, by shortening the average time needed to place or remove arch wires as shown in Table 2. The Smart clip appliance reduced the irregularity index faster than conventional MBT appliance group in the severe crowding (irregularity index>5) group. One possible reason for faster reduction in severe irregularity in self Ligating group may be that in Smart clip appliance, the arch wire was "passively" held in the bracket by means of the programmed nickel-titanium clip. There was no constant normal force of ligation, thereby dramatically reducing frictional effects. This may be translating into a more rapid alignment of teeth [9].

In the present study on rate of retraction, both SLB and CLB show statistically non significant result which may be due to more friction present between the bracket and archwire in SLB than with the CLB. Our study corroborated with study done by Miles et al [10] where it has been observed that the rate of en masse retraction with sliding mechanics between passive self-ligating SmartClip[TM] brackets and conventional twin brackets ligated with stainless steel ligatures had no difference in the rate of space closure.

In a quest to reduce the number of lateral cephalograms taken to record incisor inclination and to improved the outcome of treatment in respond to the inclination and angulation of the teeth we used this device. In addition the radiographic technique records the most prominent incisor and there may be superimposition and lack of clarity between the apices of the six anterior teeth. Cast method is occasionally used to reduce the number of lateral cephalograms taken to record incisor inclination and to improved the outcome of treatment in respond to the inclination and angulation of the teeth. It is further understood that the radiographic technique records the most prominent incisor and there may be superimposition and lack of clarity between the apices of the six anterior teeth.

The TIP records crown inclination and can also record individual inclinations of all eight anterior incisors allowing more detailed assessment of proclined or retroclined teeth. Recent study also revealed , the torque of upper anterior before the treatment and after the space closure, custom made cast method and the values when compared with the routine cephalometric measurements it has been found that the % difference with SLB with decreased moment developed during inertion of wire and decreased torque loss than the CLB [6].

Conclusion

Hence, it may be postulated from our study that although both SLB and CLB have shown similar performance in space closer but for the alignment and torque loss SLB was found to be better than the CLB.

References

1. Scott P, DiBiase AT, Sherriff M and Cobourne MT. Aligning efficiency of Damon 3 self Ligating and conventional orthodontic bracket systems: A randomized clinical trial. *Am. J. Orthod Dentofacial Orthop* 2008; 134(2): 471-8.
2. Chen SS, Greenlee GM, Kim JE, Smith CL and Huangd GJ. Systematic review of self-Ligating brackets. *Am J Orthod Dentofacial Orthop* 2010; 137(6): 726.e1-18.
3. Franchi L, Baccetti T, Comporesi M and Barbato E. Forces released during sliding mechanics with passive self Ligating brackets or nonconventional elastomeric ligatures. *Am J Orthod Dentofacial Orthop* 2008; 133(1): 87-90.
4. Rohaya Megat AW. Comparison of Self Ligating and Conventional Ligating brackets in the alignment stage. *Eurp J Ortho* 2011; 33(2):1-6.
5. Lotzof LP, Fine HA. Canine retraction: A comparative of two preadjusted bracket systems. *Am J Orthod Dentofacial Orthop* 1996; 110(2): 191-6.
6. Richmond S, Klufas M and Sywanyk M: Assessing incisor inclination: a non invasive technique. *Eurp J Ortho* 1998; 20:721-6.

7. Indian Council of Medical Research. Ethical Guidelines for Biomedical Research on Human Subjects. New Delhi, 2006.

8. Badawi WT, Morina E, Eliades T, Pandis N, Jäger A, Bourauel C. Torque expression of self Ligating brackets. *Am. J. Orthod Dentofacial Orthop* 2008; 133(5): 721-8.

9. Little RM. The irregularity index: A quantities score of mandibular anterior alignment. *Am J Orthod Dentofacial Orthop* 1975; 68(5): 554-9.

10. Miles PG. Self Ligating Vs Conventional twin brackets during en masse space closure with sliding mechanics. *Am. J. Orthod Dentofacial Orthop* 2007; 132(2): 223-2.

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