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TIPS

for Using Glass Ionomers

How to Use Dentistry's **Other**
Direct Tooth-Colored Material



to Solve Restorative Problems

Daniel H. Ward, DDS

INTRODUCTION

Dentists who reduce the use of metallic restorations in favor of composite restorative materials are reporting challenges. Placement techniques are more demanding and less forgiving. Maintaining the proper moisture of the tooth surface is critical.¹ Polymerization shrinkage requires cumbersome layering techniques to reduce the resulting stress.² Increased immediate postoperative sensitivity is reported.³ Marginal leakage resulting in recurrent decay can be more prevalent.⁴

Another class of tooth-colored direct restorative materials deserves consideration to solve these challenges. Glass ionomer (GI) restorative materials are easier to place and are less technique-sensitive. Surface moisture conditions are less critical.⁵ Self-curing GI materials exhibit no shrinkage during setting, which allows for bulk placement.⁶ Immediate postoperative sensitivity is reported to be less.⁷ Fluoride release helps to reduce recurrent decay.⁸ In addition, GI materials are antibacterial.⁹

Uncertainty about the selection of the appropriate material to use and the proper technique prevents many dentists from placing glass ionomers. The early materials had shortcomings that alienated initial users.¹⁰ Manufacturers have not helped by selecting product names that often do not adequately describe the product.

Glass ionomers comprise two different formulations: self-curing GI's and resin-modified glass ionomers (RMGI's). The following tips may help to better differentiate and identify their use in the modern dental practice. These are materials that can and should be used in every practice.

1

Prepare butt joint margins around the preparation in both dentin and enamel (Figs 1 & 2). GI's do not work well in feather edge or beveled margins. In thin increments, they have a tendency to chip. Although not mandatory, undercuts help to better retain the restoration. Enamel margins can be pre-treated with phosphoric acid for better adhesion.



Figure 1: Class V lesions.

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Prepare all dentin to be covered and pre-treat with polyacrylic acid conditioner. The use of a conditioner prior to placing the GI significantly increases the ionic bond to dentin. Polyacrylic acid is a very weak acid and does not significantly demineralize dentin nor increase the likelihood of postoperative sensitivity.



Figure 2: Preparations for Class V restorations.

3

Do not over-dry dentin following rinsing of polyacrylic acid conditioner; leave it moist. GI absorbs water during the setting reaction. If the tooth surface is left too dry, fluid from within the dentinal tubules may be drawn out, resulting in postoperative sensitivity. As long as the surface is not covered with water, GI materials can set under varying moisture conditions.

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Cover setting GI with a curable resin coating and then polymerize the resin with a curing light (Fig 3). GI is susceptible to desiccation during setting. Applying the resin with a micro-brush can be a convenient way to shape the material before it sets. The placement of a resin coating over the setting restoration prevents early water loss and deterioration of the restoration.



Figure 3: Covering unset glass ionomer with resin sealant.

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Use copious water spray when shaping set GI. GI's are susceptible to desiccation. Use a light touch to shape the set restoration with a very fine diamond bur. GI's are much softer during the first 24 hours prior to final set. Go over the surface with a fine finishing carbide to remove scratches and blend the restoration margins. Polish lightly with a coated abrasive prior to placing a resin sealant.



Figure 4: Completed Class V glass ionomer restorations.

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Following finishing and polishing, place a filled resin coating. GI's continue to set over an extended period of time, especially during the first 24 hours (**Fig 4**). A resin coating helps to prevent desiccation and improves the physical properties of the set restoration. The resin also helps to fill in microscopic porous areas, leaving a smoother and harder surface. Wear on the occlusal surface of posterior restorations is reduced during the lifetime of the resin sealant.

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Do not acid-etch set GI. Placing phosphoric acid over set GI obliterates the surface and results in very poor bonding to resin. Practitioners are accustomed to routinely acid-etching prior to resin placement in most procedures, but this is deleterious to self-curing GI's. Simply wash the set restoration, dry the surface, coat the restoration with resin, and light-cure.

