

Long Term Effectiveness of Various Orthodontic Retention - A Review

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Abstract:

Aim: To determine the long term effectiveness and efficiency of various orthodontic retainers.

Materials And Methods: A thorough search was done in pubmed using words orthodontic retainers under clinical trials.

Conclusion: Removable retainer have showed equal significance compared to fixed retainer. However when it comes to compare the efficiency of which retainer is better there are not much of data available. Only one article compared fixed retainer with removable retainer based on only on tooth wear and hence more clinical trials should be conducted to compare the effectiveness of removable retainer and fixed retainer.

Keywords: Removable retainers, fixed retainers.

I. Introduction

In orthodontics the long term stability of the achieved result remains a fundamental issue of concern and debate. Orthodontic retainers are specially made devices, usually made of wires or clear acrylic, that hold tooth in position after orthodontics, orthognathic surgery or any method of realigning teeth. They are most often used after orthodontic correction to keep teeth in position while allowing remodelling of the surrounding tissue and to hold the teeth in ideal aesthetic and functional relation and to prevent the inherent tendency of the teeth to return to their former position (relapse)¹. There are four types of retainers typically prescribed by orthodontists and dentists: Hawley, Essix, Zendura, and Bonded (Fixed) retainers.

Maintaining teeth in their corrected positions after orthodontic treatment has been and continues to be a challenge². Tirk has said "The result of Orthodontic therapy – good, bad or indifferent is only evident many years out of retention"³. Stability can only be achieved if the forces derived from the periodontal and gingival tissues, the orofacial soft tissues, the occlusal forces and post treatment facial growth and development are in equilibrium¹.

• Conditions that do not require retention are:-

1. Anterior cross bite.
2. Serial extraction procedures.
3. Posterior cross bite in patients having steep cusps.
4. Highly placed canines in class I extraction cases.

Retainers play a key role in maintaining stability. Retainers are of different types. Their contribution in maintaining stability has been discussed in this paper.

II. Removable Retainers

The removable retainers serve as retention for intra-arch stability and are useful as retainers in patients with growth problems⁴. The available removable retainers are discussed briefly.

Hawley's retainer:

The most commonly used removable appliance for orthodontic patients post treatment was designed in 1920's. It incorporates clasps on molar teeth and a characteristic outer labial bow with adjustment loops, extending from canine to canine⁵.

In 1997 Sauget et al⁶ investigated the role of Hawley retainers versus Essix retainer. The results revealed that those wearing the Hawley retainer showed a greater increase in occlusal contact leading to the conclusion that Hawley retainers allow for relative vertical movement of teeth (settling) whereas, the Essix retainer maintains tooth position just as it is at the debonding stage.

Removable wrap around retainer:

The wrap around or clip-on retainer consists of a plastic bar along the labial and lingual surfaces of teeth. A full arch wraparound retainer should allow each tooth to move individually, stimulating reorganization of the periodontal ligament. In addition, a wraparound retainer is quite esthetic⁵. In a study conducted by Kumar AG⁷ et al to determine the effectiveness of Begg's retainer over Essix they concluded that more subjects with Begg retainers considered that their retainers were acceptable for biting and chewing than the subjects wearing Essix retainers.

Thermoplastic retainers: (Essix retainers)

Essix thermoplastic copolyester retainers are thinner, but stronger. Essix retainers can be placed on the same day the fixed appliances are removed. Their flexibility and positioner effects help in correcting minor tooth movements. They can serve as a temporary bridge for a missing anterior tooth. They can also act as night guard for bruxism and act as bite planes to relieve bracket impingement⁸.

In 2007, Rowland et al⁹ implemented a prospective single-center randomized controlled trial to investigate the effectiveness of Hawley and vacuum-formed (aka. Essix) retainers. There was a significantly greater change in the Irregularity Index for the Hawley retainer compared to the vacuum-formed retainer. They concluded that vacuum-formed retainers are more effective in stabilizing the maxillary and mandibular anterior segments.

In another study conducted by Sylvia Jaderberget al¹⁰ they concluded that no significant changes in overjet and overbite were found, moreover the retainer was well tolerated by the patients. It was therefore concluded that the Essix retainer is sufficient for maintaining the results after orthodontic treatment and that night-time wear is adequate.

4-4 Crozat retainer

A 4-4 Crozat appliance has cribs on the first bicuspids, recurved double lapping lingual finger springs and a labial bow. Advantages are firm retention, labiolingual control of anterior teeth, flexible, maintenance of adequate oral hygiene, because it is removable and esthetic. The major disadvantages of the appliance are: It is cost effective and it is breakable¹¹.

Osamu active retainer for correction of mild relapse:

It is a transparent removable appliance that can be used to correct individual tooth position during the retention phase. The retainer is elastic and stable. The Osamu active retainer is inexpensive and it is transparent and does not impair speech. It can correct individual tooth positions while maintaining close adaptation to the remaining teeth¹².

Vander linden retainer:

The Vander linden retainer is constructed to offer complete control over the maxillary anterior teeth, with firm fixation provided by clasps on the canines. This retainer does not usually interfere with the occlusion¹³.

Fixed Retainers

A fixed retainer typically consists of a passively bonded wire to the lingual side of the tooth usually in the mandibular incisor region, taking into complete analysis of patient's bite. Orthodontists prescribe fixed retainers, especially in cases where stability is questionable and long term retention is required⁴.

Types of fixed retainers

- Banded Canine to Canine Retainer
- Bonded Lingual Retainers
- Band and Spur Retainer.

Banded canine to canine retainer and band spur retainer has been no longer used now a days and not much of clinical data available to favor its use. Bonded lingual retainer has been used as a fixed retainer most commonly.

