

# Contention following the orthodontic treatment and prevalence of relapse

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**Abstract.** Introduction. The relapse after orthodontic treatment has been defined by British Standards Institute as being a recurrence to initial position following the correction of malocclusion through orthodontic treatment. For the orthodontic specialists it is very important a rigorous understanding of all the etiological factors of relapse and be acquainted with different methods of diminishing the risk of relapse. In order to prevent the relapse, the retention phase of the orthodontic treatment is required. There are several types of retainers, the simplest classification of them being in removable retainers and fixed retainers. Objective. The scope of the current study has been the assessing of the proportion of contention phase patients, presenting to orthodontic monitoring during certain time frames, the various types of contention devices applied to these patients as well as the incidence of relapse within the batch of patients being monitored. Material and methods. The study was conducted on 874 patients aged between 11–25 years in the North-West of Romania, in accordance with the World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects approved by the Ethics Committee of the University of Oradea, Romania. We have conducted a frequency statistical study regarding the proportion of patients presenting to orthodontic monitoring following the end of the active orthodontic treatment, respectively during the relapse phase of the treatment. Results. One year following the contention device application, the number of patients rejoining orthodontic monitoring decreased to 528 (62.93%) patients; after 2 years the number of patients rejoining the orthodontic monitoring decreased to 478 (56.97%). Regarding the various types of contention devices, a total of 585 bounded retainers, 470 Hawley retainers, 392 thermoplastic retainers and 79 positioners have been used. Conclusions. Relapse after orthodontics treatment is unpredictable. Retention phase has the same importance as the active phase of the orthodontic treatment. None of the retention devices offers an absolute certainty for the avoidance of relapse.

**Key Words:** relapse, retention, orthodontic treatment.

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## Introduction

The relapse after orthodontic treatment has been defined by British Standards Institute as being a recurrence to initial position following the correction of malocclusion through orthodontic treatment (Mitchel 1996).

Therefore, the relapse is a very important issue when it comes to orthodontic treatment, regardless of various treatment technicalities applied to different malocclusions. The aim is that at the end of an orthodontic treatment which has been professionally conceived, well guided and finalized, to obtain the occlusal balance and a timely stable correction. For the orthodontic specialists it is very important a rigorous understanding of the etiological factors of relapse and be acquainted with different methods of reducing the risk of relapse. This includes the advantages and disadvantages of various retainers, as well as the ability to advise patients on how to wear retainers effectively (Littlewood et al 2017).

Riedel and Little demonstrated (on a sample of 800 post retention cases) that relapse occurred in the majority of the patients,

but relapse was quite unpredictable. (Little et al 1981; Little et al 1988; Littlewood et al 2017). Little specified that a permanent retention solution was the only safe way to prevent relapse (Little et al 2009; Littlewood et al 2017).

Over time several theories have been issued related to the factors involved in relapse. Thus, the most important etiologic factors of relapse were considered the follows: occlusal factors, periodontal and gingival factors, soft tissue pressuring the dentition, the residual facial growth or changes that occur during lifetime including some changes in the relationship between the mandible and maxilla and the evolution of the third molar (De La Cruz et al 1995; Burke et al 1997; Little 1990; Behrents et al 1989). However, there is no clear evidence of the contribution of these factors.

In order to prevent relapse, the retention phase of the orthodontic treatment is required. There are several types of retainers, the simplest classification of them being in removable retainers and fixed retainers. Removable retainers present the advantages of being more facile to maintain a are also more appropriate for maintaining a proper oral hygiene. They may often be

worn only part-time. Most of the time the removable retainers have the indication of full time wearing (excepting while eating and brushing) only in the first 3 or 4 months of retention, after that they should wear only at night. In many cases, removable retainers should be worn only at night to maintain dental stability (Gill et al 2007; Shawesh et al 2007; Thickett et al 2010). This method of retention requires good patient compliance. The most common removable retainers are the Hawley retainers, thermoplastic retainers and positioners. Many authors suggest that patients prefer the thermoplastic retainers thanks to their comfort and appearance; they are considered to be cost-effective and slightly more effective in maintaining the result of the orthodontic treatment (Littlewood et al 2017; Hichens et al 2007; Rowland et al 2007).

