



Demystifying Retention in Orthodontics- A Review

Namrata Dogra^{1*} Archana Jaglan², Jasmine Nindra³

^{1,2,3}Department of Orthodontics, SGT University, Gurgaon, India

*Email id : namrata.dogra@sgtuniversity.org

ABSTRACT

The role of an orthodontist does not cease after the achievement of well finished occlusion, but the real challenge lies in maintaining the correction achieved for a prolonged period of time. "Retention and Relapse" are two important components of Orthodontics. Although, retention is the last stage in orthodontic treatment, its importance cannot be overlooked. Proper retention provided at the end is the key to successful orthodontic treatment. It is essential to understand the various changes occurring in dental and skeletal structures at the end of orthodontic treatment. Following the use of orthodontic braces, the holding phase of treatment aims to maintain the restored placements of the teeth. Without a retention phase, teeth have a propensity to move back to their original positions (relapse). The present review focuses on importance of retention, different retention protocols and types of retainers.

KEYWORDS: Stability, Periodontal Fibres Reorganization, Retention, Relapse, Retainers

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INTRODUCTION

Orthodontists are committed to orthodontic excellence, not only because of ethical responsibilities, but also because our profession, in many ways, is aimed to improve the quality of life. The term Retention (described by Moyers) implies maintenance of teeth in their positions attained after defined orthodontic treatment [1]. Retention is the last phase of orthodontic therapy when all active tooth movements are complete. This is when we have planned, treated and now have to maintain what has been attained. Understanding the journey to reach the goal and respecting the factors which can lead to probable disruption of successful orthodontic treatment is compulsory. Retention can be described as a process where positions of teeth achieved after orthodontic treatment is maintained without any active tooth movement.

On the contrary, if the treatment did not go according to the treatment plan albeit because of the nature of the difficult malocclusion, patient compliance problems or aberrant growth interferences, it is imperative to have an excellent retention protocol in place to actively pursue the ultimate goal of a healthy and functional occlusion. Another name given to the retention period is "Secondary orthodontic treatment" [2]. It is said that need of retention can be minimized if the case is correctly diagnosed and treated, still in many cases relapse tendency is seen.

Instability of the alignment achieved is variable among cases. It is understood that after active treatment is over, additional time is required by the periodontal and gingival fibers so that they can stabilize around the teeth. Expansion of arches, periodontal fibers rebound, remodeling of, and alveolar bone, mesial drifting of posterior teeth and poor compliance of patients are major causative agents for relapse [3]. Little showed that the alignment of lower teeth does not have long-term stability, as a result they require more attention. Different authors and researchers advocate different time periods for retainer wear also, there is no definitive literature that can suggest a fixed retention protocol that ensures long-term stability [4-7]. Thus the problem of "Retention and Relapse" must be given equal importance as it is given to active treatment.

RETENTION

Following orthodontic treatment retention phase is required:

1. To allow for reorganization of periodontal and gingival fibres.
2. To minimize changes in the orthodontic result due to remaining growth
3. To permit neuromuscular adaptations to the corrected occlusion
4. To maintain tooth position that are unstable

Classification of Retention

Riedel has classified retention according to the requirements of various types of cases [8].

Minimum or no retention	<p>a. Class I extraction cases with blocked out canines and absence of any crowding in incisors.</p> <p>b. Class I cases with cross bites in anterior or posterior region having steep cusps and absence of any crowding in anterior.</p> <p>c. Cases II cases with maxillary prognathism which are over treated with headgear and have spacing in mandibular arch with absence of any rotations.</p> <p>d. Cases in which premolars are tripped mesially and molars are tipped distally to provide space for eruption of second premolars.</p>
Moderate retention	<p>a. Class II cases, extraction or non-extraction, need no mandibular retention if therapy is well instituted provided that the original mandibular arch did not show any severe rotations</p> <p>b. Class II, Division 2 cases require indeterminate periods of retention.</p> <p>c. Class III corrections achieved with the assistance of surgery in shortening the mandible</p>
Indefinite retention	<p>a. Instances where expansion has been carried out in one or both arches.</p> <p>b. Severe rotations in anterior teeth of maxillary and mandibular arch and mandibular premolars.</p> <p>c. Cases which initially has considerable spacing</p> <p>d. Patients with uncontrolled muscular or tongue habits.</p>

Duration of Retention

When the child is in growing phase, a lot of bone remodeling happens and continues even after orthodontic treatment is finished. Thus retention must be continued until the growth ceases. Also, Retention must be continued until third molars erupt [9]. Study done by SilvaFilho *et al* [10] showed that long term retention must be used for the mandibular arch. Reitan[11] showed that upto 7 months after orthodontic treatment, periodontal fibers have the ability to go back to their original position. This implies that retention in both maxillary and mandibular arch must be continued for at least 7 months after orthodontic treatment finishes.

