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AN UPDATE OF SELF LIGATING BRACKETS –A REVIEW ARTICLE

Orthodontics

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ABSTRACT

Numerous bracket kinds have developed during the past two decades with various built-in features provided by Andrews, Roth, Burstone, Ricketts, Alexander, Bennet, and McLaughlin. Additionally, alternative bracket materials such stainless steel, chrome cobalt, titanium, ceramic, ceramic with metal holes, and polycarbonate were introduced. Self-ligating brackets have recently been linked to quicker and more effective treatments, which has piqued interest in comparing them to the traditional technique. Additionally, they don't need metal or elastomeric ligatures. There is a wealth of material that supports the conclusion that this characteristic supposedly reduces friction resistance during sliding mechanics. Additionally, employing these accessories has been reported to reduce the need for extractions and maxillary expansion. In order to confirm or disprove current theories, the aim of this study was to find the most recent research on self-ligating brackets that are now utilized in orthodontic treatments.

KEYWORDS

Orthodontic brackets, Self-ligation, Friction

INTRODUCTION

The specializationSince its invention at the beginning of the 20th century, orthodontics has developed continuously. According to the occlusal connections of the first molars, Edward H. Angle developed his taxonomy of malocclusion in the 1890s [15]. Simply presenting the ligating brackets was a developing development in the history of brackets. The primary concepts of self-ligating brackets have been around since Dr. Jacob Stolzenburg introduced The Russell Attachment in the 1930s. Self ligating brackets have been steadily being idealized since 1970.

Insofar as they provide better patient comfort, less total anchorage requirements, quick alignment, and more certain space closure, self-ligating brackets are thought to be preferred. Soft tissue injuries are less common, and dental hygiene has also improved[22].

1.Russell lock:

Russell lock was introduced in the year 1935 by Dr.Stolzenberg. The section had flat head screw situated cozily a roundabout, treaded opening in the face of the bracket. [Fig-1] Flat screw could be loosened or tightened to get the desired tooth movement. Wire.[1]

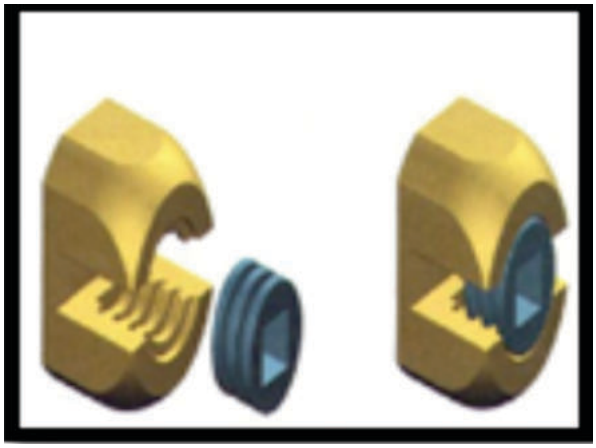

Fig-1 courtesy -15

2. Edgelock bracket:

The first passive self ligating section was presented in the year 1972.[Fig -2] It had a round body with a rigid labial sliding cap. An unknown opening device was utilized to move the slide occlusally for archwire inclusion. The section aperture was transformed to a tube at the point where the cap was shut over the archwire using finger pressure.[2]

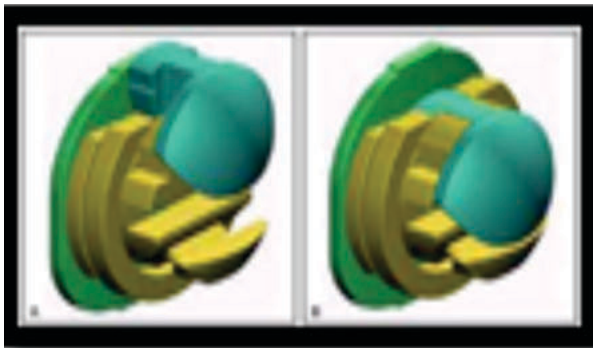

Fig -2 courtesy -24

3.Speed brackets:

