ORTHODONTIC RETENTION- A REVIEW.

Anjali Koul[1], Neal Bharat Kedia[2], Najibah Manzoor[3], Aayush Ranjan Deb[4], Sidharth Kaul[5], Anuradha Pandey[6]

ABSTRACT :

After the teeth have been corrected orthodontically and malocclusion has been relieved the job of orthodontist is not over. The active phase of treatment is to be followed up with a passive phase in which corrected positions of teeth needs to be maintained after treatment and is often the most challenging part of an orthodontic treatment plan. Hence, a phase of retention is normally required after orthodontic tooth movement which may be in the form of removable or fixed retainer wear. In this review article, we have discussed about the importance of retention protocols and patient education regarding the same to ensure that the patient is in the know how of the care that is expected from him at the end of the active orthodontic phase.

KEYWORDS: Malocclusion, retention, removable retainers, fixed retainers.

INTRODUCTION :

Orthodontists have strived since long to give a pleasant smile and improve facial esthetics of their patients. It is a known fact that a person's dental appearance can contribute to his/her feel about oneself.[1] Orthodontic treatment can provide a significant psychosocial benefit to patients resulting thereby in improved self-esteem.[2] An improved dento-facial appearance can also contribute to improvement in one's overall quality of life.[3]

After the teeth have been corrected orthodontically and malocclusion has been relieved the job of orthodontist is not over. The active phase of treatment is to be followed up with a passive phase in which corrected positions of teeth needs to be maintained after treatment and is often the most challenging part of an orthodontic treatment plan. This is thought of as a tendency of teeth to move back towards the original malocclusion leading to relapse. However, a return towards the initial malocclusion does not always occur, but any unfavourable change in tooth position after orthodontic treatment does have an undesirable effect on corrected malocclusion. These changes may also be the result of normal age-related effects.

Hence, a phase of retention is normally required after orthodontic tooth movement to hold the teeth in their treated position and is as important part of the treatment as the active orthodontic treatment. Moyers has defined Retention as "the holding of teeth following orthodontic treatment in the treated position for the period of time necessary for the maintenance of the result."[4] Riedel defines it as "the holding of teeth in ideal aesthetic and functional position."[5] In 1934, Oppenheim stated "Retention is one of the most difficult problems in orthodontia; in fact, it is the problem."[6] In an essay presented on March 1919 to the Eastern Association of the Graduates of the Angle School of Orthodontics in Baltimore, Maryland, Dr. Hawley passed on two statements of his contemporaries with regards to the retention process. The first statement was from his colleague, who stated, "Any fool can move teeth, but it takes a wise man to make them stay." Another quote attributable to Dr. Hawley's colleagues was, "If anyone would take my cases after they are finished, retain them, and be responsible for them afterward, I would give him half the fee."[7] Even today in contemporary orthodontic practice, regardless of the method used to align the dentition and establish the occlusion these statements hold true. In an article published by Dr. George Hahn in 1944 entitled "Retention - The Stepchild of Orthodontia," he stated,

Corresponding Author : Dr. Anjali Koul

[1]Associate Professor, [2]Professor, [3]PG Student,
Dept. of Orthodontics and Dentofacial Orthopaedics, BIDSH, Patna
[4]BDS Student, Sri Ramachandra Dental College and Hospital, Chennai
[5]BDS Student, JSSDCH, Mysuru, Karnataka.
[6]Anuradha Pandey, Consultant Orthodontist

"The newer concept of retention was evolved the hard way, that is by clinical evidence, the result of trial and error, and in all clinical evidence in the history of orthodontia, this one basic fact stands out: That irrespective of the length of time a tooth is held in its new position by any means whatsoever, it will upon release seek a position where it is in balance with the forces that act upon the denture; whether these forces are for good or evil is immaterial, the greatest of these forces is the force of occlusion."[8]

