Volume 9, Issue 4, April – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24APR1179

# A Review on Damon Self- Ligating Brackets

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**Abstract:- Self-ligating bracket systems are accepted more by orthodontists nowadays. This is because of their superior quality, improved reliability and ease of use. However, it might also be related to claims of superior function made by the manufacturers of these appliances. In particular, the Damon appliance system claims to offer significant advantages to both orthodontist and patient over conventional-ligation and other forms of self-ligated appliances. We have reviewed present literature relating to use of the Damon appliance system. There is some evidence to suggest this appliance may lead to reductions in chairside time for the orthodontist, particularly those experienced with this system, in comparison to conventional-ligation. There is no high quality evidence that treatment with the Damon appliance takes place more quickly or gives a superior occlusal or aesthetic result. The best available evidence would suggest there is no difference in treatment outcome or time, at least in extraction cases. There is no evidence that treatment with the Damon appliance is more stable. Claims relating to improved clinical performance of the Damon appliance system are currently being made to orthodontists and patients that are not substantiated in the scientific literature.**

***Keywords:-*** *Damon system, Self-ligation, Evidence, Treatment efficiency,SLB.*

## I. INTRODUCTION

With each passing year there is a variable transformation happening in orthodontics treatment; correction of severe crowding with the extraction modality is not the only option available for orthodontist. Now with the advancements in the bracket systems with the introduction of self-ligating brackets and the temperature activated wires the non- extraction treatment for the relieving of the crowding is the best choice. Even though the exception do exist for this but most of the cases can be handled with conservative mode of treatment. Self-ligating brackets have imprinted their name in the history of orthodontics because of their time saving ability during appointment times, '*2 very low friction "*4 and increased efficacy of treatment 5 7. The present article is review of one such case of severe crowding treated using self-ligating bracket system.

Damon Self- ligating system having been pioneered in the 1930s, have undergone a revival over the past 30 years with a variety of new appliances being developed. A host of advantages over conventional appliances system have been claimed typically relating to reduced frictional resistance.

The most compelling potential advantages attributed to Damon self-ligating bracket are a reduction in overall treatment time and less associated subjective discomfort. Preliminary retrospective research has pointed to definite advantages, with a reduction in overall treatment time of 4 to 7 months and a similar decrease in required appointments. Efficient orthodontic appliances result in stable and timely treatment. Efficiency is the keyword and is influenced by important factors like, biomechanics, chair time per visit, frequency of appointments and patients comfort.

Since the mid-1970s the search for a bracket system with an ideal ligation and low friction resulted in renewed interest in the development of Damon self-ligating brackets.

Damon selfligating bracket were designed to overcome the limitations of treatment with conventional bracket system and were looked on as a welcome evolution in this direction, commanding an ever-increasing market share and often said to represent the pinanacle of bracket technology10.

## II. HISTORY AND DEVELOPMENT OF SELF-LIGATING BRACKETS

In1933 - Charles E. Boyd first introduced Boyd® band bracket a passive self-ligating system. In the same year. Ford lock design was manufactured by Dee Gold Company of Chicago, Illinois and patented by James W. Ford. Production of this bracket was abandoned due to the high cost and bulk of the appliance. William F. Ford reintroduced the bracket in 1951 exclusively for Johnson twin wire technique. 1952 - Russell appliance, a passive bracket with a rigid sliding lock was introduced. 1953 - Schuster device was developed with a characteristic passive rigid locking pin. 1957 - Rubin device was introduced which had a passive rigid hinged plate. 1966 - Branson bracket was manufactured with a passive rigid rotational screw. Though innovations in the field of efficient brackets were progressed from as early as 1933, the commercial success and acceptance by the orthodontic fraternity was limited. After a few years of lull, renewed interest in SLB was shown by Ormco. 1971 - Edgelocke bracket designed by J. Wildman was manufactured by Ormco. It had a round bracket body with a rigid labial sliding cap. This received initial wide scale commercial success but soon lost its popularity due to disadvantages like inadequate rotational control, excessive bulk, inconvenience of opening and closing the slide. 1979 - Mobil-Locke bracket (Forestadent, Germany) was developed by the University of Bonn. The Bracket had a passive rigid circular rotational disk turned with a screw-driver, covering part of the labial surface of the slot. The wire could be tightly or loosely engaged

