Orthodontic Brackets -A Review Article

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Abstract:- An effective bonding between the bracket and the tooth surface is necessary for fixed orthodontic treatment to be successful. Researchers have experimented with a variety of materials, including surface preparation processes, orthodontic adhesives, and bonding techniques, to develop the bracket bonding system.The bracket is used as a means of incorporating the bio mechanical regimen into the being treated tooth. More tooth-colored or invisible bracket systems have been developed in response to rising aesthetics demands, without sacrificing their effectiveness. Dr. E.H. Angle was the first to use the term "BRACKET," though he presented the ribbon arch appliance in 1916. A simple stiff L-shaped construction with one arm fastened to a vertical surface and the other protruding horizontally to support a weight as a shelf is what he meant by a bracket.The new age in orthodontics began with the invention of brackets. As time went on, both orthodontists and manufacturers assumed more responsibility for the discovery of novel bracket designs and various bracket systems. The conventional Edge-wise bracket, also known as the Siamese or twin bracket, was introduced as the wave of design improvements continued to build with contributions from Angle, Steiner, Holdaway, Jaraback, Fizzell, Ricketts, and many more. Through clinical trial and error, Dr. Ronald H. Roth created an appliance by first using the typical Andrew Brackets and then changing the values and location of some anterior brackets. The process of changing the brackets is still in progress, though. Even if we utilise the brackets that are currently on the market, it's crucial to understand how they were employed in the past.

Keywords:- *Brackets, Pre-adjusted Edgewise, Archwire, Lingual, Self-ligating, Customized, Ceramic , Plastic ,Titanium, Gold, Twin-Slot.*

I. INTRODUCTION

Brackets act as handles to transmit the force from the active components to the teeth.[(1)] Most malocclusions are treated with orthodontic fixed appliance therapy, and the most popular orthodontic materials are brackets, tubes, band material, ligating materials, and archwires. Placing attachments on the tooth surface allows for the movement of teeth during orthodontic treatment. The attachment of orthodontic brackets is created by welding it to tiny bases made of stainless steel that are attached directly to the tooth's enamel. Recently, adopting fixed orthodontic appliances has become increasingly influenced by aesthetics. Bracket and material manufacturing technology has progressed at an exponential rate. A lot of new technologies, procedures, and designs are developing. These enable the orthodontist to provide patients with the finest functional and cosmetic outcomes. This article's goal is to provide an overview of orthodontic brackets.

II. EVOLUTION

When Dr. Edward Harley Angle created the ribbon arch appliance in 1916, he coined the term "bracket"(fig1). A simple, inflexible L-shaped construction with one arm fastened to a vertical surface and the other protruding horizontally to support a weight, such as a shelf, is referred to as a "bracket”. With the debut of his pin and tube appliance, Angle was the first to design and utilize a bracket-like attachment. In 1915, he improved this attachment and combined it with his new technique, the ribbon arch appliance, which was actually the first orthodontic appliance to incorporate a proper bracket. The pin-and-tube equipment was not properly referred to as a bracket.[(3)]"An orthodontic attachment affixed to a tooth for the purpose of engaging on arch wire and transmitting the neighbouring force to the tooth in the proper, accurate, and effective manner," according to Raymond C. Thurow, defines a bracket.[(4)]Ribbon arch appliance brackets had a vertical slit facing occlusally and were wide gingivo-occlussally. The identical bracket design was adopted by Raymond Begg in 1956, but he flipped it over and positioned the slot so that it faced the gums, creating the modified Ribbon arch appliance.[(3)]The Edgewise appliance, Angle's crowning achievement, was created to make it easier to shift teeth into his concept of the line of occlusion. The main part of the appliance was a metal (soft gold) bracket with a horizontally oriented rectangular slit that measured 0.022" x 0.022"[(2)].In the late 1960s, plastic brackets were introduced primarily for aesthetic reasons, but their propensity to creep deform when transmitting torque loads and their discoloration made them undesirable. In 1987, ceramic brackets made their debut as a more aesthetically pleasing alternative to conventional stainless steel brackets. However, brittleness, incidence of enamel fracture during the de-bonding, and sporadic tie-wing fracture were the most important clinical issues with ceramic brackets.[(4)]

