

Long-Term Experience with Direct-Bonded Retainers: Update and Clinical Advice

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The use of fixed lingual retainers in orthodontics is increasing,¹ and the various options now available to the clinician allow more differentiated retention than ever before. Bonded retainers have

advantages compared to more conventional removable retainers in that they are invisible from the front,² require less patient cooperation, and provide long-term (as long as 10 years) or even permanent



Fig. 1 Routine retention regimen in young orthodontic patient. A. 8-year-old female with anterior crowding and mesially rotated maxillary first molars before treatment. B. After orthodontic leveling and space opening by molar derotation and uprighting of posterior teeth. C. Retention with thick (.030") mandibular 3-3 and thin (.0215") maxillary 21-12 retainers and removable plate. Patient was instructed to use Superfloss* to clean around fixed retainers.



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retention more safely and predictably than removable plates or all-wire retainers.

Clinical experience and differential retention philosophy^{3,4} have demonstrated the need for two types of bonded wire retainer: thick (.030" or .032" diameter) and thin multistranded (.0215" diameter). The thick wire is used for a mandibular 3-3 retainer bonded only to the terminal dental units, whereas the thin spiral wire is used for various retainers in which all teeth in a segment are bonded.

The purpose of this article is to present a clinical update of the author's use of different forms of bonded retainers during more than 30 years of practice, and to offer some clinical advice on retainer design and fabrication.

Routine Retention

Young and Adolescent Patients

The recommended routine retention regimen described here for young and adolescent ortho-

dontic patients has produced excellent clinical results for more than 10 years (Fig. 1). It consists of a mandibular retainer bonded only to the canines, a maxillary retainer bonded to each of the four upper incisors, and an upper removable plate.⁴

The mandibular retainer (Fig. 1C) is an .030" gold-coated wire** that is sandblasted at the terminal ends to improve retention of the bonding composite resin,⁵ which can be either chemically cured*** or light-cured.†⁴ The detailed technique for fabrication, tacking, and bonding of this type of retainer is presented elsewhere.⁴ The thick mandibular retainer is solid, easy to place, and safer and more hygienic than retainers bonded to all six anterior teeth. A patient notices 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 if necessary. As the simplest and safest of the bonded retainers, this type is also useful in many adult patients with minor pretreatment crowding or spacing.

The routine maxillary retainer (Fig. 1C) is a gold-coated .0215" five-stranded spiral wire. The inclusion of only the incisors in the routine retainer for children is based on the success rates of various types of bonded lingual retainers^{4,6} (Table 1). Failure rates have been significantly higher when the maxillary canines were included. A detailed description of the fabrication, tacking, and bonding of this retainer is provided elsewhere.⁴

The maxillary plate is made of acrylic resin

**TABLE 1
SUCCESS RATES FOR VARIOUS
BONDED LINGUAL RETAINERS**

	Wire Diameter	No. Patients	Success Rate*
Mandibular			
3-3	.030"	381	96.5%
321-123	.0215"	191	94.7%
Maxillary			
21-12	.0215"	323	93.8%
321-123	.0215"	186	78.5%

*Data include gold-coated retainers bonded from May 1994 to May 2004. All retainers were bonded by the author in the same office. Mean observation time was 4.2 years (range of 1-10 years). Success refers to intact retainers (without bond failures or wire fractures) throughout the follow-up period.

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**Gold'n Braces Inc., 2595 Tampa Road, Suite I, Palm Harbor, FL 34684-3131; www.goldnbraces.com.

***Concise, trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016; www.3m.com.

†Transbond LR, trademark of 3M Unitek, 2724 S. Peck Road, Monrovia, CA 91016; www.3m.com.

that incorporates rectangular labial wires (.019" × .026" Blue Elgiloy††) extending between the lateral incisors and canines (Fig. 1C) and .032" stainless steel wires distal to the terminal molars.⁴ The acrylic should not contact the maxillary retainer wire (Fig. 1C). In the routine procedure, the plate is worn full-time for six months and then at night for at least two years.

