Orthodontic Retention Protocol - A Review

Abdullah A. Alnazeh

Abstract

Orthodontics is the branch of dentistry which deals with misalignment of teeth and facial skeleton. The mechanics of fixed appliance therapy completely relies on retention of orthodontic appliance. Following the attainment of new positions of misaligned teeth after fixed orthodontic appliance therapy they need sustainment of new position mechanically so that supporting structures and bone attains concrete position and maturity. Retention is the period of Orthodontic treatment that keeps teeth in new position after treatment with orthodontic treatment. Without period of retention, there is a propensity for teeth to new position for their underlying position causing relapse. Hence it is very necessary to prevent relapse which depends on many factors. Every orthodontic patient must wear retention appliances to prevent relapse. This review article discusses the protocol of retention, need and requirements, indications, types and various factors affecting it.

Key words:Orthodontics, dental prosthesis retention, protocol, factors, recurrence, review

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Introduction

Relapse after Orthodontic treatment is the commonest complication reported by patients and known by Orthodontists. Appropriate retention post orthodontically serves to control it[1]. Appropriate management plan which includes complete history, examination, analysis of cast and cephalometric evaluation followed by orthodontic treatment favours the retention and its outcome[2]. However the predisposition of relapse can never be ignored[1]. Following the attainment of new positions of misaligned teeth after fixed orthodontic appliance therapy they need sustainment of new position mechanically so that the supporting structures and bone attains concrete position and maturity[3]. They must stabilize them mechanically and functionally to fulfil the requirements of new position in the arch[4].

So the definition is: holding teeth in an ideal, dynamic and purposeful position or the period of orthodontic treatment that endeavours to keep teeth in the adjusted situations after treatment with ortho-dontic braces [5]

Department of Pedodonics and Orthodontics,
College of Dentistry, King Khalid University KSA.

Correspondence: Dr. Abdullah A. Alnazeh
Department of Pedodontics and Orthodontics,
College of Dentistry, King Khalid University KSA.
Email: aalnazh@kku.edu.sa
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Reorganization of Periodontal and Gingival Tissue

Widening of the periodontal ligament spaces and disturbance of the collagen fibre packages that help every tooth are ordinary reactions to orthodontic treatment. These changes are necessary to allow orthodontic tooth movement to occur[6]. Also, if teeth movement stops before removing the appliance, reorganization of usual periodontal structural design does not accomplish until tooth is splinted tightly to its neighbours. Once the tooth can respond individually to the forces of mastication each tooth can be displaced slightly relative to its neighbour as the patient chews. There structuring of the periodontal ligament (PDL) takes 90 - 120 days. The PDL restructuring is vital for solidity of periodontal that naturally reins tooth location on the desired place[7].

The gingival fiber networks are also upset by orthodontic tooth development and must redesign to oblige the new tooth positions. Both collagenous and elastic fibres occur in the gingiva, and the reorganization of both occurs more slowly than that of

the PDL itself. It usually takes 4-6 months, for the collagen fibers in the gingiva to accomplish the re-structuring[9]. However, the elastic supracrestal fibres (CSF) modify very slow and yet apply traction and hence can move the tooth into original position after fixed orthodontic therapy. In patients with extreme turns, separating the supracrestal strands around seriously malposed or pivoted teeth, at or not long before the hour of machine expulsion, is a suggested system since it diminishes relapse inclinations coming about because of this fiber elasticity[10].

Factors Affecting Retention Protocols:

The usual duration of orthodontic is 18 to 30 months. Attainment and maintenance of new tooth position is very important. Many factors effect on retention postorthodontically. The various factors include[11].

1- Mandibular incisors misalignment:

Increase in lower incisors malpositioning happened commonly amongst great proportion of patients after fixed appliance therapy. Research has shown that these are usually reported by the patients in the third decade of life. Appropriate retention of mandibular incisors till the end of complete facial development may reduce chances of relapse. Both types of retainers i.e. fixed or removable can be incorporated to lower anterior teeth to enhance retention[12].

2- Correction of rotations of lower anterior teeth:

Fibbers in the supracrestal region of gingiva take longer duration for restructuring. They require longer retention through mechanical stabilization which in turn helps to prevent relapse. Surgical correction and cutting of supracrestalfibres may also contribute to reduce relapse during 4-6 years of fixed appliance therapy. Although long term results of the procedure are inevitable[13].

3- Correction of anterior-posterior mandibular tooth location:

Correction involving greater than 2mm in the anterio-posterior dimension after fixed Orthodontic therapy may require prolong retention[14].

