

CLINICAL GUIDELINES: ORTHODONTIC RETENTION
C.Johnston, D.Burden & D.Morris (2008)

Revised July 2013 by Farnaz Parvizi, David Morris, Nikki Atack

ORTHODONTIC RETENTION

1. INTRODUCTION

Retention is the phase of orthodontic treatment which maintains the teeth in their orthodontically corrected positions following the cessation of active orthodontic tooth movement. Orthodontic retainers resist the tendency of teeth to return to their pre-treatment positions under the influence of periodontal, occlusal and soft tissue forces, and continuing dentofacial growth. Very few prospective controlled studies have evaluated the effectiveness of retention. A recent systematic review concluded that there was a need for randomised controlled trials in this area of orthodontic practice.¹

Retention is advisable for almost all treated malocclusions. A survey carried out in the UK found that the most commonly used retention period was 12 months.² This approach is supported by histological studies which have shown that the supracrestal periodontal fibres remain stretched and displaced for more than 7 months after the cessation of orthodontic tooth movement,^{3,4} suggesting that the retention period should generally be at least 7 months. However, individual patient factors can often modify the length of the retention phase.

2. OCCLUSAL AND OTHER FACTORS WHICH MAY MODIFY THE RETENTION PROTOCOL

2.1 Lower incisor alignment

Increases in lower incisor irregularity occur throughout life in a large proportion of patients following orthodontic treatment and also in untreated subjects. Evidence suggests that most change will take place by the middle of the third decade.⁵ It has been suggested that prolonged retention of the lower labial segment until the end of facial growth may reduce the severity of lower incisor crowding.⁶

Patients' expectations of the stability of their lower incisor alignment should be considered on completion of orthodontic treatment. If an individual is unwilling to accept any deterioration in lower incisor alignment following orthodontic treatment then permanent fixed or removable retention may have to be considered.

[SIGN Grade B]

2.2 Corrected rotations of anterior teeth

As the supracrestal gingival fibres are known to take the longest amount of time to reorganise, prolonged retention of corrected rotations may be helpful in reducing relapse. One study demonstrated that while the use of adjunctive circumferential supracrestal fibrotomy (CSF) has been shown to be effective in reducing relapse within the first 4-6 years after debonding, the additional long term clinical benefit from the procedure is relatively small.⁷ The study by Taner et al.⁸ revealed that CSF and full time removable retainer wear of the Hawley type provides a significant reduction in relapse over 1 year compared to using a removable retainer alone. CSF was found to have no adverse effects on dental or periodontal health.⁸

CSF can be undertaken in the conventional way using a surgical scalpel to transect the gingival fibres or by using a laser-aided probe. It is thought that the laser-aided probe has a number of advantages such as less bleeding, minimal swelling and no apparent damage to the supporting periodontal structures.^{9,10}

[SIGN Grade B]

2.3 Changes in the antero-posterior lower incisor position

Any intentional or non-intentional change of more than 2mm indicates the need for long-term or indefinite retention.¹¹

[SIGN Grade C]

2.4 Correction of deep overbite

Following the correction of a very deep overbite, the use of an anterior biteplane until the completion of facial growth has been recommended.¹¹ This may be particularly useful when there is evidence of an anterior mandibular growth rotation.¹²

[SIGN Grade C]

2.5 Correction of anterior open bites

While the use of retainers incorporating posterior biteblocks has been recommended for prolonged retention of anterior open bite malocclusions with unfavourable growth patterns¹¹, there is currently a lack of scientific evidence to support this.

[SIGN Grade C]

2.6 Patients with a history of periodontal disease or root resorption

In patients with previously treated severe periodontal disease, permanent retention is advised. For those with minimum to moderate disease, a more routine retention protocol can be used.¹³ There is evidence of an increased risk of deterioration of lower incisor alignment post-retention in cases with root resorption or crestal bone loss.¹⁴ These cases may therefore benefit from prolonged retention.

