Impression Matrix Technique for Cusp Replacement Using Direct Composite Resin

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ABSTRACT

Placement of Class II composite resin restorations often presents unique challenges in achieving proper contour and contact. Although the use of sectional bands has provided solutions to these problems, their use typically is limited to more ideal cavity preparations. With more extensive loss of tooth structure, recreating the natural tooth contours and contacts with direct resin composite can be difficult. Typically an indirect restoration is the treatment of choice when a cusp is lost. However, situations may arise that require the use of direct resins for cusp replacement. This article describes the use of an impression matrix to facilitate the replacement of missing tooth structure and allow the dentist to use sectional bands in certain cusp loss situations.

CLINICAL SIGNIFICANCE

When applicable, the impression matrix provides a significant saving in time and effort in cusp replacement with direct composite resins.

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Composite resins have become one of the most popular materials for the restoration of posterior teeth. Although the selection of these materials is often based upon esthetic properties, their ability to bond to enamel and dentin makes them the ideal restorative material for conservation of tooth structure. It is no longer necessary for the dentist to conform to traditional cavity design, and defect-specific cavity preparations are becoming the norm rather than the exception.[1] Conservation is readily apparent when the defect is small; however, tooth structure may also be preserved when treating the more extensively destroyed tooth. Although an indirect restoration is the ideal treatment for cusp replacement, direct restoration using resin composite is an alternative in certain clinical situations in which an onlay or crown is not feasible or must be delayed.[2] These indications include a long-term provisional for teeth with questionable prognosis, interim restorations during the disease-control treatment phase, and placement in patients who are medically compromised or who have financial limitations.

Special attention to material confinement must be taken when restoring Class II preparations. Since composite resins do not allow for lateral condensing pressure on placement, it is difficult to produce a tight contact with the adjacent tooth using conventional straight metal matrix bands normally used with amalgam.[3] In an attempt to improve contacts, a variety of instruments have been developed that produce internal pressure on the band during material placement.[4,5] Unfortunately, these still may result in the restoration having a flat proximal area with

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undercontoured embrasures and a high contact. This lack of anatomic contour can lead to a light contact after occlusal adjustment, food impaction, and a less-than-satisfactory result.[6] A reliable method for achieving a properly contoured proximal surface and tight contacts is through the use of sectional matrix bands. These bands, when used with a wedge and/or separating ring, produce a normal anatomic proximal contour in both an occlusogingival and buccolingual direction, thus recreating the proper curvature of the marginal ridge and embrasures.[7]

When a major portion or the entire cusp of a posterior tooth needs to be restored, confinement of the material and reproduction of the desired contours can be difficult and time consuming. Although sectional bands work well in conservative Class II preparations, if the preparation extends beyond the buccal or lingual line angle, the bands do not provide adequate coverage.[8]

If the cusp of a tooth to be restored is weakened or has a fracture line and there is question about its integrity, consideration should be given to the construction of a preformed matrix. This preformed matrix is used in much the same way as the Class IV lingual matrix for anterior teeth or the occlusal matrix for posterior teeth.[9,10] By taking an impression of the existing tooth contour before preparation, a molded matrix of the desired result is retained and the process of restoration is greatly simplified. To achieve a proper impression of the tooth, a quick-setting silicone putty or high-viscosity polyvinyl siloxane impression material can be used. The impression is taken after the rubber dam has been applied and should cover the questionable cusp extending from the cervical aspect to approximately 1.5 mm over the cusp ridge. The impression material should also extend to at least one tooth on each side of the preparation tooth to produce a solid seating guide. After the impression has set, it may be removed and set aside until the restorative phase. This process takes only a few minutes and greatly facilitates the restorative outcome.

When the cusp is lost during tooth preparation, proper retention must be established to retain the restoration. Retention is primarily achieved through bonding to enamel and dentin, but it may also be supplemented by an intracoronal groove or slot. Enamel on the cavosurface margin should be beveled.[6] After the preparation is complete, the matrix is placed back in the mouth. It should fit accurately to place, guided by coverage of the adjacent teeth. Once the proper fit is established, the matrix is again removed for the placement of the bonding system.

The tooth is etched, and the bonding agent is applied and properly cured. A 1 mm layer of enamel shade of composite resin is placed on the internal surface of the matrix in the area of the lost cusp. The material should cover the cusp tip in the matrix and extend to the missing line angles of the tooth, leaving the proximal box area open. The matrix is seated back on the tooth, and the excess material is carefully removed. With the matrix in place, the composite resin is cured from the occlusal position for 30 seconds. The matrix is then removed and the resin material cured for another 30 seconds, with the light in close proximity to the material's surface. The cured composite should now form a framework for easy placement of the internal components of the restoration. The line angles should conform to the original tooth contour, creating an ideal Class II cavity preparation with the proximal box area left open.

