

Contemporary Approaches to Orthodontic Retention

Guest Experts

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Wouldn't it be nice if teeth stayed aligned for life? In the absence of orthodontic movement, teeth exist in their current positions as a result of a dynamic equilibrium of multiple forces acting upon them (cheeks, tongue, lips, periodontal ligament, etc.).¹ Following orthodontic movement, teeth have a tendency to return to their initial positions; hence, a retention phase is an integral part of orthodontic treatment.

EXPECTED CHANGES OVER TIME

Aligned teeth have a tendency to relapse because of:

- 1 Periodontal causes: bone, periodontal ligament and gingival fibers remodeling
- 2 Post-treatment active growth
- 3 Habits lasting at least 6 to 8 hours per day or
- 4 Normal maturation and decrease in arch perimeter, including maxillo-mandibular compensations (adjustments)

For over 30 years, Little and colleagues followed patients who had nonextraction treatment with crowding, premolar extractions, incisor extractions, nonextraction treatment with generalized spacing, and patients with no orthodontic treatment.²⁻⁸ All of them showed similar changes in the dentition despite high variability. The natural tendency after orthodontic retention is removed includes (1) a decrease in arch length and intercanine distance and (2) an increase in mandibular crowding (which also occurs in untreated dentitions).⁹ Based on current evidence, it is impossible

to predict relapse on an individual basis, and there are no pretreatment variables that are useful as predictors.² Third molars have little effect on relapse following orthodontic treatment.⁴

ORTHODONTIC RETENTION PHASE

At present, there is insufficient research data on which to base our clinical practice of retention.¹⁰ We know that circumferential supracrestal fibrotomy (CSF) can reduce the rotational relapse mainly in maxillary teeth, but it is rarely performed.¹¹ Extraction cases on average are more stable than arch-development cases, but it is impossible to predict on an individual basis. In other words, stability is not the main determinant in the extraction decision.

Some reduction of mandibular irregularity after orthodontic treatment is associated with the interproximal reduction of lower incisors.¹² This procedure is not related to an increased incidence of caries¹³ or gingival or periodontal problems,¹⁴ but it is not sufficient by itself to assure the permanence of the orthodontic treatment results.

Based on these considerations, it is now accepted that some sort of retention is needed. The majority of US orthodontists prescribe full-time retainer wear for less than 9 months following braces removal, and advise indefinite part-time wear after that point. In 2002, 33% of the orthodontists in the United States were routinely using a fixed retainer in the mandible.¹⁵ In a recent

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survey, this figure among 658 orthodontist respondents increased to 40.2%, and three-quarters of these were planned as permanent retention.¹⁶

TYPES OF RETAINERS

Fixed or bonded retainers can be made of a thick 0.030" to 0.032" wire or from multistranded wire 0.0215" or 0.0195". The former is bonded to two or three teeth (canine-only bonded retainers), and the later is normally bonded to three or more teeth (most frequently all lower incisors and canines, and all upper incisors) (Figure 1).

Removable retainers can be an acrylic/wire type of appliance (Hawley-type, etc.), a clear thermoplastic, or other design:

- 1 Hawley retainers: rigid, yet adjustable, and allow for some settling of the occlusion. Less esthetic than other retainers (Figure 2)



FIGURE 1. Examples of mandibular fixed retainer. (Top) 0.030" stainless steel canine-only bonded retainer. (Bottom) 0.0195" multistranded fixed retainer bonded to mandibular canines and incisors.

- 2 Clear thermoplastic retainers: esthetic, easily fabricated but with occlusal coverage that does not allow settling of occlusion (Figure 3)
- 3 Other designs: positioners and silicone-based retainers

EVIDENCE-BASED USE OF RETAINERS

The three main concerns during the retention phase are: ability of the retainer to actually retain the orthodontic correction (efficacy), breakage and repairs to the fixed retainers, and long-term periodontal/gingival/dental effects on the teeth adjacent to the retainer. We will address the first concern separately and the other two together.

