MAVEN e-ISSN: 2581-4443 | www.idahow.org

REVIEW ARTICLE

Efficacy of Self Ligating Brackets- A Review

Dr. Trisha Ghosh[1], Dr. Kenneth F. H. Tan[2], Dr. Geeta M.D.[1], Dr. Sameena B.[3], Dr. Vani J.[3], Dr. Vivek C. R.[4]

[1]MDS (Orthodontics) Private Practitioner, [2]Professor and Head, [3]Reader, [4]Senior Lecturer, Department of Orthodontics and Dentofacial Orthopaedics, The Oxford Dental College and Hospital, Bangalore, India.

Corresponding author: Dr. Trisha Ghosh, Private Practitioner, Apollo Clinic, 168, G.T. Road, Howrah-711102, West Bengal, India. Email- trishaghos@gmail.com.

Abstract

The ligature – less bracket system or the self ligation bracket have been touted as the best in bracket systems. This article reviews the various claims of their advantages. (2018, Vol. 02; Issue 02: Page 50 - 55)

Key words: Self ligating, Brackets, Ligation, Friction.

Introduction

A self-ligating bracket is a ligature less system with a mechanical device built-in to close-off the bracket slot (1). Secure en- gagement of the main archwire into bracket may be produced by a clip mech- anism replacing the stainless steel or elas- tomeric ligature (2).

Self-ligating brackets, authors have ad- vantages in relation to treatment efficiency such as secure, full archwire engagement, lower resistance to sliding between bracket and archwire, faster ligation and archwire removal, and less need for chair- side assistance (1).

Our purpose in this review article was to consider the evidence on these issues.

Secure, full archwire engagement

Taloumis and Colleagues, in an in-vitro study, demonstrated that within 24 hours there were high decay rates of elastomeric forces. Only decay has been extensively in- vestigated although the potential for decay or loss of elastomeric ligatures is well known (Fig 1) (3).

Fig 1: Decay of Elastomeric ligature [Source: Fleming PS, O'Brien K. Self-ligat- ing brackets do not increase treatment ef- ficiency. Am J Orthod Dentofacial Or- thop, 2013; 143: 11-19].

Harradine reviewed that a study did quan- tify the loss of elastomeric ligatures, find- ing 15 lost ligatures in 25 consecutively seen patients in a 12-month treatment pe- riod (1).

Full, robust arch wire engagement is as- sured in self-ligating system unless the clip or slide mechanism fails. However,

50% patients have reported slide mecha- nism breakages in cases where Damon SL brackets were used. The introduction of newer systems like clip mechanism has virtually eliminated such problems (2).

Faster ligation and archwire removal

In Shivapuja & Berger study, the use of wire ligatures added almost 12 minutes to the time needed to remove and replace two arch wires (2). Several authors have shown self-ligating brackets to be better in this respect, with savings of up to 9 minutes per visit com- pared with wire ligation and approxi- mately 2 minutes compared with elasto- meric ligation. Reduced chair side time could be used to schedule more patients, increase efficiency, improve patient rela- tions, or oral hygiene reinforcement. On the contrary a saving of 2 minutes per pa- tient is insignificant and would not make many operators change their practice (1).

Lower resistance to sliding

Resistance to sliding with active arch- wires, where binding is an important con- tributor, has been investigated, by Thor- stenson and Kusy. They examined the ef- fects of varying active tip (angulation) on the resulting resistance to sliding (Table 1) (1, 4-6).

Table 1: Resistance to sliding for different bracket angulations with an 0.018 x 0.025-in archwire [Source. Harradine N. Self-ligating brackets increase treatment efficiency. Am J Orthod Dentofacial Orthop, 2013; 143: 10-18.]