Fixed retainers have the advantage of not requiring patient compliance. On the other hand, they are more susceptible to plaque and calculus accumulation. These types of retainers require special measures for a good oral hygiene (Littlewood et al 2017). The fixed retainers may detach from one or more teeth so they need periodic checking. In addition, these retainers may cause undesirable dental movements as a result of the tearing/detachment from the retainer of one or more teeth (Abudiak et al 2011; Kucera et al 2016; Shaughnessy et al 2016).

The scope of the current study has been the assessing of the proportion of contention phase patients, presenting to orthodontic monitoring during certain time frames, the various types of contention devices applied to these patients as well as the incidence of relapse within the batch of patients being monitored.

## Material and methods

The study was conducted on 874 patients aged between 11–25 years in the North West of Romania, in accordance with the World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects approved by the Ethics Committee of the University

of Oradea, Romania. All patients were taken in the study with their or their parents' consent. Before the starting of treatment, patients and their parents were informed about the retainer commitment required.

We have conducted a frequency statistical study regarding the proportion of patients presenting to orthodontic monitoring following the end of the active orthodontic treatment, respectively during the relapse phase of the treatment. A reassessment of the compliant patients has been done 6 months, 1 year, 2 years, 3 years, 4 years and 5 years following the end of the active orthodontic treatment.

We have also assessed the batch regarding the type of retainer that has been applied. For the contention phase we have opted for devices such as Hawley retainers, clear thermoplastic retainers, positioners, fixed retainers (Fig. 1, 2, 3, 4). Therefore, we have used two types of Hawley retainer, as follow: both of them were constructed with an acrylic base plate, Adams clasps made from 0.7 mm diameter stainless steel wire on the first molars and a plain labial bow, also made from 0.7 mm stainless steel wire with two vertical "U" loops, extended from first premolar to first premolar from the first type of Hawley, and a contoured long labial bow soldered to the clasps, to contact the labial surfaces of the incisors from the other type of Hawley retainer used (see Figures 1a, 1b). Clear thermoplastic retainers (vacuum-formed retainer) fabricated of Essix type C thermoplastic material with a 0.5 mm thickness after being thermoformed, full dental arch coverage and the edges extended about 2-3 mm lingual past the gingival margin (see Figure 2). We used tooth positioners made from polyethylene material (see Figure 3). For fixed retainers (bonded retainers) we used round or multistrand stainless steel wire, 0.0175-inch size (see Figure 4).

We consider necessary the use of removable retainers for a 2 to 3-year time period following the end of active orthodontic treatment. In case of fixed retainers, we consider necessary the use of these devices for a 5-year time period following the end of active orthodontic treatment.



Figure 1a. Hawley retainer plus bonded retainer



Figure 1b. Hawley retainer



Figure 2. Clear thermoplastic retainer



Figure 3. Positioner



Figure 4. Bonded retainer

Another phase of the current research has been to investigate the frequency of relapse following the active orthodontic treatment, as of the type of contention device that has been applied.

### Results

Out of the total batch of 874 patients assessed within the current study (patients that finished the active orthodontic treatment), 35 patients decided not to join the post-treatment monitoring and application of orthodontic contention device; these patients stand for 4% of the total batch (see Figure 5).

Consequently, 839 patients (96%) have been monitored for various time periods during the contention phase. Out of the batch of 839 patients adhering to orthodontic contention phase monitoring and being applied contention devices, 6 months following the application of such device 711 (84.74%) patients rejoined the orthodontic monitoring. One year following the contention device application, the number of patients rejoining orthodontic monitoring decreased to 528 (62.93%) patients; after 2 years the number of patients rejoining the orthodontic monitoring decreased to 478 (56.97%). After 3 years following the application of contention, the number of patients