It is very important for orthodontists to be familiar with factors associated with relapse, the aetiology of relapse and the different methods of reducing this relapse. This includes having a knowledge of the advantages and disadvantages of various retainers, and accordingly giving advice to patients regarding effective retainer wear. The retention protocol has a significance since after active orthodontic therapy, additional time is required for reorganization of periodontal and gingival fibres.[9] Other potential factors that may play a role in post-orthodontic relapse are: Arch expansion, periodontal fibres rebound, remodelling of alveolar bone, growth pattern, occlusal settling, mesial drift of posterior teeth, parafunctional habits, final occlusion and poor patient's compliance etc.[10,11] It is very important to ensure stability of occlusion and prevent post treatment changes so as to reduce relapse. A proper understanding of the changes occurring and the factors affecting retention and relapse is important, to achieve such goals.[12] If the growth is complete or teeth are not in an unstable position, retention period is still considered necessary to permit for gingival and periodontal reorganisation.

RATIONALE FOR RETENTION :

1. The gingival and periodontal tissues are affected by orthodontic tooth movement and require time for reorganization when the appliances are removed.
2. The teeth may be in an inherently unstable position after treatment, so that soft tissue pressure constantly produces a relapse tendency.
3. Changes produced by growth may alter the orthodontic treatment result.

Neuromuscular adaptation in the achieved position takes time and till such time retention becomes important

Types of retention:

According to Duration

Group I -No retention

Group II- Limited retention

Group III- Prolonged retention

Group IV- Permanent retention

Group I -No retention

Period of retention: Not applicable

Indications:

1. Anterior and posterior cross bite
2. Highly placed canine
3. Impacted mandibular 2nd premolar

Group II- Limited retention

Period of retention:

First 3to 4 months full time retention to be followed by part-time wear next 12 months.

I**ndications:**

1. Class I proclination and spacing of maxillary incisor
2. Class I and Class II extraction cases
3. Corrected deep bite cases
4. Class II division 2 cases

Group III - Prolonged retention

Period of retention: cases require 232 days or more of retention

Indications:

1. Patients exhibiting abnormal musculature or tongue habits
2. Non-compliant patient who do not cooperate by not wearing the appliance regularly.
3. Completion of the treatment before completion of growth; especially in skeletal Class III and open bite, deep bite etc.

Group IV- Permanent retention

Period of retention: Lifelong

Indications:

1. Severe rotation
2. Midline diastema
3. Cleft palate cases
4. Generalized spacing
5. Expansion of lower arch

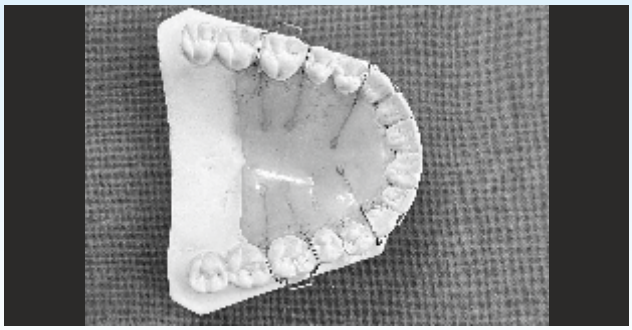
Types of retainers:

Depending on whether the patient can remove the retainer or not, the retainers can be classified as removable one and fixed one.

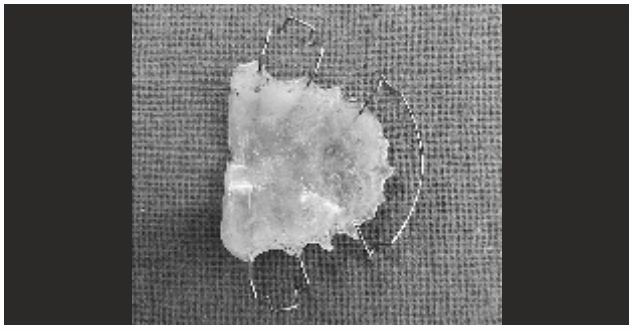
Removable retainers:

These retainers allow individual movement of teeth and initially need to be worn full time (except during eating and brushing), followed by part time wear, depending on the type of malocclusion. However, since the onus of wearing rests on the patient good patient compliance is essential with removable retainers, and if consistent wear is overlooked, relapse occurs. This method of retention places full responsibility directly on the patient in maintaining tooth alignment following orthodontic treatment. Removable retainers have the advantages of being easier to maintain oral hygiene as they can be removed at the time of eating and brushing and can be put back after proper cleaning. It has been shown that in many cases, removable retainers need only be worn at night to maintain dental stability.[13-15]

