

Orthodontic Fixed Retainers-A Review

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Abstract

Orthodontic retention is defined as holding the teeth in aesthetic and functional position following orthodontic treatment. Retention is necessary for rearrangement of gingival and periodontal tissue health after orthodontic treatment. Prerequisite of retention phase has been discussed by several researchers. Both removable and fixed retainers have been in use by the clinicians for many years. The objective of this paper is to review the fixed retainer, their evolution, clinical implications, their failure types and their rate, types of fixed retainers, techniques, their hygiene status, and latest newer technologies.

Keywords: Retainers fixed bonded retainers, lingual retainers.

Introduction

Orthodontic retention is defined as holding the teeth in esthetic and functional position following orthodontic treatment(1). Retention is a part of active orthodontic treatment. It is necessary for the rearrangement of gingival and periodontal tissue health after orthodontic treatment(2). After the orthodontic tooth movement, periodontal tissues need to remodel to maintain teeth in its new position. Without retention, teeth tend to return to its original position(2). Relapse of teeth can occur mainly due to the tension develops in between the dentogingival and

interdental fibers(3). Researchers suggested that retention is necessary to hold teeth in their corrected position. The only limited number of orthodontist suggested that retention is not necessary(1). In 19th century Kingsley suggested that occlusion of teeth is an important factor in determining the stability in a new position(4). In the middle of 1920s, Lundstrom stated that in the correction of malocclusion and maintenance of teeth in the final position the important factor was apical base. McCauley also stated that for stability intercanine width and intermolar width should be maintained(1). In 1944 Tweed reported that incisors should be placed upright to maintain stability(5). Stability is the primary objective of orthodontic treatment(1). Both removable and fixed orthodontic retainers have been used by the clinicians for many years to maintain the stability of the outcome. Fixed retainers were 1st introduced in 1970s to prevent relapse of the lower incisor area(6). Fixed retainers have shown to be effective in retaining anteriorly aligned teeth after post orthodontic treatment in the long term(7). Fixed retainers consist of orthodontic wires that are bonded on to the lingual side of teeth. A study published in 2011, reported that 42% of fixed retention was used most frequently in the mandibular arch and 11% was used in the maxillary arch⁸.

Evolution of fixed bonded retainers:

Buonocore introduced acid etch technique which heralded as a new area in dentistry(8). In 1965 Newman was the first person who discussed the direct bonding to orthodontic attachments(9). Then in 1973, Knierim(10) suggested the use of this technique in retention purposes. Initially, round or rectangular wires were used for fixed retention. Wire size 0.016x0.022 stainless steel was popular that bonded to upper and lower lingual surface of anterior teeth. Later In 1977, Zachrisson(11) suggested the benefits of multistranded wire in the fixed retention. He

said spiral wire gives good retention for the adhesive. In 1982 Artun and Zachrisson(12) suggested the technique of bonding of multistranded wires cuspid to cuspid only. Later Zachrisson(13)proposed the technique bonding of all the anterior teeth by the multistranded wire. It was hypothesized that flexible wire permits more physiologic movement. In his paper he suggested bonding of wire size 0.0215 inch 5 stranded stainless steel or gold coated wire gives excellent retention. In the last 10 years(14), multistranded wire retainer has gained popularity. With that resin, fiber strips(15) came in the market as an alternative to multistranded wires. Nowadays newer digital scanning technology, 3D technology are in the use.

Types

Two designs of fixed retainers are generally used. They are fixed canine to canine retainer and flexible spiral wire retainer(7). Fixed canine to canine mandibular lingual retainers were 1st developed in 1973 that *1st generation*(10) consists of 0.025-0.036inch round stainless steel or blue elgiloy wire bent into loops and bonded on to the lingual surface of either side of canine. This 1st generation was effective in holding intercanine width but was less effective in preventing the rotation. Then the *2nd generation*(16) consists of 0.032inch stainless steel 3-stranded wire bonded to all the anterior teeth(seeFigure1(3)).Multistranded wire allows the physiologic movement of teeth because of their flexibility. This multistranded wire used for more than 10years with less failure rate approx 15%. This wire was less comfortable than the round wires. The *3rd generation*(17) (18) used thick 0.032inch stainless steel or 0.030inch gold coated plane wire, instead of retentive loops sandblasted their ends with 50 to 90µm aluminium oxide particles to increase the micromechanical retention bonded to the canine of either end. Retentive pads have also used at the end of wire alternatively. The disadvantage of this

generation was possibility to move the anterior teeth labially when the retainer only bonded to canine to canine even though in case of normal overjet or overbite they were protected by upper anterior teeth. The 4th generation(19) 0.0215 inch more flexible wire-bonded to each tooth of the anterior segment. This provides more physiological movement of teeth. The 5th generation(19) 0.032inch sandblasted plain elgiloy wire bonded to canine only.



Figure 1: Multistranded wire retainer

Techniques

There are two techniques to fix the retainers(20).