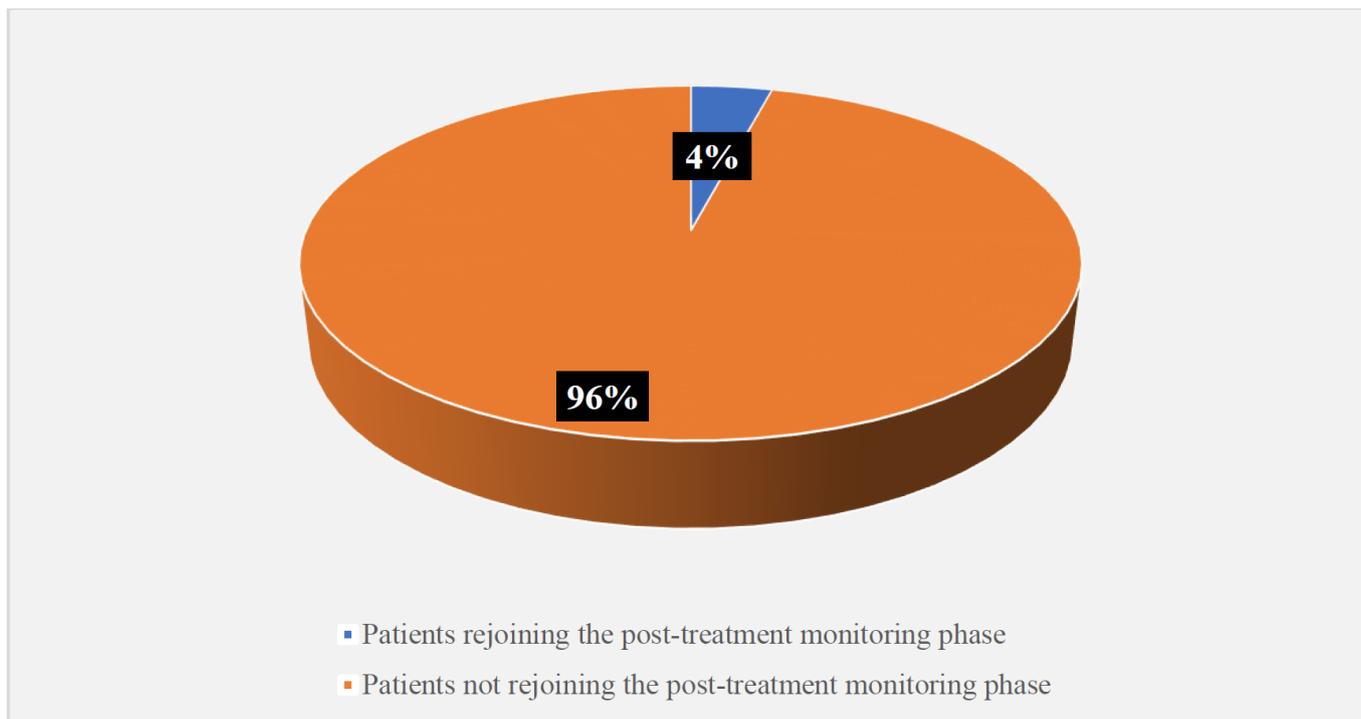


Figure 5. Distribution of total batch by the adherence to the contention phase

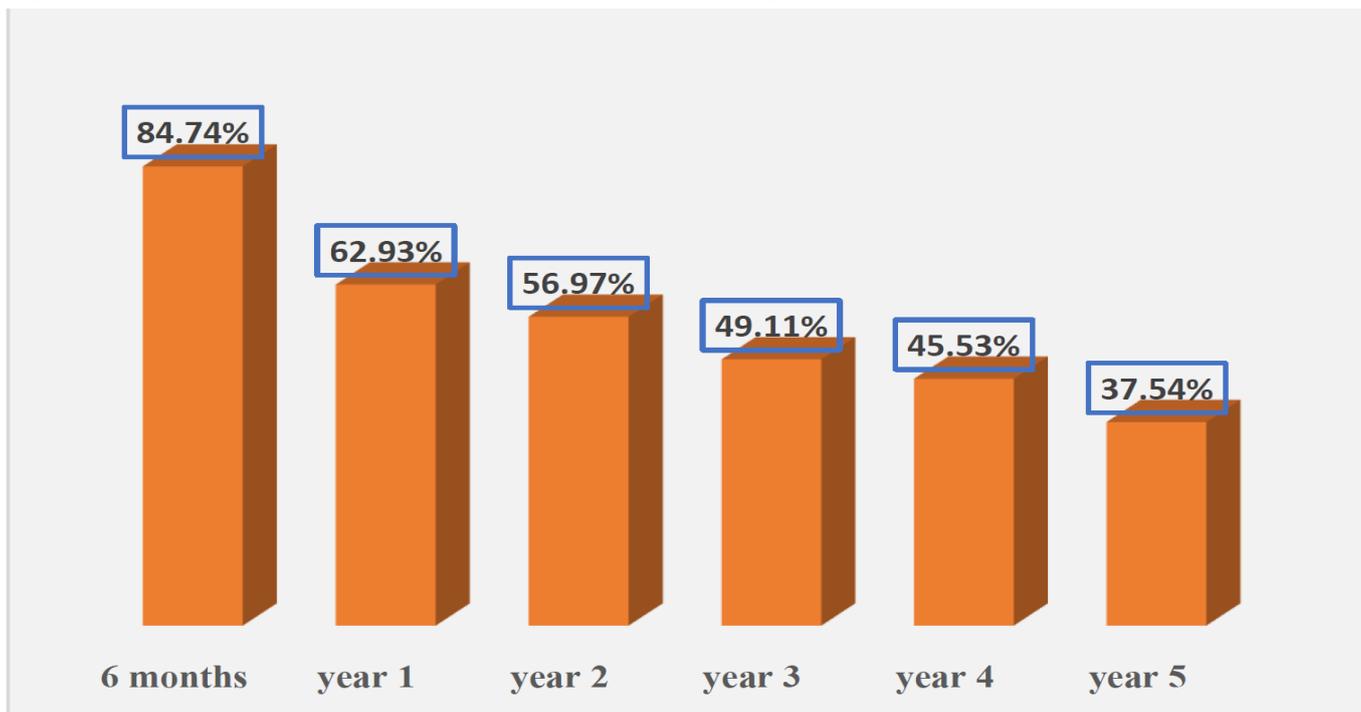


Figure 6. Distribution of patients by the presence to monitoring during the contention period

has not decreased considerably as 412 (49.11%) patients re-joined to monitoring. The slow decrease in numbers continues in the 4th year following the application of contention device (382 patients, 45.53%) and the 5th year (315 patients, 37.54%). (see Figure 6).

Regarding the various types of contention devices, a total of 585 bounded retainers, 470 Hawley retainers, 392 thermoplastic retainers and 79 positioners have been used.

Thus, 76 patients were applied Hawley retainers exclusively as contention solution, on one or both dental arches. For 40 of them has been optioned for a combined contention method, namely the use of Hawley retainer for the upper jaw and thermoplastic retainers for the mandible. For 277 patients were applied Hawley retainers for the upper jaw and bonded retainers for the mandible (see Figure 7).