There is no single definitive duration of retention that can be followed for all patients. A lot of factors such as orthodontist's preference, occlusal condition, skeletal and soft tissue features and lack of evident data contribute to this[12]. In 1990, a survey was conducted in UK and it was concluded that 12 months was the most commonly used retention period[13]. When plates are used, their use should be gradually eliminated first by leaving them out in the daytime and inserting at night for about six months, then every other night until they can be dispensed entirely. The upper plate should be discarded some time before the lower as this gives the maxillary teeth a better chance to settle into more intimate contact with those of the mandible. In those cases in which a cuspid to cuspid retainer has been used in conjunction with a lower plate the fixed retainer can be removed after about six months at which time a new lower plate should be substituted[14-15]. It can be concluded that

- For the first 3 to 4 months, full-time is advised and they must be removed while eating
- For at least 12 months, they must be worn part-time gingival tissues remodeling.
- Part time wear must be continued until growth is complete.

Retention appliances/retainers

Retainers are such appliances that act passively in maintaining the position of teeth achieved by orthodontic treatment [16]. Various factors influence the type of retainer to be used like the malocclusion type, the esthetic need of the patient, oral hygiene of the patient, patient co-operation and the duration of retention required.

Retainers can be classified into: -

- 1) **Removable retainers**- As their name suggests, these are those appliances which the patient can remove and wear on their own. They provide excellent retention in cases that require intra-arch stability.
- 2) **Fixed retainers**.
- 3) **Active Retainers**- They are those retainers which first bring about some active tooth movement and then act as passive retainers.

Hawley Retainers and its Modifications

In 1920, this retainer was designed by Charles Hawley, and this is the most commonly used retainer till now. It has a base plate, clasps and a labial bow. (Fig.1).



Fig.1: Standard design of Hawley's retainer

The retainer which is most commonly used in orthodontics is Hawley retainers. It can be modified or a number of springs or active appliances can be added to it to bring about slight tooth movement. For the first 6 months, patients are advised full time wear of these appliances. The appliance can be removed while brushing teeth and having meals. Patients speech gets affected on wearing these appliances, specially the "S" sounds.

Clear Plastic Retainers

These are vacuum formed plastic retainers (VFR) also known as Essix retainers, these have proven quite versatile (Fig.2). The appliance is prepared from a transparent thermoplastic sheet of 2 mm thickness. They can be used in place of spring retainers for little tooth corrections as they are flexible. They have another advantage, they serve the purpose of night guards that can be used for bruxism patients. They can also act as bite planes to open the bite [17].



Fig.2: Clear Plastic Retainers

A study concluded that patients who receive VFRs are most satisfied (50%) as compared to those who receive Hawleys (35%) or fixed bonded (36%) retainers [18].

Fixed Retainers

Fixed retainers are preferred in cases requiring prolonged retention. Intraarch tooth position can be maintained easily with segmental retainers. Flexible wires are chosen for this to allow. The wires used for such retainers should be flexible enough to bring about physiologic tooth movement. Bonded retainers are effective in holding and consolidating extraction spaces. Thus they are effective in maintain arch circumference and mandibular anterior teeth alignment.

In extraction cases, bonded canine-to canine retainers extending to premolars must be given in order to hold the extraction space.

Active Retainers

"Active retainer" is a one which provides slight tooth movement and then act as a retainer. Thus it is called active retainer. They are used for irregular incisors alignment and also functional appliances act as active retainers in management of class II or class III cases that have tendency to relapse.

Selection of type of retainer

Class I non-extraction case

In cases with anterior cross-bite of one or two teeth, no retention is required as the lower arch retains the upper teeth relapse. If an associated crowding is present, then a Hawley retainer can be used to prevent the relapse of rotated teeth. In cases with severe crowding and multiple rotations, it is a good idea to either retain with very well fitting Hawley retainer or Begg's wrap around retainer. The cause of relapse is often negligence in strictly wearing the removable retainer or bond failure on one or more teeth of spiral wire bonded retainers. Spring aligner can act as active appliance and then as a retainer. Children with an expansion appliance for the buccal correction of cross-bite would need longer retention and stronger appliance. A child treated at the optimum age for the skeletal expansion of the maxilla with rapid

maxillary expansion (RME) is likely to be more stable than a case where dental expansion has been achieved with fixed orthodontic appliance alone. Expansion cases needs to be focused upon, their original arch shape , occlusion and the amount of arch expansion achieved . It is said that, there is less chances of relapse in cases having good occlusion. After the treatment finishes, there should be balance and harmony between the stomatognathic systems. The position of teeth should be in neutral zone so that equal forces exist between lingual and buccal muscles. The aberrant muscular pattern must be modified for prevention of relapse.

Class I extraction case

Malocclusion treated with extraction of all first premolars or second premolars extractions are prone to relapse. Proximal contacts maintenance is critical at extraction site. In cases of Hawleys appliance, as the U loop wire of labial crosses occlusal surface, it affects the bite closure. As A result the extraction spaces can reopen between canine and second premolar. Begg's retainer, is the preferred choice in such cases in maintaining tight contacts. The preferred choice of retainer in mandibular arch is flexible spiral wire (FSW) which is bonded on the lingual surfaces and in extraction cases the wire must extend to mesial occlusal pits of the second premolars.