4- Correction of deep bite:

If the correction of deep bite, anterior bite plane is utilized until the finishing of development of face. It is helpful in case of rotation of anterior mandibular growth[15].

5- Treatment of anterior open bite:

Patients with treatment of anterior opens bite and unfavourable growth patterns are recommended to follow posterior bite block construction. However, current research doesn't support this[16].

6- Orthodontic treatment involving periodontally compromised tissues and root resorption.

Orthodontic treatment involving periodontally compromised tissues and patients with root resorption requires fixed retention through permanent retention appliance[17].

7- Growth modification treatments:

After using headgear or functional appliance, retention by means of modified activator appliances is effective in the maintenance of Class II malocclusion treatment[18].

8- Treatment of posterior and anterior crossbite:

If anterior and posterior occlusion has been achieved properly, there is no evidence for the requirement of retention[19].

9- Treatment involving Space closure:

Permanent retention is required for treatment involving space closure and diestema correction[20].

Retention Following Different Types of Treatments

1. Class II treatment
2. Class III treatment
3. Deep Bite treatment
4. Open Bite treatment
5. Lower incisor alignment
6. Orthognathic Surgery

1. Retention After Class II Treatment

Relapse after the correction of class II relation may occur due to complex intermingling of movement of teeth both in maxilla and mandible. It occurs forward in the maxilla and backward in the mandible. It may also occur due to alteration in the development of maxillary jaw in relation to mandibular jaw. As might be expected, tooth movement caused by local periodontal and gingival factors can be a critical short-term problem. In contrast, altered jaw development is a more basic long haul issue both on the grounds that it legitimately modifies jaw position and in light of these facts that it adds to the repositioning of teeth[21]. Over corrections of the occlusal relationship as final technique is an essential method which controls movement of teeth which if uncorrected may leads to relapse of Class II. In treating Class II, the labial movement of mandibular incisors must not be exaggerated. However, traction by class II elastics may leads to this.The constant pressure through lips may bring the protruded incisors into upright position which leads to crowding and relapse of overjet and overbite[22]. Therefore, it is recommended that if correction of greater than 2 mm is performed, they need permanent fixed retention. Another cause of long-term relapse is discrepancy in growth as there is discrepancy of tissues required to fill the gap. The amount of growth remaining after orthodontic treatment will depend on the gender, oldness and adulthood of the patient. However, afterwards management that involved growth alteration, some post treatment rebound is likely, with more growth of the upper than the lower jaw[23].

The tendency of relapse could be managed by two methods. The one, by fixed appliance therapy and other one is functional appliance therapy. Fixed treatment involves the use of headgear on maxillary molars along with a retainer to control alignment. Use of functional appliance involves the use of activator- bionator type appliance which helps to hold the teeth in position[24]. A problem with functional appliance therapy involves the part time wear of appliance commonly at night along with a retainer for day time wear which helps to control the tooth position in the desired area. This is especially important for patients with severe development issues. Patient with moderate problems requires simple and conventional retainers on both jaws along with optional wear of functional appliance as per requirement in cases of suspected relapse[25].

2. Retention after the Treatment of Class III

Retaining a patient after correcting a Class III malocclusion early in the permanent dentition can be frustrating because relapse from proceeding with mandibular development is probably going to happen, and it will be incredibly hard to control. Applying a limiting power to the mandibular, as from a chin cap, isn't close to as compelling in controlling development in a Class III patient as applying a controlling force to the maxilla is in Class II issues[26]. The chin cap will in general pivot the mandible descending, making development be conveyed even more vertically and less on flat plane, and class III useful device has a comparative effect. If facial height is pointless or normal after orthodontic meds and backslide occur from mandibular turn of events, cautious alteration following the improvement may be the primary answer. In mellow to direct Class III issues, a utilitarian machine or a positioner may be adequate to keep up the occlusal associations during post treatment advancement[27].

3. Retention Subsequently Deep Bite Treatment

Rectifying abundance overbite is a basically standard bit of orthodontic treatment, and thus the majority of patients require control of the vertical cover of incisor during support. This is developed most quickly by using the removable upper retainers made so the lower incisor will encounter the base plate of the retainers if they begin to slip vertically behind the upper incisor. Technique, as such, is to construct a potential base plate into the retainers, which the lower incisors will contact if the bite starts to develop. Bite profundity can be kept up by wearing the retainer just around evening time, after dependability in different respects has been accomplished[28].

4. Retention after Open Bite Correction

Relapse of the mandibular anterior teeth may happen through mix of intrusion of the maxillary teeth and lengthening of the molars. Dynamic propensities for example thumb sucking can be expected to produce intrusive force on the incisor, while simultaneously prompting a changed stance of the jaw that permits posterior teeth to eject. Controlling ejection of the maxillary posterior teeth, subsequently maintains open bite patients[29].

