

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

185,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



The Value of Self-Ligating Brackets in Orthodontics: About the Damon Protocol

*Suvetha Siva, Shreya Kishore, Suganya Dhanapal,
Janani Ravi and Chandhini Suresh*

Abstract

In orthodontics there has been a change in the treatment plan of crowding cases from extraction protocol. This was mainly due to the introduction of self-ligating bracket and temperature activated wires. Even though there are certain exceptions, the self-ligating bracket have evolved in orthodontics because of its advantages such as low friction, shorter treatment duration and increased efficacy. Damon's self-ligating system has been in existence since 1930 but it has been well developed in the past 30 years with the introduction of newer systems. Damon's self-ligating brackets have been designed to overcome the drawbacks of conventional bracket system and are often considered as the pinnacle of bracket technology. The main advantage of Damon's system was low friction and shorter treatment duration. But the efficiency of the appliance is influenced by several factors such as Biomechanics, frequency of dental visits and patient comfort. The chapter will highlight the efficiency of the appliance, the various possible outcomes and its influence on the ease of orthodontic therapy.

Keywords: self-ligating bracket, Damon's system, Damon brackets, passive self-ligating bracket, Damon philosophy

1. Introduction

Orthodontics and orthodontists have always worked towards delivering better care for patients. This has led to the invention of various bracket systems along with the changes in the protocol of management of extraction cases.

The Self Ligating Brackets (SLB) has come into orthodontic practice since 1930's with the invention of Boydband bracket. These bracket systems along with the thermally activated NiTi wires have reduced the treatment duration, chair-side time, and improved the treatment efficacy and patient co-operation. This led to the invention of Damon's system by Dr. Dwight Damon in the year 1996. It is called as "System" rather than "Brackets" because it utilizes the benefits of both the brackets and copper NiTi wires, thus delivering a "low force- low friction" mechanics for the management of dental malocclusion [1].

There has been lot of evidence in literature which states that “atraumatic” remodeling of periodontal tissues was rarely achieved using conventional orthodontic bracket system. This is mainly because the tooth was always moved in group. In Damon’s system, the tooth is allowed to move individually, yet stay in the group. The bracket system allows for easy sliding of the tooth along the path of least or no resistance thus leading to faster leveling and alignment and reduced treatment duration [2]. The aim of this chapter is to describe the bracket prescription, efficiency of the appliance, the possible outcomes and its influence on orthodontic therapy.

2. Why choose Damon?

Damon philosophy uses the concept of passive self-ligation technique which claims to have the lowest frictional resistance of any ligation system. Reduction in friction helps the force to transmit directly from the arch wires to the teeth and its supporting structures without any force dissipation by the ligature system [3].

Comparing the other prescriptions, Damon system has lots of benefits:

- Limitations in the use of intraoral expansion appliances such as quad-helix or jack-screw as the optimal forces from the arch wires completely allows the connective tissue and alveolar bone to follow tooth movement with uninterrupted vascular supply to the tooth and its surrounding system thereby providing the necessary expansion [3–5].
- In a study stated that Damon System produced a significant transversal increase in the posterior region of the arches with differences in teeth buccolingual inclinations at post-treatment [6].
- Faster alignment of teeth as passive self-ligation produces lower resistance thus allowing a wire to slide.
- Reduced amount of pain experienced by patients, and higher treatment efficiency as this friction-free system produces less forces on the teeth [4, 5].
- Reduction in the need for extraction as the force applied is minimal that the pressure from lips can control unwanted tipping of incisors during alignment stage [5].
- Decreased demand for the use of anchorage devices comparing the conventional appliances as there is reduced friction between the ligation for better tooth control [7].
- Reduction in the overall duration of orthodontic treatment up to 7 months and also reduced number of appointments have been found in few researches [8, 9].
- Control of tooth position because there is an edgewise slot of adequate width and depth [3].
- Decreased discomfort experienced by the patients with the Damon prescription as the forces applied to the teeth are kept minimal throughout the treatment [4].

- More efficient chair-side due to reduced ligation time [10].
- Promotes periodontal health with better infection control [11].

3. Classification of Damon's system

In orthodontics achieving ideal inclination of anterior using the edgewise system is challenging. In an attempt to overcome this drawback, Damon's system has different torque prescription. This includes:

3.1 High torque brackets

These brackets can be used in cases where the incisors or cuspids are severely retroclined or palatally placed. Examples are:

- Class I extraction cases with proclined of anterior.
- Class II division 1 malocclusion.
- Class II division 2 malocclusion with retroclined incisors.
- Palatally placed incisors or cuspids.

3.2 Standard torque brackets

These brackets can be used in cases where the inclination of anterior is satisfactory and when there will not be any obvious change in the inclination during the course of the treatment.

3.3 Low torque brackets

- Examples of the cases include:
- Anterior open bite cases with severe proclination of anteriors.
- Moderate and severe crowding.
- Treatment mechanics which may result in proclination of anteriors.
- Incisors with palatally positioned roots.
- In class II fixed functional cases or class II elastics cases where control of lower incisor proclination is necessary.
- Lingually placed lower incisors [3].

4. Tip and torque

The tip and torque values of Damon's system are as in **Tables 1** and **2**.

Upper arch						
U1	U2	U3	U4	U5	U6	U7
+5°	+9°	+6°	+2°	+2°		
Lower arch						
L1	L2	L3	L4	L5	L6	L7
+2°	+2°	+5°	+2°	+2°		

Table 1.
Tip values in Damon’s system.

