

Matrix Systems and the Class II Composite Resin

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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 nano-filled 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 content.⁴ 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 layer-

ing,^{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

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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 preparation 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

Many authors have looked at various other methods of creating tight interproximal contacts

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 5A and B).³¹

Many authors have looked at various other methods of creating tight interproximal contacts. Early literature looked at the ef-

SECTIONAL AND SEPARATION RING SYSTEMS

| PRODUCT | MANUFACTURER | MATRIX THICKNESS |
|-----------------------------------|---|---|
| V3 Ring | Triodent | 0.00125in/30 microns |
| Composi-Tight 3D | Garrison Dental Solutions | Slickband 0.0015in/38 microns |
| Composi-Tight Gold Contact Matrix | Garrison Dental Solutions Danville Materials | 0.0013in/33 microns 0.0015in/38 microns and 0.0022in/58 microns |
| Palodent | Dentsply Caulk | 0.0015in/38 microns and 0.002in/50 microns |

WEDGES RECOMMENDED FOR USE WITH THESE SYSTEMS

| MATRIX | MANUFACTURER |
|-----------------------|---------------------------|
| Wave-Wedge | Triodent |
| V-Wedge | Triodent |
| Contoured Wood Wedges | Clinician's Choice |
| Wedge Wands | Garrison Dental Solutions |
| G Wedge | Garrison Solutions |
| Flexi Wedge | Common Sense |
| Sabre Wedge | Bioclear |

fect 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 degree 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 (Clinical Research Dental) 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 focus on these systems.

The clear celluloid contoured Bioclear matrices (Clinical Research Dental) which are 50 microns thick, and developed by Dr. David Clark, also work well with the use of separation rings to give well defined and anatomically precise interproximal contour (Figures 6,7,8). The newly introduced Sabre wedge from Bioclear (Figure 9,10) is variably hollow on the underside allowing it to slip over the papilla and thus rides lower in the embrasure



FIGURE 1



FIGURE 2



FIGURE 3

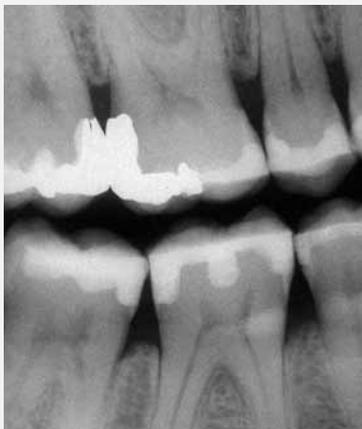


FIGURE 4



FIGURE 5A



FIGURE 5B



FIGURE 6



FIGURE 7



FIGURE 8

which facilitates the gingival emergence profile.

Of the ring systems currently available, the Garrison Composi-Tight 3D and the Trident V3 give the author the most predictable results.

The Garrison Composi-Tight 3D sectional matrix system (Clinical Research Dental) has a Soft-Face which is different from other available rings (Figure 11). 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 12). 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 13) which are designed to minimize sticking to the bonding agent.

The Trident V3 Ring (Clinical Research Dental) matrix system is available in two sizes, a univer-

sal and a narrow (Figure 14). This additional smaller size facilitates a constant pressure even when the embrasure space is narrower as when the ring is placed between premolars. The ring is fabricated from nickel titanium which has a high elastic memory. The glass reinforced plastic tines are V-shaped which allow easy placement over the wedge, with a design that does not go as deep interproximally, enabling the ring to also be used as well in wider proximal cavity preparations. The built-in lip on the plastic inner part of the ring makes the ring more stable in the forceps. The forceps have a notch internally to



FIGURE 9

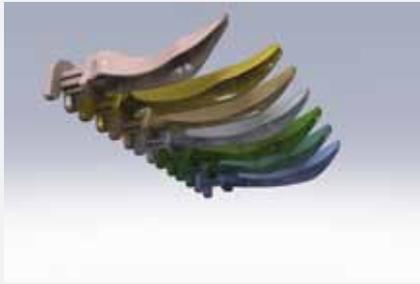


FIGURE 10



FIGURE 11



FIGURE 12



FIGURE 13



FIGURE 14



FIGURE 15



FIGURE 17A



FIGURE 17B



FIGURE 16

facilitate re-tensioning of the ring. The matrix bands are designed not only with a gingival rounded contour, but also with an occlusal marginal ridge contour as well, which when placed at the appropriate height interproximally, virtually shapes the occlusal embrasure with little if any finishing (Figure 15). The matrix has a holed tab extension which allows for easy placement with the pin tweezer (although these are not essential), and there are also lateral holes to facilitate easy removal of the matrix after restoration. The Wave-Wedges have a unique shape that helps them

stay interproximally to adapt the band and protect the tissue and rubber dam, but do not exert separation force (Figure 16).

The Garrison Fender Wedge (Figures 17A,17B) and the Trident Wedge-Guard (Figure 18) are an excellent way to protect the rubber dam, interproximal gingival tissues, and the tooth surface adjacent to the preparation. The Trident Wedge-Guard does not have the pre-wedging effect of tooth separation, as this role is undertaken by the Trident V3 Ring. The Wedge-Guard is unique in that

the fender can be removed to leave the Wave-Wedge behind.

Two cases will be presented which show their similarities and differences.