- *PARTS OF BRACKET*

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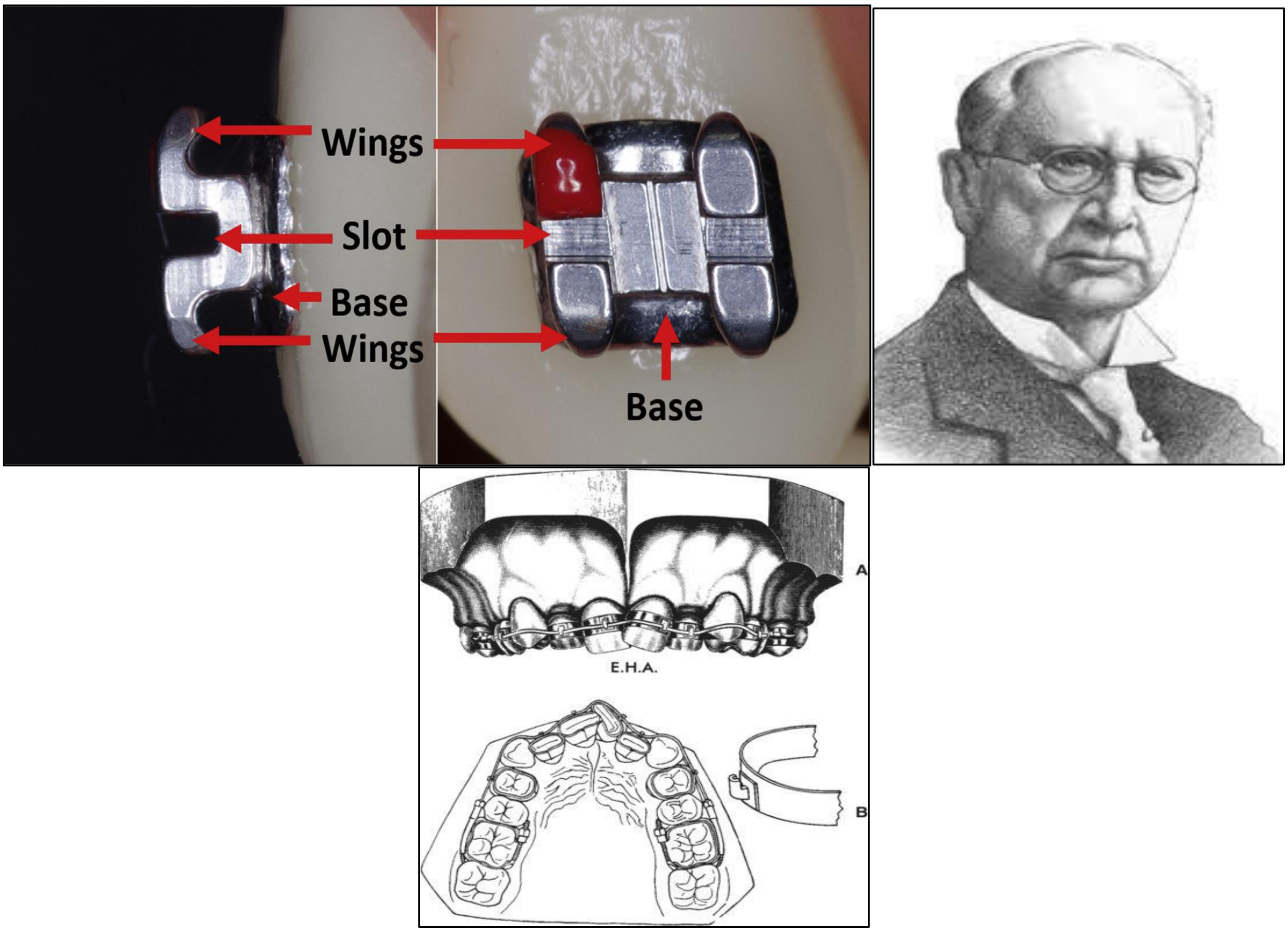


Fig 1: Figure showing parts of bracket ; Edward H Angle ; Ribbon Arch Appliance

➢ *TRADITIONAL BRACKETS*

A rectangular labial archwire was inserted into brackets or tubes fastened to bands that were affixed to specific teeth in Angle's fixed multibanded edgewise orthodontic appliance, which was first developed in 1928. Although it produces light orthodontic force due to the increased inter-bracket distance, the original edgewise bracket introduced by Angle was a single narrow bracket with one set of tie-wings, as shown in (fig 2a). This bracket is inferior to a twin bracket (fig 2c) for rotational and tipping controls.[(3)]

The Lewis bracket (fig 2b) was created to address the Lewis bracket's inability to effectively regulate the rotation and tilting of a tooth. It had mesial and distal extension wings that made contact with the bottom of the archwire.[(4)]