	Upper arch						
	U1	U2	U3	U4	U5	U6	U7
High torque	+17°	+10°	+7°				
Standard torque	+12°	+8°	0°	−7°	−7°	−18°	−27°
Low torque	+7°	+3°					
	Lower arch						
	L1	L2	L3	L4	L5	L6	L7
High torque			+7°				
Standard torque	−1°	−1°	0°	−12°	−17°	−28°	−10°
Low torque	−6°	−6°					

Table 2.
Torque values in Damon’s system.

5. Advantages and disadvantages

5.1 Advantages

- Clinically proven
- Enhances facial esthetics
- More comfortable than traditional braces
- Reduced friction and faster tooth movement
- Shorter treatment duration
- Lesser visits

5.2 Disadvantages

- Expensive than traditional braces
- “Metal Mouth” look

6. Arch wire sequencing

The phases of tooth movement are generally.

- Initial leveling and aligning – where initial round wires made of multistranded steel or NiTi are used, starting from the smaller dimensions then proceeded with the larger dimensions.
- Retraction and space closure – where rigid rectangular wires are used for major mechanics like torque expression and space closure.
- Finishing and detailing – round steel wires are usually used.

There are two sequences which are generally followed in pre-adjusted edgewise prescription.

6.1 Universal arch wire sequencing

An older concept of a sequence which initially uses round steel wires from sizes .014, .016, .018 and .020 followed by rectangular steel wires from dimensions $.018 \times .025$, $.019 \times .025$ and $.021 \times .025$ in .022 slots.

Multi-stranded wires of dimensions .015 and .0175 were used for initial aligning before .014 round Steel wire came into practice and finishing and detailing was done with .014 steel wires.

Later with the introduction of MBT prescription, arch wire sequencing started with initial .016 CuNiTi wire followed by $.019 \times .025$ CuNiTi and then $.019 \times .025$ Steel wire was used for major biomechanics and detailing was done with .014 round steel wire [12, 13].

A clinical research by Mandall, in which three wire sequences were randomly allocated to patients to compare are as follows:

Group A - 0.016 NiTi, 0.018×0.025 NiTi, and $.019 \times 0.025$ Steel wires.

Group B- 0.016 Niti, 0.016 SS and finally 0.020-inch Steel wires.

Group C - 0.016×0.022 CuNiTi wire, followed by 0.019×0.025 CuNiTi, and ending with 0.019×0.025 Steel wire,

And found that all sequences were equally effective. However, the CuNiTi may be preferred by the clinicians as it reduces the number of appointments [14].

In another study by Ong, the three different archwire sequences were applied are as follows:

- 0.014 Niti, 0.017×0.017 HANT, 0.016×0.022 Steel
- 0.014 Sentalloy, 0.016×0.022 Bio force, 0.016×0.022 Steel
- 0.014 CuNiTi, 0.014×0.025 CuNiTi, 0.016×0.022 Steel,

And found that there were no differences among the archwire sequences in terms of aligning or discomfort [15].

6.2 Damon arch wire sequencing

Phase 1: Light Round Wires

This phase of treatment uses 0.013, 0.014, or 0.016 CuNiTi arch wires. The aim of this first phase of treatment is to achieve tooth alignment including rotation correction except second molars, level the arches and initiate arch development with light forces to permit the soft tissues to desired arch shape. This phase of treatment normally extends from 10 to 20 weeks and the intervals between appointments are about 10 weeks.

Phase 2: High Rectangular Wires

Phase 2 uses two arch wires: 0.014×0.025 CuNiTi followed by 0.018×0.025 CuNiTi wires. In case of well aligned arches only 0.016×0.025 CuNiTi are used in this phase. If intrusion of anteriors is planned, 0.017×0.025 or 0.019×0.025 CuNiTi arch wires with preformed curves or reverse curves of Spee or additional torque can be applied anteriorly in this stage.

The main purposes of this phase are:

- Continue arch development
- achieve complete alignment of all teeth including second molars,
- consolidate anterior spaces and maintain tooth contact,
- Initiate torque control and bite opening,

The duration of this phase ranges from 20 to 30 weeks. The first archwire is placed from 8 to 10 weeks and the second is from 4 to 6 weeks.

Phase 3: Major Mechanics

Preposted stainless steel arch wires of size $0.019 \times .025$ are used. Presence of cross bite at this stage when persisted can be corrected with the use of 0.016×0.025 pre-posted stainless steel arch wire with the use of cross elastics where buccal and lingual tipping can be achieved at this stage.

The main purposes of this phase are:

- Finish torque control,
- Consolidate posterior space and
- Maintain the arch form which developed during the initial two phases,
- Completely correct the tooth position in all the three relationships.

This phase of treatment extends from 8 to 10 weeks with an interval about 10-weeks between appointments.

Phase 4: Finishing and Detailing

The stainless steel arch wires continued in this phase with elastics for achieving proper interdigitation. But for individual teeth position 0.019×0.025 β -titanium arch wires may also be used [2, 3, 16].

In a study by Handem, used the arch sequence with initial round wires 0.014 or 0.016, followed by rectangular 0.016×0.025 , 0.018×0.025 , and 0.019×0.025 CuNiTi arch wires subsequently, rectangular 0.017×0.025 or 0.019×0.025 Steel arch wires [17].