High-pull head gear to the upper molars related to standard removable retainers to keep up teeth position is one powerful route for controlling open bite deterioration. A superior endured elective is a utilization with bite block which obstructs between the molars (an open bite activator or bionator), which ranges delicate tissues of the patient to give power restricting emission. Subjects with serious open bite issues are especially prone to profit by having ordinary maxillary and mandibular retainer for daytime usage, and an open bite bionator as an evening retainer, earliest starting point required time frame[26].

5. Retention after Lower Incisor Alignment

Not exclusively preceded with skeletal development influence occlusal connections, however it additionally can possibly adjust the position of teeth. For instance if the mandibular development is forward or descending, the effect is to move the lower incisor into the lip, which made a power tipping them distally. Henceforth, continued with mandibular advancement in regular or class III patients are associated with crowding of the lower incisors. A retainer in the lower incisor region is relied upon to shield swarming from making until improvement has declined to grown-up levels. It frequently has been recommended that orthodontics retainers ought to be kept, in any event on low or partial time wear, until third molars have either erupt into ordinary position or have been eliminated[27]. The ramifications of this rule that pressure from the growing third molars cause late incisors crowding is practically off base. Then again, on the grounds that the eruption of third molars or their extraction for the most part doesn't occur until the late adolescent years, the rule is certainly not implicated in its accentuation on delayed maintenance in patients who are proceeding to develop. Most grown-up patients, including the individuals who had orthodontic treatment and once had completely adjusted teeth, end up with some crowding of lower incisors[28].

6. Retention after Orthognathic Surgery

Postsurgical retentions done with intermaxillary fixation and are kept set up for around 21 days. The rebuilding efforts of capacity start subsequent to eliminating the intermaxillary fixation. An occlusal support is fixed to the orthodontic curve with ligature wires, and the patients start to open and close their mouths utilizing the spaces present in the brace as a guide. For the principal days, the width of the mouth opening is decreased as an outcome of immobilization and the new occlusal positions with an alternate skeletal direction and the subsequent modification in the dental, skeletal, and solid proprioceptive receptor[33]. Following fourteen days, the patients normally open their mouths sufficiently wide, after the solid reconstruction completed under the direction of the occlusal forces when the oral capacity is re-established adequately, the capacity is restored with an alterations of the

occlusal supports; parallel retrusive and protrusive trip guides are made to consummate the dynamic jaw developments. During this stage,all the dental components must have sections attached to a fixed apparatus to keep away from undesirable expulsion, with the exception of when the treatment plan explicitly requires this[28-30].

Scheduling of Retention

Three categories of retention planning were identified limited retention

1. Moderate retention (in terms of both time and appliance wearing)

2. Permanent or semi-permanent retention

1- Situations Necessitating Limited Retention

1. Corrected Crossbites:

I-Anterior: when appropriate overbite has achieved.

II-Posterior: When axial tilt of molars continue adequate after the completion of curative surgery.

2. Dentition treated by serial extractions.

3. The correction that has been achieved by retardation of maxillary growth after patients have after the termination of growth spurt.

4. Dentition involving separation of upper and lower teeth in case of impactions of multiple teeth[31].

2- Conditions Necessitating Moderate Retention

1. Class I non-extraction cases, portrayed by projection and separating of maxillary incisor. These require maintenance until typical lip and tongue work has been practiced.

2. Class I or Class II extraction cases doubtlessly require that the teeth be held in contact. Generally it is alluring to use a maxillary such a retainers until typical utilitarian variety has happened[31].

3. Corrected significant overbites in either Class I or Class II malocclusions for the most part require maintenance in a vertical plane. In the occasion that front teeth were debilitated to achieve overbite modification, a nibble plane on maxillary retainers is alluring.

4. Early update of turned teeth to their average positions possibly before root revision has been done. In the zone of the mandibular incisors, a removable sort of appliance with a labial bow is likely the best.

5. Cases including ectopic emissions of teeth or the supernumerary tooth required an alternate retention times, normally long, and incidentally fixed or lasting maintenance apparatuses.

6. The corrected Class II div II malocclusion may requires long term maintenance to take into account the transformation of musculature as per function.

3- Conditions Necessitating Permanent or Semi-Permanent Retention

1. Cases, in which extension has been the decision of treatment, particularly in the mandibular curve, may require either perpetual or semi-enduring maintenance to keep in tooth game plan.