The most common types of removable retainers used worldwide are the Hawley-type retainer and Thermoplastic retainer. Hawley's retainer has an acrylic baseplate and a wire labial bow with adams clasps on molars as retentive unit (Figure 1a and 1b). The thermoplastic retainers are made from clear plastic (Figure 2). There is some evidence to suggest that, at least in the short-term, patients prefer the appearance and comfort of thermoplastic retainers which are more cost-effective and slightly more effective in maintaining stability, particularly in the lower arch.[16,17]



1a hawleys retainer



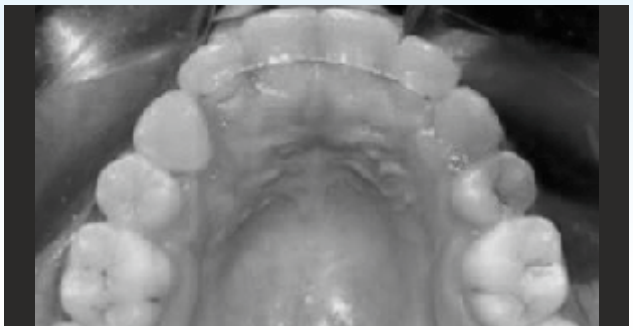
1b hawleys retainer

2.thermoplastic retainer

Fixed retainers:

These are bonded onto the lingual/palatal surfaces of the teeth and cannot be removed by the patients at their will. Fixed retainers offer the advantage of being in place permanently hence removing the need for patient compliance with retainer wear (Figure 3). However, as they cannot be removed for cleaning, they are more prone to plaque and calculus accumulation.[18] Oral hygiene maintenance becomes critical. It is therefore vital that patients are provided with clear instructions on oral hygiene measures associated with their bonded retainers. Since bonds of the retainers to tooth is critical factor so these need to be checked regularly to ensure that they are still bonded in place. In addition, there are reports of occasional, severe, unwanted tooth movements

caused by different types of failed/faulty fixed retainers as a result of the bonding of some or all teeth within the span of the fixed retainer.[19-21]



3. bonded lingual retainer

Adjunctive retention procedures:

Adjunctive procedures are techniques that alter the hard or soft tissues in an attempt to reduce relapse, thereby aid in retention of the corrections made by the orthodontist at the end of the active phase of treatment. Examples include pericision and interproximal reduction.

Pericision:

Pericision is a simple soft tissue surgical technique aimed at severing the periodontal fibres around the neck of the teeth (dento-gingival and interdental fibres) and is sometimes referred to as supracrestal circumferential fiberotomy. The procedure is performed under local anaesthetic and there is weak evidence to suggest that it reduces relapse of rotated teeth, particularly in the maxilla.[22,23] The procedure should only be undertaken in cases in which there is a good gingival biotype and cortical bone support, minimal or no recession and the patient has excellent oral hygiene. Since it is a surgical procedure, it is usually reserved for severely rotated teeth.

Interproximal reduction:

It is suggested that interproximal reduction may compensate for the normally occurring reduction in inter-canine width which occurs during adolescence.[24]

Requirements of a good retainer:

- It should restrain each tooth that has been moved into the desired position in directions where there are tendencies toward recurring movement.
- It should permit the forces associated with functional activity to act freely on the retained tooth, permitting them to respond in as nearly a physiologic manner as possible.
- It should be as self cleaning as possible and should be easy to maintain optimal hygiene.

Theories of retention:

Riedels gave nine theories of retention[25] and Moyers[26] added another theory as the tenth theorem.

Theorem 1: Teeth that have been moved tend to return to their former position.

Theorem 2: Eliminating of the cause of malocclusion will prevent relapse.

Theorem 3: Malocclusion should be over corrected as a safety factor.

Theorem 4: Malocclusion should be over corrected as a safety factor.