Fig 2a:Figure showing Single bracket

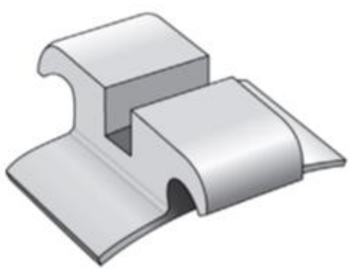


Fig 2b:Figure showing Lewis bracket

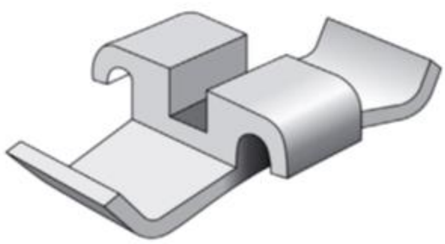
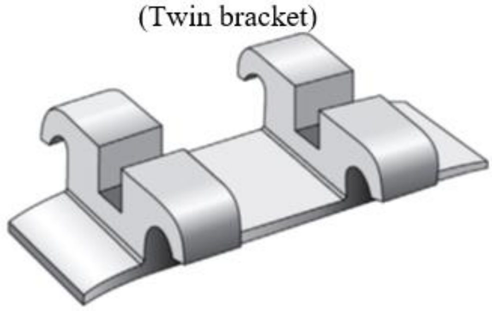


Fig 2c:Figure showing Siamese brackets (Twin bracket)



III. TYPES OF ORTHODONTIC BRACKETS

➢ *METALLIC BRACKETS:*

Metallic brackets have a lengthy history in orthodontic therapy and have shown positive clinical outcomes. Initially, stainless steel alloys of various types were used to make metallic brackets, with the base and wings being cast or machined(fig 3). Soldering was used to attach the various components. Brackets consisting of titanium and its alloys, cobalt chromium alloys, and gold alloys have been added to the orthodontic market because to recent innovations like laser welding and metal injection mounding (MIM).(6)

A variety of qualities, including corrosion resistance, frictional behaviour, and cytotoxicity, improved in brackets manufactured of super SS (SR-50A) with good corrosion resistance. Because of this, it is thought that the SR-50A bracket is more cytocompatible, has a decreased likelihood of causing an allergic reaction, and can be used in clinical orthodontics without risk.(6)

Fig 3: Figure showing Metallic Bracket

➢ *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

➢ *SELF LIGATING BRACKET:*

A self-ligating bracket is one that closes the bracket slot mechanically and does not require ligatures. The primary arch wire is engaged into the bracket by a clip mechanism, which takes the role of the stainless steel or elastomeric ligature. Based on the interaction between the bracket and arch wire, both active and passive self-ligating brackets have been designed (fig 4).(7)

New designs arose, the Time bracket (Adenta GmbH, Gliching, Germany) becoming available in 1994, the Damon SL bracket ("A" Company, San Diégo, CA) in 1996, and the Twin-lock bracket (Ormco Corp., Orange, CA) in 1998, being three designs from that decade. Since the turn of the century, the pace of development has greatly accelerated with the launch of at least 13 new brackets and rapidly increasing sales for such brackets. (7)Correcting the upper and lower dental midlines and filling any remaining gaps with sliding mechanics while employing final arch wires made of 019 X.025 stainless steel completes the procedure(8). Analyzing the amount and direction of tooth movement in each quadrant is crucial to decide whether to extract the tooth or not as well as to select the best anchoring. A ligature-free system with a robot integrated to shut the bracket slot is known as a self-ligating bracket(9). A clip mechanism in place of the chrome steel or elastomeric ligature could also generate a secure engagement of the most arching wire into bracket. Depending on the interaction between the bracket and arch wire, both active and passive self-ligating brackets are produced.[9]

Fig 4: Figure showing SELF-LIGATING BRACKET

➢ *TYPES OF SELF-LIGATING BRACKET:*

Speed brackets: Since 1980, Strite Industries Ltd., 298 Shepherd Avenue, Cambridge, Ontario, N3C IVI Canada, has continued to produce speed brackets with great success. The clips on earlier brackets were too readily moved or warped. These shortcomings have been fixed. The recognizable tie-wings are absent from these brackets.(fig 4a) (12)

Activa brackets: The spinning slide used in Activa brackets (A Company, San Diego, CA) gave the labial surface of the slot a concave inner radius. Alignments have led to reduced slots and increased efficiency Because the bracket is bigger than the typical bracket, the inter-bracket span was reduced, which had negative effects. The lack of tie-wings and the use of a unique bonding base made bracket positioning more challenging(fig 4b) (12).