A sectional band can now be used in a traditional manner to restore the proximal aspect to its proper contact and contour. The marginal ridge, occlusal surface, and triangular ridges are easily developed using the preestablished cusp tip and facial surface as a guide. After finishing, the completed restoration accurately reproduces the original cusp height and contours.

CASE STUDY

A 46-year-old female patient on recall exhibited a discolored crack on the mesial marginal ridge of tooth

Figure 1. Preoperative occlusal view of tooth no. 12.

Figure 2. Preoperative facial view of tooth no. 12 showing buccal horizontal crack.

no. 12 (Figure 1). The tooth contained a disto-occlusal amalgam restoration with recurrent caries, and a horizontal craze line was apparent on the middle of the buccal cusp (Figure 2). The tooth had been asymptomatic and responded within normal limits to both CO_2 ice and electric pulp testing.

Since there was concern that the buccal cusp would be lost during cavity preparation, a buccal matrix was constructed using a quick-setting polyvinyl siloxane impression material (Template™ [Clinician's Choice, P.O.Box 1706, New Milford, CT, USA]). The impression material was injected onto the facial surface of tooth no. 12, covering the entire facial surface (Figure 3) and extending slightly over the cusp tip (Figure 4). Coverage also included the facial surfaces of the adjacent teeth to provide a guide for the insertion of the matrix.

After it had set, the matrix was removed (Figure 5) and cavity preparation was begun. During the removal of the amalgam, the weakened buccal cusp was lost at the site of the horizontal craze line. Examination of the pulpal floor showed a crack extending mesio-distally (Figure 6). A decision was

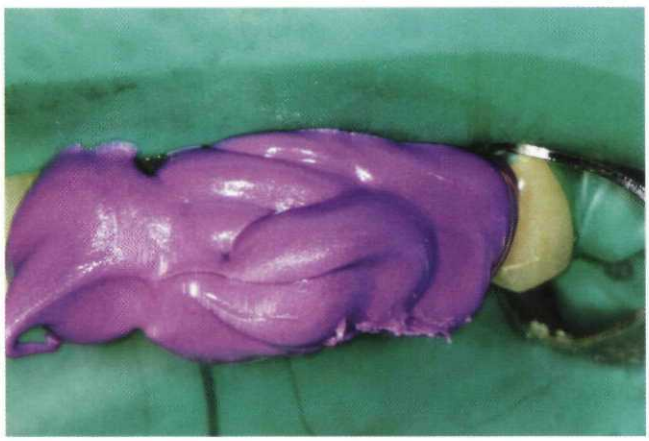

Figure 3. Placement of matrix material—facial view.

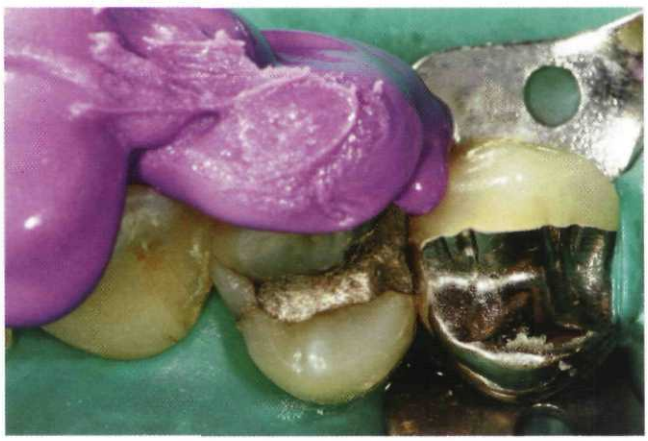

Figure 4. Placement of matrix material—occlusal view.

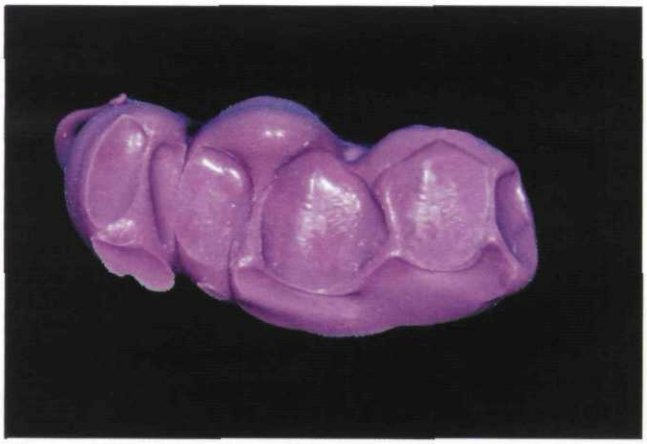

Figure 5. Polyvinyl siloxane matrix after removal.