Angulation (^{0})	Damon SL (cN)	Conventional bracket (cN)
0	0	34
3.5	0	55
6.0	80	140
The difference in forces is 60 g at6^0 of angulation		

Thorstenson and Kusy's paper shows “clinically relevant illustrations showing that in terms of sliding with second order angulation, this bracket is superior to the conventional bracket.” (7). Interpretation of this important point can vary widely, even when the same research is being quoted (1).

A. In laboratory, bracket can be ori- ented so that any resistance to wire sliding through it results only from friction be- tween wire and bracket base (F = force, FR = friction, BI = binding).

B. In mouth, because of resistance from dental root, bracket tips until wire contacts corners of bracket, and wire binding becomes major component of re- sistance to sliding.

It was mentioned by Kusy and Whitley as resulting from a combination of three fac- tors which were:

- Friction (FR), static or kinetic, that opposes movement due to contact be- tween objects. When an archwire slides through a bracket, some friction due to contact of the wire with the bracket walls or floor is unavoidable.

• Binding (BI) of an archwire against the corners of the bracket. This occurs as soon as the tooth begins to move, because a force applied against the crown initially causes tipping (Fig 2). The distinction between FR and BI is im- portant because a bracket can be moved along a wire without binding in the labor- atory, as opposed to the mouth, a data of that type has been used in the marketing of self-ligating brackets.

• Notching (NO) when permanent de- formation of the wire occurs at the wire- bracket interface (3).Either RS = FR + BI or RS = NO, because all movement stops if notching occurs (Fig 3). This equation ex- plains why laboratory studies of the fric- tion obtained without allowing for tipping of the bracket don't predict what will hap- pen clinically.

Articolo and Kusy concluded that "RS be- comes dependent on BI very quickly" (Fig 3) and that BI contributes such a high per- centage of RS that FR can essentially be disregarded. They found that "RS in- creased proportionally with the second-or- der angle" and that binding was "inde- pendent of bracket design". They con- cluded that in a clinical setting, where binding occurs, RS is not lower in self-li- gating brackets than in conventional brackets (3).

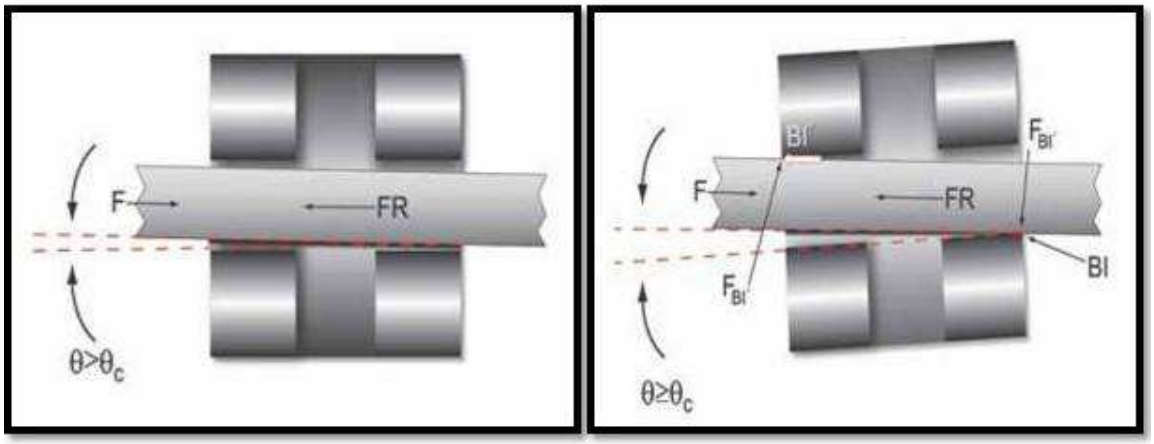

Fig 2: Friction vs. Resistance to Sliding- Binding of an archwire against the corners of the bracket. [Source: Thorstenson GA, Kusy, RP. Effect of archwire size and material on the resistance to sliding of self-ligating brackets with second-order angulation in the dry state. Am J Orthod Dentofacial Orthop, 2002; 122: 295-305]