Time 2 bracket: The clip on the time 2 bracket from Adenta Gmbh spins around the gingival tie wing and towards the occlusal rather than the gingival wall of the slot.(fig 4c)(11)

DAMON SL Brackets: The labial face of the Damon SL brackets ("A Company, San Diego, CA") had a slide that circled around it. The introduction of Damon brackets in the middle of the 1990s significantly increased the popularity of self-ligating brackets. (11)

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DAMON 2 Brackets: Ormco Corp.'s Damon 2 brackets were developed to fix the flaws in Damon SL. Damon 2 brackets are virtually immune from accidental slide opening or slide breaking thanks to the addition of metal injection moulding production and minor design improvements. The brackets,however, weren't always and consistently simple to open.(fig 4e) [10]

DAMON 3 and DAMON 3MX Brackets: The Damon 3 and Damon 3MX brackets from Ormco Corp. offer a highly simple and secure mechanism for opening and closing thanks to a modified location and action of the retaining spring. Damon 3 brackets are also somewhat aesthetically pleasing. Early Damon 3 bracket manufacturing, however, experienced three serious issues: a high rate of bond failure, metal components separating from reinforced resin components, and broken tie wings.(fig 4f) [11]

System R Brackets: The System R brackets, also known as In-ovation brackets, are available from GAC International Inc. at 355 Knickerbocker Avenue in Bohemia, New York 11716. They are conceptually and aesthetically very similar to speed brackets, but have a twin arrangement and tie wings. For the lower anterior teeth, smaller brackets became accessible in 2002. Reduced bracket widths were used in In-Ovation R, and the increased inter bracket span was a result of this lower width. The bracket subsequently became known as system R.(fig 4g) [11]

Smart Clip Brackets: Two C-shaped spring clips are placed on either side of the bracket slots to hold the wire in place in the smart-clip brackets (3M unitek 3M Center, St. Paul, MN55144-1000). Therefore, the force needed to insert or remove an arch wire is applied to the arch wire rather than the clip, which in turn applies the force needed to deflect the clips and enable arch wire insertion or removal. Smartclip is also available in all attractive ceramic brackets dubbed as CLARITY -SL (with metal slots)(fig 4h)[11].

Fig 4a: Figure showing Speed bracket

Fig 4b:Figure showing Activa bracket

Fig 4c: Figure showing Time 2 bracket

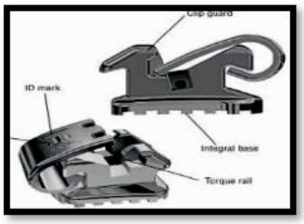

Fig 4d: Figure showing Damon SL bracket

Fig 4e: Figure showing Damon 2 bracket

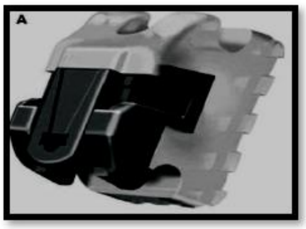

Fig 4f: Figure showing Damon 3 and Damon 3MX bracket

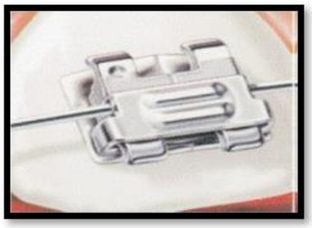

Fig 4g: Figure showing System R bracket

Fig 4h: Figure showing Smartclip bracket

- *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"[13].

➢ *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. [(14)]
- The increased size of ligating brackets also can cause occlusal interferences, particularly within the lower anterior position. there's reduced torque expression. [(14)]
- Failure of the closing mechanism.[(14)]

➢ *CERAMIC BRACKET:*

Aluminum oxide (alumina) particles are used to make ceramic brackets, which come in both polycrystalline and monocrystalline varieties. Nowadays, ceramic injection moulding is used to create the bulk of polycrystalline (many crystals) brackets (CIM).[(15)]

➢ *What CIM entails is as follows:*

Particles of aluminium oxide (Al2O3) are combined with a binder. By using heat and pressure, this mixture is made flowable before being injected into a bracket mould. After the binder is eliminated (burned out), a coherent mass is produced by heating without melting (sintering). The benefit of CIM is the quick and efficient production of several complex and exact goods with smooth surfaces. Monocrystalline (single crystal) ceramic brackets, often known as sapphire brackets, are produced in a totally distinct manner.[(15)]

The monocrystalline brackets are heat-treated after milling to remove surface flaws and to release tension brought on by the milling process. When compared to the production of polycrystalline brackets, the cost of making these brackets is higher. The complexity of milling is what led to this increase in costs.[(15)](fig 5)

- *A novel customized ceramic bracket for esthetic orthodontics:*

Through the use of intraoral scanning, cone-beam computed tomography (CBCT), three-dimensional (3D) photography, and computer-aided design and computer-aided manufacturing (CAD/CAM) technologies, a novel customised system enables the assessment of progress in 3D and treatment planning with brackets, and wires. A wide range of specialised orthodontic appliances, such as metal labial or lingual brackets and clear aligners, are currently advancing quickly and attracting increasing attention. While this is going on, standard orthodontic brackets are under severe threat from personalized appliances. Fixed tailored appliances have shown to improve patient comfort, improve treatment outcomes, and cut down on chair time and overall treatment duration [(16)].

