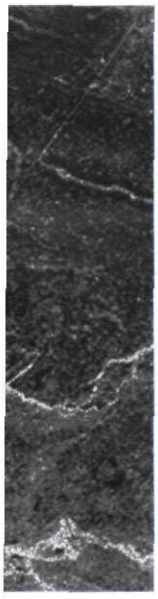

# Ask the Experts

## THE "SANDWICH" TECHNIQUE

**Guest Expert**
Theodore P. Croll, DDS*

QUESTION: Is the glass ionomer/resin-based composite "sandwich" technique a viable option for tooth restoration, considering the advances that have been made in resin-dentin bonding?

ANSWER: Stratified tooth restoration using glass ionomer/resin-based composite is a scientifically sound concept based on principles of "biomimesis" and is well supported by experimental evidence, logic, and practical experience. An example is shown in Figure 1.

In the late 1970s and 1980s, when McLean, Wilson, and colleagues suggested the restoration of teeth by first replacing dentin using glass ionomer cement followed by bonded resin-based composite to replace enamel,[1–3] the available glass-polyalkenoate systems were quite impractical to use. Initial hardening of the blended glass powder and acid liquid of original glass ionomer formulations took 5 to 7 minutes, and handling properties of the cements were poor. These problems were ameliorated in 1987 with the introduction of Vitrabond™ (later renamed Vitrebond™) resin-modified glass ionomer liner/base material (3M ESPE Dental Products, St. Paul, MN, USA). This novel glass ionomer system includes a photopolymerizable resin component that not only allows substantial initial hardening in 30 seconds of visible light exposure, but also enhances physical properties of the material. In addition, the resin component bonds with the resin-based composite overlay, and the fluoride component of the glass filler has antimicrobial properties that render internal dentin less soluble to acid challenge.

In my opinion, there is no doubt that the water-based glass ionomer formulations are the best direct-application dentin replacement systems available to dentists, and that the light-hardened versions are the most practical. Advantages of these materials include physiochemical bonding to dentin and enamel, fluoride ion release, internal compensation for polymerization shrinkage of overlying filled resin layers, greatly reduced postoperative tooth sensitivity, antimicrobial effects, contraction and expansion properties similar to those of surrounding tooth structure, and long-term protection from the effects of microleakage.

Likewise, with advances in filler type, configuration, particle sizes and distributions, high wear resistance, fracture strength, and fracture toughness, resin-based composites are undoubtedly the best direct-application enamel replacement materials available. All these remarkable features of resin-based composites are further augmented by the fact that the dentist can bond the materials to enamel micromechanically using the acid-etch technique and imperceptibly replicate enamel coloration and texture in the process.

When an orthopedic surgeon replaces a shoulder, hip, or knee joint, the selected prosthesis replicates the original joint as closely as possible in form and function. In addition, the metallic artificial bones must be biocompatible and of sufficient physical strength to

*Figure 1. An example of stratified tooth restoration using resin-modified glass ionomer/resin-based composite.*

withstand forces that will be applied, over the longest time possible. These goals of bioengineering are based on the principles of biomimesis, defined by Bugliarello as "the attempt to imitate features of living systems."[4] Dentists can take a lesson from this and strive to replace tooth structure with materials that best replicate the biologic essence of the lost tissues. Perhaps research in bioengineering will eventually give us restorative materials that perfectly replicate enamel and dentin, but until then, we should use the best available materials for their most advantageous purposes.

There is no doubt that resin-based composite can be bonded directly to dentin after infiltration, saturation, and polymerization of a liquid resin into the conditioned surface. Resin-based composite can be layered over the resin-dentin interface and retained for an indefinite period. However, success of that bonding procedure and long-term consequences for the treated tooth and patient cannot be ignored. What will happen as many years pass, and stresses of mastication, occlusion, and thermal and hydrodynamic influences in the mouth make margins available for salivary-borne bacterial access? Why do some patients complain of postoperative tooth sensitivity after direct bonding of resin-based composite without a dentin replacement liner, even if a self-etching adhesive system was used according to manufacturer's instructions? Why is it that such sensitivity seems to arise more often with occlusal restorations that sustain constant impact stresses when compared with smooth surface restorations that undergo less stress? Why does tooth sensitivity disappear in those same patients when new resin-based composite is placed, but this time with a resin-modified glass ionomer liner? Why do some endodontic specialists relate that in the past few years they have noticed a disturbing increase in patients requiring endodontic intervention in teeth restored with unlined resin-based composite?

Cavanaugh and I believe that separate restoration of the dentinal layer using certain glass ionomer cement systems should be considered an intrinsic part of direct-application adhesively bonded restorations, and that the stratification method should perhaps be considered the standard of care.[5] The only disadvantage to using a suitable glass ionomer liner/base to replace dentin is the time it takes. Advantages of the sandwich or stratification method overwhelmingly outweigh that one disadvantage.