Theorem 4: Proper occlusion is a potent factor in holding teeth in their corrected positions.

Theorem 5: Bone and adjacent tissues must be allowed time to reorganize around newly positioned teeth.

Theorem 6: If the lower incisors are placed upright over basal bone they are more likely to remain in good alignment.

Theorem 7: Corrections carried out during periods of growth are less likely to relapse.

Theorem 8: The farther the teeth have been moved the lesser is the risk of relapse.

Theorem 9:

Arch form, particularly in the mandibular arch cannot be permanently altered by appliance therapy.

Theorem 10: Many treated malocclusions require permanent retaining devices.

Retention monitoring:

Retention protocols involve frequent monitoring for which the patient needs to visit a clinician who will review the same. In case of removable retainers, it is imperative to check the fit of the retainer, review the stability of the dentition and ensure that the patient is sticking to the prescribed retention regimen. Fixed retainers need to be inspected for any bond failure as

that will ensure and preserve stability of results. Proper hygiene maintenance also needs to be evaluated so that they don't become a source of accumulation of plaque.

COVID-19 lockdown measures disrupted regular retention check-ups. Digital technology however allowed communication and virtual reviews. Patients with broken or lost retainers could be provided with new retainers manufactured using patients' existing digital scans. Technological advancements have allowed use of thermal monitors inserted into removable retainers which can detect normal intraoral temperature when the appliances are in the mouth. This can help determine how well patients are wearing their retainers.[27,28] The technology needs to be further developed to improve their reliability and reduce the size of the devices.[29] However to retrieve and analyse the data the patient needs to come for a review appointment. A mobile retainer reminder app was developed to improve adherence to retainers; however, it did not seem to significantly improve objectively assessed adherence levels, stability or patient experiences at three-month follow-up.[30] With conventional mobile reminder apps, tracking is dependent on patients entering the usage data themselves and some users perceived this as a 'commitment' and 'time-consuming'.[31] To overcome this issue, another pilot study coupling Bluetooth tracking with reminders has shown that this type of compliance tracking has a clinically acceptable level of accuracy and usability, validating its use within future clinical studies.[32] AI is the use of computers and software that have the ability to perceive information and reason, and ultimately convert that information into intelligent actions.[33] A product called Dental Monitoring (Paris, France) makes use of this technology. This software uses intraoral photos taken by patients on smartphones to remotely monitor dentitions. It has most frequently been used to monitor aligner treatment, tracking individual tooth movement, detecting lost attachments and identifying poor oral hygiene. Pre-recorded, customisable instructions are then issued directly to the patients, notifying the supervising orthodontist, but not necessarily needing the clinician's direct input unless desired.[34]

Patient awareness:

Even before the start of the treatment it is the responsibility of the orthodontist to make the patient aware of the need for retention at the end of the treatment and explain the unpredictable nature of relapse. Hence the patient is in the know how of the care that is expected from him with his retention protocol. It is at the diagnosis level only that the clinician decides on what kind of retainers are required for the patient depending on the type of initial malocclusion. It has to be explained in detail that repairing or replacing retainers will be at extra charges. Hence the financial burden will increase in case removable retainers are not worn as advised or broken fixed retainers are not fixed as these will lead to inadvertent tooth movements which may not be desirable. Hence to reduce the risk of relapse appropriate use of retainers has to be overemphasised. Advice should include a retainer review program to assess the need for repair or replacement.

CONCLUSION:

Prevention of unwanted post-treatment changes remains one of the biggest challenges in orthodontics and needs co-operation from the patient.

- Fixed retainers, need to be monitored for detachments or fractures which otherwise will lead to unwanted tooth movement and monitoring of proper hygiene to prevent plaque accumulation giving rise to periodontal complications in the long run.
- Removable retainers, require excellent long-term adherence to wear and periodic replacement as they may be subject to degradation and fracture.
- The understanding that without provision of retainers in the long term, there will be an unpredictable amount of post-treatment tooth movement, which can either be accepted or corrected with orthodontic re-treatment. Hence the emphasis at the time of start has to be laid

equally on the passive retentive phase as much as to the active orthodontic phase.

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