Resin fiberglass bonded retainer:

The Resin fiberglass bonded retainer was developed by Michael¹⁴ a direct technique that solves the major problem with cuspid to cuspid retainer and takes very little time for preparation. The system uses glass fiber from woven fiberglass fabric.

The main advantages of the resin fiberglass retainer have proven rigid and impervious. Patients appreciate the tooth colored material and the comfort that is provided by smooth margins. It is recommended for patients who

need only the canines to be retained. In cases of severe incisor rotations, however, this technique is flexible enough to allow the incisors to be bonded as well¹⁴.

Molar to molar mandibular retainer:

The molar to molar mandibular retainer is done with the heavy gauge wire and with the use of molar bands. The advantages of molar to molar mandibular retainer over a Hawley's or a cuspid to cuspid retainer include the following, it allows the mandibular canines and molars to settle naturally, mandibular arch can be expanded or contracted and rotations can be corrected by ligating the teeth to the lingual arch¹⁵.

Bonded lingual retainer:

They are normally used in situations where intra-arch stability is questionable and prolonged retention is planned, especially the mandibular incisor region⁴. The following are the indications¹⁶:

- In midline diastema cases
- Spaced anterior teeth
- Adult cases with potential post orthodontic tooth migration
- Accelerated loss of maxillary incisors, requiring the closure and retention of large anterior space.
- Severely rotated tooth.

In a study conducted by Pandis N et al¹⁷ the long-term fixed retainer presented higher calculus accumulation, greater marginal recession, and increased probing depth ($P < 0.05$). However, they also concluded that tooth natural anatomical position and patients oral hygiene also plays role in success of retainer.

But Butler J et al¹⁸ disproved stating that the presence of a bonded retainer appears to cause no increase in incidence of caries or periodontal disease. Use of interdental cleaning aids is required to ensure adequate oral hygiene. Hence to aid patients with better oral hygiene thin twisted wires with better strength can be used to prevent plaque accumulation.

In 2001, Watted et al¹⁹ investigated the effect of mandibular canine-to-canine lingual retainers bonded to 2 or to 6 teeth on incisor mobility. The study showed that tooth mobility decreased with the number of teeth bonded to the retainer.

In 2002, Stirmann et al²⁰ in a prospective randomized study, compared 2 types of fixed mandibular retainers with respect to detachment rate, relapse, periodontal problems, oral hygiene and subjective patient discomfort. Using Little's irregularity index to measure relapse over a period of 24 months, it was found that canine-to-canine retainers had a greater degree of stability whereas the canine-and-canine retainers were associated with frequent relapse of the incisors not bonded.

In 2006, Naraghi et al²¹ retrospectively looked at 45 patients to examine the amount of relapse of the maxillary anterior teeth when using a bonded retainer. The results revealed a significant decrease in the irregularity index from before to end of treatment and a significant angle for correction during the same time period. From the end of treatment to 1 year post-treatment, minor or no relapse was noted.

Fixed Retention Compared To Removable Retention

In 2009, Kuijpers et al²². conducted a retrospective study involving 222 subjects, all of which were followed for 5 years post-treatment. In the maxilla, a bonded retainer on all 6 teeth or a removable retainer was used whereas in the mandible, a bonded lingual retainer either to all 6 teeth or just the canines was used. Along with the degree of wear of the upper and lower incisors/canines, the upper and lower intercanine width and the lower anterior alignment (Irregularity Index) were measured. It was found that the Irregularity Index decreased significantly from before treatment to the end of treatment and then increased significantly when measured 5 years post treatment. With respect to the intercanine distance, there was a significant increase in both the maxilla and mandible. Anterior tooth wear increased through all phases and was more significant for those with maxillary removable retainers. This study did not specifically assess whether one method of retention showed less incisor irregularity.

From the above literature it can be stated that removable retainers offer the advantage of ease of use. Regardless of your retainer schedule, patient will be able to enjoy some time with no retainer. However, patients can easily be neglect to wear at times, and this means full advantage of teeth retention is compromised. Another potential advantage of a removable retainer is that patients can remove it out and brush and floss their teeth with ease, which is more of a challenge with a permanent retainer. Although removable retainers can be very effective, they don't tend to be as effective as permanent retainers, especially if they are not used as directed.

The above mentioned 4-4 Crozat retainer, Osamu retainer, Vander linden retainer are very rarely used and there is not much of data available to prove its effectiveness.

Permanent retainers are the clear choice for patients who can show signs of negligence especially young adults, because teeth begin to shift naturally as we age, a permanent retainer typically offers better long-

term results for retaining teeth than a removable one. Temporary retainers get lost or are forgotten to wear, and often fail to get used as often as they should be.

One drawback to permanent retainers is flossing. Some patients find it more difficult to floss with a permanent retainer. Some orthodontists may recommend a combination of the two; for example, a removable retainer for the top teeth and a permanent one for the lower ones because the lower teeth are smaller and tend to shift more.

Resin fiber glass reinforced retainer is a recent advancement and still clinical trials yet to be assessed to validate its effectiveness and molar band retainer failed to control labial tooth movement hence they are not commonly used.

III. Conclusion

From the available data removable retainers have showed equal significance compared to fixed retainers. However when it comes to compare the efficiency of which retainer is better there are not much of data available. Only one article compared fixed retainer with removable retainer based on only on tooth wear and not on the movement of the incisors and did not specifically assess whether one method of retention showed less incisor irregularity.

Further, most studies in fixed retainers have focused on mandibular anterior alignment, while the maxillary anterior alignment has been studied to a much lesser degree.

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