A COMPARATIVE STUDY OF CONVENTIONAL LIGATING AND SELF LIGATING BRACKET SYSTEMS

Gauravardhan Kulkarni[1*], Yojna Atram[2], Resham Irshad[3], Sunil Kumar Rath[4]

Article History: Received: 09.05.2023 **Revised:** 14.06.2023 **Accepted:** 24.07.2023

Abstract

Introduction: Orthodontic mechanotherapy is primarily dependent upon the material science and design. Bracket designs and arch wires greatly affect the efficiency of treatment.

Methodology: Retrospective case analyses of 800 patients was carried out at Department of Orthodontics and Dentofacial Orthopaedics, Government College of Dentistry, Indore. In department , the patients had treatment with fully fastened orthodontic gear. In Group 1, 400 patients were treated in a row using standard, pre-adjusted single wing 0.022 x 0.028 inch orthodontic brackets. The data from old OPD register for each patient were extracted.

Results: The mean duration of treatment for the two groups were 15.8 months for the traditional, pre-adjusted brackets in Group 1 and 15.5 months for the self-ligating brackets. These differences were not statistically significant. Group 1 received 13.2 appointments, whereas Group 2 received 12.5. Compared to patients with Class I molar relationships, patients with Class II molar relationships needed more appointments (7% vs. 1%; $p = 0.016$).

Conclusion: Active self-ligating brackets saw more bond failures and breakages than traditional brackets.

[1*]Reader, Department of Orthodontics and Dentofacial Orthopaedics, Government College of Dentistry, Indore
[2]Tutor, Department of Orthodontics and Dentofacial Orthopaedics, Government College of Dentistry, Indore
[3]Senior Lecturer**,** Department of Orthodontics and Dentofacial Orthopaedics, Institute of Dental Sciences, Bareilly
[4]Assistant Professor, Department of Orthodontics and Dentofacial Orthopaedics, SCB Dental College

DOI: 10.31838/ecb/2023.12.s3.827

1. Introduction

Orthodontic mechanotherapy is primarily dependent upon the material science and design. Bracket designs and arch wires greatly affect the efficiency of treatment. In recent years self-ligating brackets (SL) have been accepted by the profession as an alternative to conventional pre-adjusted orthodontic brackets. Self-ligating brackets are said to have a number of benefits over traditional brackets, including quicker therapy times, less friction, a reduction in chairside time, enhanced oral cleanliness, and ease for patients.[1,2] There's only a little amount of in vivo evidence to back these claims, despite the fact that these brackets have had extensive exposure in the orthodontic market. Self-ligating brackets' therapeutic efficacy in comparison to traditional brackets has been evaluated both at the conclusion of treatment and at specific points along the way.[3,4] These investigations, which are mainly retrospective in nature, have produced contradictory results, showing that self-ligating brackets can either increase the effectiveness of treatment or have no such benefit.[3,4] For instance, when Damon SL brackets were contrasted to an unidentified conventional, pre-adjusted twin bracket, Harradine observed a significant 4 month decrease in the length of therapy.3 More recently, Miles et al. revealed that neither the Smart Clip nor the Damon 2 SL brackets outperformed traditional brackets in terms of treatment effectiveness.[5,6] Self-ligating brackets do have a higher rate of bond failure than conventional brackets, an observation that may have an influence on the effectiveness and cost of treatment with them.[3,4,7] A larger demands is placed on the doctor-staff's time to maintain the same level of efficiency in patient treatment as more orthodontic offices upgrade or enlarge their sterilisation processes in order to comply with present standards. One of the largest underlying benefits of the ligature less system may be the much reduced time factor connected with the usage of self-ligating brackets to help balance this new equilibrium. Many of the more recent papers have emphasised the rising popularity of self-ligating bracket systems 3,16 and how they might impact the system's amount of friction. Numerous distinct assertions have been made that are related since the launch of the Edgelok bracket in 1972, the SPEED system in 1980, and the Activa bracket in 1986. As comparing to traditional bracket structures, all three innovators report a significant decrease in friction as well as quicker treatments and chairtime.[8] Therefore, it's crucial to establish whether self-ligating brackets are more effective than traditional pre-adjusted brackets when applied in a setting of specialised practise. The objective of this research was to assess the similarities and differences between bracket systems that use self-ligation and conventional ligation.