Fig 5 :Figure showing CERAMIC BRACKET

➢ *POLYCRYSTALLINE CERAMIC BRACKET*

Aluminum oxide particles and a binder are mixed to create polycrystalline brackets, which may then be shaped into a bracket-like shape using a mould. To burn off the binder and fuse the particles together, the moulded mixture is heated to temperatures above 1,800°C. The slot dimensions and other important tolerances are then provided on this fused component through machining with diamond cutting tools. To eliminate surface flaws and relieve pressures brought on by the cutting operations, the machined bracket needs to be heat-treated.Polycrystalline ceramics cannot have both strong optical characteristics. The degree of transparency or translucency increases with the size of the ceramic grain. But after the grains are roughly 30 microns in size, the material starts to weaken[(17)].

➢ *SINGLE CRYSTALLINE CERAMIC BRACKET*

Brackets made of single crystal ceramic are produced using a totally distinct method. Aluminum oxide is formed into single crystals by melting it at temperatures above 2,100°C. This results in synthetic sapphire. In order to enable a carefully managed crystallisation, this mass is slowly cooled. The resulting crystal is more pure than its equivalent in nature[(17)].

➢ *PLASTIC BRACKET*

Advertising for plastic brackets first appeared in the early 1980s(fig 6). They were quickly adopted by orthodontists as an attractive alternative to metal braces. acrylic was used initially, and then polycarbonate. It didn't take long to discover their inborn faults, which included staining, odours, but more significantly, a lack of strength and stiffness that caused bonding problems, tie wing fractures, and irreversible deformation a simulated intraoral situation, Harzer et al. found that polycarbonate brackets had higher torque losses and smaller torquing moments than metal brackets. Recently developed and gaining popularity are high-grade medical polyurethane brackets and polycarbonate brackets strengthened with ceramic or fiber-glass fillers and metal slots. Polycarbonate brackets with metal reinforced slots show less creep than regular polycarbonate brackets, yet torque problems still occur. Over the course of 24 hours, the torque of polycarbonate brackets with metal lining and ceramic reinforcement both decreased by roughly 15%. However, they

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outperform polycarbonate brackets in terms of performance, and with more study, they might be able to compete with ceramic brackets.When comparing the torque deformations of seven commercially available plastic brackets to stainless steel brackets, Sadat-Khonsari et al. discovered that pure polyurethane, pure polycarbonate, and fibre glass reinforced polycarbonate brackets all experienced the least degree of distortion. Ceramic reinforced polycarbonate brackets showed the highest distortion when subjected to torque strains. For the lack of stiffness and strength in the original polycarbonate brackets, fibreglass and ceramic have been added to the plastic brackets.[18]However, the addition of ceramic and fiber-glass to plastic brackets did not greatly improve the torque stability of the polycarbonate brackets, despite the fact that pure polyurethane brackets did not significantly differ from pure polycarbonate at optimal torque. Comparing plastic brackets to stainless steel brackets demonstrates that plastic brackets are only suitable for clinical application if they have a metal groove[18].

Fig 6: Figure showing PLASTIC BRACKET

Usually mechanical, resin orthodontic adhesive bonding to plastic brackets is accomplished by adding macro retentive components to the base (Brantley and Eliades, 2001). It has been suggested that plastic bases be primed with methacrylate to improve inter facial strength. None of the newly tested brackets required this step, as per the manufacturer's instructions. Most brackets showed a rough micro morphology at the base to improve bonding area and, consequently, micro mechanical interlocking. A significant central retentive indentation was present in the brackets with sub-millimeter rectangular retentive elements (AL, BR, SP, and SL), which increased torque resistance. This feature was absent from the bases with solid horizontal protrusions (AV, EL, and OF), which already have inherent torque resistance.[19]

➢ *LINGUAL ORTHODONTICS*

Clinician preference affect the choice in some cases as it has been reported that lingual orthodontics has many favorable outcomes like favorable position for anterior teeth], diastema closure, pre-prosthetic tooth movement, surgical cases, class I with generalized spacing or with mild crowding and Class III cases[20].