1. Direct bonding technique
2. Indirect technique

Direct bonding is the most common technique. In this technique, composite pads are directly placed into the patient's mouth with or without prefabrication of the wire by a laboratory technician. Then in the late 1990s the indirect bonding technique proposed as an alternative of direct bonding technique(21). In this composite pad 1st prepared on to the patients cast instead of directly prepared into the patient's mouth. Studies considered that indirect technique requires less time than the direct bonding technique. A study conducted in 2011 compared the failure rate of two bonding techniques and concluded that there is no difference in failure rate between direct

and indirect bonding techniques(22). Laboratory constructs two basic types(23) of retainers that are metal mesh pad retainer or custom composite pad retainers. In 1980 metal mesh pad were more popular. Metal mesh pad retainers(23) were connected to each tooth by the wire. These retainers are more stable but are technique sensitive and difficult to fabricate in the laboratory. Nowadays custom composite pad retainers are more popular. In this retention wires aligned on to the lingual surface of patients cast and over that custom composite pad directly placed over that. This pad is then cured and resulting in a custom fit composite pad. The custom composite pad is durable. Both custom composite pads and metal mesh pads can be bonded either by self-cure or light-cure(23).

Newer technology

As we are living in the advanced world. With the help of CAD/CAM(24) we can fabricate fixed lingual retainers that are made up custom cut 0.014x0.014inch rectangular nickel-titanium wire. The nickel-titanium wire is flexible and easily adapt to the lingual surface of teeth. Memotain(25)(seeFigure2(26))is the first digital lingual retainer. This was invented by Pascal Schumacher in 2012. The name memotain is a combination of memory and retainer. This memotain wire is an alternative of multistranded wire. Memotain wire has a good precision fit, corrosion resistance, avoidance of interference, and minor tooth movement. Another the SureSmile(27) wire (OraMetrix, Richardson, Tex) uses a copper-nickel-titanium wire.



Figure 2: Memotain

Indications of fixed retainer(2)

1. Maintenance of lower incisor position during late growth: Even a small amount of growth between the age of 16 and 20 can cause re crowding. Relapse is every time accompanied by the lingual tipping of the central and lateral incisors.
2. Diastema maintenance: teeth are maintained permanently or semi-permanently bonded together with the retainer to close the space between them.
3. Maintain pontic and implant space: fixed retainers maintain a space where bridge pontic and implant will be placed.
4. Keeping extraction spaces closed in adults.

Clinical Implications

The two designs fixed canine to canine retainer or multistranded retainer bonded to incisors or canine become so popular. These multistranded wire retainer gained so much of popularity because of their flexibility, control mandibular incisors, allow physiologic movement to teeth. Multistranded wires have so much of a drawback that are plaque accumulation, difficulty in flossing, irritation of tongue and occlusal interference. Some clinical studies reported failure rate of 23% to 58% with maxillary retainers and 5% to 37% with mandibular retainers(28).

Failure types with fixed retainer

Different types of failure(14) observe with fixed retainers. Patients should be instructed that if they observe any failure with fixed retainers, they must have to visit dental clinic immediately.

1. Failure at the enamel adhesive interface: The reason for failure is moisture contamination during bonding and due to extreme force during the biting hard food.
2. Failure at wire adhesive interface: This is the most common type of failure that occurs mostly due to the inadequate bulk of adhesive or due to the abrasion of adhesive(29).
3. Fracture of wire: This may occur due to the metal wire fatigue.
4. Unwanted torque movement(30) by retainer wire: This causes to open the spaces between the teeth.

Failure rate with fixed retainers:

Fixed retainers reduce the demand of patient compliance. Retainers have long-term failure rate. So many studies investigated the overall failure rates of fixed retainers. In 1977 Zachrisson(11) reported 11.6% of the failure rate. Then in 1981, Lee¹⁴ reported a 19.6% failure rate. Jones in 1987 reported a 20.4% failure rate. Then in 1988 Artun and Urbye reported 47% of failure rate and then in 1991 Dahl and Zachrisson investigated 30.8 % of failure rate. and reported that failure rate is higher in first 6 months of retainers. so, the overall failure rate ranges from 10.8% to 47.0%. Maxillary retainers have a high failure rate than mandibular retainers(14).

Hygiene status of oral tissues with fixed retainers

Patient must be aware about the retention phase and their maintenance of hygiene before the starting of orthodontic treatment. Orthodontist should give proper hygiene instructions to their patient. With the fixed spiral retainer floss can be threaded in between each interproximal area and with fixed canine to canine retainers floss in between

wire and teeth. So many studies investigate the hygiene status with the fixed bonded retainers(7). Some studies reported no plaque and calculus deposition and no gingival and periodontal hazards(31)(32) whereas some studies find plaque and calculus deposit, gingival and periodontal inflammation. And found the interproximal area beneath the retainer difficult to clean(12) (33).

Conclusion

Fixed bonded retainers provided long term retention. Two types of wire single canine to the canine and multistranded wire are used for bonding fixed retainer. The multistranded wire provided good mechanical retention but multistranded wires are not stable in maxillary arch because of occlusal interference. Memotain is the digital lingual retainer that came as an alternative of multistranded wire retainers. So many studies compared the hygiene status with fixed retainers and concluded that hygiene status is critical with fixed bonded retainers. Patients should be well instructed about the maintenance and hygiene status; they should be Instructed about proper brushing and proper flossing techniques. Also, patients should be properly instructed about the follow-up time and importance of not missing their follow-up. If there is any breakage of the wire they have to immediately call the orthodontist or instruct don't eat hard object otherwise wire can break.

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