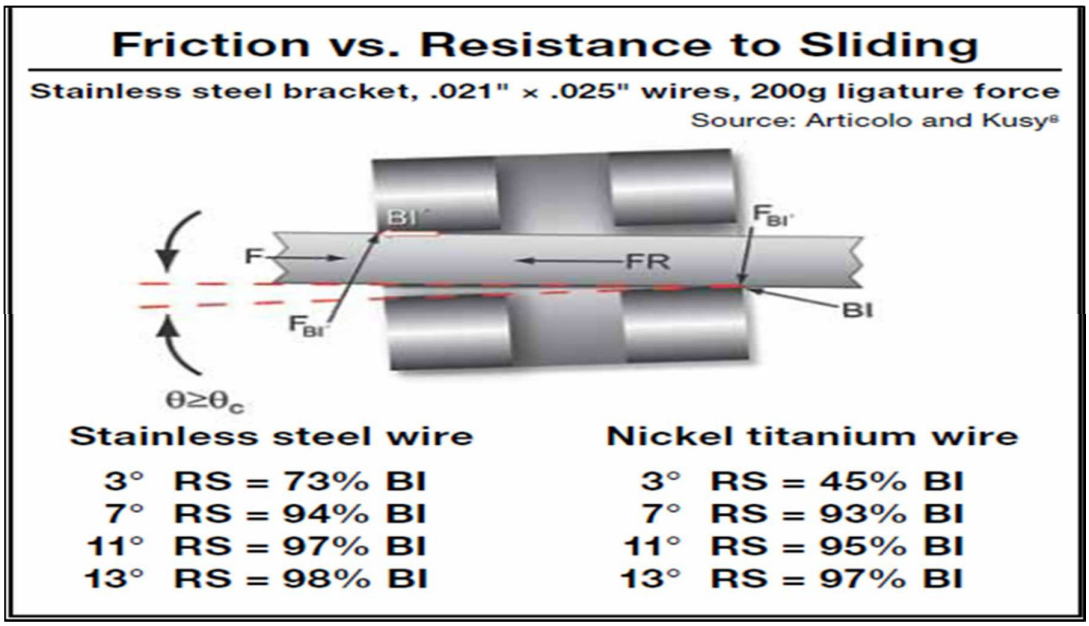

Fig 3: All movement stops if notching occurs. [In laboratory study, Articolo and Kusy tied wires into brackets so that angle of contact at corners of brackets would increase resistance to sliding. Initial contact occurs at about 3^0; 7^0 is typical sliding space closure and higher angles are possible under some conditions. Clinically, binding (BI) is so much greater than friction that effect of friction is negligible. Source: Thorstenson GA, Kusy, RP. Effect of arch- wire size and material on the resistance to sliding of self-ligating brackets with second-order angulation in the dry state. Am J Orthod Dentofacial Orthop. 2002; 122: 295-305.]

More rapid treatment

A study of treatment efficiency by self-li- gating brackets by Harradine found a mean reduction of 4 months in treatment time and a mean reduction of 4 visits dur- ing active treatment. Eberting et al found an average reduction in treatment time of

7 months and 7 visits for self-ligating brackets compared to conventional liga- tion (4).

However, other studies and all random- ized controlled studies have found no dif- ference in these parameters. Two recent systematic reviews have concluded that there is insufficient evidence to support the view that treatment with self-ligating brackets results in fewer visits or shorter treatment. Current evidence does not in- dicate differences between self-ligating systems and conventional systems for treatment time, rate of alignment, rate of space closure, final arch dimensions or oc- clusal outcomes (1).

Less Painful treatment

Three studies found that patients reported lower pain levels with various self-ligating brackets; 2 others found no difference. The authors of a systematic review con- cluded that the balance of evidence from the 3 published randomized controlled tri- als on this topic just favor a reduction of pain during alignment with self-ligation. These results should be interpreted with

caution because of potential study bias. The randomized trial has a moderate risk of bias. Although bracket type was allo- cated to patients randomly, ‘‘clinician and patient blinding of the bracket type was impossible’’ (4).