Lingual orthodontics covers the lingual side of the teeth with brackets, making the appliance virtually invisible. An effective method has arisen as a result of the lingual appliance's and the procedures' significant advancements over time. It has undergone extensive clinical testing over a long period of time and delivered positive outcomes.[21]

The opening of the arch wire slots to the occlusal aspect rather than the lingual aspect forms the basis of the design. Arch wire insertion with lingually opening slots is more difficult than arch wire insertion with the occlusal technique. The occlusal side of the first 1 mm of the molar tube opens, enabling clear direction for inserting the arch wire occlusal to the arch wire plane.The remainder of the arch wire travels gingivally right into the occlusal aperture of the bracket slots as the ends of the arch wire are put into the tubes. As opposed to lingually opening slots, which calls for the arch wire to be inserted distally past the anterior brackets, constricted lingually to engage premolar slots, and then brought mesially to fully engage the anterior brackets. This explains why it is so challenging to insert and remove stiffer arch wires from lingually opening arch wire slots. The arch wire won't pull out of an occlusal slot with space-closing mechanics, which is another advantage. This does away with the unique, time-consuming ligation techniques (double-over ties) required for lingually implanted devices (fig 7)[23].

➢ **KRUZ lingual appliance**:

Kruz developed the first lingual appliance in 1979[23].

➢ **CONCEAL system**:

Developed by Thomas Creekmore in 1989. The opening of the arch wire slots is occlusal rather than to the lingual aspect. This occlusal approach makes arch wire insertion, seating, and removal easier than arch wire insertion with lingually opening slots[23].

➢ **FUJITA lingual brackets**:

This system was first introduced in 1979 and developed mushroom bow line appliance, latterly modified by Ryoon Ki Hong and Hee Wook Sohn. Firstly it featured a niche that opened towards the occlusal. A lockpin was fitted mesiodistally in to a groove in the niche to secure the bow line in confluence with elastomers and ligatures. Modified to classes for the anterior teeth and premolars now have three places occlusal, lingual, and perpendicular. Molar classes have five places one occlusal, two lingual, and two verticals. Each of the three types of archwire places provides different capabilities for effective tooth movements. Main occlusal niche 0.019”x0.019”easier archwire insertion, seating, and junking than with lingually opening places..018" X.018" lingual niche partial canine retraction. The molar type has .028" X.022" external and.018" X.018" inner lingual places(" niche in niche"). The.016" X.016" perpendicular niche permits the insertion of supplementary uprighting springs or elastic hooks on one or further teeth at any time during treatment.[23] The maturity of orthodontic issues that can be resolved with conventional labial system, similar as tooth misalignment, anteroposterior disagreement, and pre-prosthetic surgical cases, can be resolved with lingual orthodontics[24],[25]. This fashion contains of classes that are precisely made to fit the lingual face of the tooth[26]. Compared to youngish cases, the adult patient population is more reticent to commit to orthodontic procedures[27]. Due to utmost grown-ups' preference for its aesthetic appeal, lingual orthodontic treatment has grown in fashionably with the rise in adult cases in orthodontic services(fig 7)[28],[29].

➢ *ADVANTAGES:*

Due to differences in surface morphology, plaque retention, salivary flow, and mechanical cleaning of surfaces by the tongue, lingual surfaces of the teeth appear to be less prone to caries than buccal surfaces, and it is the best option for adolescent and adult patients. Because aesthetic concerns are a major concern for these patients [30], the main benefit of lingual orthodontics is that it is the most aesthetically pleasing treatment[31].

➢ *DISADVANTAGES:*

Placing brackets on the lingual surface is very uncomfortable for the patient and can cause speech issues, tongue inflammation, and ulcers on the tongue's edge .

However, due to anatomical variances in the lingual surface and lengthy chair times for both patients and orthodontists, the practitioner also experiences challenges with the insertion, handling, and positioning of these appliances and brackets. over time, brackets may modify the morphology of teeth[31].

Fig 7: Figure showing FUJITA LINGUAL BRACKET

➢ *TITANIUM BRACKETS:*

The use of titanium (Ti) in medicine and dentistry has increased in the last three decades.Titanium has been considered to be the suitable material for use in both dental and prosthetic implants. Titanium brackets plays significant role in overcoming the cons of stainless steel brackets. The Ni and Cr elements in stainless steel brackets are known to induce allergy, toxic, or carcinogenic effects . The use of titanium brackets is favourable in the treatment of patients with allergy to nickel and other materials. Titanium brackets are the improved alloys of increased hardness and corrosion resistance.Titanium (Ti) has been recently introduced as an alternative material for the production of metallic orthodontic brackets[31](fig8).

