

The Use of Separating Rings in the Placement of Class II Composite Resins

Procedure/Study by
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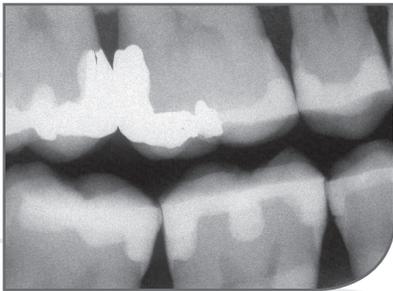
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Many articles have addressed the challenges faced by the clinician in placing posterior composites. The inherent chemical nature of today's composite resins still force the clinician to deal with polymerization shrinkage, which can range from 2–3% for hybrids, microfills, and nanofilled composites^{1,2,3} and low viscosity or flowable composite resins which are often used as liners, or initial increments in proximal boxes which can demonstrate a volumetric contraction of up to 5% because of their lower filler content⁴. These shrinkage values are only approximate for each composite, as the shrinkage depends on the polymerization reaction which is proportional to the degree of conversion⁵ (exposure time x light irradiance or radiant exposure measured in J/cm²).⁶ To address or compensate for this chemical contraction, many composite insertion techniques have been proposed which usually incorporate an incremental placement of the composite resin such as the three site technique using clear matrices with reflective wedges,^{7,8} a horizontal layering,^{9,10} the oblique technique,^{11,12} or a segmental technique as described by Jackson which may include an initial bulk placement in 3 to 3.5 mm increments.¹³

In spite of the various techniques used to place these composite resins, these materials' challenges can lead to post-operative sensitivity,^{14,15} wear higher than tooth structure,¹⁶ marginal leakage with recurrent caries,^{17,18} and open contact areas.^{13,19,20} For posterior Class II restorations especially, open contacts result in food impaction into the interproximal space resulting in periodontal inflammation and disease, due to bacterial ingress into the periodontium,^{21,22} with subsequent bone loss^{23,24} (Figure #1), and recurrent caries²⁵ (Figure #2). The high incidence of open contacts with food impaction may be one of the reasons why, as Strassler states, "clinical evidence has demonstrated that Class II composite resins have significantly higher rates of caries at the gingival margin when compared to amalgam restorations."²⁶

The clinical challenge of creating tight interproximal contacts has been discussed in many published articles. Liebenberg states that "the clinician's achievement of an intact proximal contact when delivering a direct restorative option is reliant on tooth separation greater than or equal to the thickness of the matrix used."²⁷ I would submit that due to post light-cure polymerization contraction, the separation required for the creation of routinely tight interproximal contacts for direct placement should always be greater than the thickness of the matrix band. The re-establishment of the correct interproximal contact and convex contour (bucco-lingually and occluso-gingivally) requires a properly contoured matrix which is stabilized and adapted gingivally with a properly inserted and contoured wedge.²⁸ The use of a Tofflemire metal matrix and retainer that is not contoured (Figure #3), and even if contoured, stabilized gingivally with a wedge only, without the use of auxiliary tooth separation, will often result in open or light contacts.²⁹ A circumferential matrix will cause the band to flatten out interproximally due to tensioning (it often has to be released somewhat), and when the interproximal contact is wide, an open contact is the only possible clinical outcome. A non contoured circumferential matrix creates a flat interproximal contour which migrates the contact point from the upper middle third to the marginal ridge occlusally (Figure #4).³⁰

This translocation can create an open contact when proper marginal ridge convexity is created and will result in premature interproximal fracture due to lack of support for the marginal ridge which can often be in an area of a centric stop (Figure #5).³¹

Many authors have looked at various other methods of creating tight interproximal contacts. Early literature looked at the effect of "pre-wedging" as it not only creates some initial separation of the teeth, but also protects the rubber dam interproximally and the interproximal tissue as well.³² The clinician should note that the wedge should be continually advanced during the preparation phase, as the wedge may back out, or soften due to saliva, if a wooden wedge is placed. "Packable" composite resins have been evaluated,^{33,34} but not only did these show increased wear and surface roughness^{35,36} (being no better than a hybrid), their use did not ensure reliably tight contacts.³⁷ It is important to note that the use of a separating ring when restoring Class II composite restorations has a greater influence on the obtained proximal contact tightness compared to the influence of the consistency of the composite resin.³⁸ Ceramic inserts or pre-polymerized resin particles have been used which can wedge the contacts interproximally as well as decreasing the overall amount of composite used, thereby reducing the overall amount of shrinkage.^{39,40} Special instruments to help hold the matrix in better adaptation in contact with the adjacent tooth, such as the Contact Pro (Clinician's Choice, Brookfield CT) can be especially helpful⁴¹ when the preparation is very wide interproximally, which can negate the use of some small tine matrix rings. The thickness of the matrix band used can have an effect on contacts, as these can vary from .030 mm to .058mm.⁴²

Since Class II posterior composite resin restorations placed with a combination of sectional matrices and separation rings result in the strongest contacts,^{43,44} and since the use of a contoured matrix results in a stronger marginal ridge⁴⁵ this article will now look at one of those systems.

Of the ring systems currently available, the Garrison Composi-Tight 3D gives the author one of the most predictable results.

The Garrison Composi-Tight 3D sectional matrix system has a Soft-Face which is different from other available rings (Figure #6). The ring is made of polished stainless steel which is circular in shape, with the bow section encased in plastic that stiffens the ring (Figure #7). The hard and soft plastic combination of the tine area creates

separating pressure while entering the interproximal area to minimize flash and enhances the grip on the contoured matrix band which comes in a number of sizes and shapes. The U-shaped gingival contour of the soft face allows the ring to be placed over the wedge. The system has the option of using the regular contoured bands or the new Slick bands (Figure #8) which are designed to minimize sticking to the bonding agent.