Class II non-extraction case

Appliances that are used for Class I extraction cases can be used here also. In class II cases, some additional measures may have to be taken to maintain the class I molar relation which is often accomplished with the forward placement of the mandible. An anterior bite plane can be added to the Hawley or Begg's wrap around retainer that can help in maintaining the anterior bite and provide forward slide of mandible.

Class II extraction case

High angle class II cases may need additional use of the night time high pull headgear in growing children with aberrant vertical growth trend. Class II cases treated with functional appliances may require a night time bionator or a modified activator appliance so as to maintain the class I correction.

Class III cases

Facemask therapy treated Class III children must be advised to wear chin cup continued at night time till the mandibular growth is complete. Appliances such as reverse twin block and FR III can also be used as a retaining device for young children immediately following protraction facemask therapy.

Adjuncts to retention

In some cases, we have to use additional procedures that help in maintain retention.

These include: -

- **Circumferential Supracrestal Fiberotomy (CSF):** This procedure must be done for rotated teeth in order to cut the supragingival fibres (Fig.3). This procedure must not be done if patient has poor gingival health..

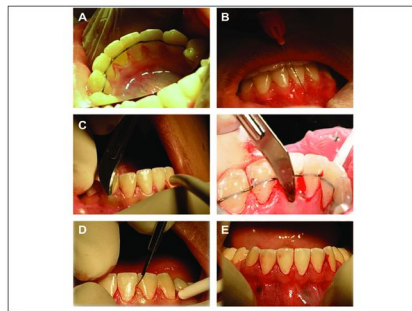


Fig.3: Illustrating Circumferential Supracrestal Fiberotomy (CSF) Procedure

- **Reproximation:** Reproximation is used in cases where crowded lower incisors are crowded (Fig.4), that have poor Mesiodistal to faciolingual ratios and on teeth where shape of contact points is not favourable. First it enhances contact stability by providing broader contact point, secondly it provide additional space in mandibular arch. This procedure has disadvantages also .Reproximation may result in tooth sensitivity if excess of it is done.

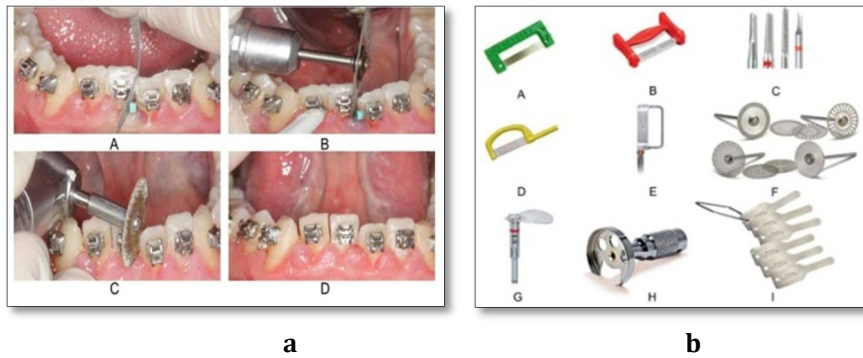


Fig.4 a. illustrating steps of reproximation procedure/Interproximal reduction
b. Depicting various tools (Proximal strips, Disc, Burs) used for procedure of Reproximation

- **Frenectomy and associated procedures:** Etiology behind reopening of maxillary diastema after treatment is thick fibrous maxillary frenum. Once the space is closed, then the frenectomy should be planned. Frenectomy must never be done before closing diastema as the scar tissue formed will not allow for space closure. This procedure provides long term stability in cases where midline diastema has been closed orthodontically.

RECENT ADVANCES

Memotain: A Ni-Ti lingual retainer fabricated through CAD/CAM

Memotain is the CAD/CAM fabricated NiTiNol lingual **Memory Retainer**. It is a very flexible and precise alternative to the available multistranded lingual retainers. It is resistant to corrosion or microbial colonization and can be used for minor corrections because of the property of shape memory[19]It is highly successful in maxilla as it does not cause any occlusal interferences or tongue irritation[20] (Fig.5a,b)



Fig.5a: Intraoral pictures of Memotain Fig.5b: Digitally positioned Memotain

Biomedical agents –

Biopharmacological agents like osteoprotegerin, RANKL inhibitor agent denosumab, bisphosphonates like pamidronate and zoledronate, bone morphogenic proteins, relaxin, simvastatin, strontium ranelate, olive oil have been shown to have an inhibitory effect on tooth movement and thus a positive effect on post-treatment stability. Long term safety of agents like denosumab must be evaluated so that long retention periods can be minimized [21].

CONCLUSION

Knowledge of retention regimens is as important as knowledge of treatment mechanics. Proper treatment mechanics, good occlusion and excellent retention protocol are essential for long term success of orthodontic treatment. The retention appliance choice and retention protocol is specific for every patient and no single protocol can be followed. Further research is required in this direction to provide definite protocols for retention.

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