➢ *COMPOSITION AND TYPES:*

Commercially pure (CP) titanium that has been alloyed with alpha-stabilizing elements like oxygen and nitrogen is known as an alpha Ti alloy. High creep strength and enhanced weldability are features of this alloy. The two types of titanium brackets now on the market are one with a Vickers hardness (HV) comparable to grade II commercially pure titanium and one with grade IV commercially pure titanium [13,14]. Titanium brackets can be built of pure titanium or a titanium alloy (Ti-6Al-4V). Titanium brackets are made up of 99% titanium, 0.30% iron, 0.35% oxygen, 0.35% nitrogen, 0.05% carbon, and 0.06% hydrogen[32].

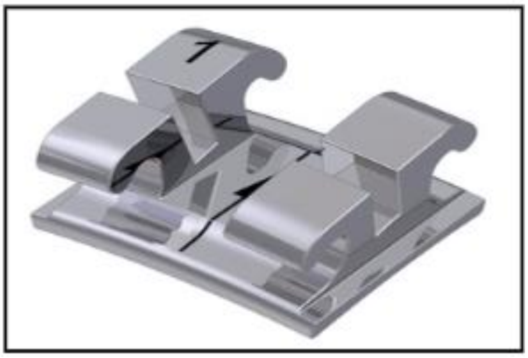

Fig 8 : Figure showing TITANIUM BRACKET

➢ *ADVANTAGES***:**

- Non allergic to tissues
- Highly biocompatible
- Shows superior dimentional stability.
- Increased corrosion resistance[32].

➢ *DISADVANTAGES:*

- Increased plaque accumulation and marked change of color with titanium brackets.
- Exhibit lower static and kinetic frictional force as the wire size increased[32].

➢ *TWIN - SLOT BRACKETS IN ORTHODONTICS:*

Twin-Slot brackets is a newly designed brackets featuring two horizontal slots on the facial aspect.A typical edgewise appliance served as the basis for the prototype bracket's initial design. On the bracket's facial aspect, there were two parallel slots with a 0.4 mm spacing between them. The bracket height was not greatly increased, but this width did separate the two slots. The slots measured between 0.022 and 0.028 inches. The bracket's overall dimensions were 2 3.5 mm2. The slots had a rectangular (90 degree) cross section but no built-in prescriptions(fig 9)[33].

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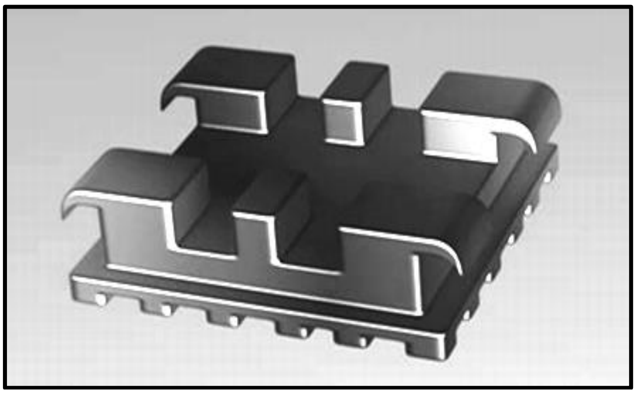

Fig 9:Figure showing TWIN-SLOT BRACKET

Twin-slot bracket tooth movement effectiveness was evaluated and contrasted with edgewise bracket tooth movement efficiency. Labiolingual, derotation, mesiodistal tipping/uprighting, and mesiodistal body translation are three orthodontic tooth movement techniques that needs a significant force moment[33].

The significance of the variations in canine relocation between the two bracket types was examined statistically using a t-test. The findings revealed that, in the twin-slot bracket group, the canine position was treated by derotation and uprighting at 40° and 25°, respectively, as opposed to 20° and 10°, respectively, in the edgewise group (P 0.01). The mesiodistal angulation of the canines in the twin-slot bracket group remained unaltered when retracted into an extraction area with an initial 10 degrees of mesial tip, but the canines in the edgewise group distally tipped by 5 2 degrees (P 0.01). The twin-slot bracket considerably expanded bracket width without decreasing inter bracket spread, allowing for enhanced power generation[34].

➢ *GOLD BRACKETS IN ORTHODONTICS:*

Standard silver braces are made of stainless steel, just as gold braces, except that the latter are covered with gold. Due to the fact that gold is thought to be more fashionable, attractive, and for some, a symbol of high socioeconomic standing, some people prefer the appearance of gold braces over regular braces.(fig 10)

Fig 10: Figure showing GOLD BRACKET

Like ordinary braces, gold braces are typically made of stainless steel, but the brackets and wires have a gold plating or coating.However, in some circumstances, braces can be coated in actual 24-karat gold, which gives them a more expensive appearance and is also advantageous for people who might be allergic to other metals. If the braces are gold for purely aesthetic reasons, they might just be coated with a gold-colored material.[35]

➢ *ADVANTAGES:*

- **Bacterial resistance:** Since gold doesn't corrode or attract plaque accumulation, it is simple to keep clean and clear of bacteria.
- **Easy to shape and mould:** Because gold is a more malleable metal, you may be able to receive personalised brackets that match the size and shape of your teeth.
- **Non-toxic:** Because gold is non-toxic and less reactive than other metals, it may be a safer choice than other materials.

