

A Predictable Technique for Managing Deep Dentin Exposure



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Abstract

Postoperative pain continues to be a serious problem after the bonded cementation of nonmetal inlays and onlays. The management of areas with deep dentin exposure is crucial to minimize postoperative pain following the bonded cementation. Most techniques advocated today for lining, basing, and the bonded cementation are complicated, technique sensitive, and unpredictable. There is a time tested, simpler, and more predictable technique. This article will explain a well-established, predictable, and uncomplicated technique for the management of the deep dentin exposure area using a new paste-paste resin-modified glass ionomer liner, followed by self-etch bonded cementation of nonmetal onlays.

Learning Objectives

After reading this article, the reader should be able to:

- list the benefits of nonmetal partial coverage onlays.
- discuss the benefits of using RMGI as liners for bonded restorations.
- explain the bonded cementation of a nonmetal onlay, using the appropriate liner and a self-etch, self-bond resin cement.

Nonmetal onlays and combination inlay/onlays are becoming more popular in part because of their improved esthetics, but also because more tooth is preserved during preparation and supragingival margins allow for better gingival health. Tooth preparation for this technique is uncomplicated, and the basic principles will be discussed in this article. However, postoperative pain continues to be a serious problem, and it continues to plague these restorations.¹ The management of areas with deep dentin exposure is crucial to avoiding postoperative pain followed by the bonded cementation of the restorations. Because most techniques advocated today for lining, basing, and bonded cementation are very complicated, a simpler and more predictable technique would increase the acceptance and use of these tooth preserving restorations.

Restoration Options

When the tooth caries or damage is small, a directly placed resin-based composite restoration is an ideal choice, because it preserves tooth structure. When large portions of teeth are missing or have caries, porcelain-fused-to-metal (PFM) crowns are the most popular indirect restorations for posterior teeth.² PFM crowns are radical restorations requiring up to 75.6% of the coronal tooth structure to be removed during preparation (Figure 1).³

Patients are becoming more interested in restoring their teeth with tooth-colored restorations, and the demand for these types of restorations continues to increase.^{4,5} The use of metal-free onlays and combination inlay/onlays to restore badly destroyed teeth help us to preserve as much dental tissue as possible, as well as to protect the overall health of the supporting oral tissues. These restorations are an alternative to a full crown, which may be a better option in some situations, and help us fulfill our responsibility as clinicians.⁶⁻⁹

Nonmetal onlays and combination inlay/onlays have demonstrated good results and longevity.¹⁰⁻¹² However, problems that continue to plague these types of restorations, such as pain during the provisional stage, lingering postoperative pain after definitive bonded cementation, and in some cases eventual tooth necrosis, are not uncommon.^{13,14} This problem is often seen when total-etch bonding systems are used. In addition, the cementation techniques presented appear to be quite complicated.

Controlling Postoperative Sensitivity

Because indirect restorations are used mostly in large caries or fractures,

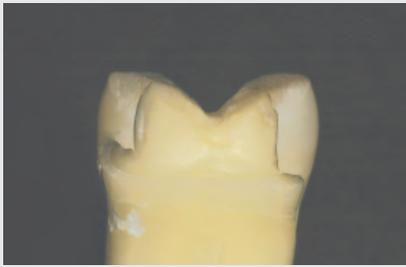


Figure 1—Observe on this overlapped image how much more tooth removal is needed for a conventional full crown (75%) vs an onlay preparation (39%).

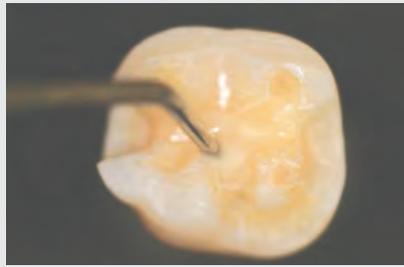


Figure 2—Application of thin layer of paste-liquid Vitrebond Plus (3M ESPE), using a Dycal instrument.