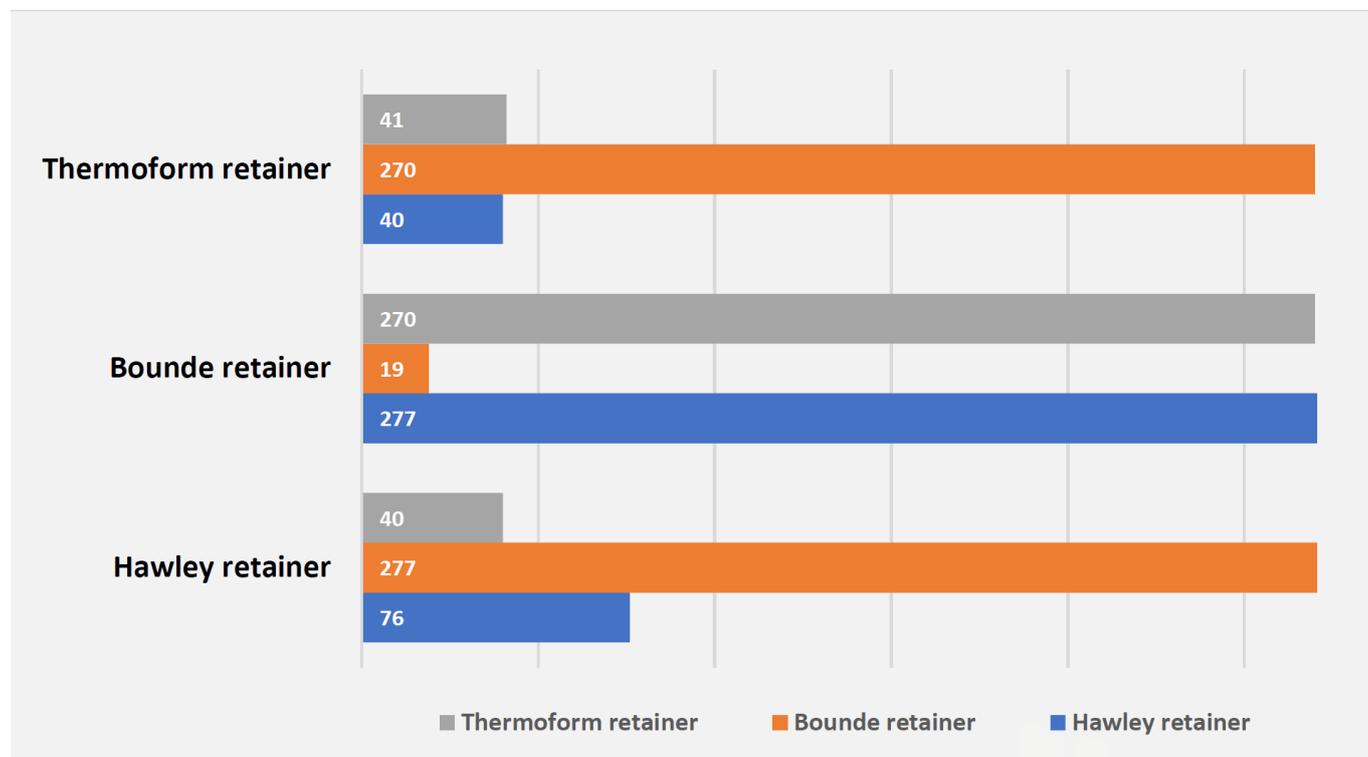


Figure 7. Distribution of patients by various containers devices applied in various associations