Adult Patients

Our routine retention regimen in adults is different from that in younger patients. The mandibular retainer is a thin .0215" gold-coated spiral wire bonded to the six anterior teeth (Fig. 2C). In the maxillary arch, the same retainer wire is bonded to the incisors and the canines, and the removable plate therefore extends between the canines and first premolars.⁴

The reasons for using a stricter retention regimen in adults are their generally more marked relapse tendencies, improved motivation to maintain ideal results, and better ability to keep bonded retainers clean with the use of dental floss (Fig. 1C). Retainer failure rates in adults may be somewhat higher than in adolescents, but not alarmingly so (Table 1).

Failure Rates

Table 1 shows long-term success rates in our office for the different retainer designs. Bond failures and wire breakage with various retainers were also reported by Dahl and Zachrisson.⁷ The failure rates in our office are considerably lower than those reported by other authors.⁸⁻¹¹ The difference may be explained by technical factors such as the use of adequate composite resin over the wire (Figs. 1,2), smooth contouring of the adhesive resin, completely undisturbed setting of the adhesive in every case, and careful adaptation of the wire to the lingual contours of the teeth, as well as avoidance of occlusal interference from opposing teeth.⁴

The preferred five-stranded wire is relatively easy to shape into complicated configurations with a fine three-pronged wire-bending plier. The wire must be completely passive when bonded into position on the teeth. It is secured by a four-handed approach, with initial tacking to one tooth, which allows a careful check of the wire's passivity.⁴ The wire maintains its form once bonded, and no side effects due to wire distortion have been observed, as sometimes occurred when thinner (.0195" and .0175") wires were used. Because the wires are not heat-treated or dead-softened, they are optimal for the maintenance of anterior tooth corrections, including rotations, height differences, and in-out positions (Figs. 1-6).

Individualized Retention for Selected Patients

The term "differential retention"³ implies that special attention is given to the site that is most prone to relapse in each orthodontic case. The most appropriate mode of retention for the post-treatment situation in question should be used, based on a careful evaluation of the patient's pretreatment diagnostic records, habits, cooperation, growth pattern, and age. A discussion of the acid-etch technique for direct-bonded retainers offers a variety of new approaches for retention, including the use of labial retainers¹² (Figs. 3,5).

In clinical practice, the decision on what type of bonded retainer to use should be made at the end of active treatment, with the appliances still in place. A careful chairside comparison with the pretreatment plaster models will indicate which teeth in each individual case are most prone to relapse (Figs. 3,4). These teeth must be fully corrected before appliance removal, which is surprisingly difficult and requires careful archwire bends. Once fully corrected, these teeth may then be included in the retainer design (Fig. 4) or receive additional retainer wires to supplement the anterior retainer (Figs. 3,5).

The use of short labial retainers may improve the long-term results in some specific situations, including the prevention of space reopening in

††Registered trademark of Rocky Mountain Orthodontics, 650 W. Colfax Ave., Denver, CO 80204; www.rmortho.com.

closed extraction sites in adults or in other instances where premolars and molars have been moved mesially (Fig. 5). The rationale for bonding these retainer wires labially was based on the unsatisfactory results obtained when retainer wires were bonded to the lingual surfaces of premolars.¹² Axelsson and Zachrisson reported excellent initial results for short segments (two teeth) in terms of bonding success rate and, somewhat

surprisingly, outstanding patient acceptance.¹² When longer retainers (three to four teeth) were placed labially, however, bond failures increased significantly. A gold-plated labial wire is understandably more acceptable to the patient than a steel wire, even if some of the plating wears off over time. The failure rate for short labial retainers in our office is only about 4% during the two-year period in which they are generally used.¹²



Fig. 2 Routine retention regimen in adult patient. **A.** 30-year-old female with bimaxillary crowding, mesially rotated maxillary first molars, and narrow upper and lower archforms before treatment. **B.** Excellent post-treatment smile, with upright maxillary canines and premolars. **C.** Retention with maxillary removable plate and six-unit maxillary and mandibular bonded retainers made from gold-coated .0215" five-stranded spiral wire.

Crowded and Rotated Premolars in Adults

Two-unit labial retainers in the posterior segments may be a useful supplement to routinely bonded lingual retainers in some adult patients.