SPEED is a fully pre-adjusted miniaturized edgewise appliance that uses a super -elastic nickel titanium and are specifically designed for each individual tooth. Each attatchment consist of upto 5 components

1. Multislotted bracket body
2. An in-out adapter
3. Permanently installed super elastic nickel titanium spring clip
4. Micro-retentive mesh bonding base
5. An integral mushroom hook.[3]

4.Activa bracket:

Activa bracket had an inflexible, curved arm that rotates occluso-gingivally around the cylindrical bracket body. [Fig-3] A sturdy clip that transforms into a holding groove gingival to the arch wire, positioning two straps labial to the wire, and creating a bracket that is essentially mechanically equivalent to a molar tube with the twin channel caps retain the arch wire in place.[4]

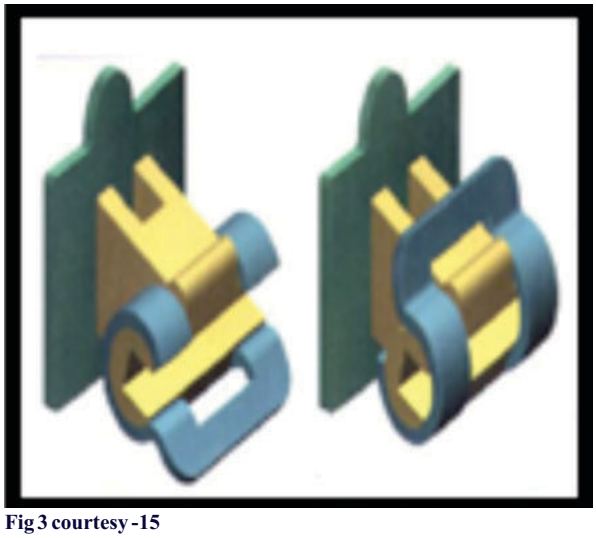

Fig 3 courtesy -15

5.Time bracket:

Time brackets is developed in the year 1994 by Dr.wolfgangheiser.it is the first one-piece self ligating system was developed using CAD/CAM technology.The time bracket[Fig -4] has a clip that rotates into place around the gingival tie wing and pivots away from the gingival wall of the slot and toward the occlusal. [5]

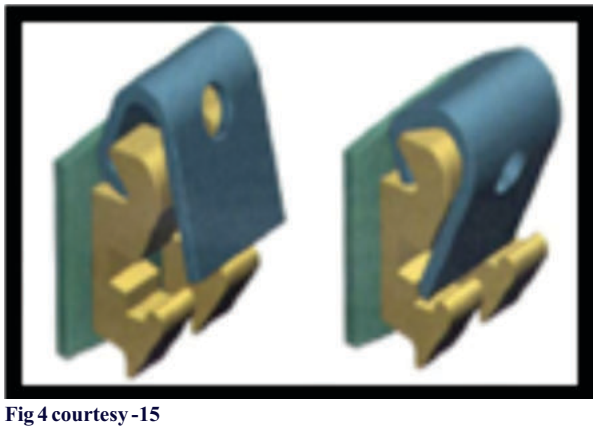

Fig 4 courtesy -15

6. Damon brackets:

These brackets are introduced by Dwight Damon. [Fig-5]

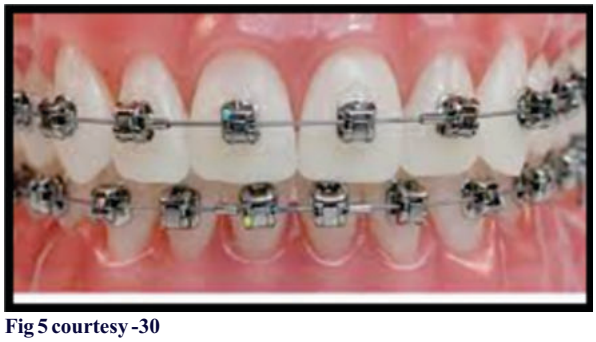

Fig 5 courtesy -30

Damon SL

a) It had a slide that wrapped around the labial face of the bracket. To provide positive open and shut positions.