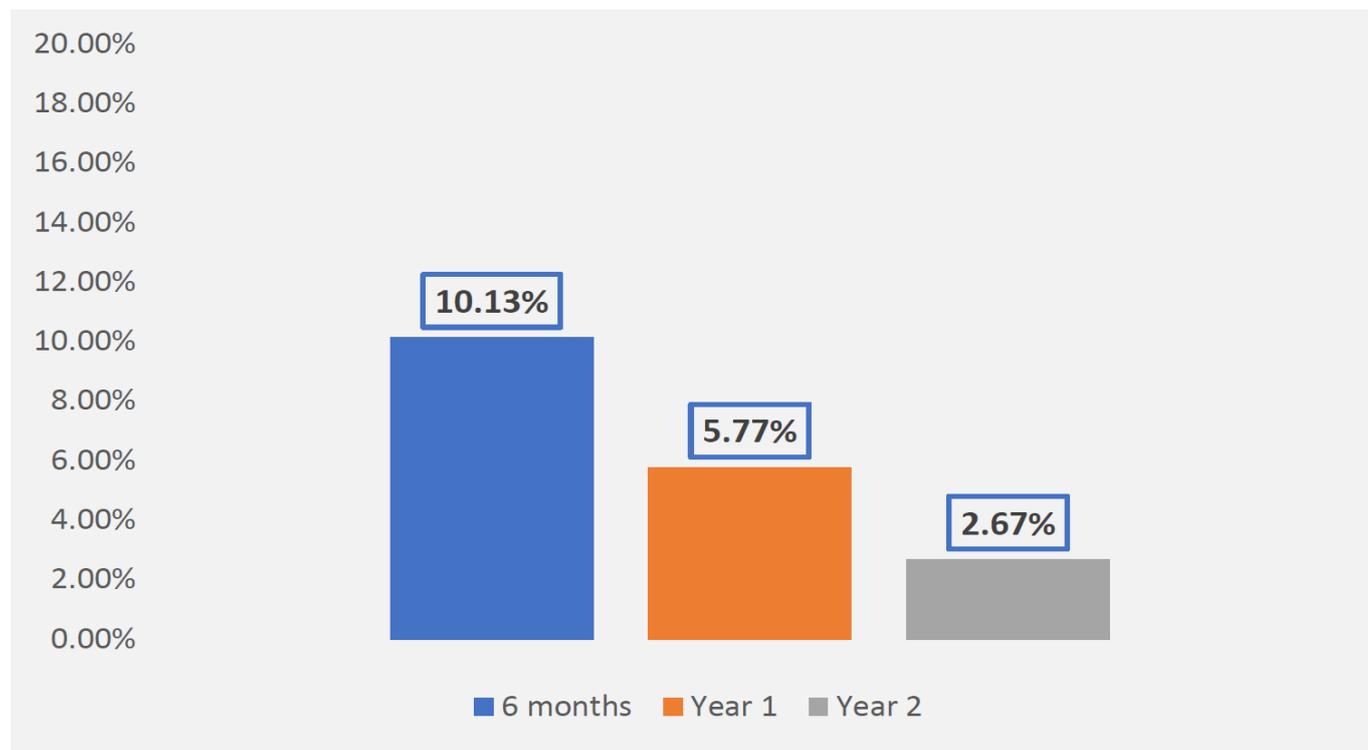


Figure 8. Distribution of patients by time of relapse re-appearance

The 585 bonded retainers have been applied as follows: 277 of patients have been treated in a combined approach, namely the Hawley plate for the upper jaw and bonded retainers for the mandible; 270 patients have been applied a mixed contention of thermostatic retainer for the upper jaw and bonded retainer for the mandible; for the other 19 patients has been opted for bonded retainers exclusively for both dental arches (see Figure 7). During the contention phase 392 thermostatic retainers have been used. Out of these, 270 patients have been applied thermostatic retainers for the upper jaw and bonded retainer for the mandible, 40 have been treated with thermostatic retainer for one of the dental arches and Hawley plate to the other. 41 patients have been applied thermostatic retainer for both dental arches (see Figure 7).

Out of the 711 patients who rejoined the orthodontic monitoring 6 months following the contention device application, 72 (10.13%) patients presented relapse. One year following the contention application, 41 (5.77%) patients presented relapse while 2 years following the contention application only 19 (2.67%) patients have been confronted with partial relapse of initial anomaly (see Figure 8).

## Discussions

There is no comparison of current results with results of other studies available in specialized literature. The discussions are mainly based on real life situations, various observations and measurements and comparisons of various cases. The current results could be reviewed and restructured in further assessments that could include data provided from other authors. To be mentioned also that there is a rather scarce available information referring to relapse in dentomaxillary anomalies.

Even though both patients and their caregivers (in case of children and adolescents' patients) have been thoroughly informed about the importance and consequences of the relapse phase, 4% of the patients decided not to participate to the post-treatment phase and consequently they have not been applied any retainers. Also, it has been observed that the number of patients rejoining post-treatment monitoring has downsized during the 5-year time period; at the end of the 5-year time period only 37.5% of the patients participated to the monitoring.

