Simplifying Posterior Restorations Using Self-Adhesive Systems

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Glass ionomer (GI) technology has continuously evolved from its inception as introduced to dentistry by Wilson and Kent[1] in the early 1970s. The initial formulations were chemically cured by a complex acid-base setting reaction and their use was indicated for the primary and permanent dentition in Classes III and V, provisional restorations, liners and bases, core buildups, occlusal fissure sealing and filling, luting cements, and for those patients with high caries susceptibility.[2-4] The early materials were available only in hand-mix form; therefore, early attempts to use these formulations resulted in shortcomings that included poor clinical handling, low wear resistance, insufficient strength, moisture sensitivity, and color instability.[5-7]

The search continues for an ideal restorative material that will be similar to tooth structure, have similar physical and mechanical properties to that of the natural tooth, be resistant to masticatory forces, and possess an appearance similar to natural dentin and enamel. Also, as the mechanical properties of a restorative material approximate the enamel and dentin, the restoration's longevity increases.[8]

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An ideal restorative material should fulfill 3 basic requirements of biocompatibility, function, and aesthetics. In addition, optimizing the adhesion of restorative biomaterials to the mineralized hard tissues of the tooth is a decisive factor for enhancing the mechanical strength, marginal adaptation, and seal while improving the reliability and longevity of the adhesive restoration.[9] At present, there is no restorative material which fulfills all these prerequisites. However, a recent advancement in technology has introduced an innovative system that can provide some of these restorative solutions through alternative treatment options for a myriad of clinical situations. This restorative system, (Equia [GC America]) combines an improved high viscosity, conventional GI cement Fuji IX GP (GC America) with a nanofilled self-adhesive light-cured protective coating G Coat Plus (GC America). Using these technologies in combination may provide a multitude of clinical benefits. The following characteristics for each are provided.

InFocus

CHARACTERISTICS OF THE GLASS IONOMER

The GI, Fuji IX GP, is a self-adhesive material that can be used with or without a cavity conditioner. By utilizing it without a cavity conditioner, there is a chemical adhesion between the cement and the hard tissues. This bond is achieved through an ionic exchange at the interface, resulting in an ion-enriched layer of cement that is firmly attached to the tooth structure.[10] However, the use of a conditioner (Cavity Conditioner [GC America]) can provide an additional improvement in bond strength through micromechanical retention. This additional procedure uses a mild 10% polyacrylic acid to remove the smear layer and any other contaminants. And this preactivates the calcium and phosphate ions in the dentin in preparation for ion-exchange with the cement. This material has a coefficient of thermal expansion that is similar to dentin, which may improve marginal adaptation and resistance to microleakage at the restorative interface. Additional benefits of this material include improved translucency, high fluoride release, and can be bulk filled and finished in 2 and one-half minutes.

CHARACTERISTICS OF SELF ADHESIVE COATING

This self-adhesive resin coating (G Coat Plus) can provide a smooth surface with high gloss to the restoration. One report indicates that an application of this surface coating can provide a smooth glossy surface to GI and composite resin restorative materials. This International Association for Dental Research (IADR) study suggests that this coat-

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Figure 1. Preoperative view of a carious lesion on the disto-occlusal surface of a mandibular right first premolar.

Figure 2. A glass ionomer (GI) system, (Equia [GC America]) was selected as a final restorative material and shade selection was completed prior to the restorative procedure.

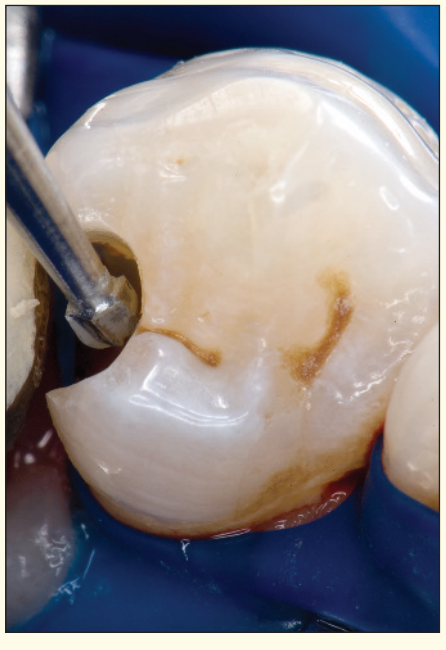

Figure 3. The carious dentin was removed using No. 6 slow speed round bur and spoon excavator. The preparation design is controlled by the extent of the carious lesion with respect for maximum tissue preservation.