7. Bracket placement in Damon system

Various clinicians have put forth bracket placement methodologies of the Damon bracket system to achieve the desired smile arc protection, functional occlusion and enhancing the facial esthetics.

Standard bracket placement by Dwight Damon [18]:

According to him, the arch wire slot should be at the distances mentioned below from the incisal edge.

Maxillary

U-1 4.75 mm.

U-2 4.50 mm.

U-3 5.00 mm.

U-4 4.50 mm.

U-5 4.25 mm.

Mandibular

L-1 4.75 mm.

L-2 4.50 mm.

L-3 5.00 mm.

L-4 4.50 mm.

L-5 4.25 mm.

7.1 Placement tips

- The upper brackets open occlusally and the lower brackets open gingivally.
- The mesiodistal width of the pad and the mesiodistal edges of the teeth should be given importance.
- Panorex view prior to bracket placement allows to identify root position.
- The internal slot and the horizontal components should be parallel to the occlusal plane. This is of greater importance in the lower anteriors.
- The scribe line of the bracket and crown long axis should be focused while placing the bracket.

Dr. Dwight Damon advises placement of the bracket within the green zone (in between the green lines). The Damon prescription has variable torque prescriptions to foster the need for different clinical cases. A clinician can place the upper and lower mid-bracket slot within the green lines without dramatically impacting torque.

Dr. Thomas. R. Pitts Protocol [19]:

Dr. Thomas. R. Pitts worked with a philosophy of “beginning with the end in mind”. He believed that developing acumen in precise bracket placement is the single most important protocol to achieve an esthetically pleasing smile and functional occlusion.

Basic principles of the Pitts placement protocol:

Detailed bonding plan before the day of bonding and to select brackets of appropriate torque based on the demand of the case.

Ensure tray setup entails all items for an efficient bonding.

Use two assistants to assist in bonding.
Recontour teeth for esthetics and bracket fit.
Follow an exacting placement protocol to achieve an ideal smile arc in the anteriors and leveling buccal cusps and marginal ridges in the posteriors.
Dr. Pitts bonds the maxillary anteriors to achieve a consonant smile arc at the end of the treatment, the mandibular anteriors for overjet and overbite and the remaining teeth for a good occlusion. He first bonds the mandibular teeth, from the second molar to canine on one side, and repeats the same on the opposite side, followed by lateral to lateral. This is followed to achieve symmetry on either side. The same sequence is repeated in the upper arch. He believed in keying off the maxillary canine to ensure that the canine-lateral and canine- premolar contacts are esthetic and functional.
In the posteriors, to achieve leveled marginal ridges and contact points, the teeth are bonded using the contact points as reference. This is done up to the canine and then the incisors are bonded based on the slot of the maxillary canine to give a sweep in the smile arc which gives a pleasing appearance **Figures 1 and 2.**

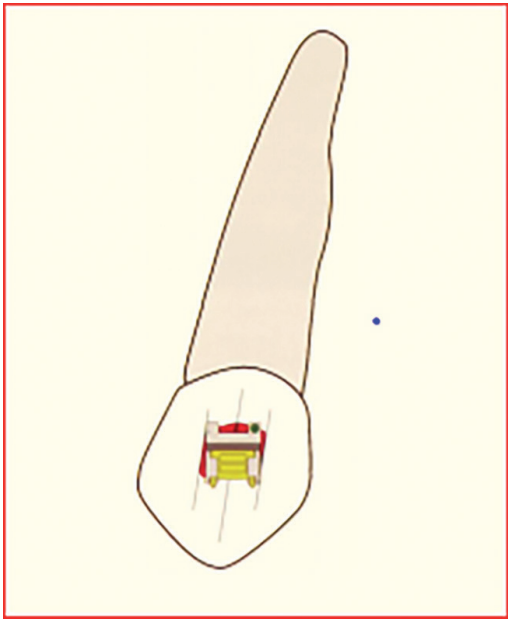


Figure 1.
Standard bracket placement of damon bracket.

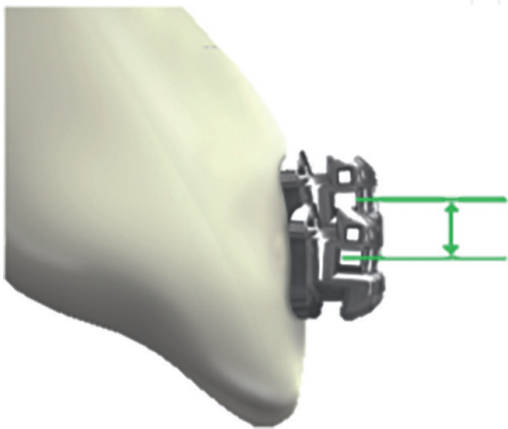


Figure 2.
Picture depicting the “green zone” for bracket placement in the Damon system.

Dr. Pitt's occluso gingival positioning of brackets is slightly more gingival to the conventional placement on both arches. He believed positioning the brackets more incisally will prevent us from achieving the ideal smile arc and hinders torque control (**Figure 3**). Dr. Pitts along with Dr. Mike Steffan developed a method to making the bracket positioning easier by drawing lines on the stone models from contact points for the canine, premolars and molars to prevent mistakes in bracket positioning in the transition of contact points from posteriors to anteriors (**Figure 4**).