2. Methodology

Retrospective case analyses of 800 patients was carried out at Department of Orthodontics and Dentofacial Orthopaedics, Government College of Dentistry, Indore. In a specialised orthodonticdepartmentsave, the patients had treatment with fully fastened orthodontic gear. In Group 1, 400 patients were treated in a row using standard, pre-adjusted single wing 0.022 x 0.028 inch orthodontic brackets. The data from old OPD register for each patient were extracted. With active self-ligating brackets measuring 0.022 by 0.028 inches, 400 patients made up Group 2. Numerous patients in both groups underwent an initial period of treatment with either the Herbst or pendulum-type appliances. The identical archwire sequences and mechanics, including segmental mechanics where appropriate, were employed with both appliances. Following this initial therapy, there was a lengthy "settling" period before fixed equipment could be inserted. During the time an appliance was attached to the time it was withdrawn, the length of treatment (3-month intervals), the quantity of appointments, and the number of months spent using each type of archwire were all documented. Each patient's total number of bracket bond failures during appliance treatments was noted. Breakages of the molar attachment were not considered in this evaluation. The pretreatment and posttreatment research designs were evaluated using the Index of Complexity, Outcome, and Need (ICON) to see if the groups were comparable at the beginning of the research and at the conclusion of intervention.[18] In independent analyses, the ICON score and both of its elements were utilised to search for correlations with the aforementioned treatment characteristics in order to be thorough. The implications of the technique of ligation ('Conventional' or 'Self-ligating'), malocclusion ('Class I', 'Class II', or 'Class III'), and tooth extraction ('Yes' or 'No') against the length of medication, the number of scheduled appointments, and the number of days either round or rectangular archwires were used were examined using a general linear model strategy. The number of bond defaults and the amount of unplanned emergency appointments were then evaluated using a two-stage approach. For significant variations, odds ratios are shown.

3. Results

The mean duration of treatment for the two

groups were 15.8 months for the traditional, pre-adjusted brackets in Group 1 and 15.5 months for the self-ligating brackets. These differences were not statistically significant. (Table 1) Group 1 received 13.2 appointments, whereas Group 2 received 12.5. Compared to patients with Class I molar relationships, patients with Class II molar relationships needed more appointments (7% vs. 1%; p = 0.016). In addition, treatment for patients who had extractions took 26% longer (p = 0.005) and required 26% more appointments (p 0.001) than for individuals who did not have extractions. Only 44 out of the 762 individuals examined had ICON values between 3 and 5. When contrasted with the number of patients with mild crowding/spacing (ICON score 2) for both bracket types, the frequency of individuals with moderate to severe crowding/spacing (ICON score >2) was correlated with considerably lengthier treatment (Mean difference: 1.7 months, p = 0.01). Bond failures occurred in 80.2% of patients treated with active self-ligating brackets and 53.0% of patients treatment with traditional brackets (odds ratio: 3.52; 95% CI: 2.55, 4.87). Individuals in the self-ligating group had significantly more bond failures than those in the traditional group when the study conditional on experiencing bond failure was performed (Mean difference in bond failures: 1.41; p 0.001). (Table 2) In the first six time periods, or 18 months, the self-ligating group experienced statistically substantially more damage (all time periods, p 0.05).

Table 1- Treatment duration and number of scheduled appointments in patientstreated with conventional and active self-ligating brackets

		Conventional/pre-adjusted		**Self-ligating**	
		Number (%)	**Treatment duration (Mean± SD)**	**Number (%)**	**Treatment duration (Mean± SD)**
Molar relationship	Class I	169 (44)	15.0 (6.0)	131 (34)	14.7 (4.7)
	Class II	202 (53)	16.5 (6.0)	223 (59)	15.9 (5.4)
	Class III	12 (3)	17.7 (8.4)	25 (7)	17.2 (5.5)
Extractions	Yes	102 (27)	18.2 (6.5)	76 (20)	18.5 (5.5)
	No	281 (73)	15.1 (5.8)	303 (80)	14.8 (4.8)
Overall		383	15.9 (6.1)	379	15.6 (5.2)