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ing can reduce the surface roughness value to 0.24 µm.[11] This approximates the critical surface roughness value of 0.2 µm where no further bacterial accumulation or colonization is expected to occur.[12] This coating technology improves the smoothness of the restoration by filling in the voids and surface irregularities from the material and finishing procedure. Another IADR study indicates that the coating allows for maturation of the chemistry of the GI by protecting it from the negative influences of the oral environment.[13] Also, a study at the University of Illinois reports an improvement in the microtensile strength of the GI from the coating.[14] In addition, since this self-adhesive coating bonds to tooth structure, this material has the potential of improving marginal integrity and reducing microleakage at the restorative interface.[15]

Using these technologies in combination may improve the physical and mechanical properties and extend the clinical applications of this group of materials quite markedly. The clinical applications for this system include Class I, II, and cervical posterior restorations. Also, composite and amalgam replacements for nonload-bearing regions and in some clinical situations moderate occlusal loading provided that the restoration is well supported by surrounding tooth structure. In addition, this system is highly recommended for moderate to high caries risk patients using Caries Management by Risk Assessment.[16]

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Furthermore, it should be considered for use with any patient where there is a limited treatment time required such as pediatric, geriatric and special needs patients.

The ultimate goal of continuous material research and development is to enhance the practice of dentistry. Applications of GI technologies in dentistry have only approached the horizon with opportunities and possibilities for the future that can only be limited by our Imagination. Although the long-term benefits of this self-adhesive system remain to be determined through long-term clinical studies, the recent findings suggest a promising future. The clinical illustrations demonstrate the utilization of this novel system to restore a carious lesion on the mandibular right first premolar.✦

References

1. Wilson AD, Kent BE. A new translucent cement for dentistry. The glass ionomer cement. *Br Dent J.* 1972;132:133-135.
2. Nicholson JW, Croll TP. Glass-ionomer cements in restorative dentistry. *Quintessence Int.* 1997;28:705-714.
3. Aboush YE. Dentine bond of light-activated glass-ionomer liner/bases. *J Ir Dent Assoc.* 1994;40:63-65.
4. Craig RG, Powers JM, Wataha JC. *Dental Materials: Properties and Manipulation.* 8th ed. St. Louis, Mo: Mosby; 2004.
5. Sturdevant CM, Roberson TM, Heymann HO. *The Art and Science of Operative Dentistry.* 3rd ed. St. Louis, Mo: Mosby; 1995.
6. Terry DA, Leinfelder K, Ngo H. The intermediate layer. *Inside Dentistry.* 2007;3:64-71.
7. Mount GJ. An Atlas of Glass-Ionomer Cements: A Clinician's Guide. 3rd ed. London, England: Martin Dunitz; 2002.
8. Summitt JB, Robbins JW, Schwartz RS. *Fundamentals of Operative Dentistry: A Contemporary Approach.* Chicago, Ill: Quintessence Publishing; 2001.
9. Terry DA, Leinfelder KF. Managing stress with composite resin, Part I: The restorative-tooth interface. *Dent Today.* 2006;25:98,100-104.
10. Nicholson JW, Wasson EA. The setting of glass-polyalkenoate ("glass-ionomer") cements. In: Setting mechanisms of dental materials. *Trans Acad Dent Mater.* 1992;5:1-14. **[AUTHOR: PLEASE VERIFY ENTIRE REFERENCE]**
11. Yarimizu H, Usuki D, Ohta D, et al. Esthetic effects on restoratives of experimental surface coating (UC-3). 2006 AADR 35th Annual Meeting, Orlando, FL. *J Dent Res.* 2006;85(special issue A):1911. **AUTHOR: PLEASE VERIFY "SPECIAL ISSUE A"**
12. Bollen CM, Lambrechts P, Quirynen M. Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: a review of the literature. *Dent Mater.* 1997;13:258-269.
13. Kato K, Noguchi T, Nakaseko H, et al. The influence of coating for the maturation of glass-ionomer cement. 2006 IADR 84th General Session, Brisbane, Australia. *J Dent Res.* 2006;85(special issue B):2076. **AUTHOR: PLEASE VERIFY NAME OF JOURNAL**
14. Shinohara M. Effect of resin coating on the ultimate strength of glass-ionomers. 2010 AADR 39th Annual Meeting, Washington, DC. *J Dent Res.* 2010;89(special issue A):796. **AUTHOR: PLEASE VERIFY NAME OF JOURNAL**
15. Magni E, Zhang L, Hickel R, et al. SEM and microleakage evaluation of the marginal integrity of two types of class V restorations with or without the use of a light-curable coating material and of polishing. *J Dent.* 2008;36:885-891.
16. Young DA, Featherstone JD, Roth JR. Curing the silent epidemic: caries management in the 21st century and beyond. *J Calif Dent Assoc.* 2007;35:681-685.

