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Self-Ligating Brackets- A review

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Abstract

Brackets are continuously evolving and with the advent of newer technology, it is now possible for manufacturers to fabricate fixed appliances with a great deal of precision hence more efficient appliances. The self-ligating system offers a number of advantages over conventional systems such as less friction, faster leveling, and alignment, better torque control, and develop esthetic post-treatment results.

Keywords: Brackets, Archwires.

Introduction

Brackets form an integral part of Orthodontic fixed mechanotherapy and carry out biological tooth movement. The brackets have specific inbuilt tip and torque to achieve an ideal tooth position after the completion of the fixed mechanotherapy. The art and science of brackets are continuously evolving and recent advances in the field of metallurgy and CAD-CAM have brought forward newer and advanced bracket systems that have low friction, reduced treatment time due to faster leveling and alignment, and more patient comfort.

One such bracket system is the “Self-Ligating” bracket system.

The goal of this article is to review self-ligating brackets as they form an integral part of fixed mechanotherapy hence orthodontists should have a sound knowledge of the newer systems available.

The self-ligating bracket system is of two types i.e., Active and Passive.

Active self-ligating brackets exert a spring force to the archwire until it is completely seated in the slot, a process Hanson refers to as homing action of the spring. The action and the force of the spring in the bracket exert a force on the archwire to completely seat the archwire in the bracket slot hence the spring clip that stores energy to press against the archwire for rotation and torque control. The various examples of active self-ligating bracket systems are Speed, In-novation, Forest dent Quick.

In passive self-ligating brackets, a slide is present that can be closed and does not encroach on the slot lumen thus exerting no active force on the archwire. The wire is passively restrained in the bracket slot. The various passive self-ligating systems available are Pitts 21 bracket system, Damon self-ligating system, and Smart clip.

Evolution of the Self-Ligating Bracket system

The advent of the Self-Ligating Bracket system dates back to 1935. The Russell attachment was the first self-ligating system developed by Dr. Jacob Stolzenberg.[1]

A flat-head screw was firmly placed in a round, threaded opening on the face of this bracket. The archwire could be easily ligated as there was no requirement for elastics ties or stainless-steel ligatures. The ligating screw could be loosened or tightened by the orthodontics with the aid of a screwdriver. Unfortunately, the Russell attachment did not gain much attention and failed to be recognized worldwide.

Another self-ligating bracket system the “Edge Lok” was developed by Dr. Jim Wildman in 1972. This bracket system had a round body and a sliding cap. The archwire ligation was done with the help of a special opening and closing tool. The fourth wall of the bracket system was passive and rigid and the archwire was housed within the bracket slot. This system was the first self-ligating system and gained commercial success.[2]

A similar passive self-ligating bracket system the “Mobil- Lock” gained popularity in 1980. It was developed by Dr. Franz Sander. A special opening tool was used to ligate the archwire into the bracket slot. The fourth wall worked as a housing mechanism in this bracket system.[3]

However, in the same era, the elastomeric ligatures were also introduced hence Edge Lok and Mobil Lock did not gain much popularity.

The Damon System

In the mid-1990s, Damon SL brackets were introduced, which had a slide that circled around the labial face of the bracket. Under the slide, a short U-shaped wire spring clicked onto the two labial "bulges" to create positive open and closure positions. These brackets were a great improvement, but they had two major flaws: the slides occasionally opened accidentally, and they were prone to breaking.[3]

Damon 2 bracket system

Damon 2 bracket system kept the same vertical slide movement and U-shaped spring to govern opening and shutting, but the main difference was that the slide was concealed within the tie wings of the brackets.

The advancements that were made in the bracket design and with the introduction of metal injection molding manufacturing nearly eliminated inadvertent

slide opening or slide breakage, and accelerated the usage of self-ligation. The brackets, on the other hand, were not always and consistently easy to open, which is a vital feature for a novice user.[4]

Damon 3 and Damon 3 MX brackets

These passive self-ligating bracket systems were a breakthrough as all the problems encountered with the previous versions were resolved in this new advanced design. These brackets had a different action and location of the retaining spring.

However, Damon 3 is the semi-esthetic bracket and early design suffered breakages and bond, failures. Fractured tie wings and separation of the metal from the reinforced composite were the major problems that were encountered. Hence the manufacturers looked into these issues and with the advancement, in the bracket manufacturing process the later versions of these brackets resolved all the problems and at present Damon is the leading self-ligating bracket system that is being followed worldwide.

Damon Q and Damon Q2 brackets

The most recent development in the field of passive self-ligation is Damon Q and Damon Q2.

All the flaws in the previous versions were rectified and newer designs were introduced.

These brackets have 2x rotation control for optimal precision, predictability, and efficiency.

The new features were

1. A new Tie-wing design provides ample under-tie-wing area for better accommodation of power chain, elastics, steel ligatures, and other auxiliaries for treatment versatility.
2. New Drop-in Hook designed to provide improved bending strength and durability with elastics and auxiliaries.
3. A new vertical scribe line along the rhomboid-shaped pad helps guide desired bracket placement.

With the introduction of this new system, it is now easier to perform orthodontic tooth movement with less patient discomfort.

The Speed Bracket System

It was Dr. Herbert Hanson in 1980 who introduced the Speed system. The main feature is a curved, flexible "Super-Elastic Spring Clip" wraps occlusogingivally over a miniature bracket body.

The clip is moved occlusally using either a universal scaler at the gingival aspect of the bracket body or a curved explorer inserted into the labial window to permit archwire placement, then seated gingivally with finger pressure.

Speed stands for (Spring-loaded, Precision, Edgewise, Energy and Delivery system).[5]

The ability of the speed bracket to realign itself three-dimensionally until the archwire is entirely seated in the slot is referred to by Hanson as the "homing action of the spring."

The Quick Bracket System

The active self-ligating bracket system is the Quick bracket. Metal injection moulding (MIM) and sintering are used to create a one-piece structure. A chromium-molybdenum alloy is used to make the elastic clip. The gingival or labial features of this bracket can be opened with a specially developed device. The clip mechanism is simple to use.[6]

The Pitts 21 Bracket System

One of the latest introductions in the field of passive self-ligating brackets is the Pitts 21 brackets system developed by Dr. Tom Pitts.

Pitts 21 enables rapid alignment and better axial torque control.

The design of the bracket slot is 0.021 x 0.021 inch for anterior teeth, 0.021 x 0.023 inch for bicuspids and 0.021 x 0.024 inch for molars.

Early square archwire engagement results in better torque control at the early stages of the treatment.

These brackets work on the Smile arc protection protocol for bracket positioning.[7]

Conclusion

With the advent of the advanced bracket manufacturing process and new biomaterials, it is now possible to fabricate fixed appliances that have state-of-the-art efficiency and patient compliance. The treatment time is reduced and greater control of tooth movement is now in the hand of orthodontists.

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