[SIGN Grade B]

2.7 Growth modification treatment

Following the use of headgear or functional appliances, retention using a modified activator appliance has been reported as effective in maintaining Class II correction.¹⁵ However, no comparative studies have confirmed the usefulness of this form of retention.

[SIGN Grade B]

2.8 Correction of posterior and anterior crossbites

When the incisor overbite and posterior intercuspation are adequate for maintaining the correction, no retention is necessary.¹⁶

[SIGN Grade C]

2.9 Adult Patients

When the periodontal supporting tissues are normal and no occlusal settling is required, there is no evidence to support any changes in retention protocol for adult patients compared with adolescent patients.

[SIGN Grade C]

2.10 Spaced dentitions

Permanent retention has been recommended following orthodontic treatment to close generalised spacing or a midline diastema in an otherwise normal occlusion.¹⁷

[SIGN Grade C]

3. RETAINER DESIGN

3.1 Removable retainers with a labial bow (Hawley and Begg type retainers)

These retainers are robust and can be worn during eating. Hawley retainers have been shown to have the advantage of facilitating posterior occlusal settling in the initial three months of retention.¹⁸ The labial bow can be used to accomplish simple tooth movements if required, and an anterior biteplane can easily be incorporated for retention of a corrected deep overbite. A retention regime with Hawley retainers of 6 months full time wear followed by 6 months nights only has been recommended as it has been shown to be associated with less relapse than 3 months full time wear and 3 months nights only.¹⁹

[SIGN Grade B]

3.2 Removable vacuum formed retainers

Vacuum formed retainers (VFRs) are relatively inexpensive and can be quickly fabricated on the same day as appliance removal. They are discreet and can be modified to produce tooth movements if required. Full posterior occlusal coverage (including second molars if present) is advisable in order to reduce the risk of overeruption of these teeth during retention. There is evidence that they are preferred by patients compared with Hawley retainers.²⁰

One study has shown that VFRs were significantly less likely to allow posterior occlusal settling than Hawley retainers.¹⁸ However, this is likely to be of little importance if good posterior intercuspation has been established by the time of debonding.

[SIGN Grade B]

A more recent prospective randomised clinical trial showed that VFRs were significantly more effective than Hawley retainers at maintaining the alignment of the labial segments. Although the mean differences in irregularity between groups were small (0.56mm in the mandibular arch and 0.25mm in the maxillary arch) this degree of relapse would be clinically important if localised to a single mandibular incisor.²¹ A further published paper based on the same sample showed that VFRs were more cost-effective than Hawley retainers with VFRs being less costly to produce, and less likely to require repair or replacement.²⁰

[SIGN Grade A]

3.3 Fixed bonded retainers (Smooth wire, Flexible spiral wire)

Fixed retainers are indicated for long-term retention of the labial segments, particularly when there is reduced periodontal support, and for retention of a midline diastema.¹¹ Fixed retainers are discreet and reduce the demands on patient compliance. However, they are associated with failure rates of up to 47%,²² particularly on upper incisors when there is a deep overbite.^{23,24} In addition, calculus and plaque deposition is greater than with removable retainers.²⁵ Fixed retainers, therefore, require long-term maintenance.

Flexible spiral wire retainers allow differential tooth movement and are particularly useful for patients with loss of periodontal support. Current orthodontic opinion recommends either the use of 0.0215 inch multi-strand wire,²⁵ or 0.030 - 0.032 inch sandblasted round stainless steel wire.²⁶

[SIGN Grade B]

3.4 Fixed bonded retainers vs removable retainers

When considering the lower labial segment alignment following fixed orthodontic appliances, relapse can occur with both fixed and removable retainers. There is no statistically significant difference between the amounts of relapse seen with both types of retainer.²⁷ Another study which investigated the survival rates of three types of bonded retainers versus Hawley type removable retainer showed there were no differences between the retainers over 3 years.²⁸

[SIGN Grade B]

4. Frequency of Retainer Wear

4.1 Part time vs Full time wear (vacuum formed retainers)

Full time wear of vacuum formed retainers offers no clinical or statistical advantages in terms of incisor irregularity, inter canine width and overjet correction.²⁹

[SIGN Grade A Ib]

4.2 Part time vs Full time wear (Hawley retainers)

As both retention regimes are equally effective in the first year following treatment it would seem clinically acceptable to ask patients to wear their retainers at night only³⁰.