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depending on the degree of rotation. Upper incisor brackets were redesigned with twin cams to overcome poor rotational control. Difficulty of access to open and close premolar brackets with the straight screwdriver along with disadvantages like design bulk lead to their poor acceptance commercially"'’2. Mid-70’s- “SPEED ” - Dr. Hanson conducted clinical design tests in collaboration with a Canadian aerospace manufacturer, Strite Industries Limited in an attempt to improve clinical efficiency of brackets. Sectioned pieces of watch springs from a local jeweller were fitted by Hanson on prototype bracket bodies welded to bands and placed on specific teeth to be tested. Successful tests of these “hand-made” prototypes led to a process of design optimization, which culminated into the wide scale clinical testing of machine-made prototypes".More than 600 patients underwent successful treatment between October 1977 and January 1980, confirming the design soundness of the concept of an active self-ligating bracket. 14 1996 — “A” Company introduced the Damons SL I The bracket had a thin metal cover that wrapped around the labial surface of the twin bracket body and tie-wings with convertible tubes". The bracket had excessive bulk and limited tooth control with increased tendency to breakage' 2. 2000 - The TwinLock bracket was modified by “A” Company/Ormco and the new metal injection molded bracket became commercially available as Damon® SL II 6.The design retained the vertical slide action and U-shaped spring to control the opening and closing, but placed the slide within the shelter of the tie wings. This eliminated the inadvertent slide opening and breakage thus increasing its popularity in clinical use. 2004 - Damon III was developed by Ormco. This bracket had a few inherent disadvantages, thus the company made the necessary modifications and marketed in 2006 as Damon MX 310. 2004 — SmartClip —3 M Unitek developed the new SLB with characteristic C- shaped Nitinol spring clips on either side of the bracket slot to retain the archwire. 2006 - Smartclip 2 - 3M Unitek introduced the modified bracket with increased flexibility of the spring clips' 2.

## III. TYPES OF SELF-LIGATING BRACKETS

### *A. Based on the Bracket Archwire Interaction*

- Passive Self-Ligating Brackets
- Active Self-Ligating Brackets and
- Interactive Self-Ligating Brackets

- Passive type: The clip or rigid door does not actively press against the archwire. The increased clearance between the archwire and a passive slide results in increased play thus reducing friction (Figure 01). This promotes patient tolerance, enhances early and efficient aligning due to lower resistance to sliding. Examples of the passive SLB - Boyd band bracket; Schurter0 device; Rubine device; Branson bracket; Edgelok® bracket; Mobil-Lock bracket; Activa bracket; Twin Lock bracket; Smart clip ; Damon 3MX; Praxis Glide® and Carrier LX brackets. (Figure 1)

Fig 1: Passive SLB with Round and Rectangular Wire

The Active SLB’s have a spring clip that press against the archwires and are able to maintain a large amount continual contact between the archwire and the self- ligating mechanism' 2'. The rigidity of the spring clip depends on the material properties, essentially the elastic modulus. The clips may be fabricated of alloys like Nickel-Titanium, stainless steel and elgiloy or Co-Cr-Fe- Ni alloy. The benefit obtained from the active clip lies in the capacity of it to store some of the force in it as well as in the wire. This ensures an extended range of labiolingual action and produces more alignment compared to a passive slide with the same dimension wire. Active self-ligating appliances allow closed interactions even with undersized wires, thus permitting better torque control. Additionally the frictional forces lower than those with elastomeric ligatures ties on a conventional tie-wing brackets.' 2 Examples: In-Ovation ; SPEED and Quick Brackets. (Figure 2)