Damon 2 bracket:

Damon 2 were introduced to address the imperfections of damon SL. They kept the U-shaped spring and vertical slide motion to control opening and shutting but relocated the slide under the cover of the tie wings.

Damon 3 bracket:

These bracket have three major changes:

a) Upper tie wing and tooth colored composite resin base reduces the visual impact of the bracket. A new vertically placed chair molded clip behind the slide. When fully closed, the slide has a satisfying tactile and aural signal.
b) It is opened with an exceptional opening apparatus resembling a modified blunt dental probe.
c) A rhomboidal shape of the bracket and slide which encourage the bracket sitting.

IV. Damon mx bracket:

These brackets are on the whole metal and have basically an indistinguishable mechanism from D3 they have a vertical slot behind the arch wire slot into which pre-assembled click in auxillary hooks can be added to any brackets required.[22]

7. Bracket:

Twin block is developed by Dr. Jim Wildman in the year 1998. Its flat, rectangular slide is contained by the edgewise twin brackets' tie wings.Passive slide moved gingivally with finger pressure to entrap the arch wire in a passive configuration and it is moved occlusally into the slot-open position with a universal scaler.[2]

8. Gac – inovation bracket:

These brackets [Fig-6] are introduced by michealcalpern in 2000. These are similar to SPEED brackets, but are of

a) Twin configuration
b) Bracket manufactured with metal injection moulding
c) Active clip which is made from cobalt chromium alloy is highly resistant to fracture.
d) Slot blocker: it prevents arch wire from escaping from t he bracket and enhances torque expression
e) Horizontal slot: this slot runs through the occlusal wing which can be used for rotation and uprighting spring.[23]

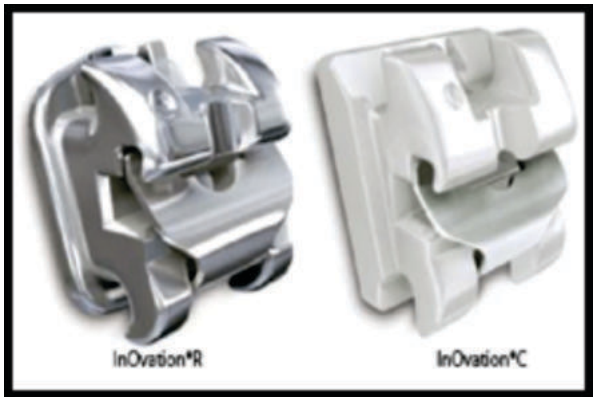

Fig 6 courtesy -15

9. Gestenco oyster brackets:

In 2001, this first transparent self-ligating bracket was designed. The Oyster bracket is semi-translucent polycarbonate bracket and it resists discoloring as it is made from strong, fiber glass reinforced composite polymers.

10. Adenta evolution brackets:

It is developed by Dr. HattoLoidl and C. Schendell . The Adentaself ligating lingual bracket [Fig -7] was designed with nonlocking rotating clip resulting in unique flexibility. It hold even a non-situated wire safely with simply the appropriate measure of pressure, consistently pushing the archwire to the base of the bracket slot.[9]

Fig 7 courtesy-25

11. Phillipe lingual self ligating bracket:
It is developed by Aldo macchi in the year 2002.Philippe 2D self-ligating lingual brackets [Fig-8] providing 2-dimensional control, were suggested for the correction of simple malocclusions, such as minor crowding or spacing with the lingual technique. These brackets can be bonded straightforwardly to the lingual surface of the tooth.