Figure 6. Prepared tooth—facial view.

made to restore the tooth with a direct composite resin until a more definitive diagnosis of the long-term vitality and integrity of the tooth could be determined. After caries removal and cavity preparation, all enamel surfaces were beveled and a retentive slot was placed in the gingival floor at the buccal aspect just inside of the dentoenamel junction (Figure 7).

The preparation was etched for 15 seconds with 37% phosphoric acid (UltraEtch™, Ultradent Products Inc., South Jordan, UT, USA), rinsed, and lightly air dried, and a three-component bonding agent (OptiBond FL®, SDS/Kerr,Orange, CA, USA) was applied and properly polymerized. A 1 mm thick increment of an enamel shade of microhybrid composite resin (Point 4® A1, SDS/Kerr) was placed in the area of the buccal matrix to replace the missing facial tooth structure (Figure 8), and the matrix was seated to place (Figure 9). The resin in the matrix was polymerized for 30 seconds from the occlusal aspect; then the matrix was removed and the resin cured for another 30 seconds from the buccal aspect. The resin shell extended to the line

Figure 7. Prepared tooth—occlusal view.

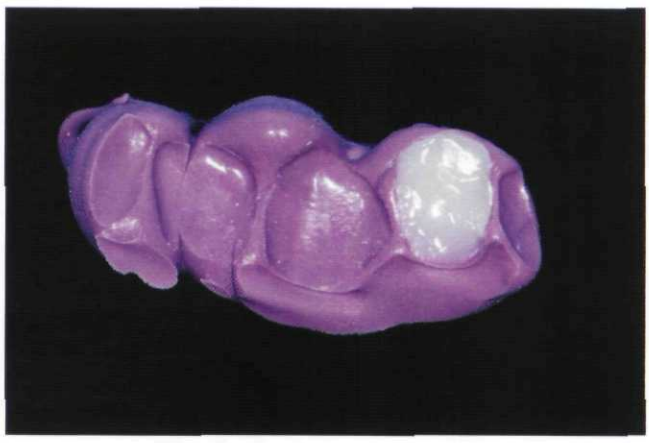

Figure 8. Composite resin in matrix.

Figure 9. Matrix with resin applied to facial aspect of tooth.

Figure 10. Resin shell after matrix removal—facial view.

angles and formed the boundary of the occlusal ridges and cusp tip (Figures 10 and 11).

The internal triangular ridges were built up using a dentin shade of microhybrid resin (Point 4 A2 Opaque, Kerr). Once polymerized, the dentin replacement produced the configuration of an idealized mesio-occlusodistal cavity preparation with two separate proximal boxes (Figure 12), which was properly confined with sectional matrices (Composi-Tight Gold®, Garrison Dental Solutions, Spring Lake, MI, USA). The matrices were placed, along with wedges and separating rings (Figure 13), and the preparation was restored using an incremental buildup of composite (Figure 14). After the removal of the matrix bands, the restoration was post-cured from the buccal and lingual surfaces; subsequently, it was finished using disks, brushes, and polishing points (Figure 15). The rubber dam was removed, and the restoration was adjusted to proper occlusion. The resultant restoration reproduced the desired cuspal contour and position (Figures 16 and 17).

Figure 11. Resin shell after matrix removal—occlusal view.

Figure 12. Replacement of dentin with opaque composite resin.

Figure 13. Sectional bands with rings and wedges in place.

Figure 14. Polymerized composite resin before band removal.

Figure 15. Contoured facial surface.

Figure 16. Completed restoration—occlusal view.

Figure 17. Completed restoration—facial view.

SUMMARY

The posterior impression matrix provides an efficient method for restoring a cusp lost during cavity preparation to original contours in clinical situations in which the natural cusp is present preoperatively but has a significant fracture line. When cusp loss is suspected, the minimal effort required to take an impression preoperatively will be greatly rewarded with this simplified restorative technique if the inevitable happens. Although size may compromise the longevity of direct resin restorations, this restorative technique provides a viable alternative when an indirect restoration is not feasible.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are discussed in this article.

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