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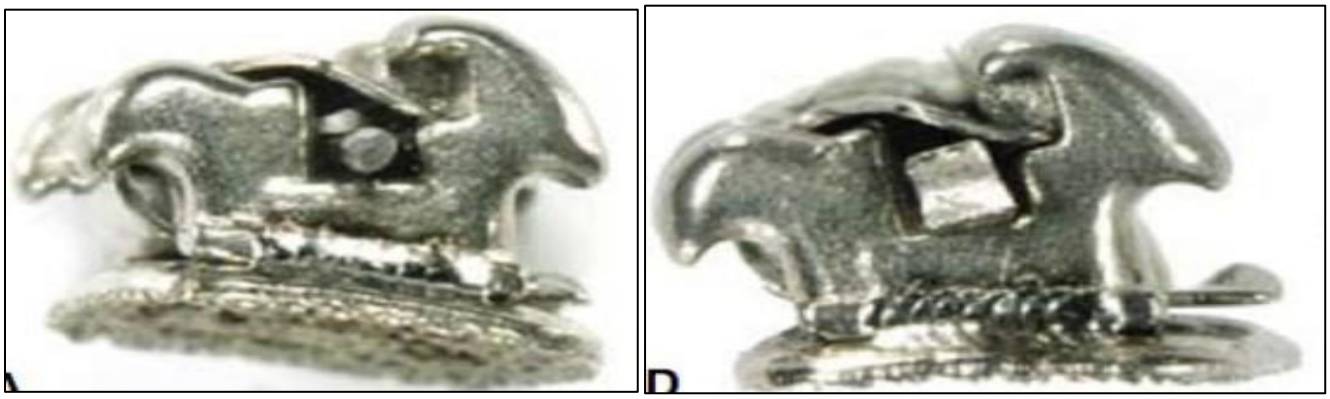

Fig 2: Active SLB with Round and Rectangular Wire

- Interactive SLB An interactive mechanism has the inherent capacity to interact selectively with different archwires in varying degrees depending on the amounts of force, friction and control that is required during various phases of treatment. The advantages of interactive SLB would include minimal force and friction in the early stages of treatment, along with torque and rotational control in the middle and finishing stages of treatment and the capacity to achive finishing details in a controlled manner in all three planes of space25. Example: Timed bracket.

*B. Self-ligating Brackets are Classified based on the Material:*

- ***Stainless Steel SLB:*** Rubin device; Branson bracket; Edgelok bracket; Mobil-Lock® bracket; Activa bracket; Twin Lock bracket; Smartclip; Damon 3MX; Praxis Glide and Carrier LX brackets; In-Ovation ; SPEED and Quick Brackets; Philippe 2Dself -ligating lingualbrackets; 3D Torque-Lingual self ligating brackets; The Adenta Evolution lingual bracket; In-Ovation -L.

- ***Ceramic SLB:*** Clarity SL, In-Ovation C, Phantome.

✓ *The Damon System*

The Damon philosophy in orthodontics centers on employing gentle force, referred to as the threshold force, to initiate tooth movement. This approach is based on the idea of using force that is mild enough to avoid blocking the blood vessels in the periodontal membrane, allowing cells and biochemical messengers to freely reach the site of bone resorption and apposition, thus facilitating tooth movement.

✓ *Key Principles Include:*

- Threshold Force: The principle of applying the minimal force necessary to induce tooth movement without obstructing blood flow in the periodontal membrane.
- Passive Self-Ligation Mechanism: Damon employs a passive self-ligation mechanism that minimizes frictional resistance compared to other ligation systems. This design allows the forces from the archwire to be directly transmitted to the teeth and supporting structures without being hindered by the ligature system.
- Low Friction: The passive self-ligation mechanism of Damon ensures minimal frictional resistance, enhancing the efficiency of tooth movement and improving patient comfort.
- Avoidance of Elastomeric Ligatures: Unlike traditional orthodontic systems that use elastomeric ligatures, Damon does not rely on them. This is because the forces exerted by elastomeric ligatures can have adverse effects on treatment progress.
- Overall, the Damon philosophy emphasizes gentle and efficient tooth movement through the use of low-force mechanics and minimizing friction. This approach aims to achieve optimal treatment outcomes while ensuring a comfortable experience for the patient.
- When comparing to traditional preadjusted edgewise appliances, it is suggested that using passive self-ligation leads to significant reductions in several aspects
- Anchorage Devices Usage: Passive self-ligating appliances, by virtue of their reduced frictional resistance due to the absence of ligatures, require fewer anchorage devices. Research by Srinivas indicates that passive self-ligating appliances utilize less anchorage compared to conventional ones, supporting the notion of decreased reliance on anchorage devices with passive self-ligation.
- Intraoral Expansion Auxiliaries: Passive self-ligation diminishes the transformation or absorption of force by ligatures, allowing necessary expansion to be achieved through the force of archwires alone. Consequently, there is reduced reliance on intraoral expansion auxiliaries such as quad helices or W-springs.
- Extractions Requirement: With reduced frictional resistance from ligatures in passive self-ligation, alignment can be accomplished using smaller diameter archwires, thereby decreasing the need for extractions to facilitate orthodontic mechanics. Moreover, the alignment process imposes minimal stress on the periodontium, mitigating the risk of iatrogenic damage to the periodontium.
- Furthermore, passive edgewise self-ligation systems offer three key features:
- Low Friction Levels: Passive self-ligation systems exhibit minimal levels of both static and dynamic friction, contributing to smoother tooth movement.