Standard medium twin, a confined single-wing bracket for lower incisors, a large twin, and a three-wing bracket are the four types of Philippe brackets that are available. [9]

Fig 8 courtesy -25

12.Opal brackets:
It is developed by Dr. Norbert Abels in the year 2004. Completely nonmetallic (resin) Bracket work as a compelling slot and sufficiently flexible in pivot region to open and close There are no tie wings, so elastic chain is put in before shutting the cap.[16] [Fig-9]

Fig 9 courtesy-25

13. Smart clip:
Gary L. Weinberger created it in 2004. It [Fig-10] consists of two nickel titanium clips, called the mesial and distal tie wings, which open and close as the arch wire pulls on the clip. The lack of moving doors or latches can solve issues with other forms of self-ligating brackets, such as sticking, spontaneous opening, or plaque buildup. [11]

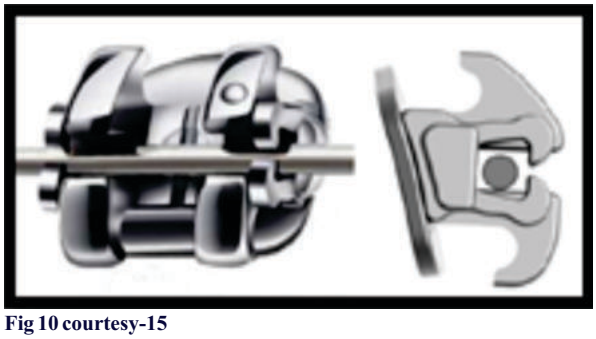

Fig 10 courtesy-15

14. Forestadent quick:
It is developed by Dr.Bjorn Ludwig in 2006. Externally passive brackets differentiated from active by a vertical marks on metal ligature wing. Anatomically correct positioning of the base prevents the bracket from rocking when it is placed against the tooth

15. Lancer praxis glide:
It is developed by Dr. Robert Lokar in 2006. It have feature like Open Lumen bracket, passive at the first stage of treatment. Complete control using a ligature on top of the clip. Design of each tooth's anatomy (11 different bracket shapes). simple positioning (avoiding any repositioning of the bracket). Low profile, ergonomic, and smooth design for patient comfort. Quick alignment and leveling. [10]

16. Vision LP:
These brackets are completely passive, low profile, and don't bond with bio debris because of their tiny contact point.

17. Discovery:
Dentauraum created it in 2007 utilizing CAD/CAM technology. Best therapy results with minimal size for cosmetic treatment are among the features. High level of user comfort brought on by a simple locking mechanism.

18.Damon Q:
These are the most recent versions of the Damon framework [Fig-11] the sliding component is meant to be more user-friendly, safe, and pleasant. These brackets are also smaller and room has been found for both a horizontal and vertical slot.

Fig 11 courtesy -23

19.Damon aesthetic:
A translucent passive self-ligation bracket without a metal insert is called the "DAMON AESTHETIC." The robust polycrystalline alumina (PCA), an inert substance resistant to staining or discoloration, is used to create the entirely fashionable bracket body and slide. A fourth wall is formed by the SL bracket's slide.

20.Smart clip sl3:
The only difference from a Smartclip bracket is a lessened clip force reduction. In addition, a framework with an adhesive precoated and fluoride discharge property is available.

21.Sensation active ceramic bracket:
The Sensation Active Ceramic Self-Ligating Bracket [Fig-12] features a steel clip that has been treated and covered in rhodium and is made of a resilient, translucent ceramic substance.[26]

Fig 12 courtesy -26

22. Bio quick bracket:
Forestadent'sBioQuick self-ligating bracket presently includes a lower profile and rounder edges for enhanced patient comfort. The upgraded clip's thickness has been expanded by 20%, making it more strong and ready to withstand disfigurement while giving better control of angulation, rotation, and torque.[18]

23. Carriereslx bracket system:
This bracket includes an amazingly low profile and occlusally opening doors; visual signs including six horizontal and five vertical references are intended to help guarantee exact bracket arrangement.[27]

24. Empower 2:
An variant of Empower self-ligating bracket system, now known as Empower 2. It have micro-etched bonding pads, intended to enhance bond strength by 15-30% over different bases, and a thicker clip to expand wire-seating power while staying away from clip disfigurement.[21]

25. In -ovation X:
In-Ovation X, is recent expansion to its self-ligating. In-Ovation line, holds a similar core design and treatment standards, with improvements including a streamlined shape and a diminished profile and occlusal impression. There is an updated encased-clip system and shut gingival bracket base will decrease the calculus develop that can hinder with clip function.[28]

PROPERTIES OF AN ORTHODONTIC LIGATION SYSTEM

1. Secure and robust ligation
Secure and full arch wire engagement increases the potential long range of action of modern low modulus wires.