[SIGN Grade A Ib]

EXPLANATORY NOTES

2.1 Deterioration in lower incisor alignment during the second, third and fourth decades of life has been reported in multiple studies of normal subjects as well as in subjects who have undergone previous orthodontic treatment followed by retention.^{31,32} Such changes in lower labial segment alignment are now recognised to be a normal rather than an exceptional occurrence. It continues throughout life, although it is reported that the greatest changes in untreated occlusions occur before the age of 18 years.^{5,33,34}

The use of prolonged retention of the lower labial segment has been suggested to be effective in reducing the severity of lower incisor crowding following treatment. The results reported by Sadowsky et al.⁶ using an

average period of 8.4 years with a fixed lower lingual retainer were more favourable than other studies using shorter retention times. However, no comparative studies have been reported.

2.2 The pattern of rotational tooth displacements in a malocclusion has a strong tendency to repeat itself when post-treatment changes occur.³⁵ Edwards⁷ observed that most relapse in rotations occurred within 4-6 years of appliance removal.

2.3 Opinions differ about the amount of stable proclination of the lower incisors that can be achieved during orthodontic treatment.^{36,37} Mills³⁸ found that the average amount of stable proclination of the lower incisors following orthodontic treatment was 1-2 mm. Houston and Edler³⁹ reported that when the antero-posterior position of the lower incisors was changed during treatment, in the majority of cases the lower incisors returned towards their pre-treatment position after retention. Thus, the consensus of evidence supports the view that excessive lower incisor proclination should be avoided unless prolonged retention is planned.

2.5 The stability of anterior open bite correction is unpredictable, with one study reporting that more than one third of cases relapsed to more than 3mm anterior open bite when examined a minimum of nine years following retention.⁴⁰ No predictors of relapse could be identified. Although biteblock retainers are commonly advocated for treated anterior open bite cases, no controlled studies of their effectiveness have been published.

2.9 Post-retention treatment results in adults with similar retention protocols have been shown to be at least as stable as those in adolescents with regard to all clinically relevant factors including midline alignment, overjet, overbite, molar relationship and incisor alignment.^{41,42} In addition, Richardson^{5,33,34} has shown that most deterioration in lower incisor alignment occurs during late adolescence and early adulthood with the changes above the age of 21 being much less marked.

3.0 Currently there is no high quality evidence regarding type of retainer and adverse effects on dental and periodontal health.¹

SIGN CLASSIFICATION

The Scottish Intercollegiate Guideline Network (SIGN) classification system indicates whether a guideline's recommendations are based on proven scientific evidence or currently accepted good clinical practice with limited scientific evidence.

Level	Type of evidence
Ia	Evidence obtained from meta-analysis or randomised control trials
Ib	Evidence from at least one randomised control trial
IIa	Evidence obtained from at least one well-designed control study without randomisation
IIb	Evidence obtained from at least one other type of well-designed quasi-experimental study
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case control studies
IV	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Grade	Recommendations
A> (Evidence levels Ia, Ib)	Requires at least one randomised controlled trial as part of the body of literature of overall good quality and consistency addressing the specific recommendations.
B> (Evidence levels IIa, IIb, III)	Requires availability of well-conducted clinical studies but no randomised clinical trials on the topic of recommendation.
C> (Evidence level IV)	Requires evidence from expert committee reports or opinions and/or clinical experience of respected authorities. Indicates absence of directly applicable studies of good quality.

