



BJÖRN U. ZACHRISSON
OSLO, NORWAY

ASK AN EXPERT

THINGS YOU WANT TO KNOW

Differential retention with bonded retainers

There are a variety of fixed lingual retainers of varying diameters and materials in current use in our specialty. In addition, short labial retainers have been recommended for added retention in adults, particularly to prevent space reopening after premolar extractions and space closure in the posterior regions. Due to the confusion that all these retainer variants may create, I would like to know your preferred way of using different fixed retainers for routine and/or individualized use following a normal period of orthodontic intervention in children, adolescents, and adults.— Ronald A. Ramsay, Saint Michael, Barbados

The use of fixed lingual retainers in orthodontics is increasing,¹ and the various forms allow more differentiated retention.² Clinical experience and differential retention philosophy^{2,3} have demonstrated the need for 2 types of bonded wire retainer: (1) thick wire (0.030- or 0.032-inch diameter); and (2) thin wire (0.0215-inch diameter).

The thick wire is used for the mandibular 3-3 retainer, which is bonded only on the canines, whereas the thin twisted wire is used for various lingual and labial retainers in which *all* teeth in a segment are bonded.

The following overview represents a clinical update of my use of different forms of bonded retainers after an observation period of 30+ years, and it will include some clinical advice on retainer design and fabrication.

Routine retention in young and adolescent patients

The preferred routine retention regime at present for young and adolescent orthodontic patients has produced excellent clinical results for more than 10 years. It consists of (1) a mandibular 3-3-retainer bonded on the canines; (2) a maxillary 21+12 retainer bonded to each of the 4 maxillary incisors; and (3) a removable plate.²

Table 1 Data of gold-coated retainers bonded from May 1994 to May 2004 (mean observation time 4.2 years; range 1 to 10 years)

Type of retainer	Wire diameter (inches)	Number of patients	Success rate (percent)*
Mandibular 3-3	0.030	381	96.5
Mandibular 321-123	0.0215	191	94.7
Maxillary 21+12	0.0215	323	93.8
Maxillary 321+123	0.0215	186	78.5

All retainers were bonded in the same office by one orthodontist (BUZ).

*Success rate refers to intact retainers (without bond failure or wire fracture) throughout the follow-up period.

The *mandibular* 3-3 retainer is a 0.030-inch-diameter gold-coated wire (Gold'n Braces, Palm Harbor, FL, USA), which is sandblasted on the ends to improve the retention of the bonding composite resin,² which can either be cured chemically (Concise; 3M Unitek, Monrovia, CA, USA) or with light (Transbond LR; 3M Unitek). The detailed technique for fabrication, tacking, and bonding this type of retainer (Fig 1f) is presented elsewhere.² The thick mandibular retainer is solid, easy to place, and more hygienic and safer to use (Table 1) than retainers bonded to all 6 anterior teeth.² Every patient will notice immediately when a retainer comes loose if it is bonded only to the canines. The patient can then call for a rebonding appointment or remove the retainer with the fingers. Being the simplest and safest of the bonded retainers, it is useful also in many adult patients with little pretreatment crowding of the teeth.

The routine *maxillary* retainer in children is a gold-coated 5-stranded spiral wire (0.0215-inch Penta-One Twist; Gold'n Braces) bonded to the 4 maxillary incisors² (Fig 3b). The reason why the routine retainer in young patients is bonded only to the incisors is based on the hierarchy of success rate for different types of bonded lingual retainers (see Table 1)^{2,4-6} The failure rates will be significantly higher if the maxillary canines are also included in the retainer.² A detailed description of the fabrication, tacking, and bonding of this retainer is described elsewhere.² The maxillary removable *plate* contains a rectangular labial wire³ (0.017 × 0.025-inch blue Elgiloy; Rocky Mountain Orthodontics, Denver, CO, USA) extending between the lateral incisor and canine, and an 0.8-mm stainless steel wire distal to the terminal molar (Fig 3a). For the routine procedure, the plate is used full-time for 6 months and then at night for at least 2 years. As shown in Fig 3b, the acrylic should not touch the retainer wire.