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The Garrison Fender Wedge (Figures #9 and 10) is an excellent way to protect the rubber dam, interproximal gingival tissues, and the tooth surface adjacent to the preparation.



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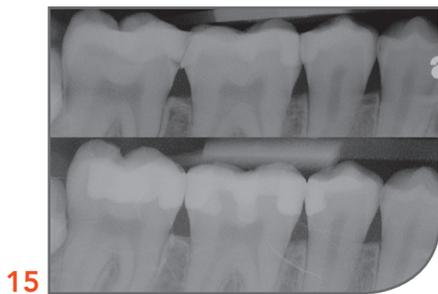
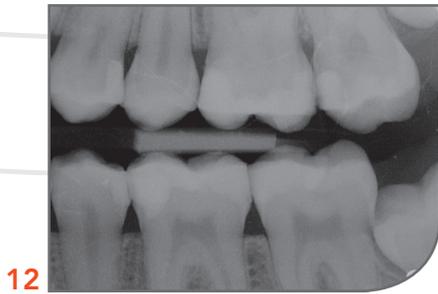
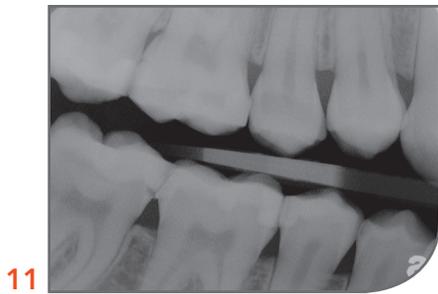
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A 20-year-old patient presented to the practice with four quadrants of failing composites due to open contacts, interproximal and occlusal decay and pain on chewing (Figures #11, 12). Tooth number 15 had a carious pulp exposure and required endodontic therapy. Rubber dam was applied to the lower left quadrant after anesthesia, interproximal wooden wedges were placed to begin the “pre-wedging process, and they were advanced during the operative procedure. After removal of the old restorations and caries in teeth #19 and 20, a BlueView Pinch Matrix (Garrison Dental Solutions, Spring Lake, MI) was applied to tooth #19 (Figure #13) and new wedges inserted to stabilize the band, adapt it gingivally to minimize the chance for composite overhang, and to create interproximal pressure. To facilitate easy access, and since teeth #18 and 20 were going to be prepared and restored, no auxiliary separation was applied. Tooth #19 was etched with Ultra-Etch 35% phosphoric acid solution (Ultradent, Salt Lake City, UT) by applying it to the enamel margins first, followed by placement within the cavity preparation, and washed and gently dried after 15 seconds, leaving a slightly moist surface. G5 desensitizer (Clinician’s Choice, Brookfield, CT) a mixture of 5% Gluteraldehyde, 35% HEMA and water was carefully applied, and the excess removed by suction. The G5 acts by coagulating plasma proteins in the tubules, acts as a pre-primer, and has residual antimicrobial effects. MPa (Clinician’s Choice, Brookfield CT), a fifth generation bonding agent was placed in a single layer, air thinned with the solvent evaporated, and light cured with a Valo (Ultradent, Salt Lake City, UT) broad spectrum curing light for 10 seconds. A thin layer of DeMark, a hyper-opaque, flowable hybrid lining composite (Cosmedent, Chicago, IL) was teased into the base of the proximal box, into the deeper carious excavation areas, and lightly teased over the pulpal floor (Figure #14) followed by light curing for 10 seconds. Its radiopacity can be clearly seen on the radiograph (Figure #15), which minimizes the chance for erroneous diagnosis of caries under the composite due to radiolucent lining materials. The placement of a flowable liner also creates an “elastic cavity wall”⁴⁶ interface which minimizes the effect of C-factor shrinkage.⁴⁷ An incremental insertion technique was used to restore the tooth with Cosmedent Nano A2 (Cosmedent, Chicago, IL), with each layer no more than 2 mm, laterally placed to reduce the C factor, and light cured for 10 seconds. The restoration was shaped on the occlusal with a 7803 multi-fluted bur, and the mesial interproximal shaped with a 7901.

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On tooth #20 the Garrison contoured matrix was placed, followed by a G-Wedge, and the Composi-Tight 3D ring applied to separate the teeth and minimize interproximal flash (Figure #16). After each placement of the contoured matrix band, a ball burnisher should be used to verify contact with the adjacent tooth. The DO restoration was placed following the above protocol (Figure #17). The final excellent contour and contact that can be routinely achieved with this system is shown in Figure #18. Because of a tear in the rubber dam, a new dam was placed to adequately isolate tooth #18 and "pre-wedging" initiated. Even with the rubber dam clamp on the same tooth, if well placed apically, Figure #19 shows the application of the Garrison contoured matrix and the Composi-Tight ring over the rubber dam clamp. Figure #20 shows the easy 90 degree direct access allowed by the shape and design of the Valo curing light, which allows maximum curing penetration.



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After restoring tooth #18 as above (Figure #21), and polishing the restorations with an occlusal diamond impregnated Groovy bristle brush (Clinician's Choice, Brookfield, CT), the immediate post operative photo is shown in Figure #22.

This article has presented a predictable method of obtaining tight, well contoured, interproximal restorations utilizing separation rings. Clinical predictability is assured when following the above protocol.

22



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Figure #5 is courtesy of Dr. David Clark

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