The young adult female patient in Figure 3 had moderate mandibular crowding with marked

mesiolingual rotation of the second premolars (Fig. 3A). The case was treated by leveling and alignment of the teeth after recontouring the triangular incisors and oval first premolars, which provided space to avoid incisor proclination and intercanine expansion and achieve full interdental gingival papillae. The retainer design included a conventional bonded wire from canine to canine,



Fig. 3 A. 30-year-old female patient with mandibular crowding and mesiolingual rotation of second premolars and left first premolar before treatment. Space for leveling was provided by interdental enamel reduction of triangular incisors and oval premolars. B. After treatment, anterior teeth were held with conventional six-unit lingual retainer; derotated premolars were held with short gold-coated labial retainer wires, which were almost invisible when patient was smiling.

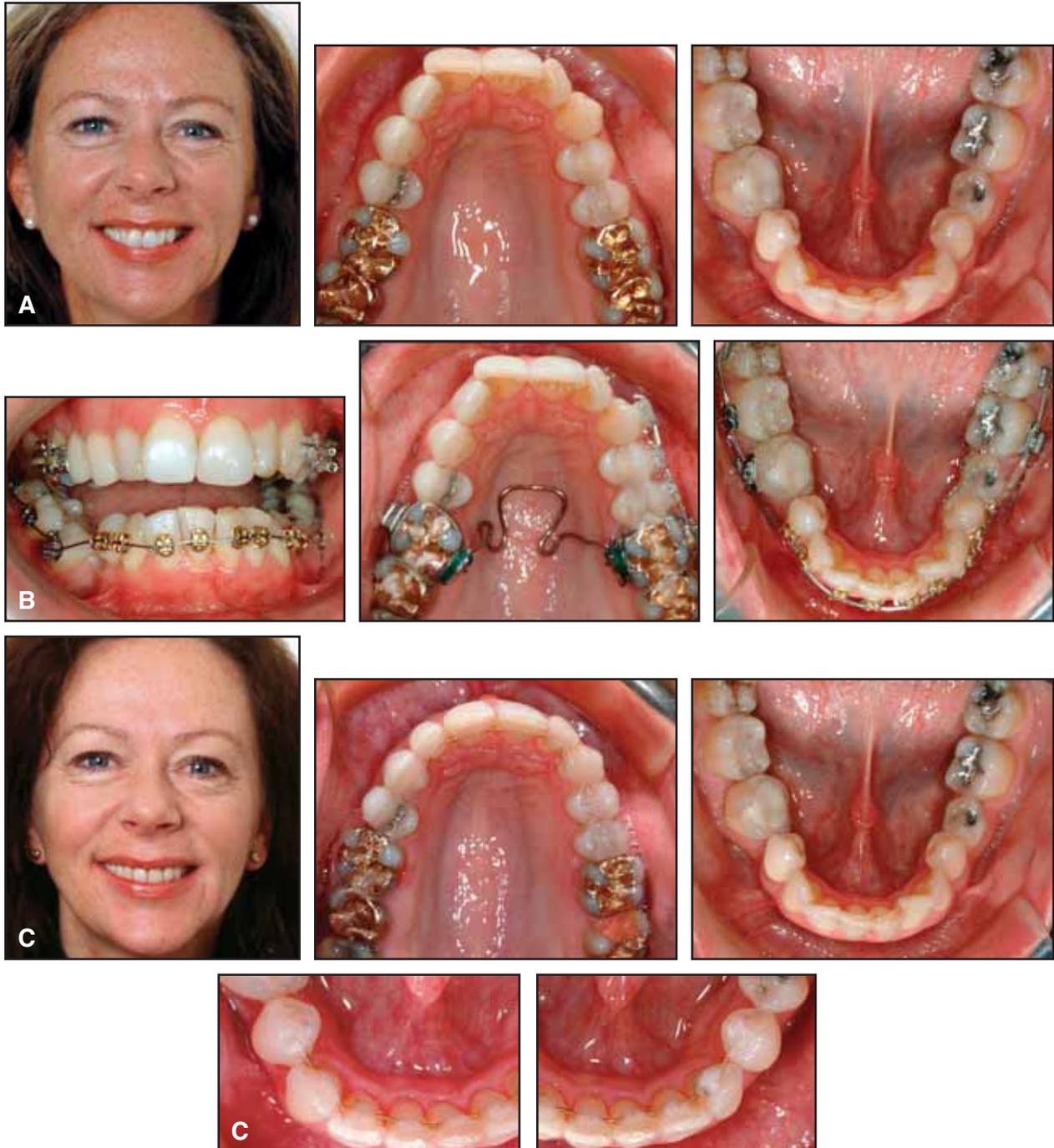


Fig. 4 A. 42-year-old female patient with bimaxillary crowding, mesially rotated upper first molars, overlapping incisors, and deep overbite before treatment. B. Orthodontic correction involved full fixed appliances, removable transpalatal arch for molar derotation, and interproximal stripping. C. Retention with maxillary six-unit bonded retainer and removable plate and mandibular eight-unit bonded retainer. Note mesially rotated lower first premolars firmly held in corrected positions by retainer wires bonded to occlusal surfaces.

plus two short labial retainers between the premolars (Fig. 3B). The short labial retainers were inconspicuous and hardly visible when the patient was smiling.