With that in mind, we have reported a step-by-step procedure for stratification restoration of a molar with a large Class I caries lesion and have extensively reviewed the literature for evidence-based corroboration of our treatment rationale.[5] We encourage readers of the *Journal of Esthetic and Restorative Dentistry* to review that article. (Please use library sources; we have no reprints remaining.) A list of suggested reading on this subject follows.

REFERENCES

1. McLean JW, Wilson AD. The clinical development of the glass-ionomer cement. II. Some clinical applications. Aust Dent J 1977b; 22:120–127.
2. McLean JW, Powis DR, Prosser HJ, Wilson AD. The use of glass-ionomer cements in bonding composite resins to dentine. Br Dent J 1985; 158:410–414.
3. Wilson AD, Mc Lean JW. Laminate restorations. In: Glass-ionomer cement. Chicago: Quintessence Publishing Co., 1988:159–178.
4. Bugliarello G. Biomimesis: the road less traveled. The Bridge 1997; 27(3):2–3.
5. Croll TP, Cavanaugh RR. Posterior resin-based composite restorations: a second opinion. J Esthet Restor Dent 2002; 14:303–312.

SUGGESTED READING

Aboush YEY, Torabzadeh H. Clinical performance of Class II restorations in which resin composite is laminated over resin-modified glass-ionomer. Oper Dent 2000; 25:367–373.

Anstice HM, Nicholson JW. Studies on the structure of light-cured glass ionomer cement. J Mater Sci 1992; 3:447–451.

Coogan MM, Creaven PJ. Antimicrobial effects of dental cements. Int Endod J 1993; 26:355–361.

Croll TP. Class I composite resin restoration. J Esthet Dent 1992; 4:148–153.

Croll TP. Replacement of defective Class I amalgam restoration with stratified glass ionomer–composite resin materials. Quintessence Int 1989; 20:711–716.

Croll TP, Cavanaugh RR. Direct bonded Class I restorations and sealants: six options. Quintessence Int 1997; 28:157–168.

Davidson CL. Glass-ionomer bases under posterior composites. J Esthet Dent 1994; 6: 223–224.

Donly KJ, Ingram C. An in vitro caries inhibition of photopolymerized glass ionomer liners. J Dent Child 1997; 64:128–130.

Forsten L. Fluoride release and uptake by glass-ionomers and related materials and its clinical effect. Biomaterials 1998; 19:503–508.

Forsten L. Resin-modified glass ionomer cements: fluoride release and uptake. Acta Odontol Scand 1995; 53:222–225.

Johnson GH, Cordon GE, Bales DJ. Post-operative sensitivity associated with posterior composite and amalgam restorations. Oper Dent 1988; 13:66–73.

Krejci I, Stavridakis M. New perspectives on dentin adhesion: differing methods of bonding. Pract Periodont Aesthet Dent 2000; 12: 727–732.

McLean JW. Dentinal bonding agents versus glass-ionomer cements. Quintessence Int 1996; 27:659–667.

Mount GJ. Clinical requirements for a successful "sandwich"—dentine to glass-ionomer cement to composite resin. Aust Dent J 1989; 34:259–265.

Nicholson JW. Glass-ionomers in medicine and dentistry. Proc Inst Mech Eng 1998; 212 (Part H):121–126.

Nicholson JW, Anstice HM. Light-curable glass-ionomer cements for dentistry. Trends Polym Sci 1994; 2:272–275.

Nicholson JW, Croll TP. Glass-ionomer cements in restorative dentistry. Quintessence Int 1997; 28:705–714.

Tam LE, Chan GP-L, Yim D. In vitro caries inhibition effects by conventional and resin-modified glass-ionomer restorations. Oper Dent 1997; 22:4–14.

Tolidis K, Nobecourt A, Randall RC. Effect of a resin-modified glass ionomer liner on volumetric polymerization shrinkage of various composites. Dent Mater 1998; 14:417–423.

Tyas MJ. Cariostatic effect of glass ionomer cements: a five-year clinical study. Aust Dent J 1991; 36:236–239.


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*Private practice, pediatric dentistry, Doylestown, PA, USA; clinical professor, Department of Pediatric Dentistry, University of Pennsylvania School of Dental Medicine, Philadelphia, PA, USA



Editor's Note: If you have a question on any aspect of esthetic dentistry, please direct it to the associate editor, Edward J. Swift Jr, DMD, MS. We will forward questions to appropriate experts and print the answers in this regular feature.

Ask the Experts
Edward J. Swift Jr, DMD, MS
Department of Operative Dentistry
University of North Carolina, CB #7450, Brauer Hall
Chapel Hill, NC USA 27599-7450
Telephone: 919-966-2770; Fax: 919-966-5660
E-mail: Ed_Swift@dentistry.unc.edu