Efficacy

Fixed retainers bonded to all incisors are capable of retaining the alignment of the teeth involved.¹⁷ Canine-only bonded retainers are effective in maintaining postorthodontic alignment in most patients, but some will have a mild increase in incisor irregularity.¹⁸

Success of retention with removable retainers depends almost completely on good compliance of the patient. Patient compliance with retainer wear decreases with time—with fewer than half of patients wearing retainers as instructed 2 years following completion.¹⁹ It is somewhat encouraging that among removable retainer styles, patient satisfaction and compliance with clear thermoplastic retainers are better than with acrylic/wire type retainers.^{20,21}

Success and Long-term Effects

Booth and colleagues examined the health effects and effectiveness of very long-term retention.²² In a group of 60 patients, 15 were removed and 45 were still wearing a canine-only bonded retainer at a minimum of 20 years after orthodontic debonding. Gingival index scores demonstrated no detrimental effects to the mandibular anterior gingiva. Eighty percent required

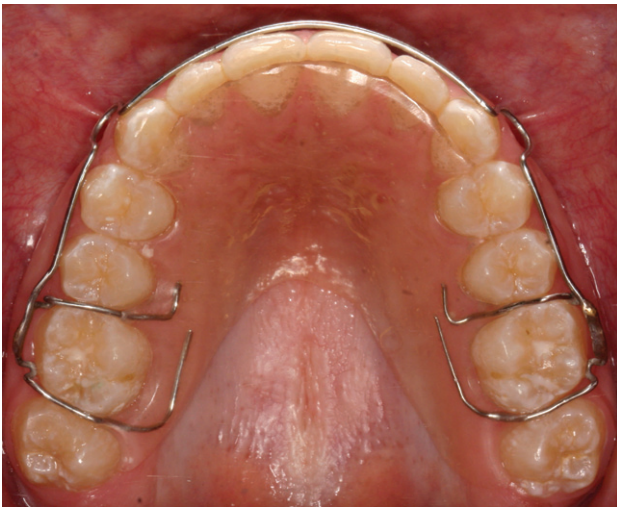


FIGURE 2. Removable maxillary Hawley type retainer. The facial bow is soldered to the molar clasps in order to avoid anterior occlusal interferences.



FIGURE 3. Removable clear thermoplastic retainer. Note the straight gingival design and full coverage of all teeth.

none or one repair of the retainer over a minimum of 20 years.²²

Artun stated that a retainer could have positive effects on patient’s hygiene in terms of motivation.²³ This concurs with Booth’s sample, in which patients who had retainers removed had worse hygiene than those who kept their retainer in place. However, Pandis and colleagues reported that patients with long-term fixed retention accumulated more calculus, and emphasized the need to assess oral hygiene when deciding whether to bond a fixed retainer.²⁴

Scheibe and Ruf retrospectively assessed 1,062 patients with lower bonded retainers for an average retention period of approximately 3 years.²⁵ One-third of the sample experienced retainer failure with canine retainers being less troublesome than those bonded to every anterior tooth. Operator technique was related to the success rate of the retainers. Zachrisson and colleagues reported a success rate of 95% with a follow-up of 1–10 years (4.2 on average) for various bonded retainers: either canine-only bonded retainers or fixed retainer bonded to all anterior teeth. Success rates decreased to 78% when a maxillary retainer was bonded not only to incisors but also to canines.¹⁷

Based on the above, it seems that with good hygiene, retainers do not cause long-term gingival or periodontal problems. Their long-term efficacy and success is related to the operator technique.

GENERAL RETENTION GUIDELINES

It is important to note that the retention protocol should be evaluated on a case-by-case basis, and that there are exceptions to these recommendations.

Retention for growing patients:

- 1 Mandibular bonded retainer (to each tooth or to canines-only depending on initial crowding)
- 2 Additional mandibular overlay removable retainer (acrylic/wire-type or thermoplastic) (Figure 4)
- 3 Maxillary removable retainer acrylic/wire-type or thermoplastic, or bonded in cases that displayed spacing before treatment

Retention for adult patients:

- 1 Mandibular bonded retainer (to each tooth or to canines-only depending on initial crowding)
- 2 Additional mandibular overlay removable retainer (acrylic/wire-type or thermoplastic)
- 3 Maxilla flat-splint and/or bonded retainer depending on the pretreatment crowding/spacing. The bite-plane effect and design will depend on the initial vertical facial pattern



FIGURE 4. Overlay mandibular retainers. (Left) Clear thermoplastic retainer over fixed mandibular retainer bonded to all anterior teeth. (Right) Removable acrylic/wire (modified Hawley) mandibular retainer over fixed mandibular retainer bonded to all anterior teeth.

CONCLUSION

In light of the evidence of instability of the dentition over time in both treated and untreated patients, perhaps the term “relapse” should be revisited. It seems that rather than relapse, which often has a connotation that implies failure or deficiency in the treatment outcome, this problem should be referred to as postorthodontic change.