REFERENCES

1. Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database Systematic Reviews*. 2006 Jan 25; (1):CD002283. Review. (Update 2009)
2. Clark JD, Kerr WJ, Davis MH. CASES--clinical audit; scenarios for evaluation and study. *British Dental Journal* 1997; 183:108-111.
3. Reitan K. Clinical and histologic observations on tooth movement during and after orthodontic treatment. *American Journal of Orthodontics* 1967; 53:721-745.
4. Edwards JG. A study of the periodontium during orthodontic rotation of teeth. *American Journal of Orthodontics* 1968; 54:441-461.
5. Richardson ME, Gormley JS. Lower arch crowding in the third decade. *European Journal of Orthodontics* 1998; 20:597-607.
6. Sadowsky C, Schneider BJ, BeGole EA, Tahir E. Long-term stability after orthodontic treatment: nonextraction with prolonged retention. *American Journal of Orthodontics and Dentofacial Orthopedics* 1994; 106:243-249.
7. Edwards JG. A long-term prospective evaluation of the circumferential supracrestal fiberotomy in alleviating orthodontic relapse. *American Journal of Orthodontics and Dentofacial Orthopedics* 1988; 93:380-387.
8. Taner T, Hayder B, Kavuklu I, Korkmaz A. Short-term effects of fiberotomy on relapse of anterior crowding. *American Journal of Orthodontics and Dentofacial Orthopedics* 2000; 118:617-623.
9. Kim SJ, Paek JH, Kang, SG, Park YG. Laser-aided circumferential supracrestal fiberotomy and low level laser therapy effects on relapse of rotated teeth in beagles *Angle Orthodontist* 2010;80:385-390.
10. Moritz A. *Oral laser application*. 2006 Quintessence; Chicago, III.
11. Proffit WR, Fields HW, Sarver DM. *Contemporary Orthodontics*. (4th ed.), Chapter 17, St Louis, Mosby Elsevier, 2007
12. Nielsen IL. Growth Considerations in Stability of Orthodontic Treatment. In: Nanda R, Burstone CJ, eds. *Retention and Stability in Orthodontics*. Philadelphia: W.B. Saunders Company, 1993.
13. Zachrisson BU. Orthodontics and Periodontics. In: Lindhe J, Karring T, Lang NP, eds. *Clinical Periodontology and Implant Dentistry*. 3rd ed. Copenhagen: Munksgaard, 1997:741-793.
14. Sharpe W, Reed B, Subtelny JD, Polson A. Orthodontic relapse, apical root resorption, and crestal alveolar bone levels. *American Journal of Orthodontics and Dentofacial Orthopedics* 1987;91:252-258.
15. Wieslander L. Long-term effect of treatment with the headgear-Herbst appliance in the early mixed dentition. Stability or relapse? *American Journal of Orthodontics and Dentofacial Orthopedics* 1993; 104:319-329.