Figure 3—20 second cure with a conventional halogen light is sufficient to set the material enough to immediately take final impression or start the fabrication of the provisional.

this usually means that in many areas there will be deep dentin exposure with proximity to the pulp. The management of these areas with deep dentin exposure is crucial to avoiding postoperative pain after the bonded cementation. Also, pain during the provisional period is common because provisional restorations often leak. Immediate dentin sealing has been advocated¹⁵ using a viscous fourth generation, total-etch adhesive to

seal all the dentin immediately after preparation and before final impression. Clinical experience has demonstrated that although total-etch bonding systems can be predictable, they are more technique sensitive and difficult to use.¹⁶ More than 4000 dentists surveyed by Clinical Research Associates reported a 4-fold increase in severe postoperative sensitivity when using total-etch bonding systems compared with

using self-etch bonding systems.¹⁷

The use of resin-modified glass ionomer (RMGI) liners in dentistry is well documented.¹⁸⁻²² Using an RMGI liner, such as Vitrebond Plus (3M ESPE) or Fuji Lining (GC America, Inc), to protect the deep dentinal exposure or under composite restorations, combined with the use of self-etch bonding systems has been advocated and used with much clinical success.²³



Figure 4—Damaged molars that would usually require removal of all the healthy enamel for a traditional crown preparation.



Figure 5—Teeth after final preparation. Observe the careful conservation of enamel and all supragingival margins. Only the deep dentin was lined using RMGI; dark dentin is hard-stained dentin.



Figure 6—Final restorations. Patient exhibited no postoperative sensitivity.

Benefits of an RMGI Liner

RMGI liners are self-etching and self-adhesive liners with a dual advantage. First, they are simple to use. Some liners require no etching or bonding of the dentin and others include a weak acid to be used to improve adhesion. Second, by avoiding the use of a phosphoric acid to etch the dentin, the opening and exposing of the dentinal tubules is avoided, which decreases the chances of postoperative sensitivity.

An additional benefit of RMGI is its low modulus of elasticity. The author reported that 2 RMGI liners (Vitrebond and Vitrebond Plus) buffered the effect of volumetric polymerization shrinkage of resin cements by 43% to 55% compared with resin cements alone.²⁴ Tolidis and Bui demonstrated similar results with a variety of light-cured composites.^{25,26}

The technique to line and protect exposed dentin is simple and predictable. Excellent isolation is indispensable and can be achieved with the use of a rubber dam or properly applied cotton roll. van Dijken and others have reported successful results with cotton isolation or with a rubber dam.²⁷⁻²⁹

To get the full benefit of the effect of the liner, a proper mix of RMGI is very important. The use of a powder/liquid can sometimes lead to improper mixing ratios and less than desirable results. This problem can be overcome and simplified by the use of a paste-paste RMGI system. A thin layer of the mixed material is easily applied onto the deep dentin exposed areas using a Dycal instrument; it also can be applied to fill minor voids and undercuts on the preparation (Figure 2). It is desirable to

apply the liner to the dentin immediately after the tooth preparation is completed. The dentin should be kept clean and free of saliva or contamination, making it unnecessary to use any additional dentin cleaning techniques. It is important to apply the liner on clean dentin. After application, the material is light-cured for 20 seconds (Figure 3); final impression and provisionalization can be performed immediately after.

The adhesion of RMGI to dentin is very acceptable; between 9.0 MPa and 11.0 MPa.^{30,31} The adhesion of the resin cement to the RMGI layer is even stronger. For this reason it may not be advisable to line the entire surface of the dentin as it is better to place the liner only in the areas of deep dentin exposure. This leaves a large amount of superficial dentin and enamel to be



Figure 7—Observe how the deep dentin exposures are covered with a layer of RMGI, but all the superficial dentin and enamel is exposed to the final bonding system and resin cement.