Our study has discovered that the highest malocclusion relapse risk appears during the 6-month period following the completion of the active orthodontic treatment (approx. 10%), afterwards the risk of relapse decreased but remained to a measurable level. Every type of retainers provisioned by the available literature has presented advantages and shortcomings. Removable retainers are often used, despite reservations about poor compliance, especially in children and adolescents (Ackerman et al 2011; Al Rahma et al 2018). However, there are, as yet, no definite indications for choosing the optimal period of retention, or the type of retainer (Johnston et al 2013) and general protocols for ideal orthodontic retention practices still remain undetermined (Pratt et al 2011; Al Rahma et al 2018). Hichens et al (2007) compared the self-reported overall retainer failure of Hawley and clear thermoplastic appliances. The authors found that more patients had broken their removable retainers or lost their removable retainers. However, subjects wearing Hawley retainers had significantly greater proportion of maxillary teeth rotation (Rohaya et al 2006). Sun et al (2011) also compared the failure

of retainers as assessed by specialists, separately for the maxillary and the mandibular dental arches. Only in the mandibular dental arch was the proportion of clear retainers presenting with fractures or exhibiting overall failure greater than the proportion in the Hawley retainer (Sun et al 2011; Al Rahma et al 2018). Regarding the oral hygiene, the Plaque Index (PI), was observed to be statistically higher (up to 3 months) in the positioner group compared to the Hawley group (Zhang et al 2003).

Regarding economic evaluation, clear thermoplastic retainers were considered more cost-effective from the perspectives of the health system, the orthodontic practice and the individual patient (Al Rahma et al; Hichens et al 2007).

In a study conducted by Kim et al, the authors proposed a method to boost the effect of the retainers and shorten the retention period. This method, named Low-intensity laser therapy (LILT) facilitates the remodeling of the periodontal ligament (PDL) during retention phase after orthodontic treatment. The LILT method accelerates the remodeling of PDL only in association with a retainer, not in the case of teeth left free, without contention (Kim et al 2013).

We underline the importance of presenting patients to periodic check up during retention phase, so that if the relapse is installed, the changes appeared would be as easy as possible. For example, Liou et al introduced a new retainer design - .018 inch nickel-titanium archwire bonded lingually from canine to canine for four months, that may solved a slight relapse in the form of crowding in the lower incisors (Liou et al 2001).

In the past two decades many biological agents have been investigated experimentally such as bone morphogenic proteins, osteoprotegerin, relaxin, bisphosphonates, to determine whether they could improve the stability after orthodontic treatment. Further longitudinal studies are required to determine the clinical applicability of these agents for orthodontic retention (Swidi et al 2018).

## Conclusions

Relapse after orthodontics treatment is unpredictable. Retention phase has the same importance as the active phase of the orthodontic treatment. We consider of major importance the information and the raising of awareness to both the patients and the caregivers of non-adult patients towards the major role of the relapse phase and the necessity of adhering to the orthodontic post-treatment phase and the compliance during this treatment phase. Nevertheless, none of the retention devices offers an absolute certainty for the avoidance of relapse; furthermore, the decision on a certain retainer device requires an individualized approach.

## References

- Abudiak H, Shelton A, Spencer RJ, Burns L, Littlewood SJ. A complication with orthodontic fixed retainers: A case report. *Ortho Update* 2011;4:112-117.
- Ackerman M.B. and Thornton B., Posttreatment compliance with removable maxillary retention in a teenage population: a short-term randomized clinical trial. *Orthodontics* 2011;12, 22-27.
- Al Rahma WJ., Kaklamanos EG., Athanasiou AE., Performance of Hawley-type retainers: a systematic review of randomized clinical trials, *European Journal of Orthodontics* 2018;40(2):115-25.

