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Brackets In Orthodontics - Review Article

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ABSTRACT

Orthodontic brackets are an important component in order to deliver the precise force from the wire to the teeth, brackets should have the right hardness and strength. They ought to have a smooth arch wire slot to scale back frictional resistance and an otherwise `smooth surface to scale back plaque deposition.

Keywords: horizontal and vertical slots, brackets, ceramic, metallic, self-ligating, buccal tubes.

Introduction

Brackets act as handles to transmit the force from the active components to the teeth. The aim of this review is to spotlight the orthodontic brackets and the way they assist the orthodontist to offer better treatment aesthetically .[1]

CLASSIFICATION OF ORTHODONTIC BRACKETS

BASED ON THE TECHNIQUE

1.Pin and tube brackets

2.Ribbon arch brackets

3.Edge wise brackets

4.Tip edge brackets

BASED ON THE MODE OF ATTACHMENT TO THE TOOTH

1.Weldable brackets

2.Bondable brackets

BASED ON THE SLOT OF THE BRACKET

1.Horizontal slot brackets

2.Vertical slot brackets

BASED ON THE FABRIC OF THE BRACKET

1.Metallic brackets

2.Ceramic brackets

3.Plastic brackets

4.Ceramic or plastic brackets reinforced with metal

BASED ON THE MODE OF SECURING THE ARCH WIRE

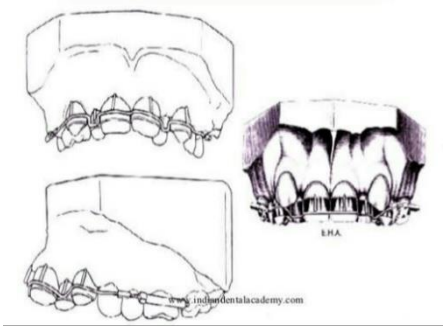
1.Self-ligating brackets

2.Brackets that require ligation

Based on the evolution and its techniques:

Pin and tube bracket:

- Introduced by Angle in 1910.
- It was the primary appliance to maneuver the teeth bodily that employed a bracket and used bands on most of the teeth.(figure 1)
- However, the perfect of e arch appliance had to be sacrificed in order that each tooth might be moved with the pin and tube attachment.
- The arch wires altered as tooth movement was administered, always progressing towards ideal arch form.
- The pin and tube appliance may be a difficult appliance to control and precise and delicate maneuvers had to be administered with each appointment, also the patients were required to return into office for activation every few days.[2]



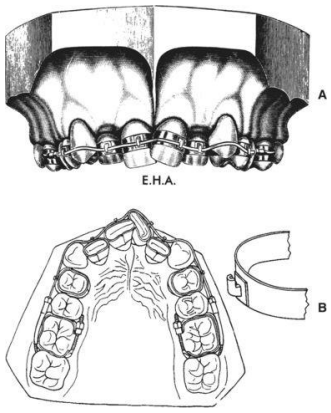
(figure 1)

Disadvantages:

- Relatively heavy base arch meant that spring qualities were poor.
- Many small adjustments were needed.
- Limited mesial-distal control.

Ribbon arch bracket:

- As the pin and tube appliance was difficult to use, Angle in 1915 discovered the ribbon arch appliance.
- Brackets were introduced with this appliance.
- Angle modified the tube on each tooth to supply a vertically positioned rectangular slot behind the tube.[3]
- A ribbon arch of 10 x 20 gold wire was placed into the slot and held with pins.(figure 2)
- The ribbon arch wire was smaller within the horizontal direction, therefore possessing better qualities, and this was the primary appliance with full three-axis control of tooth movement (especially incisors and canines).