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- Rigid Ligation: The positive closure of the slot by the gate or slide in passive self-ligation ensures rigid ligation, enhancing control over tooth movement.
- Precise Tooth Position Control: The edgewise slot of adequate width and depth in passive self-ligation systems facilitates precise control over tooth position during treatment.
- Various studies have investigated the efficiency of archwire placement and removal, providing evidence in support of the Damon Philosophy. Turnbull and Birnie conducted research categorizing archwires into four size groups. Their findings included:
- Reduced Ligation Time with Larger Archwires: Contrary to expectations, the time needed to ligate archwires decreased as their size increased. This unexpected result suggests that thicker wires did not pose significantly greater challenges in achieving full engagement in brackets, likely due to the earlier tooth alignment facilitated by smaller archwires.
- Consistent Time for Bracket Opening and Ligature Removal: The time required to open Damon self-ligating brackets and remove elastomeric ligatures remained relatively consistent across different archwire sizes.
- Efficiency of Damon Passive Self-Ligating Brackets: Compared to conventional brackets with elastomeric ligatures, Damon passive self-ligating brackets demonstrated faster archwire ligation and release.

These findings highlight the effectiveness and convenience of Damon passive self-ligating brackets in archwire management, emphasizing their efficiency in reducing chairside time and the need for assistance during treatment.

The Damon light force philosophy revolves around the concept of applying the least amount of force required to initiate tooth movement. This principle is embodied in the Damon System, which combines passive self-ligation with super elastic nickel titanium archwires. Together, they create an environment with minimal force and friction, ensuring that teeth stay within an optimal force range during treatment. The rationale behind this approach is that gentle orthodontic forces help maintain the openness of blood vessels in the periodontal ligament and support effective cellular remodeling during tooth movement.

While conventional wisdom favors light orthodontic forces for their tendency to induce frontal resorption rather than hyalinization and undermining resorption, the precise relationship between force strength and tooth movement remains unclear and has prompted various theories. The existence of an ideal orthodontic force, capable of maximizing tooth movement without causing tissue damage or discomfort, is a topic of debate. Mathematical modeling has revealed that a broad spectrum of forces can achieve the maximum rate of tooth movement, reflecting the uneven distribution of orthodontic forces across the periodontal ligament and the differing responses of individual teeth to external force application. Therefore, the notion of a single appliance generating a universal and optimal orthodontic force throughout the dentition is likely oversimplified.

## IV. CONCLUSION

Latest self ligating brackets like Damon system are new tools that. Should be choosen according to clinicians skill and experience rather than promise of better and more efficient outcomes. There is evidence that pain experience during treatment is reduced. In the presence of identical archwire sequences there is no evidence that Damon system brackets can align teeth faster or in a qualitatively different manner when compared with conventional- ligation. There is no high quality evidence that treatment with the Damon system appliance takes place more rapidly, or leads to a superior occlusal or aesthetic result. There is no evidence that orthodontic treatment with the Damon system appliance is more stable.

It is not prefered to offer treatment with the Damon system appliance to any patients on the basis that it will be less painful, faster, exclude the need for extractions or give a better result.

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