7.2 Maxillary anteriors

The position of the maxillary canine is given the prime importance for the sweep in the smile arc. Based on the positioning of this bracket, other anterior brackets were placed. In this method, the incisal edge of the canine bracket wing needs to be placed on a line drawn from mesial to distal contact at the height of contour interproximally. This line was called the mesiodistal (M-D) contact line. The level of the slot of this bracket was used as a reference for maxillary central and lateral incisor positioning. The maxillary lateral incisor bracket is placed 0.5 mm gingival to the canine bracket and central incisor bracket 0.25 mm gingival to this to achieve the ideal smile arc (**Figure 5**) Further to avoid the bracket positioning error, the author advises the use of a two inch large front surface mirror to avoid any error in bracket positioning (**Figure 6**).



Figure 3.
Gingival bracket placement for smile arc protection by Dr. Thomas Pitts.

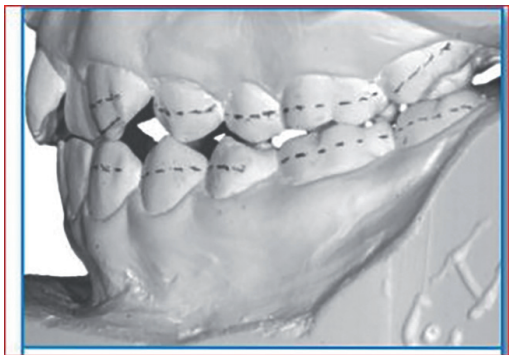


Figure 4.
Marking the contact points reference for establishing occlusogingival positioning of brackets.

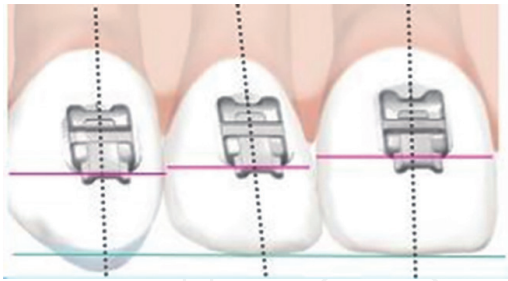


Figure 5.
Bracket positioning in the maxillary incisors and canines.



Figure 6.
Use of a large front surface mirror to prevent errors in bracket positioning.

7.3 Maxillary premolars

The maxillary premolars are positioned by aligning the scribe line with the crown long axis at the height of contour paralleling the central groove and the M-D buccal line angle. Following correct bracket placement, the bracket on the first premolar would seem too distal to the height of contour and the second premolar at times would appear mesial to the height of contour when viewed from the buccal aspect. The occlusal edge of the brackets should touch the M-D contact line (**Figure 7**).

7.4 Maxillary molars

The mesiodistal positioning of the buccal tube is done by centering the buccal tube pad over the buccal groove of the teeth and the occluso gingival positioning is done

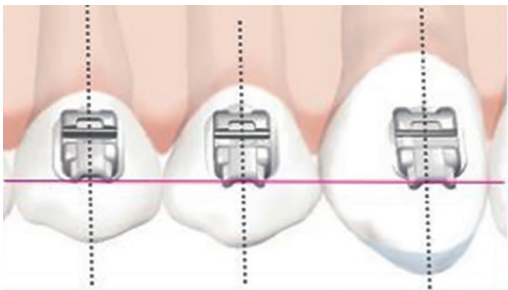


Figure 7.
Bracket positioning in the maxillary premolars.

by placing the occlusal edge of the pad on the M-D contact line of the first molar. The second molars follows the same rule for mesiodistal positioning but placed 1.5 mm more occlusally to the first molar tube (**Figure 8**).

7.5 Mandibular incisors

The mandibular incisors are placed such that the scribe line is aligned with the long axis of the tooth. The bracket position is viewed from the incisal aspect. For deep bite, the position of the top of the slot is 3.5 mm from the incisal edge to reverse the curve of spee and for open bite; the position of the top of the slot is 5 mm from the incisal edge to open the curve of spee (**Figure 9**).

7.6 Mandibular canines

The mesiodistal positioning is done by aligning the scribe line to the long axis of the crown at the height of contour. The position is verified by viewing from the incisal

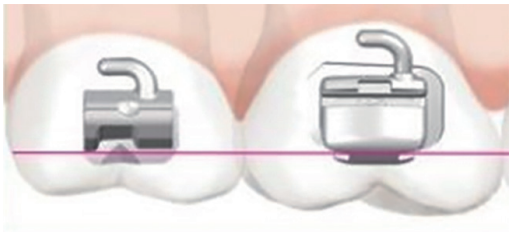


Figure 8.
Bracket positioning in the maxillary molars.

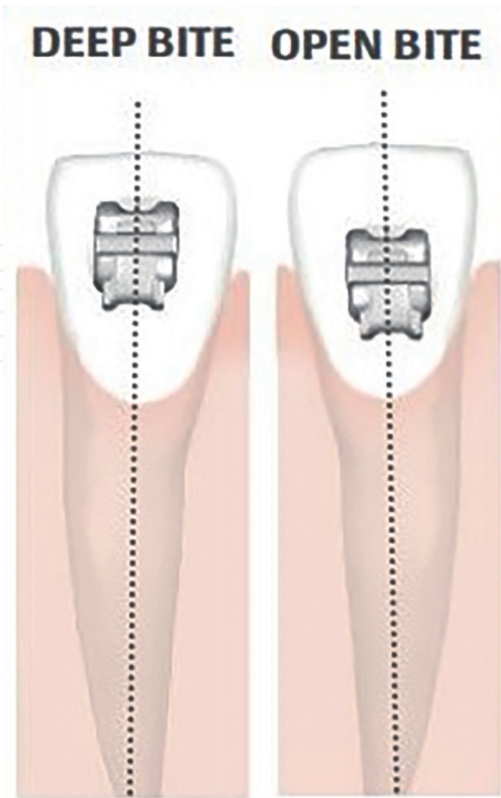


Figure 9.
Bracket positioning in the mandibular anteriors.

aspect. The occluso gingival positioning is placing the incisal edge of the bracket wing at the M-D contact line (**Figure 10**).