(figure 2)

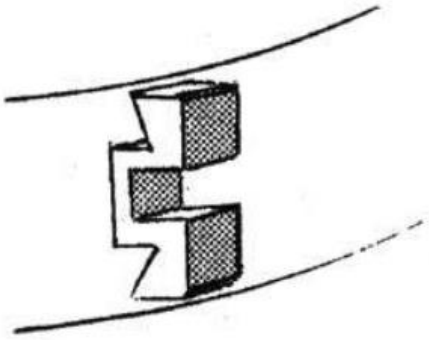
Disadvantages:

- Provided relatively poor control of root position.
- Resiliency of the appliance didn't allow generation of movements necessary to torque roots to a replacement position.

Edgewise bracket:

- Introduced in 1928.
- Angle reoriented the slot from vertical to horizontal and inserted rectangular wire in to it.
- This provided the answer to the issues caused by previous appliances.
- The arch wire held in situ first by a brass ligature and later by a fragile stainless-steel wire ligature.
- The new edge wise bracket consisted of a rectangular box with three walls with within the bracket, 0.022 inch by 0.028 in dimension.(figure 3)
- Provided more accuracy and more efficient torquing mechanisms.

Modern appliances are supported angle's edgewise concepts, with several modifications and variations.[4]



(figure 3)

Tip edge bracket:

Designed by Peter C Kesling.

Design:

- Basically it's a modified straight wire bracket.(figure 4)
- Removed two diagonally opposite corners from rectangular arch wire slot which permit the bracket to tip up to 25degree either mesially or distally. It's "dynamic" slot because:
- Unique feature that the slot increases its vertical arch wire space from 0.022 to 0.028 inch because the tooth tips.
- When the vertical slot is then closed down by the auxiliary against a rectangular arch wire, it produces a three-dimensional precision finish, also it reduces the friction during the primary stage of treatment.[5]
- Lateral extension or wings on the bracket provide good rotational control of tooth position.
- Vertical slot lingual to main arch wire slot [auxiliaries].
- Double buccal tubes:
- Preadjusted convertible straight wire tube (0.022 x 0.028).
- Gingival round tube (0.036 diameter)[.6]

(figure 4.)

BASED ON THE FABRICS OF THE BRACKET:

Plastic brackets:

They were first marketed in the early 1970's and most of the plastic brackets are made from polycarbonate or a modified sort of polycarbonate.(figure 5)

Advantages:

- They were introduced to improve the aesthetic value of the appliances.
- Plastic brackets are available in tooth colored or transparent forms.

Disadvantages:

- Discolour particular in patients who smoke or drink coffee.
- Poor dimensional stability.
- Slots tends to distort.
- The friction between plastic brackets and metal arch wire is higher than metal.

(figure 5)

Ceramic brackets:

Ceramic brackets were introduced in late 1980's and that they are composed of either polycrystalline or mono crystalline alumina counting on their distinct method of fabrication.(figure 6)The primary ceramic brackets

were mono crystalline which were milled from single crystals of sapphire using dimensional tools. Later polycrystalline zirconium or zirconium are introduced to alumina ceramic brackets.[7]

Advantages:

- Superior esethetics and enamel like translucency.
- Better color stability.
- Resistance to wear of deformation.

Disadvantages:

- Enhanced frictional resistance.
- Frequent bracket breakage.
- Iatrogenic enamel damage.
- Difficulties in debonding.

(figure 6)

Metallic bracket:

Metallic brackets have an extended history with successful clinical ends up in orthodontic therapy. Initially, metallic brackets were fabricated from a range of stainless-steel alloys where the bottom and wings were manufactured by casting and/or machining, and different parts were joined by soldering(figure7).Recent advances in manufacturing technology, like laser welding and metal injection molding (MIM) also as in new materials, have enriched the orthodontic market with brackets made from titanium and its alloys, cobalt chromium alloys, and gold alloys. [8]

Advantages:

- Less expensive.
- Sterilized and recycled.
- Resist deformation and fracture.
- Exhibit least friction at the wire bracket interface.

Disadvantages:

- Not aesthetically pleasing.
- Patient tends to have a metallic smile.
- They can corrode and cause staining of teeth[9].

