



Retention in orthodontics

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Abstract

Restraint is necessary after orthodontic treatment in order to sustain the results obtained and avoid recurrence. It is an integral part of orthodontic treatment, and requires real collaboration between the patient and his practitioner. Several restraint devices are made available to orthodontists, they incorporate mechanical devices, fixed or removable, but also so-called natural restraints. The choice of the means of restraint depends on several factors mainly related to the malocclusion, the dental arch involved, the periodontal condition and the patient's cooperation.

Introduction

Stability after treatment is a major concern for both the orthodontist and the patient. This imposes the use of a retainer that would have the objective of maintaining the corrections obtained throughout the treatment. Indeed, teeth tend to return to their initial positions because of the tension exerted by the desmodontal ligaments.

Many orthodontic masters such as Angle, Case, Tweed and Hawley have taken a special interest in orthodontic post-treatment retention and considered it as a treatment phase in its own right.

The retention phase is therefore an integral part of orthodontic treatment, and requires a true collaboration between the patient and his practitioner. On the one hand, the orthodontist must adapt the retainer to be as comfortable and effective as possible, and on the other hand, the patient must cooperate in terms of wearing and hygiene.

A variety of different retainers have been developed since the early days of orthodontics and are available to orthodontists. These include mechanical devices, fixed or removable, but also other procedures such as supracrestal fibrotomy and interproximal enamel grinding.

Interest of Retention

Occlusal adjustment: Obtaining a functional occlusion ensuring correct intra- and inter-arch relationships is one of the main objectives of an orthodontic treatment. During the entire period of treatment, the wearing of elastics, correction of the overbite, the open bite and the reorientation of the occlusion plan lead to changes in the occlusal and muscular environment and require a period of rehabilitation.

In fact, the achievement of occlusal adjustment is essential at the end of any orthodontic treatment; it must be obtained both in static and dynamic situations.

Periodontal reorganization: At the end of the orthodontic treatment, the periodontal space surrounding the tooth is widened and filled with a neoformed osteoid tissue. The calcification of the latter is done gradually and takes several weeks. The reorganization of the desmodontal fibers takes about 8 to 9 weeks with the exception of the supra-alveolar fibers, which remain stretched and have a longer turnover.

The adaptation potential of the periodontium depends on the age of the patient, it is faster in children and adolescents compared to adults in whom the reorganization takes longer

Maintaining the aesthetic result : Retention allows the teeth to be maintained in the corrected position and thus stabilize the esthetic and functional results obtained through orthodontic treatment. It also prevents anterior overlaps that may be due to mesial drift, especially in the mandible.⁵

The different types of retainers

Apart from occlusal retainers, mechanical retainers can be classified into 2 main categories: fixed and removable. As the name suggests, removable retainers are worn part-time and can be removed by patients. However, in certain clinical situations where a 24-hour retainer is required to reduce the risk of recurrence, a fixed retainer is generally indicated.

Occlusal retainers : This is a retainer obtained without the use of braces. In fact, obtaining correct occlusal ratios both posteriorly and anteriorly is considered a guarantee of post-orthodontic stability. The intercuspitation must be precise and deep and must respect the principles of tripodism and cusp/fossa relationships.

The number of inter-arch dental contacts varies from one individual to another; a minimum of 24 contacts per hemi-arch has been admitted by Ricketts. This would require occlusal readjustment at the end of any orthodontic treatment.

Rehabilitation of a functional anterior guide is a guarantee of anterior stability. Re-education of function and the removal of parafunctions play an important role in stabilizing the results of orthodontic treatment.^{6,2}

Removable retainers: There are several types of removable retainers, the latter have the particularity of being easier to achieve compared to fixed retainers. Removable retainers may be the same as those used during orthodontic treatment, but inactivated, or they may be made in the laboratory following an impression taken at the end of treatment.

Hawley's Removable appliance : The Hawley appliance is one of the oldest retainers. It was designed by Charles Hawley in 1919.⁷

It is a removable appliance made of acrylic resin, covering more or less the mucous membrane of the hard palate, it is reinforced with a 0.7mm stainless steel wire. A vestibular band comes in contact with the vestibular surfaces of the six anterior teeth and retention is ensured by hooks at the molars.

Thermoformed gutters : Designed for the first time in 1971 by Ponitz, they are also called vacuum formed removable retainers (VFR) .

They are transparent retainers made from thermoplastic materials such as polyethylene polymers and polypropylene polymers. They are relatively inexpensive and easy to make in the dental office.

They are the most common retainers used by orthodontists in many countries such as the United Kingdom, Ireland and the United States, as they are

well accepted by patients in terms of comfort, aesthetics and effectiveness.

Indeed, these appliances have proven their effectiveness in maintaining arch shape and tooth alignment and oppose the reopening of diastemas, extraction spaces and the reappearance of malpositions and rotations .

This means of retention also allows practitioners to perform activations that may result in minor tooth movements in order to perfect dental alignment or in the case of slight recurrences. They also offer the possibility of incorporating prosthetic teeth, pending definitive restorations, for a better esthetic result .