Individualized retention in adolescents

There are, of course, situations when regimens other than the standard one are used in young patients. For example, in treated Class III malocclusions when the mandibular incisors have been markedly retracted to a more lingual position, a 321-123 design (see Fig 2f) may more predictably hold these teeth in place than the 3-3 retainer. Furthermore, with space closure for uni- (see Fig 1) or bilateral agenesis of maxillary lateral incisors, the first premolar(s) used in the canine position(s) may be secured with an extension of the lingual wire (see Fig 1d and 1e). It is more difficult to bend a 6-unit than a 4-unit retainer and make sure it is completely passive in the ideal position on the teeth. A clinical tip when the first premolar is included in a bonded retainer: cut the wire between the first premolar and the canine (see Fig 1d) to ensure that the bonded retainer is optimally neat and entirely passive after the initial tacking and bonding (see Fig 1e).²



Fig 1 Routine retention regime in adolescent female patient with unilateral agenesis of maxillary right lateral incisor, deep overbite, and midline shift to the right before treatment (**a**). After orthodontic correction, and fabrication of porcelain veneers on the first premolar (in canine position) and canine (in lateral incisor position) (**b,c**), the retention consisted of a maxillary 431+123 lingual retainer (**e**), a maxillary removable plate, and a mandibular 3-3 retainer (**f**). Note that the maxillary retainer is cut between the first premolar and canine during manufacturing (**d**), which will help secure minimal bulk in an entirely passive retainer after bonding (**e**).