(figure 7)

Self-ligating brackets

A self-ligating bracket may be a ligature less system with a robot built-in to close-off the bracket slot. Secure engagement of the most arch wire into bracket could also be produced by a clip mechanism replacing the chrome steel or elastomeric ligature. Both active and passive self-ligating brackets are developed depending upon the bracket & arch wire interaction.[10]

Advantages

- Secure & robust ligation.
- Reduced friction.
- Enhanced efficiency & simple use.
- Reduced overall treatment time.
- Efficient alignment of severely irregular teeth.
- Better plaque control & anchorage conservation.
- Reduced risk of operator & patient injury including “Puncture Wounds”. [11]

Disadvantages:

- High cost compare to standard bracket.
- Because of their low friction design, some practitioners feel they need trouble expressing the minor tooth movements necessary to end cases.
- The increased size of ligating brackets also can cause occlusal interferences, particularly within the lower anterior position. there's reduced torque expression.
- Failure of the closing mechanism.[12]

Features of Self-ligating bracket

Speed brackets: Introduced in 1980.The bracket features a curved, flexible, super elastic nickel titanium spring clip that embraces the bracket and passes through arch wire.

Activa brackets: Activa brackets had an inflexible, curved arm that rotated occluso-gingivally round the cylindrical bracket body.

DAMON SL 1 Brackets: An edgewise twin bracket with a metal labial cover that straddles the tie wings.

DAMON SL 2 Brackets: Different from original Damon SL 1 by incorporating a flat rectangular slide between the tie wings. However, the brackets weren't immediately and consistently very easy to open. [13]

DAMON 3 and DAMON 3MX Brackets: Damon 3 and Damon 3MX brackets have a special location and action of the retaining spring, and this has produced a really easy mechanism for opening and shutting. They're semi-aesthetic, investigation and correction. System R Brackets: System R brackets originally called In-ovation brackets. This bracket features an interactive clip because it can provide both passive and active control counting on the arch wires used. Smart Clip Brackets: It contains an nickel-titanium clip on all sides of the dual bracket that locks within the wire. The arch wire is inserted by using finger pressure to push it past the flexible clip. Smart clip is additionally available altogether aesthetic ceramic brackets called as CLARITY–SL.[14]

Buccal tubes:

There are housed on the primary and second molars, usually 0.25inch long or smaller with internal dimensions of 0.022 x 0.028 inch. Although bondable tubes are employed by some orthodontic weldable tubes are more common in use.

Maxillary molar tubes are often a mixture of rectangular edge wise and round tube called double tube. the bottom of the tube (offset) at the mesial end is thinnest and thickest at the distal end.

Lingual Brackets:

This system consists of specially designed brackets which is suitable to be placed in the lingual surface of tooth.Not all types of malocclusions are treatable with lingual appliance systems.

Advantages:

1.Esthetic and absolutely invisible.

2.No damage to the labial surfaces.

3.Bio-mechanically efficient during retraction.

4.Easier appreciation of soft tissue response.

5.Easier evaluation of individual tooth malposition and treatment progress .

Disadvantages :

1.Indirect vision hampered accurate bracket placement .

2.Speech distortion.

3.Gingival irritation due to plaque accumulation.

4.Increased chair side time due to difficulty in insertion and ligation of arch wire.

5. The sharp edge lacerates the tongue.

Ideal Cases:

1. Low Angle Deep bite.

2.Class all Division 2.

3.Deep bite,class l with mild crowding,good facial pattern.

4.Deep bite,class 1 with spacing or diastema,good facial pattern.

5. Class lll cases with deep bite.

Difficult cases

1.Surgical cases.

2.Open bite.

3.High angle cases.

4.Poor oral hygiene.

5.Acute TMJ dysfunction.

Conclusion:

The article summarizes the evolution and therefore the functions of orthodontic brackets. As technology advances soon these brackets also will be obsolete and newer ones would take their place. The increase in quality also comes with an increase in its cost. The orthodontist should wisely choose which bracket system would be best for the chosen case and also fulfill the aesthetics requirements of the patient.

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