16. Kaplan H. The logic of modern retention procedures. *American Journal of Orthodontics and Dentofacial Orthopedics* 1988; 93:325-340.
17. Joondelph DR, Riedel RA. Retention and Relapse. In: Graber TM, Vanarsdall RL, eds. *Orthodontics Current Principles and Techniques*. 2nd ed. St. Louis: Mosby - Year Book, 1994:908-950.
18. Sauget E, Covell DA, Boero RP, Lieber WS. Comparison of occlusal contacts with use of Hawley and clear overlay retainers. *The Angle Orthodontist* 1997; 67:223-230.
19. Destang DL, Kerr WJ. Maxillary retention: is longer better? *European Journal of Orthodontics*. 2003;25:65-9.
20. Hichens L, Rowland H, Williams A, Hollinghurst S, Ewings P, Clark S, Ireland A, Sandy J. Cost-effectiveness and patient satisfaction: Hawley and vacuum-formed retainers. *European Journal of Orthodontics* 2007;29:372-8.
21. Rowland H, Hichens L, Williams A, Hills D, Killingback N, Ewings P, Clark S, Ireland AJ, Sandy JR. The effectiveness of Hawley and vacuum-formed retainers: a single-center randomized controlled trial. *American Journal of Orthodontics and Dentofacial Orthopedics* 2007;132:730-7.
22. Bearn DR. Bonded orthodontic retainers: a review. *American Journal of Orthodontics and Dentofacial Orthopedics* 1995; 108:207-213.
23. Lumsden KW, Saidler G, McColl JH. Breakage incidence with direct-bonded lingual retainers. *British Journal of Orthodontics* 1999; 26:191-4.
24. Artun J, Urbye KS. The effect of orthodontic treatment on periodontal bone support in patients with advanced loss of marginal periodontium. *American Journal of Orthodontics and Dentofacial Orthopedics* 1988; 93:143-148.
25. Heier EE, De Smit AA, Wijngaerts IA, Adriaens PA. Periodontal implications of bonded versus removable retainers. *American Journal of Orthodontics and Dentofacial Orthopedics* 1997; 112:607-616.
26. Zachrisson BU. Third-generation mandibular bonded lingual 3-3 retainer. *Journal of Clinical Orthodontics* 1995; 29:39-48.
27. Atack N, Harradine N, Sandy JR, Ireland AJ. Which way forward? Fixed or removable lower retainers. *Angle Orthodontist* 2007; 77:954-959
28. Artun J, Spadafora AP, Shapiro PA, A 3 year follow up study of various types of orthodontic canine to canine retainers. *European Journal of Orthodontics* 1997; 19:501-509
29. Thickett E, Power S. A randomized clinical trial of thermoplastic retainer wear. *European Journal of Orthodontics* 2010; 32:1-5
30. Shawesh M, Bhatti B, Usmani T, Mandall N. Hawley retainers full or part time? A randomized clinical trial. *European Journal of Orthodontics* 2010; 32:165-170.
31. Little RM, Riedel RA, Artun J. An evaluation of changes in mandibular anterior alignment from 10 to 20 years postretention. *American Journal of Orthodontics and Dentofacial Orthopedics* 1988; 93:423-428.

32. Little RM. Stability and relapse of dental arch alignment. *British Journal of Orthodontics* 1990; 17:235-241.
33. Richardson ME. Late lower arch crowding facial growth or forward drift? *European Journal of Orthodontics* 1979; 1:219-225.
34. Richardson ME. Lower incisor crowding in the young adult. *American Journal of Orthodontics and Dentofacial Orthopedics* 1992; 101:132-137.
35. Surbeck BT, Artun J, Hawkins NR, Leroux B. Associations between initial, posttreatment, and postretention alignment of maxillary anterior teeth. *American Journal of Orthodontics and Dentofacial Orthopedics* 1998; 113:186-195.
36. Mills JRE. The stability of the lower labial segment. *Transactions of the British Society for the Study of Orthodontics* 1967; 54:11-24.
37. Schulhof RJ, Allen RW, Walters RD, Dreskin M. The mandibular dental arch: Part I, lower incisor position. *The Angle Orthodontist* 1977; 47:280-287.
38. Mills JRE. The stability of the lower labial segment. A cephalometric survey. *Dental Practitioner and Dental Record* 1968; 18:293-306.
39. Houston WJ, Edler R. Long-term stability of the lower labial segment relative to the A-Pog line. *British Journal of Orthodontics* 1990; 12:302-310.
40. Lopez-Gavito G, Wallen TR, Little RM, Joondeph DR. Anterior open-bite malocclusion: a longitudinal 10-year postretention evaluation of orthodontically treated patients. *American Journal of Orthodontics and Dentofacial Orthopedics* 1985; 87:175-186.
41. Harris EF, Vaden JL, Dunn KL, Behrents RG. Effects of patient age on postorthodontic stability in Class II, division 1 malocclusions. *American Journal of Orthodontics* 1994;105:25-34.
42. Harris EF, Vaden JL. Posttreatment stability in adult and adolescent orthodontic patients: a cast analysis. *International Journal of Adult Orthodontics and Orthognathic Surgery* 1994; 9:19-29.