The adult female patient in Figure 4 also had severely rotated mandibular first premolars, as well as a deep anterior overbite with a marked curve

of Spee. The maxillary dental arch was narrow, with crowded incisors and mesially rotated first molars. After maxillary mesiodistal enamel reduction (stripping), the molars were derotated with a transpalatal arch, the archform was rounded, and the teeth were retained with a routine six-unit gold-coated bonded lingual wire. After leveling and alignment



Fig. 5 A. 54-year-old female patient in whom maxillary right first molar and mandibular right second molar had been extracted long before treatment. B. Upper second molar was moved distally and third molar moved mesially to close spaces and provide room for right second premolar. Three-unit labial gold-coated, five-stranded wire was used for maxillary retention. C. Mesially tipped lower right third molar uprighted with Sander mechanics¹³ and held with short labial retainer.

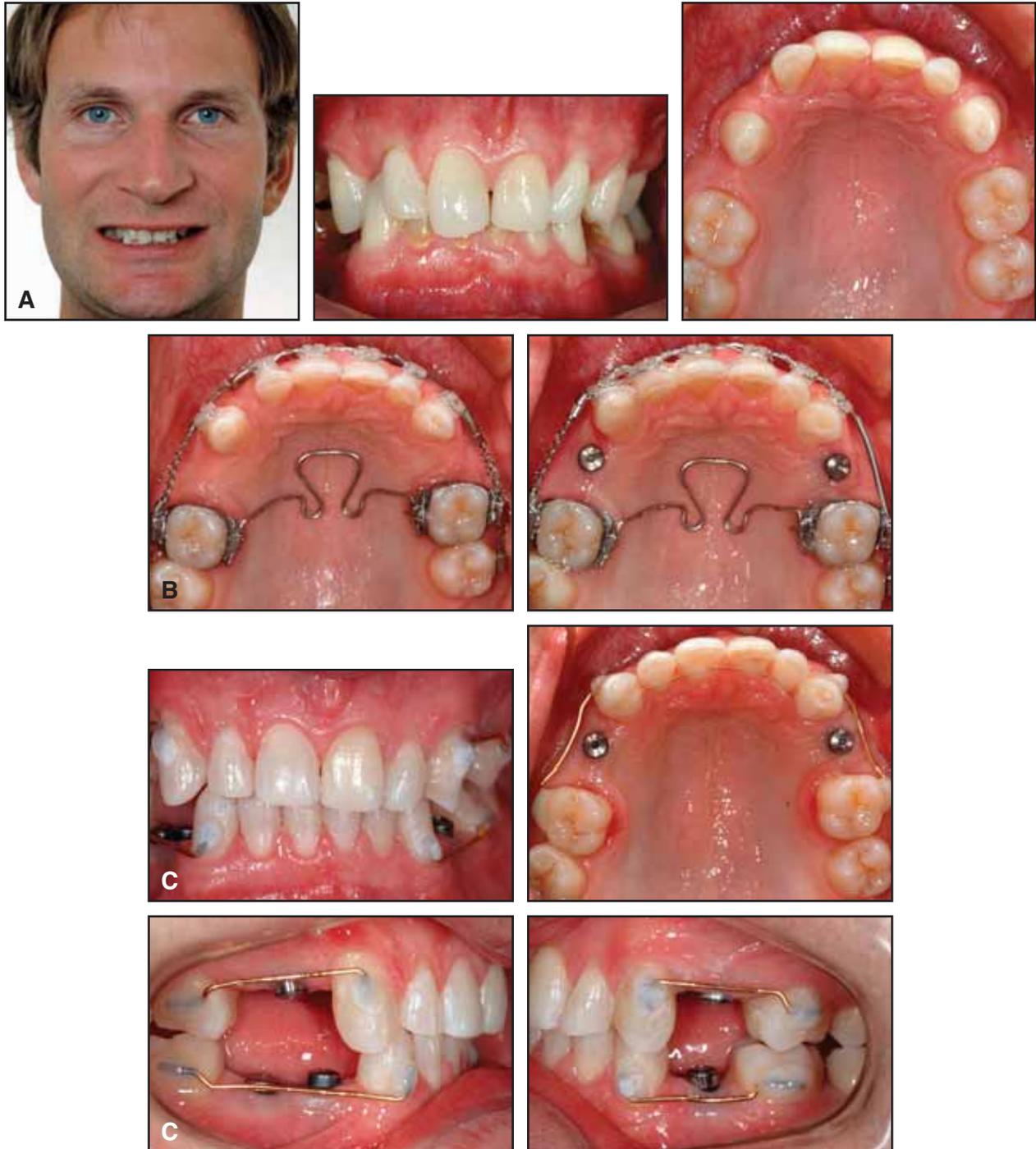


Fig. 6 A. 33-year-old male patient with deep overbite and multiple agenesia before treatment. B. Spaces opened for five implants, and deep overbite corrected by mandibular incisor intrusion. C. Retention with four bonded space maintainers made of .030" gold-coated wire. Ends of wires were sandblasted to improve micro-mechanical retention of bonding adhesive.

of the mandibular dentition, the retainer of choice was an eight-unit lingual retainer, with the wire bonded to the occlusal surfaces of the first premolars (Fig. 4C).

The 54-year-old patient in Figure 5 initially presented with a lingually displaced upper right second premolar after previous extraction of the right first molar. The second molar had drifted mesially, and there was a large space between the second and third molars. The mandibular right third molar had tipped mesially after previous extraction of the second molar. After orthodontic correction of the maxillary arch, the right posterior segment was retained with a labial wire from second molar to first premolar (Fig. 5B). The tipped mandibular third molar was uprighted according to the method of Sander¹³ and retained successfully with a two-unit labial wire (Fig. 5C).

Bonded Space Maintainers