Table 2- Bracket bond failures in patients treated with conventional and activeself-ligating brackets

		Conventional/pre-adjusted Treatment duration (Mean±SD)	**Self-ligating Treatment duration (Mean± SD)**
Molar relationship	Class I	1.2 (2.0)	3.2 (3.0)
	Class II	1.2 (1.6)	3.0 (2.7)
	Class III	1.4 (1.3)	2.2 (2.6)
Extractions	Yes	1.2 (2.0)	2.1 (2.4)
	No	1.3 (1.7)	3.2 (2.9)
Overall		1.2 (1.8)	3.0 (2.8)

4. Discussion

We discovered no significant differences in the lengths of therapy or the number of consultations needed to treat patients with either traditional pre-adjusted brackets or self-ligating brackets, which is consistent with earlier research, including several small future investigations. Shorter treatment periods using selfligating systems have been reported in a few earlier investigations with comparatively small numbers of randomly selected or matched cases.[3,4] The traditional and active self-ligating bracket groups in the present research had mean intervals for treatment of 15.8 and 15.5 months, respectively. In the group of active self-ligating brackets, we discovered a significant proportion of bond failure (54%). These results deviate from a prior study that found edgewise brackets and a passive selfligating device had comparable breaking rates. The bracket profile, base design, or active clip may be to blame for the greater failure rate in the

research we conducted.[9] Bracket breakages typically lengthen the course of treatment and should be avoided wherever possible. When the issue of breakage/bond failure is resolved, it could be hypothesised that active self-ligating brackets will perform better than their conventional bracket equivalents.[10] unexpectedly there was less breakages if teeth had been pulled. The bulk of breakages happened during the levelling and alignment stages of therapy. Both brackets would likely correct malocclusions of equivalent obstacles, as defined by the pretreatment ICON, in the same amount of time. Additionally, regardless of the bracket design used, patients can anticipate that the final result will be of a similar quality, as shown by the post-treatment ICON. Whereas many investigations have shown that the ICON is an adequate technique of determining treatment result, these findings may indicate weaknesses in the sensitivity of the ICON [11] as an indicator of patient complexities and result.

5. Conclusion

According to the findings of this retrospective investigation, treating malocclusions using active self-ligating brackets and traditional preadjusted orthodontic brackets takes about the same amount of time and requires about the same number of sessions. Active self-ligating brackets saw more bond failures and breakages than traditional brackets.

6. References

1. Harradine NW. Self-ligating brackets: where are we now? J Orthod 2003;30:262–73.
2. Berger J, Byloff FK. The clinical efficiency of self-ligated brackets. J Clin Orthod 2001;35:304–8.
3. Harradine NW. Self-ligating brackets and treatment efficiency, Clin Orthod Res 2001; 4:220–7.
4. Harradine NW, Birnie DJ. The clinical use of Activa self-ligating brackets, Am J Orthod Dentofacial Orthop 1996;109: 319–28.
5. Miles PG, Weyant RJ, Rustveld L. A clinical trial of Damon 2 vs conventional twin brackets during initial alignment. Angle Orthod 2006;76:480–5.
6. Miles PG. SmartClip versus conventional twin brackets for initial alignment: is there a difference? Aust Orthod J 2005; 21:123–7.
7. Miles PG, Weyant RJ, Rustveld L. A clinical trial of Damon 2 vs conventional twin brackets during initial alignment. Angle Orthod 2006;76:480–5.
8. Hanson H. JCO interviews Dr. G, Herbert Hanson on the SPEED bracket. J Clin Orthod 1986;10(3):183-9.
9. Pandis N, Polychronopoulou A, Eliades T. Failure rate of self-ligating and edgewise brackets bonded with conventional acid etching and a self-etching primer: a prospective in-vivo study. Angle Orthod 2006;76:119–22.
10. Taylor PJS, Kerr WJS, McColl JH. Factors associated with the standard and duration of orthodontic treatment. Br J Orthod 1996; 23:335–41.
11. Fox NA, Daniels C, Gilgrass T. A comparison of the index of complexity outcome and need (ICON) with the peer assessment rating (PAR) and the index of orthodontic treatment need (IOTN). Br Dent J 2002;193:225–30.