



**Focusing on Orthodontic
Retention**

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Do you believe that a relapse could be occur after orthodontic treatment even with a retention



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Do you think Why ?????

The best information currently available comes from the long-term post-retention registry at the University of Washington. Riedel and Little are credited with the collection of over 800 long-term post retention cases and discovered that relapse occurred in a high percentage of patients but in an individual patient, relapse was quite unpredictable. It was also found that canine width expansion was unstable in the long-term, and Little stated that lifetime permanent retention was the only reliable way to prevent relapse.

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;93:423–428.

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Orthodontic treatment planning: can we plan for stability?

Article in *British dental journal official journal of the British Dental Association: BDJ online* · June 2021

DOI: 10.1038/s41415-021-2891-5

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- Maintaining teeth in their corrected positions after treatment is often the **most challenging** part of an orthodontic treatment plan.

- In 1934, Oppenheim stated “ *Retention is one of the most difficult problems in orthodontia; in fact, it is the problem.*”

- In 1960, Riedel defined it as “*the holding of teeth in ideal esthetic and functional position*”

- In 1970, Moyer defined it as “*the holding of teeth following orthodontic treatment in the treated position for the period of time necessary for the maintenance of the result*”

AETIOLOGY OF RELAPSE

1- Periodontal and gingival factors:

When teeth are moved the tissues in the periodontal ligament and gingivae remodel to the new tooth position. Until these tissues have remodeled, they have a tendency to manoeuvre the teeth back towards their original position. The fibres that take the longest to remodel are the elastic fibres around the neck of the teeth, the dento-gingival and interdental fibres, which can take 8 months or more to remodel. The teeth therefore need to be held in position for long enough for these fibres to adjust.

2- Occlusal factors:

It is purported that a soundly interdigitated dentition, with even occlusal contacts and correct occlusal loading of teeth, is more likely to be stable; however, there is no substantial agreement or evidence to support this claim. It must be recognised that gross occlusal interferences, displacing tooth contacts and the abnormal loading of teeth may predispose the affected teeth to mobility which may contribute to relapse.

3- Soft tissue pressures

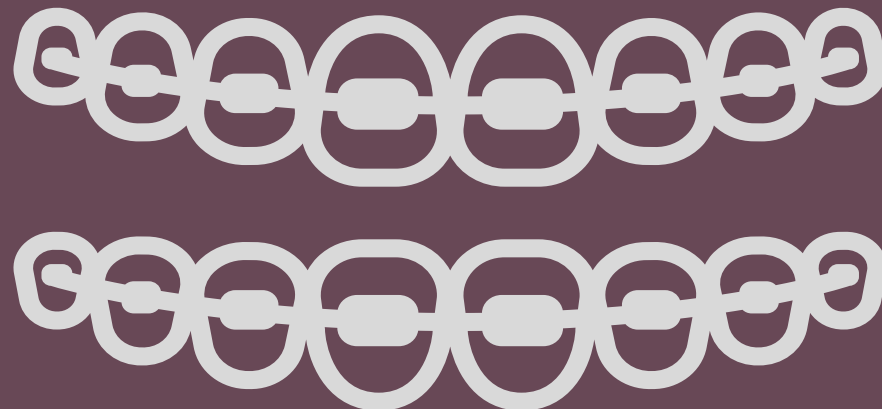
The teeth that are moved out of the 'neutral' zone, the more unstable they are likely to be. This is particularly true for the lower labial segment and if incisors are proclined or retroclined excessively, relapse is more likely. It is also believed that significant changes in the arch form, in particular the lower inter-canine width, make relapse due to soft tissue pressures more likely.

4- Physiological relapse

It has been shown that there are age-related changes that occur throughout life including minor changes in the relationship between the mandible and maxilla, and changes in the soft tissue pressures on the dentition. The dentition is therefore within a biological environment that is constantly changing, and so it is not surprising that there is the potential for changes to occur in the alignment of teeth and occlusal relationships throughout life.

Why retention is necessary?

- 1- Allow for periodontal and gingival reorganization
- 2- To minimize changes from growth
- 3- To permit neuromuscular adaptation to the corrected tooth position



Hierarchy of stability

- Vertical change: AOB → Worst prognosis
- Transverse change → Moderate prognosis
- Alignment: irregularity and spacing → Moderate prognosis
- Vertical change: deep overbite → Poor prognosis
- Antero-posterior change → Best prognosis

INFORMED CONSENT

- Clinically it is difficult to predict which patients will undergo post-treatment change and so it is critical that all patients are treated as if they have the potential for relapse.

- Many clinicians now recommend life-long retention.