2. Full bracket engagement
Full engagement of the wire into the bracket slot is required to attain complete expression of torque mainly at finishing stages of treatment. Wire ligation can maintain adequate arch wire engagement between office visits.[10]

3. Quick and easy
Wire ligation is a long procedure and this is the important reason they are not frequently used. Elastic ligatures are much faster to remove and restore.

4. Low friction
For sliding mechanics, brackets which experience low friction are the most needed. Low friction is essential during the leveling and aligning stages of orthodontic treatment. Low friction is capable during space closure as well.

5. Patient comfort
Elastomerics are good in this aspect, but wire ligatures require careful tucking in of the ends to evade soft tissue trauma, and can occasionally be displaced between appointments and cause discomfort.[29]

APICAL ROOT RESORPTION

Apical root resorption is defined as shortening of the root apex and this is the condition that often associated with orthodontic treatment. Maxillary and Mandibular incisors are the teeth more susceptible to ARR especially the maxillary lateral incisors(Linge&Linge, 1983; Mirabella & Artun,1995)[17]

The initiation of self-ligating brackets has provoked the investigation of arch wire ligation on ARR. In 1995, Blake et al., tested the hypothesis that an active self ligating bracket with an active clip might encourage more ARR [5].Using panoramic radiographs, Pandis et al., 2008, reported no mean difference in the amount of ARR of the maxillary incisors with Micro arch and Damon 2 systems.[14]

STABILITY WITH SELF LIGATING BRACKETS

Some investigators claim that lower force generated by self ligating bracket systems might result in more physiological tooth movement, therefore, SLBs generate more stable treatment results[6].The longterm follow-up retrospective study sample was conducted and this research was accepted by the Ethics Committee of the WenZhou Medical University.The aim of this study was to evaluate the long-term stability of treatment with self-ligating brackets compared with conventional brackets. The study disclosed that brackets type did not influence the long-term stability. Considering self-ligating brackets were expensive, given comprehensive consideration for the patients to select suitable orthodontic bracket type was of crucial importance.[19]

CLINICAL TIPS WHEN USING SELF-LIGATING BRACKETS

❖ **Aids to archwire engagement with self-ligating brackets**
With self-ligating brackets, it is essential to fully engage the wire before clip closure, rather than strive to close the clip and simultaneously engage the wire. If the wire is passive labio-lingually, this factor does not apply.

- The Arch wire can be held into the slot base with different tools. Simple tools like amalgam plugger, ligature tucker or Mitchell's trimmer, may suffice. However, these only push on one side of the bracket and may be inadequate to fully engage the wire across the whole width of the slot.
- The cool tool is a specific tool, which is rather akin to a torquing key.
- Dwight Damon has developed this instrument for engagement of wires, through balanced pressure on both sides of the bracket.
- GAC has developed the R tool recently , that resembles a double ligature tucker and works in the same way.
- Reduction of a pulling force on the tooth when placing an elastomeric is difficult, but it is easy to reduce the net push on the tooth when engaging a wire in a self-ligating bracket, Labio-lingual "squeeze technique" .
- Once the wire is completely or fully engaged, In-Ovation brackets and Speed brackets can be closed with a finger. Damon 2 brackets can be closed with ordinary light-wire or bird beak pliers[7]

❖ **Opening clips/slides**
In-Ovation self -ligating brackets are opened by pushing in an occlusal direction on the tail of the clip behind the bracket.
Time and speed brackets are opened with a probe or other sharp instruments, such as Mitchells trimmer using the hole in the clip.
Damon 2 brackets can be opened with ordinary pliers. Specific Damon pliers, which resemble modified distal end cutters, are easier to use.
Very effective and specific pliers for Damon 2 brackets are personally recommended for all first-time users since they make all slides very easy to open and downward rotation is not required[16].