2. Cases of diastema may require never-ending maintenance after space closure has been done.

3. Instances of genuine pivot or extraordinary labiolingual malposition may require perpetual maintenance, as given by braced retainers.

4. Spacing between maxillary focal incisors (diastema) regardless typical impediment on occasion requires perpetual maintenance, particularly in grown-up dentitions[32].

Timing of Retention

Retention is the necessary requirement for all undergone braces treatment. This is required by Hawley retainer.Fundamentally an ideal opportunity for the initial 4 to 6 months, then again, actually

the retainers ought to be taken out while eating (except if conditions like periodontal bone problems require permanent supporting). Proceed on low maintenance reason for in any event one year, to redesigning of gingival tissues. For example full time first two days followed by wearing in evening time. Allow time for if critical development remains, proceed with low retention until finish of development. Imply that approximately whole subjects treated in the early permanent dentition will require maintenance of incisorsposition till late teenager, and in those with skeletal discrepancies at first, low retention using utilization of the functional appliance or extra-oral power presumably will be required[32].

Need of Retention Appliances

1. It ought to control each tooth that has been moved into the ideal situation toward a required position when there is a propensity toward recurring development.

2. It should allow the force that related with the functional activity to act uninhibitedly on holding teeth, allowing all included teeth to react in as physiological way as could be expected under the circumstances.

3. It ought to be as self-cleansing as could be expected under the circumstances and ought to be sensibly simple to keep up in ideal clean conditions.

4. It ought to be built to be as subtle as could reasonably be expected. It ought to be sufficiently able to accomplish its goals over the necessary time of utilization[33].

Retention Appliances

A-Removable Retainer

They can serve effectively for maintenance against intra curve uncertainty and are in like manner supportive as a retainer (as adjusted useful machine or low maintenance headgear) in patients with an improvement issue. These retainers are durable and can be worn during eating. Hawley retainer has been starting late seemed to have the upside of empowering back impediment obstruction getting comfortable the underlying four months of the maintenance time span[34]. The labial bows can be utilized to achieve a simple tooth development whenever required, and anterior bite plane can without much of a stretch be consolidated for maintenance of a rectified profound overbite. There are numerous kinds of removable retainer:

1. Hawley Retainer:

Structured in 1920 by Charles Hawley and the most widely recognized removable retainer utilized;can consolidate biteplate for profound deep bite patients. Have the upsides of encouraging back teeth impediment getting comfortable the underlying four months of the maintenance time span. The patients should wear it for a half year full time then a half year evening time as suggested.

2. Hawley Retainer Modification in maxillary arch:

For premolar extraction case so as to prevent space opening from wires crossing the occlusion.

3. Modification of Hawley retainer in the mandibular arch: (Moore apparatus)

The wire of Hawley bow is less compelling than a wire-fortified by the acrylic bar that firmly contacts the lower incisors. This Moore configuration has entirely replaced the Hawley structure[35].

4. Wraparound Retainer: (Begg retainer)

Involves a labial wire that connect till the last emitted molar and twists around it to get embedded in acrylic that ranges on the sense of taste.

5. Positioner

It could be made as retainers or utilized for completing retention and afterward kept up as a retainer. Worn 4 hours/day and can be wear during sleep[35].

6. Vacuum framed retainer

Removable vacuum framed retainer (Transparent Plastic Invisible Retainers):

Theyare moderately cheap and may immediately create around simultaneously of machine evacuation. It can be altered to deliver tooth development whenever required. It is produced using a polypropylene or polyvinylchloride (PVC) material, regularly .020" or .030" thick. Full posterior occlusal inclusion (counting the subsequent molar if present) is prudent so as to decrease the danger of over eruption of these teeth during the maintenance time frame. The retainers are a case of the reasonable retainers that just fuses the anterior teeth of each arch (from canine to canine). These appliancesconsider the settling of the posterior teeth into better intercuspation and occlusion. Because of their characteristic adaptability, be that as it may, they cannot be utilized to hold cases in which arch have been extended during orthodontic treatment[36]. Late findings have indicated that vacuum shaped retainer was essentially less compelling in advancing posterior occlusal settling than Hawley retainer. Not withstanding, it is probably going to be of little significance if useful posterior impediment has been built up when of debonding, and it is more compelling than Hawley retainers at keeping up retention of the labial portion.

Fixed Retainer

Fixed retainers are exhibited for long haul maintenance of the labial bit, particularly when there is lessened periodontal help, and for support of room or midline diestema. Fixed retainers are lessening the enthusiasm for patient's consistence. In any case, they are connected with a failure movement of up to 47% particularly on upper incisors when there is a significant profound chomp. Moreover, math examination and plaque collections are more critical with removable retainers. Fixed retainers, as such, require long haul uphold[37].