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Figure 4. After placement of the sectional matrix band, a conditioner (Cavity conditioner [GC America]) was applied to the entire cavity surface for 10 seconds using an applicator tip and rinsed thoroughly.

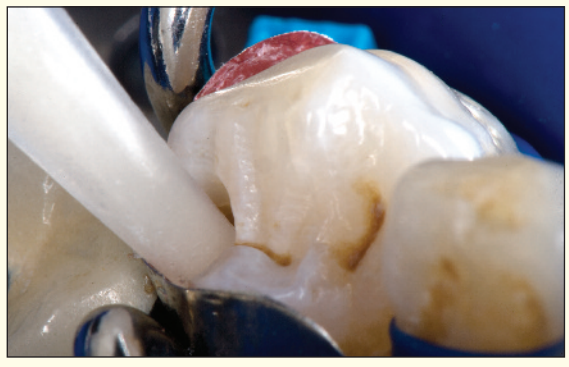
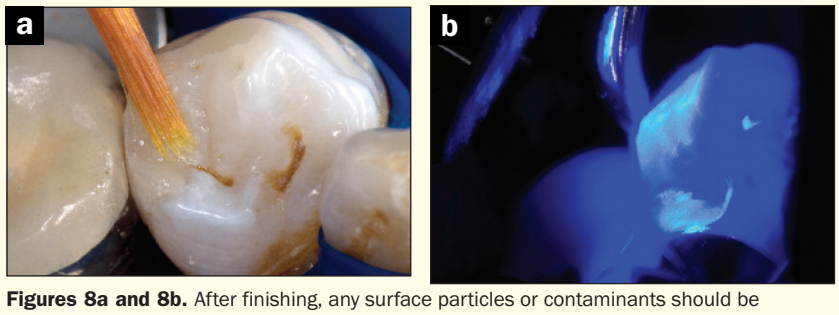


Figure 5. A GI cement restorative (Fuji IX GP Extra [GC America]) was injected into the cavity preparation. It is important to place the tip to the base of the proximal box and inject slowly, while removing the tip slowly. This technique prevents incorporation of voids.

Figure 6. The material was condensed and the anatomical contours were developed using a pyramidal-shaped instrument (PKT-3A [Brasseler USA]).

Figure 7. Once completely set, excess cement can be removed with a surgical blade (No. 12 BD Bard Parker [BD Medical]) to form optimal anatomical contours.



Figures 8a and 8b. After finishing, any surface particles or contaminants should be removed by rinsing and scrubbing with an applicator tip. A thin layer of self adhesive, (G-Coat Plus [GC America]) was applied to all exposed glass-ionomer surfaces and to adjacent tooth surfaces.

Figure 9. The completed bioactive restoration allows for a more conservative preparation which is capable of arresting and eliminating the carious process. Notice the harmonious integration of this improved GI system with tooth structure.