❖ **Prevention of wire pokes**
Low friction increases wire displacement. Even with irregular teeth , the very low friction with self-ligating brackets enables aligning arch wires to slip through the brackets and an arch wire end to protrude. Steps to prevent this can include:
Using tie-breaks with flexible wires over extraction sites to lessen the effects of occlusal forces on unprotected spans of wire.
Thorough turning in the ends of flexible arch wires. An interesting innovation in this respect is the Bendistal plier described by Khouri and this is designed to place an effective distal end bend in a superelastic wire without the need for over-bending which can be difficult and uncomfortable and also risks the loss of a bonded molar tube[9].
Selective locking of individual brackets to the wire with elastomerics can be helpful in those designs which have a full conventional tie wing assembly.
Small sections of stainless steel tube can be crimped onto the arch wire. This is quick, easy, versatile.
It is recommended that the stop is not placed on a significantly active part of the arch wire. This would diminish the range of action of the wire where it is most needed.[20]

❖ **Alterations in treatment mechanics**
It is necessary to briefly list some of the ways that treatment can be changed to take advantage of the combination of low friction and full, secure bracket engagement.

1. More traction on lighter wires
The increased effectiveness of light forces and the decreased loss of control incorporate to permit more mesio-distal tooth movement to be sensible on lighter, more flexible wires.
2. Long intervals between each appointment
Full and secure wire engagement of brackets along with the use of low modulus wires makes an extension of the interval between appointments a logical step.
3. Separate movement of individual teeth
During traction on an individual tooth, the control of rotation during

traction on an individual tooth makes this option much more attractive when required and with greater anchorage conservation.

❖ Bracket placement and bonding

Bracket placement and bonding is a curial step for the long-term success of treatment. For teeth that are well displaced from the arch line or where there is insufficient space to place a bracket in ideal position, use a traction hook to gain some initial control of these teeth. In case of rotated teeth, it is helpful to offset the traction hook so that it is on the part of the crown furthest from the line of the line of the arch to gain spontaneous derotation.

❖ Debonding of appliance

Debonding of self-ligating brackets may occur by direct failure of the bracket adhesive interface, cohesive adhesive failure, direct failure of the adhesive enamel interface or combination of any of these.[1]

BENEFITS OF SELF-LIGATING BRACKETS

i. Self-ligating brackets result in reduced chair time. [13]
ii. Self-ligating brackets deliver greater patient comfort, shorter treatment time, greater precision and control of tooth translation.
iii. Self-ligating bracket design allows the use of lighter force levels and impart lower frictional force levels and import lower frictional forces compared with ligated brackets.
iv. ligating brackets has been reported to reduce the risk of percutaneous injury and the potential for transmission of hepatitis B,C viruses, or HIV for the orthodontist and the possibility of soft tissue injury and infection from the cut end of ligature ties.
v. The elimination of tie- wings and other type of food traps on few selfligating bracket designs significantly increases the hygiene level of all patients[8]

DRAWBACKS OF SELF-LIGATING BRACKETS

i. High cost compare to conventional bracket.
ii. Some practitioners feel they have trouble expressing the minor tooth movements necessary to finish cases due to their low friction design.
iii. Increased size of self-ligating brackets can also cause occlusal interferences, particularly in the lower anterior position[12]

CONCLUSION

Self-ligating brackets offer the extraordinarily profitable combination of a great degree low friction and secure full bracket engagement and they are adequately powerful and easy to use to deliver most of the potential advantages of this sort of bracket as of now. Proof of better treatment adequacy exists however is incomplete while further refinements are desirable and additionally examines fundamental, present brackets seem ready to deliver quantifiable advantage effortlessly of utilization

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