- There are important responsibilities for the clinician and the patient:

The clinician's responsibility is to explain the unpredictable nature of relapse, the factors associated with relapse, and the appropriate use and care of retainers. The clinician needs to explain the commitment that is required, including any possible long-term financial costs associated with repairing and replacing retainers.

patients understand their responsibility and involvement in reducing relapse. Before the commencement of treatment

Schools proposed regarding retention:

1- Occlusion school according to Kingsley: proper occlusion is the key factor in determining the stability of the newly moved teeth.

2- The apical base school:

- Alex Lundstrom suggested that the apical base is an important factor in the correction of malocclusion and maintenance of the stability of the treated cases.
- Mc Cauley added that the inter-canine and intermolar widths should be maintained during orthodontic treatment to minimized retention problems.

Joondeph, D.R., Huang, G. and Little, R., 2012. Stability, retention and relapse. *Orthodontics: current principles and techniques*, 5, pp.991-1019.

3- The mandibular incisors school:

Grieves and Tweed have suggested that post-treatment stability was increased when the mandibular incisors were placed upright or slightly retroclined over the basal bone.

4- The musculature school:

Rogers proposed that proper function and balance of the musculature was related to stability

Joondeph, D.R., Huang, G. and Little, R., 2012. Stability, retention and relapse. *Orthodontics: current principles and techniques*, 5, pp.991-1019.

Retention methods

Retainers

Adjunctive retention methods

Removable retainer

Fixed retainer

Dual retention

Interproximal reduction

Mechanical methods

Pericision

Biomedical agents

Hawley retainer,
Clear plastic retainer,
wraparound,
Positioner

Low-level laser therapy,
Mechanical vibration

Bone morphogenic proteins,
Calcitonin,
Biphosphonate,
Relaxin,
Strontium,
Osteoprotegerin,
Simvastatin

Stainless-steel

Non-Stainless-steel

Multi-stranded stainless-steel wire, Plain stainless-steel wire, OrthoFlexTech .retainer

Fiber-reinforced composites retainer, Polyethylene Ribbon-Reinforced Retainer, Single-strand ribbon titanium retainer, Memotain

The RCTs that compare removable retainers with fixed bonded retainers

Authors	Aim of study	Fixed retainer	Sample size	Duration	Conclusion
Årtun et al. 1997 ^[23]	To determine which bonded orthodontic retainer types are most likely to accumulate plaque and calculus along the wire.	Canine and canine plain thick wire, canine and canine thick spiral wire, canine to canine flexible spiral wire, and removable retainer	49	3 years	After three years in retention, gingival irritation and plaque formation were scored less frequently than they were at the time of debonding.
Edman Tynelius et al. 2013 ^[22]	To compare the effectiveness of distinct retention strategies in compliant patients after (2 years) retention.	Vacuum formed retainer, Bonded retainer, Positioner	75	2 years	Maintain the stability to a clinically acceptable level could be accomplished with all three types of retention techniques.
Edman Tynelius et al. 2015 ^[9]	Comparison of three different retention strategies within 5 years or more.	Vacuum formed retainer, Bonded retainer, Positioner	49	5 years	The three retention techniques revealed similar positive clinical outcomes.
O'Rourke et al. 2016 ^[26]	Compare the clinical efficacy of bonded retainers with vacuum-formed retainers, in terms of stability	A 0.0175-inch coaxial archwire, vacuum-formed retainer	82	18 months	In the first six months following treatment, vacuum-formed retainers are less effective in maintaining the stability of the lower incisors than bonded retainers are.
Forde et al. 2018 ^[13]	Compare upper and lower vacuum-formed retainers to upper and lower bonded retainers concerning the stability, survival, and patient satisfaction during a 12-month period.	A 0.0195-inch (3 strands) twist-flex stainless steel wire, and vacuum formed retainer	60	12 months	In terms of stability or survival in the maxilla after a year, there is no evidence of a substantial difference. BRs are more successful at preserving the alignment of the mandibular labial segments in the mandible.
Al-Moghrabi et al. 2018 ^[29]	Assess the stability and periodontal health of lower anterior teeth bonded with fixed bonded retainer versus removable orthodontic retainers within 4-year follow-up.	Vacuum formed retainer, and 0.0175-inch coaxial arch-wire	42	4 years	The lower labial segment's alignment is better preserved over time with fixed retention, which is an advantage. However, increased plaque scores and gingival irritation were linked to both types of retainers.
Alkan et al. 2020 ^[30]	To assess force distribution and occlusal changes between vacuum-formed, Hawley, and bonded retainers.	Vacuum formed retainer. Hawley retainer, bonded fixed retainer	60	6 months	The occlusal force distribution significantly differs between the Hawley retainer and bonded retainer groups.
Krämer et al. 2020 ^[20]	To compares the efficacy of vacuum-formed retainers and bonded canine-to-canine retainers after 6- and 18-months retention.	Vacuum formed retainer, canine and canine 0.8 hard Remanium bonded retainer.	104	18 months	Essix retainer and bonded retainer have the same retention efficacy after 6- and 18-months retention. Most relapses happen in the first six months.
Alrawas et al. 2021 ^[20]	To assess, in comparison to existing retainers, how a CAD/CAM nickel-titanium retainer affects the stability and periodontal health of mandibular anterior teeth.	CAD/CAM NiTi, multi-stranded stainless steel, single-stranded nickel-free titanium and vacuum-formed retainers.	60	6 months	There was no statistically significant difference in the clinical survival rate between the CAD/CAM retainer and conventional retainers. In addition, less plaque buildup and gingival irritation were seen.
Naraghi et al. 2021 ^[31]	To assess the effects of different retention strategies on the irregularity of the six maxillary anterior teeth after treatment.	A 0.0195-inch bonded retainer, and removable vacuum formed retainer.	90	2 years	All the alterations reported in the groups were clinically minor, and all three retention techniques demonstrated similarly effective retention ability.
Sonesson et al. 2022 ^[32]	To assess the expenses of three different maxillary retention techniques.	A 0.0195-inch multistranded stainless steel retainer, and removable vacuum-formed retainer.	90	2 years	When expenses and retention capability are considered, all three retention techniques might be suggested.
Shim et al. 2022 ^[71]	To compare the relapse and failure rates of typical fixed retainers versus computer-aided design/manufacturing	CAD/CAM retainer, Ortho-FlexTech wires, and multistranded stainless-steel wire	46	6 months	Compared conventional chairside retainers, the CAD/CAM fixed retainers shown less relapse and fewer failures.
Krämer et al. 2023 ^[45]	Comparing the removable vacuum-formed retainers with bonded canine-to-canine retainers within 5 years of retention.	Vacuum formed retainer, and 0.8 hard, Remanium canine and canine retainer	104	5 years	Anterior alignment of anterior teeth was more stable with bonded retainers compared to removable vacuum-formed retainer after 5 years of retention