7.7 Mandibular premolars

The mesiodistal positioning is done by aligning the scribe line to the crown long axis and viewed from the occlusal aspect. The occluso gingival positioning is based on positioning the occlusal edge of the bracket wing 0.5 mm gingival to the M-D contact line (**Figure 11**).

7.8 Mandibular molars

The mandibular molars are placed in the same way as the maxillary molars in terms of mesiodistal positioning by orienting the center of the buccal tip of the buccal tube with that of the buccal groove of the tooth. Unlike the maxillary molars, both the mandibular molars are placed at the same height, which is 0.5 mm gingival to the M-D contact line (**Figure 12**).



Figure 10.
Bracket positioning in the mandibular canine.

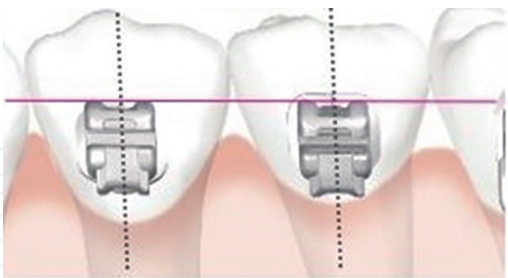


Figure 11.
Bracket positioning in the mandibular premolars.

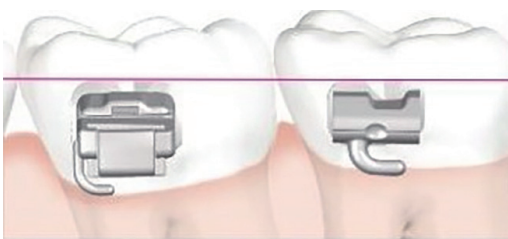


Figure 12.
Bracket positioning in the mandibular molars.

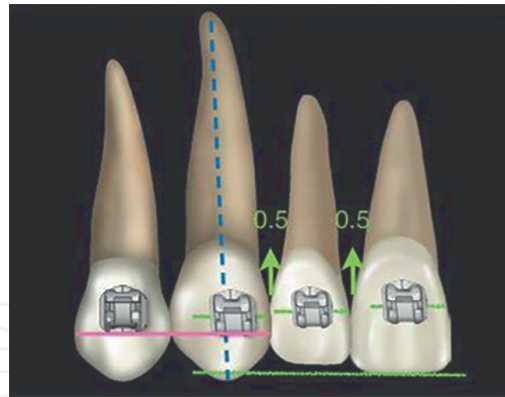


Figure 13.
 Figure showing placement of brackets in the maxillary anteriors.

Another technique that was proposed was the bracket placement in Beethoven's Orthodontic center. The bracket placement was similar to that given by Dr. Pitts except some modifications that were made in the maxillary canines. According to him, the maxillary canine bracket is placed by aligning it 1 mm mesially away from the long axis of the crown. The slot of the canine was used as a reference for placing the incisor brackets. The slots of the central and lateral incisor brackets are raised 0.5 mm consecutively (**Figure 13**).

8. Ideal cases for Damon

Dr. Damon has said that force applied to the bracket should be as light as possible to stimulate tooth movement. His philosophy was to employ the concept of biological adaptation and facially driven treatment plan that focuses on facial esthetics as a critical foundation for diagnosis.

The treatment objective in Damon cases is to

- Gain maxillary and mandibular arch length.
- Establish upper and lower incisor position to give lip support.
- Establish maxillary and mandibular posterior arch width to support mid-face.
- Establish ideal maxillary lip-to-tooth relationship.
- Design treatment mechanics to eliminate need for higher force rapid palatal expansion.
- With low-force mechanics to work with the orofacial muscle complex, bone, and tissue to establish a physiologic tooth position

Damon system can be used in the following cases

- Class I- Non Extraction- Young patient with severe crowding and a flat profile
- Class I- Non Extraction- Adult patient with severe crowding and a flat profile

- Class I- Non Extraction- Young patient- Open bite with posterior crossbite and very narrow deep palate.
- Class I- Non Extraction- Adult patient- Open bite with posterior crossbite and very narrow deep palate.
- Class I- Extraction- Bimaxillary protrusion and crowding.
- Class II division I subdivision with functional shift- Non Extraction
- Class II division I- Severe crowding and deep bite
- Class II division II- Severe crowding and deep bite
- Class III- Severe crowding.

Using the light forces from the Copper NiTi wires and friction less passive self-ligating brackets along with Superelastic NiTi open coil springs wherever required we can achieve a desired treatment outcome with the Damon system.

In case of Class II patients with retrognathic mandibles we can go for Phase 1 therapy with functional appliances or fixed functional appliances.

9. Recent advances

The Damon self-ligating appliances have certain characteristics such as ease in ligation, wire engagement without undesirable force relaxation of elastomeric modules, which helps in maintaining a constant active status of engaged wires. This makes the Damon appliance more suitable than conventional appliances. This is in agreement with the findings by various other orthodontists, Berger [20], Harradine [9], Turnbull and Birnie [4].