Uses of Fixed Retainers

1. Keeping up lower incisor position

A few cases with gentle mandibular development amongst ages of 16 and 20 can cause lower incisors crowding. A fixed lingual bar reinforced between canines can prevent distal tipping of lower incisors. On the off chance that there is space between teeth were extremely turned, all teeth between canines can be reinforced together by utilizing 17.5 mil interlaced steel wires as it isn't required to utilize too unbending wire to permit physiologic teeth development. Patients followed up for twenty years after wearing lower fixed retainer gave no indications of periodontal issues damage[37].

2. Closing Midline diestema:

Use of lighter wire (17.5 or 19.5 mil curve) along with bonding above the cingulum (out of occlusion).

3. The implant or pontic space maintenance.

Diminish tooth mobility, makes it easy to make bridge and hold spaces whenever delayed periodontal treatment is required post orthodontic treatment, before giving of the restoration. Heavy wire is reinforced for posterior teeth to shallow preparation in contiguous teeth. The more drawn out the range, the heavier the wire set out of occlusion. However, if the patient must wait for quite a while before consummation of vertical development for situation of definite rebuilding, a reinforced bridge extension is liked.

4. Retaining safe extraction spaces

Set on the facial surface of back teeth and generally used in adults, as they persevere through this better than removable retainers and more strong than a removable retainer[38].

Kinds of Fixed Retainers

1- Banded Canine to Canine Retainers

It's by and large used in the lower front locale. Canines were joined and a thick wire is formed over the lingual area and bound to the canine groups, and this will incline to helpless oral cleanliness and are unaesthetic.

2- Bonded Lingual retainer

Retainers fortified on the lingual part of the lower anterior teeth or at the palatal part of the upper anterior teeth reach out from canine-canine, or it might stretch out to incorporate premolars, depends upon actual malocclusion. It could be direct (at the chairside)/indirect (in the lab).

A fortified retainer is favoured for two reasons:

Except if the band was utilized during the dynamic treatment, band spaces could be an issue. The labial aspect of the band will in general accumulate plaque against the cervical aspect of the labial surface, inclining this territory to decalcification, which is unattractive[38].

Types of reinforced retainer:

1. First era

First era was produced using blue Elgiloy 0.032-0.036 inch round tempered steel wire with maintenance circles. Its unbending retainer attached to canines just and has helpless control of the labial development.

2. Second era

Multistrand (twist flex/turn) wires could be unbending multistrand S.S wire of 0.032 inch "fortified distinctly on canines" or adaptable multistrand S.S wire of 0.0175 or 0.0125 inch from canine to canine. The adaptability of the wire permits a physiologic development of the teeth, in any event, when all teeth are fortified together[39].

3. Third era

These are round 0.030-0.032 inch S.S wire with sandblasted closes. Its inflexible retainer attached to canines just, so it doesn't forestall the labial incisor developments.

4. Fourth era

Fiber-fortified composite based retainer (polyethylene and glass filaments). Gingival fiberglass strips absorbed composite and attached to corrosive carved finish. Has focal points of decreasing the theft of the retainer and yet it is an inflexible support and disappointment rate is high[39].

C- Active Retainer

Relapse or development changes after orthodontic treatment will prompt the requirement for certain teeth development during the maintenance time frame[40]. Typically is developed with a removable contraption that returns as a retainer after it has repositioned the teeth. It typically used in two express circumstances.

1. Spring retainer:

It realigns mal-positioned incisors. It will typically need to perform interproximal decline before machine game plan to forestall proclining incisors into fickle position "IPR smoothed contacts extending stability" and this can decrease incisors width about 0.5 mm/side. If teeth are genuinely packed, retreatment with strengthened sections is proposed; trailed by fixed retention[40].

2. Modified functional device:

Activator or Bionator: Upper and lower retainers joined by entomb occlusal chomp squares to keep up teeth inside the curve while possibly modifying the occlusal relationship. For example: If youngsters slip back 2-3 mm into Class II after early modification, this machine can be used to recover proper impediment It must be utilized if close to 3 mm remedy is required. Hold maxillary posterior segment and take into consideration to allow for mandibular posterior portion anteriorly (Class II)[40].

Conclusion

A few conditions can be referred to as impacting the outcome of orthodontic treatment but results are conceivably unsteady. Therefore, retention is fundamental. Likewise, Retention is still fundamentally significant until gingival and periodontal rearrangement is finished. Lastly, whatever the circumstance, retention can't be deserted until development of jaw is finished.

Conflict of Interests

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