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Following completion of Class V GI restorations, check for possibility of abfraction. If initial lesion was "c"-shaped, the defect may have been caused by compression. Adjust the cusp opposite to the site. If initial lesion was "v"-shaped, the defect may have been caused by tension and the cusp on the same side should be adjusted (**Fig 5**). Carefully analyze and adjust harmful lateral interferences.

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Mix a little composite stain into resin sealer to better blend color. Self-cured GI's generally are more opaque than most composite resin restorative materials. To decrease the value of the color, various composite tints can be mixed into the filled resin sealant prior to placement (**Fig 6**). Grays and browns are especially useful in better matching the color of the adjacent tooth.

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Use self-curing GI materials as long-term interim restorations (Fig 7**).** In today's challenging economic climate, patients cannot always afford to immediately place a crown on severely decayed teeth. GI's can quickly be placed in bulk and do not shrink upon setting. Even though the occlusal surface wears more than composite, the elimination of internal shrinkage stresses may prevent the fracturing of entire cusps, ultimately maintaining more tooth structure for future crown preparation.

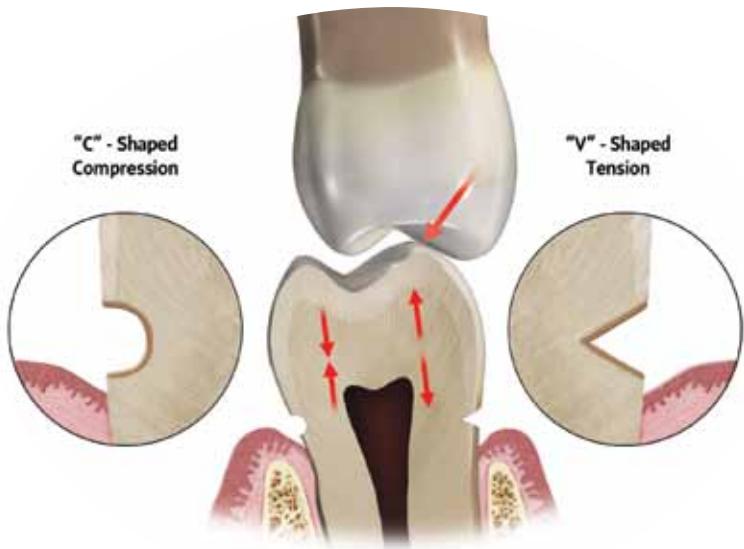


Figure 5: Abfraction forces indicator.

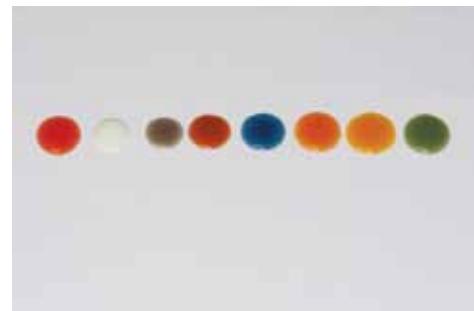


Figure 6: Tints to be mixed with surface sealants.



Figure 7: Long-term interim glass ionomer restoration.

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Use GI restorative materials when restoring cervical lesions of patients taking multiple medications. Patients taking four or more medications have a 50% chance of experiencing dry mouth symptoms. Xerostomia is the most commonly listed side effect of prescription medications. Saliva acts as a buffer to neutralize acidic attacks. Placing GI's helps to reduce recurrent decay.

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Use self-curing GI's as sealants in decay-prone teeth that are not fully erupted. Waiting until the tooth is fully erupted to adequately control moisture for the placement of a resin sealant may result in the need to place a definitive composite restoration. Even though the GI sealant wears more than composite resin, it has been observed that the tooth structure under the sealant is significantly less susceptible to decay once the sealant has worn away. Etch the enamel with phosphoric acid, wash, and dry. Place the GI and use a micro-brush dipped in resin to spread the material. Light-cure and wait for the material to set.



Figure 8: Crown excavation.

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Use self-curing GI's as core build-ups underneath crowns (Figs 8-10). With no shrinkage upon setting, GI's can reduce postoperative sensitivity in cracked teeth being restored with crowns. Fluoride release under the crown can help reduce recurrent decay. The ionic bond to tooth structure, though not as strong initially as resin, remains stable for years and is not prone to hydrolyzation or matrix metallo-protease breakdown. Compressive and tensile strengths are less than resin but long-term retention is excellent and ease of use makes it a viable alternative in small- to medium-sized build-ups.