A split-mouth study examined the ques- tion via a different measure of pain-the level of the neuropeptidase substance P in gingival crevicular fluid, which is a marker of inflammation and associated pain re- sulting from orthodontic forces. These au- thors found that treatment with self-ligat- ing brackets significantly lowered the lev- els of this marker of pain and inflamma- tion when compared with conventional li- gation at 24 hours after archwire place- ment. At this time, additional studies are needed to fairly and fully answer this claim (1).

More Hygienic

Some published reports suggested that elastomeric ligation of brackets is associ- ated with increase plaque retention and aggravation of clinical periodontal health during orthodontic treatment (5).

Pandis et al used a prospective cohort de- sign to evaluate patients bonded with con- ventional brackets and patients bonded with self-ligating brackets. The outcomes of interest were plaque, gingival, and cal- culus indexes, and probing depths. The 2 bracket cohorts showed no differences in these periodontal indexes after an average of 18 months of orthodontic treatment (4). Pellegrini et al measured bacteria counts around conventional brackets and self-li- gating brackets at 1 week and 5 weeks af- ter appliance placement. Using a split- mouth experimental design, they meas- ured total bacteria and total oral strepto- cocci. After 1 week, the total bacteria and total oral streptococci were greater around conventional brackets. However, at 5 weeks, total bacteria were not significantly different on the 2 bracket types, whereas total oral streptococci remained elevated around conventional brackets (4).

In contrast, Pandis et al conducted a more recent prospective cohort study and failed to corroborate a difference in total bacteria when comparing conventional and self-li- gating brackets at 12 weeks after appli- ance placement (8).

These studies have been evaluated in a systematic review, with the conclusion that there is insufficient evidence that self- ligating brackets are more hygienic that conventional brackets (3).

Conclusion

Some of the claims on behalf of self-liga- tion ran ahead of the evidence to firmly support them. This is because often, these claims come from marketing sources claiming that self-ligating bracket systems provide superior treatment efficiency and efficacy.

The use of marketing statements like use of self-ligating brackets will result in faster treatment times is misleading. Statements like that imply that the self-ligating bracket is a better bracket.

A lot of research to this point has estab- lished that self-ligating brackets perform no better than conventionally ligated brackets. The bracket choice is orthodon- tist’s personal preference.

References

1. Harradine N. Self-ligating brackets in- crease treatment efficiency. Am J Orthod Dentofacial Orthop. 2013; 143: 10-18.

2. Shivapuja PK, Berger J. A comparative study of conventional ligation& self-liga- tion bracket systems. Am J Orthod Den- tofacial Orthop, 1994; 106: 472-480.

3. Fleming PS, O'Brien K. Self-ligating brackets do not increase treatment effi- ciency. Am J Orthod Dentofacial Orthop, 2013; 143: 11-19.

4. Huang GJ et al. Ask us: Self-ligating bracket claims. Am J Orthod Dentofacial Orthop, 2010; 138: 128-131.

5. Berger J, Byloff FK. The clinical effi- ciency of self-ligated brackets. J Clin Or- thod.2001; 35(5): 304-308.

6. Articolo LC, Kusy RP. Influence of an- gulation on the resistance to sliding in fixed appliances. Am J Orthod Dentofacial Orthop. 1999; 115: 39-51.

7. Thorstenson GA, Kusy, RP. Effect of archwire size and material on the re- sistance to sliding of self-ligating brackets with second-order angulation in the dry state. Am J Orthod Dentofacial Orthop, 2002; 122: 295-305.

8. Pandis N, Eliades T, Partowi S, Bourauel C. Moments generated during simulated rotational correction with self- ligating and conventional brackets. Angle Orthod, 2008; 78: 1030-1034.