Fixed retainers: Fixed retainers systems are splint type devices that are bonded to the teeth to hold them in place.

The advent of bonding in dentistry has allowed the development of fixed retainers. In 1973, KNIERIM reported the first use of the mandibular bonded retainer, using a stainless steel wire only bonded to the canine teeth.

Several generations of smooth wires followed one another, until 1977 when Zachrisson, showed the advantages of using a multi-strand wire¹⁴ first on the canines and then on all the anterior teeth.

Multi-strand wires are the most used nowadays, however more aesthetic devices made of resin, composite or fiberglass are more and more available to orthodontists.

The wire is adapted to the lingual or palatal surfaces of the teeth, either directly in the mouth or on a model. The working field must be perfectly isolated in order to avoid detachment of the retainer before bonding.

This means of retention has the advantage of being more discreet and does not depend on the patient's cooperation. Nevertheless, bonded retainers are

associated with a significant long-term failure rate due mainly to detachment, fractures and deformation of the wire.

The bonded wire requires strict hygiene to prevent the accumulation of plaque and dental calculus and the development of caries under the retainer.



Figure 1: EL AOUAM A

The combination of fixed and removable retainers:

A number of practitioners favour the combination of bonded splints and thermoformed gutters. In case of failure of the fixed retainer, the removable appliance ensures the stability of the orthodontic results while waiting for the repair or replacement of the fixed appliance.

Duration of Retention

In current orthodontic practice, the duration of the retention varies considerably. It depends on several factors such as the variability of occlusal, skeletal and soft tissue relationships, as well as the beliefs of each practitioner given the lack of scientific studies conducted on the subject. Indeed, a recent Cochrane review conducted on the subject demonstrated the lack of research on post-orthodontic retention.

One of the few surveys conducted in the United Kingdom during the 1990s showed that the majority of practitioners keep the retainer for a period of 12 months.

This approach is essentially based on histological studies showing that periodontal adaptation requires

several months. However, it is frequent to note dental recurrences even after this duration.

As long as a consensus has not yet been established concerning the duration of the retention, the orthodontist must use his common sense by taking into account the various inter-individual variations. He must also adapt the post-orthodontic phase according to the skeletal, muscular, occlusal and periodontal conditions specific to each patient.

Which means of retention to choose? :

In the maxilla : According to a Cochrane review published in 2016, there is currently no concrete scientific evidence on the effectiveness of one retainer over another. Removable devices are as effective as fixed ones, although patients have a preference for bonded retainers.

The choice of the maxillary retainer can be determined by several factors such as the initial malocclusion, the treatment results and treatment modalities, oral hygiene, the patient's cooperation and the practitioner's personal experience. 22,23

Recent guidelines suggest:

- The use of a removable retainer in case of low risk of recurrence,
- A fixed retainer in patients with a medium risk of recurrence,
- Combination of the two means of retainers when the risk is high,

The combination of fixed and removable retainers:

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- Combination of the two means of retention when the risk is high,
- To extend the fixed canine-to-canine retainer if the patient had rotations prior to orthodontic treatment,
- A metal wire from side to side in the case where retention is provided by a combination of fixed and removable means,
- The use of a fixed retainer imposes strict oral hygiene,
- The choice of a removable retainer requires regular wearing and good patient cooperation, otherwise removable means will be preferred.

In the mandible: Bonded retainers are more effective than removable devices and prevent the reappearance of dental overlaps. They are therefore more recommended to retain the mandibular incisivo-canine area. 25 Combination with removable devices may be indicated in patients with a high risk of recurrence.

However, fixed devices cause more periodontal problems. It will thus be necessary to replace them by removable retainers in case of bad hygiene. Particularities of patients with weakened periodontium or root resorptions

Post-orthodontic retention in patients with a weakened periodontium is a real challenge for the orthodontist. Indeed, these patients present a higher risk of recurrence.

The objectives of retention are not only to maintain the orthodontic results obtained, since it also contributes to a functional and masticatory comfort while ensuring a better distribution of occlusal forces. It is essential to respect the interdental spaces and embrasures to

facilitate hygiene. Indeed, the use of specific and definitive means of retention is often recommended:

Direct retention techniques

It has the advantage of being performed in a single session, and groups the retention splints using a bonded metal grid, composite fiber, Kevlar fiber or preformed rigid metal wires.

Indirect retention techniques

They often require enamel preparation. It is a question of:

Cast splint bonded. It is a metal structure that encompasses the lingual and proximal surfaces of the supporting teeth and can replace one or more teeth. It provides long-term support and reduces dental mutilation.

Fiber composite splint. The indirect realization of this splint makes it possible to manage a better impregnation of the fiber with the composite, which increases the resistance of the whole.

Bridge retainer: in the presence of decay of the teeth to be retained, the construction of bride retainer can be considered and has the advantage of replacing missing teeth and retaining teeth with weakened support.

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