There is consensus about the need for retention after orthodontic treatment. At present, there is insufficient research data on which to base our clinical practice on retention, although long-term studies show positive results with fixed retention. A removable retainer also should be given to the patient to retain those teeth not included in the fixed retention, and as a backup retainer in case of failure of the fixed retainer.

REFERENCES

1. Proffit W. Contemporary orthodontics. St. Louis, MO: Mosby Elsevier; 2007.
2. Little RM. Stability and relapse of dental arch alignment. *Br J Orthod* 1990;17:235–41.
3. Little RM. Stability and relapse of mandibular anterior alignment: University of Washington studies. *Semin Orthod* 1999;5:191–204.
4. Little RM. Clinical implications of the University of Washington post-retention studies. *J Clin Orthod* 2009;43:645–51.
5. Little RM, Robert M. Little on the University of Washington post-retention studies. *J Clin Orthod* 2009;43:723–7.
6. Little RM, Riedel RA. Postretention evaluation of stability and relapse—mandibular arches with generalized spacing. *Am J Orthod Dentofacial Orthop* 1989;95:37–41.
7. Little RM, Riedel RA, Artun J. An evaluation of changes in mandibular anterior alignment from 10 to 20 years postretention. *Am J Orthod Dentofacial Orthop* 1988;93:423–8.
8. 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;80:349–65.
9. Shah AA. Postretention changes in mandibular crowding: a review of the literature. *Am J Orthod Dentofacial Orthop* 2003;124:298–308.
10. Littlewood SJ, Millett DT, Doubleday B, et al. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database Syst Rev* 2004;1:CD002283.
11. Edwards JG. A long-term prospective evaluation of the circumferential supracrestal fiberotomy in alleviating orthodontic relapse. *Am J Orthod Dentofacial Orthop* 1988;93:380–7.
12. Boese LR. Fiberotomy and reproximation without lower retention 9 years in retrospect: part II. *Angle Orthod* 1980;50:169–78.

13. Jarjoura K, Gagnon G, Nieberg L. Caries risk after interproximal enamel reduction. *Am J Orthod Dentofacial Orthop* 2006;130:26–30.
14. Zachrisson BU, Nyoygaard L, Mobarak K. Dental health assessed more than 10 years after interproximal enamel reduction of mandibular anterior teeth. *Am J Orthod Dentofacial Orthop* 2007;131:162–9.
15. Keim RG, Gottlieb EL, Nelson AH, Vogels DS, 3rd. 2002 JCO study of orthodontic diagnosis and treatment procedures. Part 1. Results and trends. *J Clin Orthod* 2002;36:553–68.
16. Valiathan M, Hughes E. Results of a survey-based study to identify common retention practices in the United States. *Am J Orthod Dentofacial Orthop* 2010;137:170–7.
17. Zachrisson BU. Long-term experience with direct-bonded retainers: update and clinical advice. *J Clin Orthod* 2007;41:728–37.
18. Renkema AM, Al-Assad S, Bronkhorst E, et al. Effectiveness of lingual retainers bonded to the canines in preventing mandibular incisor relapse. *Am J Orthod Dentofacial Orthop* 2008;134:179e1–8.
19. Kacer KA, Valiathan M, Narendran S, Hans MG. Retainer wear and compliance in the first 2 years after active orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2010;138:592–8.
20. 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.
21. Mollov ND, Lindauer SJ, Best AM, et al. Patient attitudes toward retention and perceptions of treatment success. *Angle Orthod* 2010;80:468–73.
22. Booth FA, Edelman JM, Proffit WR. Twenty-year follow-up of patients with permanently bonded mandibular canine-to-canine retainers. *Am J Orthod Dentofacial Orthop* 2008;133:70–6.
23. Artun J, Spadafora AT, Shapiro PA, et al. Hygiene status associated with different types of bonded, orthodontic canine-to-canine retainers. A clinical trial. *J Clin Periodontol* 1987;14:89–94.
24. Pandis N, Vlahopoulos K, Madianos P, Eliades T. Long-term periodontal status of patients with mandibular lingual fixed retention. *Eur J Orthod* 2007;29:471–6.
25. Scheibe K, Ruf S. Lower bonded retainers: survival and failure rates particularly considering operator experience. *J Orofac Orthop* 2010;71:300–7.

EDITOR'S NOTE

If you have a question on any aspect of esthetic dentistry, please direct it to the Associate Editor, Dr. Edward J. Swift, Jr. We will forward questions to appropriate experts and print the answers in this regular feature.

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