The same wire and technique used for making the thick 3-3 retainers bonded to the terminal teeth is also optimal for making space maintainers (Fig. 6). According to Årtun and Marstrander, a utility wire design is necessary to reduce the influence of occlusal forces.¹⁴ A lingual curvature of the wire close to the alveolar ridge (Fig. 6C) will also help keep the space maintainer from being dislodged. The failure rate for such space maintainers is reportedly about 10% for the first year,¹⁴ which is an acceptable level. Figure 6 shows a 33-year-old male patient with multiple agenesis and deep anterior overbite, in whom four space maintainers were placed while waiting for appropriate osseointegration and crown placement on five implants. Sandblasting the gold-plated .030" wire is essential for enhanced micromechanical retention of the composite resin (Fig. 6C).

Semipermanent vs. Permanent Retention

Our experience with these bonded retainers

over 10 to 15 years has generally been satisfactory, provided a careful wire-bending and bonding technique is used.⁴ Patient acceptance is usually excellent,¹⁵ and adult patients in particular appreciate the fact that stability of the treatment results does not require their active cooperation.

Because the fixed lingual retainers are invisible, it is difficult to decide when to remove them. Extended retention periods of as long as 10 years are now recommended by most clinicians.¹⁶⁻¹⁹ These longer retention periods are beneficial while waiting for a patient's third molars to erupt, and the extended retention counters the effects of postpubertal growth and maxillomandibular adjustments, which may continue well into the second decade or longer.^{16,20}

As long as the retainer remains intact, the treatment result is maintained, and as long as the patient performs adequate plaque control, no good reason exists to remove it. Accumulations of calculus on a mandibular 3-3 or 321-123 retainer may be disturbing to the referring or general dentist, but even large amounts of calculus may not cause gingival or periodontal problems.²¹⁻²³ Gaare and colleagues found no significant benefit of calculus removal in the effect of toothbrushing on gingival health,²¹ 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,^{4,7} 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 periodontal splints. Patients with marked median diastemas and adults with pronounced anterior crowding may also need permanent stabilization of the treatment results. In some cases, it may be advantageous to use the bonded retainers for a prolonged period and then to replace them with removable retainers for night-time wear on a long-term basis.

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