Figure 9: Glass ionomer crown build-up.

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Use self-curing GI's in deciduous tooth Class II restorations. Prime teeth with polyacrylic acid, rinse, and remove excess moisture. Place in bulk and hold down with thumb while material sets. There is no need to use layering techniques or a curing light. Restorations are fairly well retained and the incidence of recurrent decay is reduced. GI restorations allow conservative removal of decay, which is often near the large pulps of deciduous teeth.



Figure 10: Crown preparation with glass ionomer core build-up.

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Use GI's to repair decay around faulty crown margins that are readily visible and approachable. First remove the decay and prep into the crown if necessary to visualize the extent of the decay. It is important to be able to see the entire area and control moisture. This is not recommended in interproximal areas with an existing adjacent tooth. Repairing with GI's is especially useful for older patients who can no longer tolerate lengthy procedures.

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Use RMGI's as bases under deep composite restorations to reduce postoperative sensitivity (Fig 11). Pre-treat with polyacrylic acid, rinse, and remove excess moisture. Mix material and quickly fill restoration two-thirds full. Light-cure for 20-40 seconds. You do not have to wait to re-prepare tooth to ideal depth (Fig 12). You can safely etch set RMGI and enamel, giving the preferred etched pattern for enamel bonding with reduced dentinal sensitivity. Fluoride is great insurance under composite restorations since margins have been shown to often leak (Fig 13).



Figure 11: Excavated tooth needing a deep restoration.

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Use RMGI's in Class V restorations that require better appearance. RMGI's are more translucent and esthetic than self-curing GI's. The fluoride release is less than self-curing GI's but they have proven release of fluoride ions during acidic attack and can be recharged with exposure to external sources of fluoride. In several studies, RMGI's had better retention rates than composites placed with dentin bonding agents.



Figure 12: Set and re-prepared RMGI base.

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Use a pre-encapsulated RMGI dispensing system if possible. Proper proportions of powder and liquid are important to obtain the optimal physical properties. Capsules offer consistency of mix as well as ease of use. Triturators oscillate at different rates, so experiment to determine the proper mixing time. Powder/liquid mixes generally offer superior physical properties compared to paste/past configurations.

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Use RMGI's in situations where a dry field cannot be maintained for more than a minute. Pre-treat the area with polyacrylic acid. Rinse thoroughly and remove excess moisture. Mix the material and quickly dispense into area. Light-cure for 20-40 seconds. Contamination once the material has been light-cured does not affect the bond to dentin or the physical properties of the material.



Figure 13: Restored tooth using "sandwich technique" of RMGI base and composite outer surface.

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Use RMGI's for short-term temporaries. Patients often fracture entire cusps and desire a temporary prior to scheduling the time necessary to perform a full crown preparation. Lightly dry the area, mix material, and place material over the deficient area. Light-cure for 20-40 seconds. Use a high-speed handpiece to blend the restoration into tooth. The only disadvantage to this technique is that it may hold for several years and the satisfied patient may not return to have definitive treatment performed until it finally breaks or wears down.

DIFFERENCES BETWEEN GI's AND RMGI's

GI materials wear less than RMGI's and should be used in areas exposed to occlusion. RMGI's are better when covered by a composite resin or when not in occlusion. GI's require control of fluid contamination during the extended setting time (two and a half to five minutes). RMGI's need control only during placement and the light-curing phase. RMGI's should be used when re-preparation and subsequent acid etching with phosphoric acid will be performed. GI's should not have phosphoric acid placed on their surface once set. GI's exhibit no shrinkage or shrinkage stress and have the highest release of fluoride. RMGI's are more translucent and esthetic. Both materials are invaluable in the modern dental practice. Glass ionomers will never replace composite resin materials but are a useful adjunct in the field of tooth-colored direct restorative materials. Time and experience with the materials will ultimately help the practitioner decide the appropriate uses for these bioactive dental materials.

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Dr. Ward has a full-time practice in Columbus, Ohio.

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