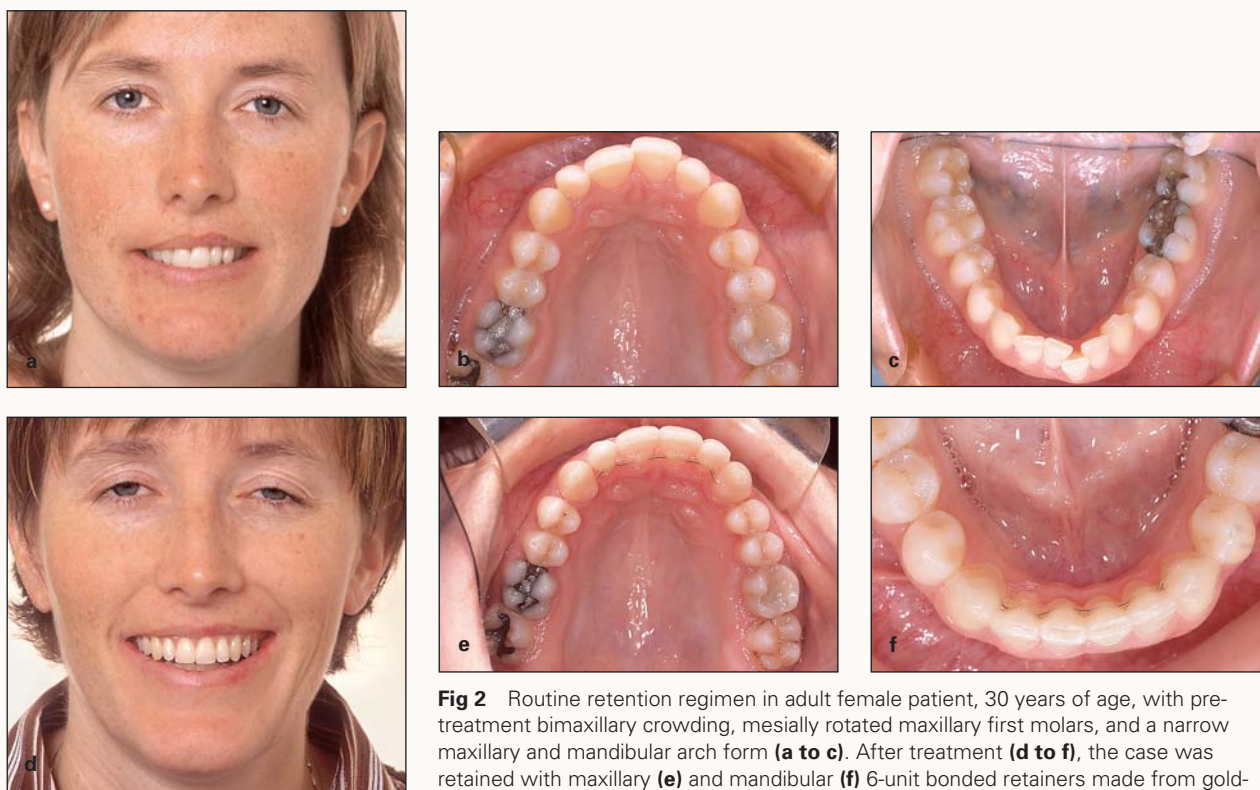


Fig 2 Routine retention regimen in adult female patient, 30 years of age, with pre-treatment bimaxillary crowding, mesially rotated maxillary first molars, and a narrow maxillary and mandibular arch form (**a to c**). After treatment (**d to f**), the case was retained with maxillary (**e**) and mandibular (**f**) 6-unit bonded retainers made from gold-coated 0.0215-inch 5-stranded spiral wire and a removable plate. Note excellent post-treatment smile with upright maxillary canines and premolars (**d**).



Fig 3 Individualized retention regimen in adult male patient with deep anterior overbite, in whom only the 4 maxillary incisors were retained with a bonded retainer (**b**). The removable plate has 0.018-inch extensions into mesial fissure of the first premolars to prevent anterior space opening (see text) and posterior 0.8-mm extensions behind the third molars (**a**). The mandibular retainer is a 43-34 retainer (see text for details).

Routine retention in adult patients

The routine retention regimen for adults is different from that for younger patients. Figure 2 shows the preferred design for most adult patients. The mandibular 0.0215-inch gold-coated spiral wire is bonded to all 6 anterior teeth (see Fig 2f). In the maxilla, the retainer wire is bonded to the incisors and the canines (see Fig 2e), and the labial wire of the removable plate therefore extends between the canine and first premolar.²

The reasons for using a stricter retention regimen in adults than in adolescents are based on their generally more marked relapse and space reopening tendencies; their increased motivation to maintain an ideal treatment result; and their better cooperation with dental floss. The failure rates may be somewhat increased compared with the retainers used for adolescents, but not alarmingly so.²

It may be noted that when only the 4 incisors are included in a bonded lingual retainer in adults, we have observed a disturbing tendency for space opening between the canines and the lateral incisors. This is because the labial wire of the removable plate may tend to sink gingivally and push the teeth apart. This side-effect can be prevented by including a small 0.018-inch wire in the mesio-occlusal part of the fissure of the premolar (see Fig 3a and 3b).

An alternative to bonding the mandibular retainer to all 6 mandibular anterior teeth in adults with deep bite and the 6 mandibular anterior teeth above the functional occlusal plane at the start of treatment is to use a thick retainer wire to the canines and then add thin wire extensions bonded in the mesial part of the occlusal fissure of the first premolars (see Fig 3c). The 43-34 retainer will prevent recurrence of the deep bite more effectively than a 3-3 retainer.

Differential retention for selected patients

The term *differential retention*³ implies that special attention is directed toward the strongest and most important predilection site for relapse in each orthodontic case. The most appropriate mode of retention for each postorthodontic situation should be used, and it should be based on a careful evaluation of the pretreatment diagnostic records, habits, patient cooperation, growth pattern, and age. Implicit in the discussion of direct-bonded retainers is the additional use of labial retainers (Figs 5 and 6).⁷

In clinical practice, the decision of what type of bonded retainer to use should be made at the end of active treatment with the appliances still in place. A chairside comparison with the pretreatment plaster casts will indicate which teeth in each individual case are most likely to relapse (Figs 4 to 7). Rotated and crowded premolars must be fully corrected before appliance removal, using attentive archwire bends. Once 100% corrected, these teeth may then be included in the retainer design (see Fig 4) or receive additional labial retainer wires in supplement to the anterior retainer (Figs 5 and 6).