The RCTs that investigated different types of fixed bonded retainer.

Authors	Aim of study	Fixed retainer	Sample size	Duration	Conclusion
Störmann I, Ehmer 2002 ^[22]	To assess the difference of lower fixed retainers, debonding rate, relapse, oral hygiene problems (periodontal), and participant discomfort.	0.0195-inch and 0.0215-inch stainless-steel retainers (canine to- canine), prefabricated canine-and-canine retainer	103	24 months	The retainers bonded on lower anterior anterior teeth (canine-to-canine) showed a better stability, while the retainers bonded only on canines show frequent relapse.
Rose et al. 2002 ^[41]	Plasma-treated woven polyethylene ribbons retainers compared with multi-stranded retainers in their efficacy to maintain canine-to-canine retention.	Plasma-treated woven polyethylene ribbons retainers, and multi-stranded stainless-steel retainers (0.0175-inch).	20	3 months	Multi-stranded stainless-steel retainers are more effective than plasma-treated polyethylene woven ribbon in stability of dentition.
Salehi et al. 2013 ^[31]	Evaluate the reliability and failure rates of polyethylene woven ribbon retainers versus 0.0175-inch flexible spiral wire retainer.	polyethylene woven ribbon retainer, and flexible spiral wire retainer (0.0175-inch).	142	18 months	The differences between polyethylene woven ribbon and flexible spiral (0.0175-inch) retainers had limited clinical significance with no statistically significant differences.
Pandis et al. 2013 ^[23]	Comparing the survival rates of mandibular bonded retainers chemically cured or light-cured adhesive.	0.022-inch soft bonded lingual retainer (Tru-Chrome multi-stranded wire; Rocky Mountain Orthodontics) that bonded directly.	220	6 months	There is no proof that the survival rate of mandibular lingual retainers bonded with chemically or light-cured adhesives are varied.
Torkan et al. 2014 ^[74]	The purpose of the research was to assess the clinical and radiographic impact on the periodontium of dentition by two widely used bonded retainers.	Fiber-reinforced composite bonded retainer, and spiral wire retainer.	30	6 months	In comparison of fiber-reinforced composite retainers with spiral wire retainers, less harmful periodontal effect in the short-term follow-up was found in spiral wire retainers.
Sfondrini et al. 2014 ^[28]	Assessment the clinical reliability of two different kinds of bonded orthodontic retainers	Glass fibers-reinforced resin composite, and multistranded stainless steel wire.	87	12 months	Over a one-year follow-up, single bond failure rates of multistranded metallic wires and glass fiber-reinforced resin composite retainers did not significantly differ.
Sobouti et al. 2016 ^[25]	To compare success rate of canine-to-canine mandibular retainers made of fiber-reinforced composite, spiral flexible wire, and twisted wire	Twisted wire, flexible spiral wire, and fiber-reinforced composite retainers.	150	24 months	Twisted wire had a failure rate that was two times lower than the FRC retainer.
Egli et al. 2017 ^[44]	to compare the percentages of mandibular fixed retainers that fail when bonded using indirect and direct procedures and to look at posttreatment changes two years after insertion.	A 0.0215-inch multistrand stainless steel wire	64	24 months	The risks of failure for mandibular retainers bonded using direct and indirect techniques were the same. Inter-canine and inter-premolar distance can be effectively maintained with bonded retainers.
Węgrodzka et al. 2021 ^[26]	To examine the survival rates and periodontal health in individuals who had fixed retainers attached to mandibular anterior teeth in either a 3-strand round twisted or an 8-strand rectangular braided configuration.	A 0.0215-inch stainless-steel (3-strand), and 0.0265x 0.0106-inch (8-strand) bonded retainer	133	24 months	There was no difference between the analyzed retainers in terms of survival or periodontal health, and the total probability for first-time failure was considerable at 52.3%.