Ormco, Damon Company keeps evolving over the years, coming out with different and more compatible bracket systems. Starting from Damon 3©, to Damon 3mx©, to Damon Q©, to Damon Q2© followed by the latest development, the Damon Ultima™© system. In clear ceramic braces from Damon clear© they have recently developed the Damon Clear 2© system.

9.1 Damon Clear2 ©

They are completely esthetic passive self-ligating brackets made of polycrystalline alumina (PCA) material, which is resistant to staining from coffee, mustard, red wine and other agents. It eliminates the need for the use of elastomers (modules) which generally stain and collect bacteria during the course of the treatment.

Damon Clear 2© brackets have a sturdy base with a fortified slide, window channel and tie wings for extra strength and durability. The four solid walls enable effective torque expression and rotation control for a good and meticulous finishing (**Figures 14 and 15**).

The base design of the Damon Clear 2© brackets is a patented laser etched pad that provides optimal bond strength for greater reliability (**Figure 16**). The contours

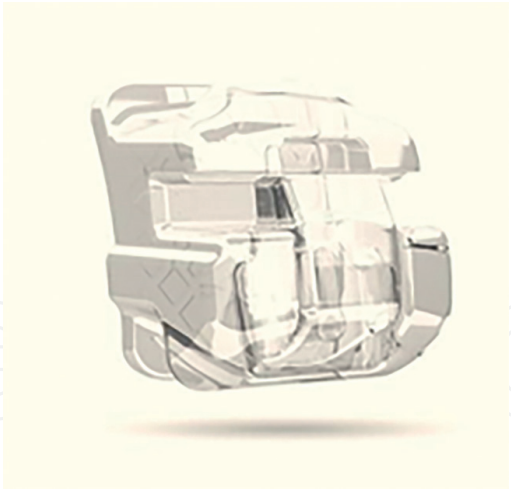


Figure 14.
Damon clear 2D bracket.

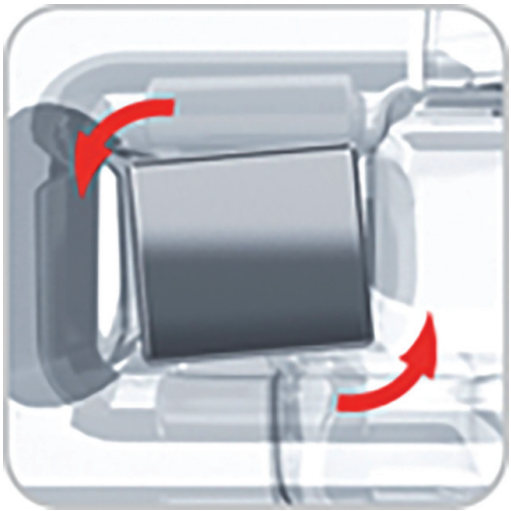


Figure 15.
Enhanced strength for effective torque expression.

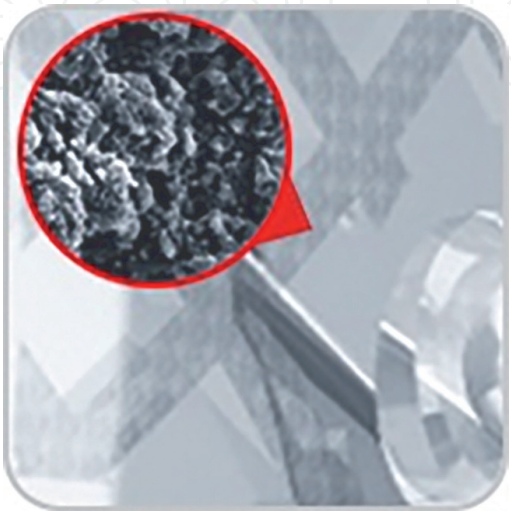


Figure 16.
Laser etched base for enhanced stability.

of the brackets are smooth and rounded, which ensures patient comfort. There is an option to switch to brackets that have discrete contoured hooks for elastics and other auxiliaries (**Figure 17**).

Generally ceramic brackets are thought of as messy, while debonding as they tend to crack and splutter while using a debonding plier to remove the bracket. Whilst, for Damon Clear 2©, Ormco has a patented debonding instrument, the Damon Clear Debonding Instrument ©, which results in fast and comfortable debonding experience for patients (**Figure 18**). There is also no requirement for removing flash after the debonding procedure.

Removable positioning gauge with scaler notch is present in each of the clear brackets for easy and efficient placement of the bracket (**Figure 19**). There are color-coded positioning gauges on brackets (13–23) present that denote torque values.

For a higher efficient and quality treatment, proper wire sequencing must be employed. The initial arch wires being the Damon Optimal-Force Copper Ni-Ti® to low-friction TMA and stainless-steel arch wires. Each wire must have sufficient time to express itself before progression to the next wire. For anterior torque expression,



Figure 17.
Discrete contoured hooks for auxiliaries.



Figure 18.
Debonding of the bracket with Damon clear Debonding instrument ©.