Figure 8—A self-etch bonding system (Clearfil LinerBond 2v, Kuraray) was applied according to the manufacturer's instructions.



Figure 9—Resin cement being injected into the tooth.



Figure 10—Initial cement removal was done using a rubber tip instead of a brush to avoid the brush from removing cement out of the margins.



Figure 11—Occlusal view of final restoration.



Figure 12—Buccal view of final restorations.

receptive to the considerably stronger adhesion that can be achieved by the use of a self-etch bonding system and resin cement. Used for the final cementation, this bond strength is usually between 16.0 MPa and 24.0 MPa.

The following cases illustrate severely damaged teeth with short clinical crowns and deep decay; a difficult situation to manage and a dangerous combination for the pulp and surrounding tissues. Short clinical crowns usually lead to subgingival margins to gain the necessary wall height to achieve mechanical retention.

Case 1

For the final bonded cementation of the restoration, 2 techniques can be used that have demonstrated predictable results. The simplest technique available is the bonded cementation of the restoration using the self-etch/self-bonded, resin cement (RelyX Unicem, 3M ESPE). This technique and material have been used with excellent results.³² Recently, other promising self-etch/self-bond resin cements have been introduced in to the market, like Maxcem (Kerr Corporation), Breeze (Pentron), and Multilink Sprint (Ivoclar Vivadent).

After removal of the provisional restoration, the tooth was isolated and thoroughly cleansed, with a microetcher or sandblaster (Danville Engineering). If that is not available, a careful cleaning with a rubber cup and pumice is acceptable; no further treatment of the tooth is needed. RelyX Unicem cement was mixed in a triturator, and applied to the bare tooth. After fully seating the restora-

tion, initial cleaning of the cement was started. After 40 seconds the cement was photo cured and final cleaning and finishing was performed (Figures 4 through 6).

Case 2

An alternative technique for the bonded cementation of a nonmetal onlay is the use of a dual-cure, self-etch bonding system (Clearfil Liner Bond 2v, Kuraray or Optibond Solo Self Etch, dual cure, Kerr Corporation), combined with dual-cure resin cement (RelyX ARC, 3M ESPE or Nexus 2 dual cure, Kerr Corporation). This technique is more complicated, but it has a longer track record with good success (Figures 7 through 12).

Conclusion

The complex problem of postoperative sensitivity caused by the mismanagement of deep dentinal exposure areas can be improved or eliminated with the use of a very well-documented and simple technique using a RMGI liner. Combining an RMGI liner technique with the bonded cementation of the restoration using a self-etch, self-bonding, dual-cure resin cement, or alternatively, a self-etch bonding system and a dual-cure resin cement, further diminishes sensitivity and makes the procedure simpler and more predictable. 

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Product References

Products: Vitrebond Plus, Vitrebond, RelyX Unicem, RelyX ARC
Manufacturer: 3M ESPE
Location: St. Paul, Minnesota
Phone: 888.364.3577
Web site: www.3MESPE.com

Product: Fuji Lining
Manufacturer: GC America, Inc.
Location: Aslip, Illinois
Phone: 800.323.7063
Web site: www.gcamerica.com

Products: Maxcem, Optibond Solo Self Etch, Nexus 2
Manufacturer: Kerr Corporation
Location: Orange, California
Phone: 800.537.7123
Web site: www.kerrdental.com

Product: Breeze
Manufacturer: Pentron Clinical Technologies
Location: Wallingford, Connecticut
Phone: 800.551.0283
Web site: www.pentron.com

Product: Multilink Sprint
Manufacturer: Ivoclar Vivadent
Location: Amherst, New York
Phone: 800.533.6825
Web site: www.ivoclarvivadent.com

Product: micro-etcher or sandblaster
Manufacturer: Danville Engineering
Location: San Ramon, California
Phone: 800.827.7940
Web site: www.daneng.com

Product: Clearfil Liner Bond 2V
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