CASE PRESENTATION #1

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 19, 20). Tooth number 27 had a carious pulp exposure and required endodontic therapy. Rubber dam was applied to three quadrant following anaesthesia,



FIGURE 18



FIGURE 19



FIGURE 20



FIGURE 21



FIGURE 22

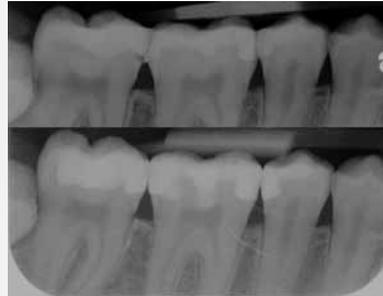


FIGURE 23



FIGURE 24



FIGURE 25



FIGURE 26



FIGURE 27



FIGURE 28

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 tooth 36 and 35, a BlueView Pinch Matrix (Garrison Dental Solutions/Clinical Research Dental) was applied to tooth #36 (Figure 21) and new wedges inserted to stabilize the band, adapt it gingivally to minimize the chance for composite overhang, and to create interproximal pres-

sure. To facilitate easy access, and since 35 and 37 were going to be prepared and restored, no auxiliary separation was applied. Tooth #36 was etched with Ultra-Etch 35% phosphoric acid solution (Ultradent) by applying it to the enamel margins first, followed by placement within the cavity preparation, then washed and gently dried after 15 seconds, leaving a slightly moist surface. G5 desensitizer (Clinical Research Dental) a mixture of 5% Gluteraldehyde, 35% HEMA and water was care-

fully 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 (Clinical Research Dental), a fifth generation bonding agent was placed in a single layer, air thinned with the solvent evaporated, and light cured with a Valo (Ultradent) broad spectrum curing light for 10 seconds. A thin layer of DeMark, a hyper-opaque, flowable hybrid lining composite (Cosmedent) was teased



FIGURE 29



FIGURE 30



FIGURE 31



FIGURE 32



FIGURE 33



FIGURE 34



FIGURE 35



FIGURE 36



FIGURE 37

into the base of the proximal box, into the deeper carious excavation areas, and lightly teased over the pulpal floor (Figure 22) followed by light curing for 10 seconds. Its radiopacity can be clearly seen on the radiograph (Figure 23), 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 Renamel Nano (Cosmedent), with each layer no thicker than 2mm, laterally

After each placement of the contoured matrix band, a ball burnisher should be used to verify contact with the adjacent tooth

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. On tooth #35 the Garrison contoured matrix was placed, followed by a G Wedge, and the Composit-Tight 3D ring applied to separate the teeth, and minimize interproximal flash (Figure 24). 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 25). The final excellent contour and contact that can be routinely achieved with this system is shown in Figure 26. Because of a tear in the rubber dam, a new dam was placed to adequately isolate the #37 and “pre-wedging” initiated. Even



FIGURE 38



FIGURE 39



FIGURE 40



FIGURE 41



FIGURE 42



FIGURE 43

A 43-year-old patient presented to the dental office with extensive caries on the distal of tooth # 45 after loss of a previous restoration months earlier

with the rubber dam clamp on the same tooth, if well placed apically, Figure 27 shows the application of the Garrison contoured matrix and the Composit-Tight ring over the rubber dam clamp. Figure 28 shows the easy 90 degree direct access allowed by the slim shape and design of the Valo curing light, which allows maximum curing penetration. After restoring tooth #37 as above (Figure 29), and polishing the restorations with an occlusal diamond impregnated Groovy bristle brush (Clinical Research Dental), the immediate post operative photo is shown in Figure 30.

CASE PRESENTATION #2

A 43-year-old patient presented to the dental office with extensive caries on the distal of tooth # 45

after loss of a previous restoration months earlier (Figure 31). After anaesthesia, the tooth was isolated with rubber dam (Figure 32) and the tooth prepared with a round ended #332 bur (Figure 33). The Trident matrix band, which has a built in occlusal embrasure form and is pre-contoured occluso-lingually, was placed with the pin tweezers, so that the occlusal embrasure was formed at the correct height, minimizing post restoration finishing and contouring. After placement of the matrix band, the Wave-Wedge was inserted to adapt the band gingivally eliminating gingival excess. The Trident V3 Ring (Trident/Clinical Research Dental) was then applied to stabilize the matrix band, and create interproximal separation (Figure 34). Note

that even though the preparation is wide lingually, the V3 glass reinforced tines separate the teeth without collapsing the matrix band. The tooth was etched for 15 seconds with 35% phosphoric acid, (Figure 35), rinsed and lightly dried. G5 desensitizing agent was sparingly applied to the dentin to coagulate the plasma proteins in the dentinal tubules and the excess removed with suction. A single coat of MPa bonding resin was applied (Figure 36), air thinned, and cured for 10 seconds with a Valo curing light. Figure 37 shows the gloss resulting from complete coverage of the enamel and dentin in a one coat application. DeMark radiopaque liner was placed in a .5 mm increment over the dentin and gingival floor and cured for 20 seconds. A segmental, incre-

mental placement of Renamel Nano in a single shade followed with a 10 second cure for each layer. Figure 38 shows the occlusal embrasure form when the matrix was teased from the restoration and Figure 39 shows the excellent bucco-lingual contour as well as the tight contact upon removal of the matrix band. After initial contouring of the occlusal surface with a multi-fluted finishing bur (Figure 40), a Contour point (Clinical Research Dental) was used for final shaping and polish (Figure 41). Figure 42 shows the polish achieved and the final restoration of tooth #45 (after removal of the rubber dam).

This article has reviewed some of the most predictable methods of obtaining tight, well contoured, interproximal restorations utilizing separation rings. Clinical predictability is assured when following the above protocol. **OH**

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Oral Health welcomes this original article.

Note: Photographs numbers 6-10 are provided courtesy of Dr. David Clark.

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