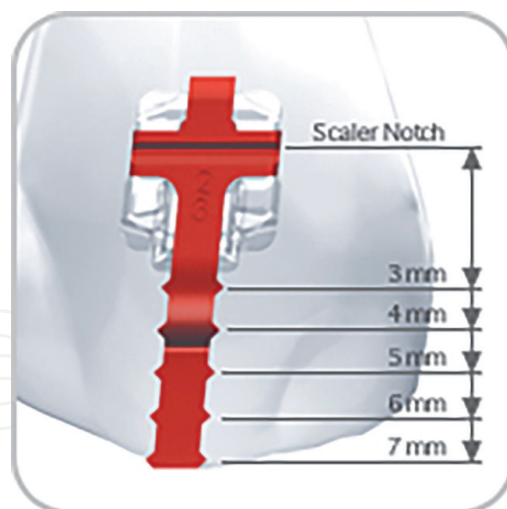


Figure 19.
 Removable position gauge with scalar notch.

either pre-torqued nickel titanium arch wires or TMA arch wires are to be used. For rotational bends, TMA arch wires or titanium niobium arch wires are to be used. However, care should be taken in employing finishing bends in stainless steel wires, since such bends may result in fractures.

9.2 Damon Ultima ©

Damon Ultima TM © was designed and introduced for a faster and a more precise finishing. Traditional passive self-ligating brackets and wires have significant play which generally results in poor control, manual adjustments and extended treatment time. The Damon Ultima TM © system is the first system that is completely reengineered to virtually eliminate play, for a precise control of rotation, angulation and torque [3].

The enhanced features in Damon Ultima TM © are as follows:

- Completely re-engineered tie-wing is said to improve the ability to engage and ligate elastomeric chains (**Figure 20**).
- Smoother tie wings were designed for a better patient comfort and minimal occlusal interference (**Figure 21**).
- The base of the bracket with 80 gauge mesh designed for reliable and increased bond strength throughout treatment and for a predictable debonding experience (**Figure 22**).
- Easy to open and close the slot door design with low reciprocal forces and tactile feedback. The bracket door and wire are designed to reduce door closure interference (**Figure 23**).
- Rhomboid shaped pad with enhanced scribe line help in guiding bracket placement (**Figure 24**).
- Presence of vertical slot for convenient placement of drop-in hooks (**Figure 25**).



Figure 20.
Reengineered tie wing in Damon Ultima TM©.



Figure 21.
Smoother tie wings for patient comfort.

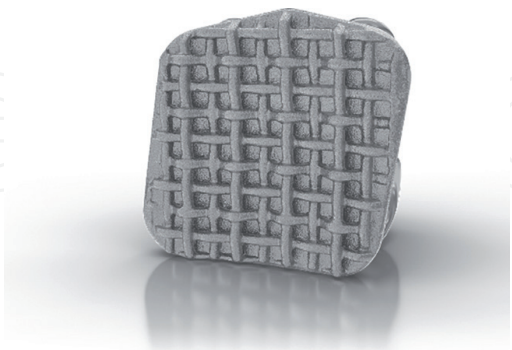


Figure 22.
Base of the bracket of Damon Ultima TM©.

The retrocline and procline bracket options were introduced for enhanced torque control. Brackets were designed from the centre point of the slot to the line-up with the FA point to express desired torque and provide easier and more precise placement (Figure 26).



Figure 23.
The enhanced bracket door design.



Figure 24.
Rhomboid shaped pad in Damon Ultima TM©.



Figure 25.
Vertical slot for placement of drop-in hooks.

Additionally, extra arch wire options were included, for torque control when needed. Sizes available are: 0.019*0.0275, 0.0020*0.0275, and 0.021*0.0275 in Copper NiTi, TMA and SS (**Figure 27**).

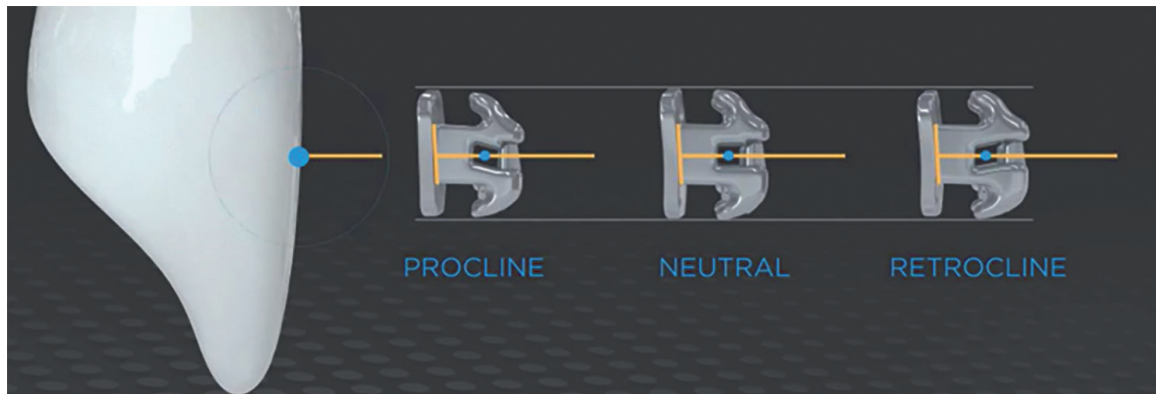


Figure 26.
Adversity of procline and retrocline brackets in the Damon Ultima TM© system, that can be used to incorporate torque whenever needed.



Figure 27.
Reengineered arch wire for better torque control.