[Intervention Review]

Retention procedures for stabilising tooth position after treatment with orthodontic braces

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Editorial group: Cochrane Oral Health Group.

Publication status and date: New search for studies and content updated (conclusions changed), published in Issue 5, 2023.

Citation: Martin C, Littlewood SJ, Millett DT, Doubleday B, Bearn D, Worthington HV, Limones A. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database of Systematic Reviews* 2023, Issue 5. Art. No.: CD002283. DOI: [10.1002/14651858.CD002283.pub5](https://doi.org/10.1002/14651858.CD002283.pub5).

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Authors' conclusions

The evidence is low to very low certainty, so we cannot draw firm conclusions about any one approach to retention over another. More high-quality studies are needed that measure tooth stability over at least two years, and measure how long retainers last, patient satisfaction and negative side effects from wearing retainers, such as tooth decay and gum disease.

The role of technology in retention

The introduction of CAD/CAM technology in dentistry facilitated the fabrication of a custom lingual retainer. With this technology, precise fitness of the retainer is ensured, and interference is avoided since it allows visualization of the retainer in relation to soft tissue and occlusal contacts in the patient's mouth.



The RCTs that investigated CAD/CAM fabricated bonded retainers versus conventional fixed bonded retainer

	Authers	Year	Title	Material
1	Pullisaar et al.	2024	Stability, survival, patient satisfaction, and cost minimization of CAD/CAM versus conventional multistranded fxd retainers in orthodontic patients: a 2-year follow-up of a two-centre randomized controlled trial	Stainless steel
2	Tran eta al.	2024	Relapse and failure rates between CAD/CAM and conventional fixed retainers: a 2-year follow-up of a randomized controlled clinical trial	Stainless Steel
3	Çokakoğlu et al.	2023	Stability and failure rate during 3 years of fixed retention: A follow-up of an randomized clinical trial on adolescents with four different lingual retainers	
4	Gera et al.	2023	Stability, survival, and patient satisfaction with CAD/CAM versus conventional multistranded fixed retainers in orthodontic patients: a 6-month follow-up of a two-centre randomized controlled clinical trial	Nitinol (Memotain)
5	Shim et al.	2022	Comparative assessment of relapse and failure between CAD/CAM stainless steel and standard stainless steel fixed retainers in orthodontic retention patients: A randomized controlled trial	Stainless steel
6	Bilir et al.	2022	CAD/CAM single-retainer monolithic zirconia ceramic resin-bonded fixed partial dentures bonded with two different resin cements: Up to 40 months clinical results of a randomized-controlled pilot study	Zirconia ceramic resin
7	Alrawas et al.	2021	Comparing the effects of CAD/CAM nickel-titanium lingual retainers on teeth stability and periodontal health with conventional fixed and removable retainers: a randomized clinical trial.	Nickel-titanium
8	Gelin et al.	2020	Innovative customized CAD/CAM nickel-titanium lingual retainer versus standard stainless-steel lingual retainer: a randomized controlled trial.	Nickel-titanium

Bardideh, E., Ghorbani, M., Shafaei, H., Saeedi, P. and Younessian, F., 2023. A comparison of CAD/CAM-based fixed retainers versus conventional fixed retainers in orthodontic patients: a systematic review and network meta-analysis. *European Journal of Orthodontics*, 45(5), pp.545-557.

Conclusions

In the short term, CAD/CAM fixed retainers show promise as an alternative to traditional retainers. They may enhance periodontal health, as indicated by lower plaque index scores than conventional retainers. However, extensive research is needed to determine the long-term durability and effectiveness of CAD/CAM retainers in orthodontic treatment



Thank
you