- Behrents RG, Harris EF, Vaden JL, Williams RA, Kemp DH. Relapse of orthodontic treatment results: growth as an etiological factor. *J Charles H Tweed Int Found* 1989;17:65–80.
- Burke SP, Silveira AM, Goldsmith LJ, Yancey JM, Stewart AV, Scarfe WC. A meta-analysis of mandibular intercanine width in treatment and post-retention. *Angle Orthod* 1997;68:53–60.
- De La Cruz A, Little RM, Sampson P, Årtun J, Shapiro PA. Long-term changes in arch form after orthodontic treatment and retention. *Am J Orthod Dentofac Orthop* 1995;107:518–530.
- Gill DS, Naini FB, Jones A, Tredwin CJ. Part-time versus full-time retainer wear following fixed appliance therapy: a randomized prospective controlled trial. *World Journal of Orthodontics* 2007;8:300–306.
- Hichens L, Rowland H, Williams A, et al. Cost-effectiveness and patient satisfaction: Hawley and vacuum-formed retainers. *Eur J Orthod* 2007;29:372–8.
- Johnston C, Burden D. and Morris D. (2008) *Clinical guidelines: Orthodontic Retention* (Revised July (2013) by Parvizi, F., Morris, D., Atack, N.). British Orthodontic Society, London, UK.
- Kim, SJ, Kang, YG, Park, JH, Kim EC, Park YG. Effects of low-intensity laser therapy on periodontal tissue remodeling during relapse and retention of orthodontically moved teeth, *Lasers Med Sci* (2013) 28: 325.
- Kucera J, Marek I. Unexpected complications associated with mandibular fixed retainers: A retrospective study. *Am J Orthod Dentofacial Orthop* 2016;149:202–11.
- Liou EJW, Chen LIJ, Shing Huang C. Nickel-titanium mandibular bonded lingual 3-3 retainer: For permanent retention and solving relapse of mandibular anterior crowding. *Am J of Orthod Dentofacial Orthop* 2001;119(4):443-9.
- Little RM, Riedel RA, Artun J. An evaluation of changes in mandibular anterior alignment from 10 to 20 years post-retention. *Am J Orthod Dentofacial Orthop* 1988;93:423–428.
- Little RM, Wallen TR, Riedel RA. Stability and relapse of mandibular anterior alignment- first premolar extraction cases treated by traditional edgewise orthodontics. *Am J Orthod* 1981;80:349–365.
- Little RM. Clinical implications of the University of Washington post-retention studies. *J Clin Orthod* 2009;43:645–51.
- Little RM. Stability and relapse of dental arch alignment. *Br J Orthod* 1990;17:235–241.
- Littlewood SJ, Kandasamy S, Huang G, Retention and relapse in clinical practice, *Aust Dent J*. 2017 Mar; 62 Suppl 1:51-57.
- Mitchell L., An introduction to orthodontics. Oxford: Oxford University Press, 1996.
- Pratt MC, Kluemper GT, Hartsfield JK Jr, Fardo D, and Nash DA. Evaluation of retention protocols among members of the American Association of Orthodontists in the United States. *American Journal of Orthodontics and Dentofacial Orthopedics* 2011;140, 520–526.
- Rohaya MAW, Shahrul Hisham ZA and Doubleday B. Randomized clinical trial: comparing the efficacy of vacuum-formed and Hawley retainers in retaining corrected tooth rotations. *Malaysian Dental Journal* 2006;27, 38–44.
- Rowland H, Hichens L, Williams A, et al. The effectiveness of Hawley and vacuum- formed retainers: A single-center randomized controlled trial. *Am J Orthod Dentofac Orthop* 2007;132:730–7.
- Shaughnessy TG, Proffit WR, Samara SA. Inadvertent tooth movement with fixed lingual retainers. *Am J Orthod Dentofacial Orthop* 2016;149:277–86.
- Shawesh M, Bhatti B, Usmani T, Mandall N. Hawley retainers full or part time? A randomized clinical trial. *Eur J Orthod* 2010;32:165–170.
- Sun J, Yu YC, Liu MY, Chen L, Li HW, Zhang L, et al. Survival time comparison between Hawley and clear overlay retainers: a randomized trial. *Journal of Dental Research* 2011;90:1197–1201.
- Swidi AJ, Taylora RW, Tadlocka LP, Buschang PH. Recent Advances in Orthodontic Retention Methods: A Review article. *Journal of the World Federation of Orthodontists* 2018; 7: 6e12.
- Thickett E, Power S. A randomized clinical trial of thermoplastic retainer wear. *Eur J Orthod* 2010;32:1–5.
- Zhang B. and Wang Q. Periodontal implication of positioner versus removable retainer. *Beijing Journal of Stomatology* 2003;3:146–7.

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