10. Conclusion

Passive self-ligation offers the most direct transmission of force from the arch wire to the tooth with very low friction, a very secure ligation along with excellent control of tooth position. Every contemporary modality of orthodontic treatment achieves tooth alignment; however passive self-ligation achieves the results effectively and efficiently. With the evolution of various systems like Damon Clear2 and Damon Ultima ©, the orthodontic tooth movement is achieved at its best.

Conflict of interest

Dr. Suvetha Siva- No conflict of interest with the product (ORMCO).
Dr. Shreya Kishore- No conflict of interest with the product (ORMCO).
Dr. Suganya Dhanapal- No conflict of interest with the product (ORMCO).
Dr. Janani Ravi- No conflict of interest with the product (ORMCO).
Dr. Chandhini Suresh- No conflict of interest with the product (ORMCO).

IntechOpen

Author details


Suvetha Siva^{1*}, Shreya Kishore¹, Suganya Dhanapal², Janani Ravi¹
and Chandhini Suresh¹

1 SRM Dental College, Ramapuram, Chennai, India

2 Sri Ramakrishna Dental College, Coimbatore, India

*Address all correspondence to: suvetha150992@gmail.com

IntechOpen

© 2021 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Ramachandra. C. S. Damon system protocol for management of class I, class II & class III malocclusions [Modular based learning].
- [2] Damon DH. The rationale, evolution and clinical application of the self-ligating bracket. *Clin Orthod Res.* 1998 Aug;**1**(1):52-61
- [3] Birnie D. The Damon Passive Self-Ligating Appliance System. *Semin Orthod.* 2008 Mar **1**;**14**(1):19-35
- [4] Turnbull NR, Birnie DJ. Treatment efficiency of conventional vs self-ligating brackets: effects of archwire size and material. *Am J Orthod Dentofacial Orthop.* 2007 Mar;**131**(3):395-399
- [5] Gianoni-Capenakas S, Flores-Mir C, Vich ML, Pacheco-Pereira C. Oropharyngeal 3-dimensional changes after maxillary expansion with 2 different orthodontic approaches. *Am J Orthod Dentofacial Orthop.* 2021 Mar;**159**(3):352-359
- [6] Lineberger MB, Franchi L, Cevidanes LHS, Huanca Ghislazoni LT, McNamara JA Jr. Three-dimensional digital cast analysis of the effects produced by a passive self-ligating system. *Eur J Orthod.* 2016 Dec;**38**(6):609-614
- [7] Srinivas S. Comparison of canine retraction with self-ligated and conventional ligated brackets-a clinical study. India: Thesis in fulfillment of postgraduate degree, Tamilnadu Medical University, Chennai; 2003
- [8] Eberting JJ, Straja SR, Tuncay OC. Treatment time, outcome, and patient satisfaction comparisons of Damon and conventional brackets. *Clin Orthod Res.* 2001 Nov;**4**(4):228-234
- [9] Harradine NW. Self-ligating brackets and treatment efficiency. *Clin Orthod Res.* 2001 Nov;**4**(4):220-227
- [10] Maijer R, Smith DC. Time savings with self-ligating brackets. *J Clin Orthod.* 1990 Jan;**24**(1):29-31
- [11] Carels C, Willems G. The Future of Orthodontics. Leuven University Press; 1998. 281 p.
- [12] McLaughlin RP, Bennett JC, Trevisi HJ. Systemized Orthodontic Treatment Mechanics. Mosby; 2001. 324 p.
- [13] Fleming PS, DiBiase AT, Sarri G, Lee RT. Comparison of mandibular arch changes during alignment and leveling with 2 preadjusted edgewise appliances. *Am J Orthod Dentofacial Orthop.* 2009 Sep;**136**(3):340-347
- [14] Mandall N, Lowe C, Worthington H, Sandler J, Derwent S, Abdi-Oskouei M, et al. Which orthodontic archwire sequence? A randomized clinical trial [Internet]. Vol. 28, *The European Journal of Orthodontics*. 2006. p. 561-6. Available from: <http://dx.doi.org/10.1093/ejo/cjl030>
- [15] Ong E, Ho C, Miles P. Alignment efficiency and discomfort of three orthodontic archwire sequences: a randomized clinical trial. *J Orthod.* 2011 Mar;**38**(1):32-39
- [16] Rahmani A, Oz U. The Effect of Copper Aided Nickel--Titanium Arch-Wire Sequences on Upper Jaw Expansion: A Comparison with Conventional

Nickel--Titanium Wire Systems in
Medical Decision Support Systems in
Medical Internet of Things. *Journal of
Medical Imaging and Health Informatics*.
2020;**10**(1):238-243

[17] Handem RH, Janson G, Matias M,
de Freitas KMS, de Lima DV, Garib DG,
et al. External root resorption with the
self-ligating Damon system—a
retrospective study. *Prog Orthod*. 2016
Jul 1;**17**(1):20

[18] de Freitas KMS, Vaz de Lima D.
Comparison of changes in dental arch
dimensions in cases treated with
conventional appliances and self-ligating
Damon system. *Open Dent J* [Internet].
2018; Available from: [https://
opendentistryjournal.com/VOLUME/12/
PAGE/1137/](https://opendentistryjournal.com/VOLUME/12/PAGE/1137/)

[19] Pitts T. Begin with the end in mind:
Bracket placement and early elastics
protocols for smile arc protection. *Clin
Impressions*. 2009;**17**(1):1-11

[20] Berger J. Self-ligation in the year
2000. *J Clin Orthod*. 2000;**34**(2):74-81