Fig 4 Adult female patient, 42 years of age, with pretreatment bimaxillary crowding, overlapping incisors, and deep overbite (**a,b**). Orthodontic correction of the malocclusion traits included the use of full fixed appliances (**c**) and interproximal stripping. The mandibular teeth were retained with a mandibular 8-unit (**d to f**) bonded retainer. Note how the pretreatment mesially rotated mandibular first premolars (**b,c**) are firmly held in their corrected position by the retainer wire bonded in the occlusal surface of the premolars (**e,f**).



Fig 5 Adult female patient, 44 years of age, with pretreatment bimaxillary crowding, blocked out mandibular left first premolar, and deep anterior overbite (**a to c**). After treatment (**d to f**), the case was retained with an 8-unit bonded retainer and a short labial segment between the left first and second premolars to prevent relapse of the crowding and deep overbite.



Fig 6 Adult female patient in whom the maxillary right first molar had been extracted long before treatment (**a**). The maxillary second molar was moved distally and the third molar was moved mesially to close spaces and provide room for the right second premolar (**b**). A 3-unit labial gold-coated 5-stranded wire was used for their retention (**b,c**).

Labial retainers

The use of short labial retainers, as originally suggested by Axelson and Zachrisson⁷ in 1992, may improve the long-term results in some specific retention situations, such as prevention of space reopening in closed extraction sites in adults; when premolars and molars have been moved mesially; and when the premolars are markedly rotated (see Fig 4) and/or crowded (see Fig 5) pretreatment. The background for bonding the retainer wires labially was based on the partly unsatisfactory results when the retainer wires were bonded to the lingual surface of premolars.⁷ The results in terms of success rate and patient acceptance are generally excellent for short segments (2 teeth). When longer labial retainers (3 to 4 teeth) are used, the bond failures increase significantly.⁷ A gold-plated labial wire is more acceptable than a steel wire, even if some of the plating may wear off over time. The failure rates for short labial retainers in my office is around 4% for the 2-year-period they are generally used.⁷



Fig 7 Removable, simple Crozat appliance is optimal for crossbite retention over the long term. The all-wire appliance with spring action contains laser-welded 0.8-mm transpalatal wire, with 0.6-mm-diameter mesial and distal extension arms.

Crossbite retention

As discussed elsewhere,⁸ long-term retention of posterior crossbites may be cumbersome (particularly in adults) when conventional retainers (Hawley plates, hard or soft acrylic splints, bonded retainers, cemented transpalatal arches, etc) are used. Over the past 6 years, my preferred retention appliance for treated posterior crossbites and other marked changes in maxillary arch shape has been a simplified Crozat appliance (see Fig 7).

This all-wire appliance is laboratory-made (M&W Zahntechnik, Linz, Austria) with laser-welded clasps and transpalatal arch. The biggest advantage of the simple Crozat is its spring action. If the retainer is forgotten some nights, the spring activity will move the teeth back to the posttreatment position when it is inserted again, in contrast to a removable plate.

Semipermanent (10 years) versus permanent retention

Experience with the different bonded retainers over 10 to 15 years is excellent, provided a careful wire bending and bonding technique is used.² Patient acceptance is also satisfactory,^{2,9} and adult patients, in particular, appreciate that the stability of the treatment results are secured without need for their active cooperation.

Because the fixed lingual retainers are invisible, a problem may exist in deciding when to remove them. Extended retention periods of up to 10 years are now recommended by most clinicians.¹⁰⁻¹³ The long retention periods are favorable in many patients while waiting for the patient's third molars to erupt; and long retention counters the effects of postpubertal growth activity and maxillomandibular adjustments, which may continue well into the second decade and longer.^{10,14}

As long as the retainer remains intact, the treatment result is maintained; and as long as the patient performs adequate plaque control, there are no real reasons to remove the retainer. Accumulations of calculus on mandibular 3-3 and 321-123 retainers may be disturbing to the referring or general dentists, but even large amounts of calculus may not be causing gingival and periodontal problems.¹⁵⁻¹⁷ Gaare et al¹⁵ found no significant benefit of calculus removal on the effect of toothbrushing, which supports the view that it is not the calculus, but the plaque that forms on the calculus, that has pathogenic potential.