Gold brackets are nickel-free, making them anti-inflammatory and anti-allergenic.[35]

➢ *FRICTIONAL EVALUATION:*

After being used in a clinical setting, brackets have a rougher surface, a higher coefficient of friction, and a higher friction force. Intraoral ageing affects brackets, both traditional and self-ligating. After 24 months of exposure to the oral environment, the metallic brackets' highest distance between peaks and valleys (Rtm) grew.

With use, the sliding mechanics' maximum levels of friction dropped. The steel ligature, loosely fastened across all four bracket wings, provided the lowest amounts of friction for fresh brackets during ligation. The lowest static friction values were seen in experiments utilising brackets that had been exposed to the oral environment for 12 or 24 months[36].

➢ *BRACKETS SURFACE ROUGHNESS ANALYSIS:*

The Rtm analysis showed that the brackets, as supplied from the manufacturer, had reduced surface roughness values. In comparison to the other two groups, the bracket group showed the highest Rtm levels after 24 hours of intraoral usage. These findings are consistent with studies in the literature that assessed how the surface roughness of metallic orthodontic wires changed following use in the oral environment. The authors' conclusion that such exposure increased the diversity, kind, and quantity of surface imperfections is supported by the data.[37]

➢ *CORROSION OF ORTHODONTIC BRACKETS:*

The regions where the bracket base and the bonding or tooth surface are poorly bonded cause areas of corrosion of the stainless steel. The usage of Type 304 metal is the main contributing factor, although other elements including galvanic action, the design and construction of the bracket base, and the unique oral environment (including distinct plaque microorganisms) may also be to blame. Another important aspect would be the thermal recycling of brackets.

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For orthodontic attachments, the more corrosion-resistant stainless alloys would be recommended to reduce corrosion[(38).]

➢ *IMPACT ON MICROBIAL PROFILE:*

The incidence of potential periodontal pathogens in subgingival dental plaque from gingivitis lesions in orthodontic patients was significantly different, according to Lee et al. Samples from orthodontic patients were substantially more likely to include *Tannerella forsythia*, *Treponema denticola*, and *Prevotella nigrescens* than samples from non-orthodontic patients. According to Papaioannou et al., the salivary pellicle appears to increase Porphyromonas gingivalis adherence and biofilm production on orthodontic brackets, although the material used to make the brackets has little effect on the bacterial population. This demonstrates that the presence of periodontal pathogens in dental plaque may vary locally as a result of wearing orthodontic brackets[(39).]

Dental caries and demineralization are sporadic side effects of orthodontic treatment. There were comparable levels of *S.mutans* and *Lacidophilus* in plaques isolated from the two bracket types, two species that are frequently linked to dental caries. Results of an in vitro study conducted by Fournier et al.13 showed that *S.mutans* had weaker adhesion to metallic brackets than it did to plastic and ceramic brackets, suggesting that metal brackets had a lower potential for bacterial accumulation than plastic and ceramic brackets. The current study indicates that these variations in in vitro adhesion may not have much of an impact on the microbial populations that inhabit orthodontic brackets in vivo[(40).]

Plaque micro-flora may be negatively impacted by bracket designs. The positioning of brackets with varied designs can increase or decrease the risk of periodontal disease over time, but the long-term effects have not yet been fully understood. It would be feasible to identify any potential clinical importance of these minute variations in plaque composition among various types of brackets through clinical examinations of patients' dental and gingival health. To make sure that the brackets are made to prevent plaque adhesion, periodontal maturation, and preservation of periodontal health, it is essential to understand the periodontal difficulties of various orthodontic bracket systems used with fixed equipment[(40).]

IV. CONCLUSSION

It is mandatory to understand different orthodontic bracket systems used with fixed appliances. The rise in quality also comes with a rise in the cost. Its the duty of the orthodontist to wisely choose the bracket system which would be the best and also fulfill the aesthetic requirement of the patient.

The evolution of orthodontic brackets and their subsequent uses are summarized in the article. These brackets will soon become obsolete as technology develops, and newer ones will take their place. The cost rises along with the improvement in quality. The orthodontist should select the best bracket system which is ideal for the selected case and satisfy the patient's requirements for aesthetics.

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