It is probably wise, however, to restrict the use of permanent retention to those orthodontic patients who really need it. As discussed elsewhere,^{2,4} this category may include adults with advanced periodontal tissue breakdown, in whom the bonded retainers serve the dual purpose of preventing unwanted tooth movements and acting as a periodontal splint. In addition, patients with pretreatment marked median diastemas and adults with pronounced anterior crowding may need permanent stabilization of the treatment results. In some cases, it may be advantageous to use the bonded retainers for a prolonged retention period, and then replace them with a removable retainer for nighttime wear on a long-term or more permanent basis.

REFERENCES

1. Keim RG, Gottlieb EL, Nelson AH. 2002 JCO study of orthodontic diagnosis and treatment procedures. *J Clin Orthod* 2002;36:553-568.
2. Zachrisson BU, Büyükyilmaz T. Bonding in Orthodontics. In: Graber TM, Vanarsdall RL Jr, Vig KWL (eds). *Orthodontics. Current Principles and Techniques* (ed 4). St Louis: Elsevier, 2005:579-659.
3. Jensen JL. Personal communication, 1993.
4. Dahl EH, Zachrisson BU. Long-term experience with direct-bonded lingual retainers. *J Clin Orthod* 1991;25:619-630.
5. Årtun J, Spadafora AT, Shapiro PA. A 3-year follow-up study of various types of orthodontic canine-to-canine retainers. *Eur J Orthod* 1997;19:501-509.
6. Bearn DR. Bonded orthodontic retainers: A review. *Am J Orthod Dentofacial Orthop* 1995;108:207-213.
7. Axelsson S, Zachrisson BU. Clinical experience with direct-bonded labial retainers. *J Clin Orthod* 1992;26:480-490.
8. Zachrisson BU. Long-term retention of treated posterior crossbites. *World J Orthod* 2006;7:84-91.
9. Wong P, Freer TJ. Patients' attitudes towards compliance with retainer wear. *Aust Orthod J* 2005;21:45-53.
10. Behrents RG. The consequences of adult craniofacial growth. Monograph 22, Craniofacial Growth Series, Center for Human Growth and Development. Ann Arbor: University of Michigan, 1989.
11. Gorman JC, Smith RJ. Comparison of treatment effects with labial and lingual fixed appliances. *Am J Orthod Dentofacial Orthop* 1991;99:202-209.
12. Sadowsky C, Schneider BJ, BeGole EA, Tahir E. Long-term stability after orthodontic treatment: Nonextraction with prolonged retention. *Am J Orthod Dentofacial Orthop* 1994;106:243-249.
13. Zachrisson BU. Important aspects of long-term stability. *J Clin Orthod* 1997;31:562-583.
14. Iseri H, Solow B. Continued eruption of maxillary incisors and first molars in girls from 9 to 25 years studied by the implant method. *Eur J Orthod* 1996;18:245-256.
15. Gaare D, Rølla G, Aryadi FJ, van der Ouderaa F. Improvement of gingival health by toothbrushing in individuals with large amounts of calculus. *J Clin Periodontol* 1990;17:38-41.
16. White DJ. Dental calculus: Recent insights into occurrence, formation, prevention, removal and oral health effects of supragingival and subgingival deposits. *Eur J Oral Sci* 1997;105:508-522.
17. Heier EE, DeSmit AA, Wijgaerts IA, Adriaens PA. Periodontal implications of bonded versus removable retainers. *Am J Orthod Dentofacial Orthop* 1997;112:607-616.

Have a question you would like to see featured in this column?

Send it to: T. M. Graber, Editor-in-Chief
University of Illinois at Chicago,
College of Dentistry
801 South Paulina, M/C 842
Chicago, Illinois 60612, USA

or E-mail to: tgrab@uic.edu