As minimally invasive dentistry and Caries Management by Risk Assessment (CAMBRA) guidelines become more commonly observed in dental practices, glass ionomers represent a useful but perhaps underutilized tool for the dentist. Confusion about the various types of tooth-colored restorative materials and their characteristics might contribute to this. While classic formulations of glass ionomers earned a reputation for being unaesthetic and brittle, the newer resin-modified glass ionomer (RMGI) materials have helped address this issue. Not to be confused with composites, RMGIs offer improved aesthetics and wear resistance while still maintaining the fluoride-releasing properties of traditional glass ionomers. A review of the characteristics of each of these materials shows that RMGIs are indeed true glass ionomers, offering the same benefits of GIs while improving on several weaknesses of the conventional materials.

What Makes a Glass Ionomer?

Originally introduced in the 1970s, glass ionomers consist of an acid functional polymer, water and fluoroaluminosilicate (FAS) glass. When combined, these materials react and form an acid-base material that is self-curing, capable of adhering to tooth structure and which releases fluoride over time. Because these materials are water-based, they offer the advantage of ion exchange, with fluoride ions having the ability to move into and out of the material. In addition to fluoride, GIs also encourage the exchange of calcium, strontium and phosphate ions, all contributing to remineralization of dentin. An additional advantage that glass ionomers offer over composites is that they do not necessitate etching to adhere to teeth.

However, as noted above, aesthetics and strength can be an issue for these materials. Their chemistry makes them vulnerable to water uptake for at least one week after placement, a lengthy window of time. To address these concerns, 3M ESPE introduced the resin modified glass ionomer in the early 1990s. This class of materials adds a polymerizable resin to the formula for a glass ionomer, giving the material the ability to be light cured. Photopolymerization can set the material immediately to a depth of 2mm, allowing it to resist water uptake. Despite this variation in the formula, RMGI materials retain the defining characteristics of glass ionomers, including the following:

- A two-part system of polyalkenoic acid, FAS glass, water and monomers
- Acid/base setting plus photo initiation
- Pretreatment of cavity with primer or organic acid, (e.g. polyacrylic acid)
- Adheres directly to pretreated tooth surface
- Ion-exchange adhesion via polyacid interaction
- General ion exchange available
- Sustained fluoride release via acid/base reaction
- Exhibits significant fluoride recharge

Compomers, a combination of composite and glass ionomer materials, differ from GIs and RMGIs in several respects. These materials are resin-based, with modifications made to add ion-leaching glass particles and anhydrous polyalkenoic acid. They are photoactivated, and their fluoride release levels are significantly lower than those of GIs or RMGIs.

Because of their fluoride release capabilities, RMGIs are frequently used in treatments for both pediatric and geriatric patients. I personally use them often for geriatric patients, many of whom are experiencing dry mouth and root caries. For children, an RMGI can be instrumental in being able to quickly restore an area without the need for isolation. I also utilize it as a core material, which is useful in cases with deep decay. For patients with limited financial resources, glass ionomers can provide an inexpensive treatment option.

Achieving Consistency with RMGIs

My preferred RMGI material, 3M ESPE Ketac Nano Light-Curing Glass Ionomer Restorative, is classified as a nano-ionomer for its incorporation of nanotechnology with FAS glass, giving it unique properties among RMGIs. Typically, a broad range of particle sizes are incorporated into GI materials, with effects on strength, abrasion resistance and optical properties. However, because Ketac Nano restorative includes bonded nanofillers and nanocluster fillers in addition to FAS glass, its aesthetic properties are higher than products with varying particle sizes.

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Another difference offered by Ketac Nano restorative is its paste-paste system, as opposed to the powder and liquid components of other glass ionomers. This results in dispensing that is more consistent and less messy than powder-liquid products. A recently introduced QuicK Mix Capsule delivery system mixes the two pastes inside the tip, further simplifying delivery. With this capsule system, only three steps are necessary to prepare the product, resulting in significant time savings over a triturated capsule.

The priming system with this material saves steps as well. Most GIs and RMGs utilize a polyacrylic acid primer, which serves to remove the tooth’s smear layer and increase “wettability.” While these materials are much less acidic than a phosphoric acid, they still necessitate a rinse step to remove before application of the restorative. Ketac Nano reduces a step in this category, as its acid primer is no-rinse. The material consists of Vitrebond copolymer, with crosslinked methacrylates, water, and microfill particulates. The primer is applied to the tooth surface for 15 seconds, air dried, and light cured for 10 seconds. Once applied, the primer actually enhances the release of fluoride ions from the restorative material.

In the past, the mix of glass ionomer materials that required hand mixing or trituration could often be inconsistent and might lead to reduced physical properties. However, with the improved delivery system, the mix of Ketac Nano restorative is very reliable, and I have gained confidence in using the material knowing that it is dispensed predictably. The clinical strength of the product is improved with this delivery system as well. Data shows that the capsule delivery system results in fewer voids than triturated capsules. The fluoride release of the material remains high as well, and in vitro tests have also shown an artificial caries inhibition effect, as well as the ability to recharge the fluoride release. As I have seen more of the predictability of the latest generation and delivery system of RMGI, I have felt more confident using it for a greater variety of indications. While it is not a cure-all for patients susceptible to caries, its fluoride release helps give extra reassurance when placing restorations, and its excellent polishability helps it look more natural. While in the past, glass ionomers were not often my instruments of choice, I have since discovered the utility and benefits of these products, and lately find myself reaching for them more and more.

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Thomas F. Trinkner, DDS, graduated from The Ohio State University College of Dentistry in 1983 and has been in private practice in Columbus since 1985. His focus is on cosmetic and complex rehabilitation cases. Dr. Trinkner was awarded Accredited Member status in 1998 by the American Academy of Cosmetic Dentistry for Excellence in the Art and Science of Cosmetic Dentistry. He is the first accredited member in South Carolina. Dr. Trinkner teaches as an associate at the L.D. Pankey Institute for the aesthetic programs. He has been selected to serve on the editorial board of Practical Procedures in Aesthetic Dentistry, Inside Dentistry, and was formerly the editor of the American Academy of Cosmetic Dentistry Journal. He continues to lecture nationally and internationally in the field of aesthetics and complex restorative dentistry. In addition, he offers hands-on training programs in his office with nationally and internationally known ceramist, Matt Roberts from CMR Dental Lab in Idaho. Combining their talents, Dr. Trinkner and Mr. Roberts focus on the development of advanced clinical skills and communications for the doctor and ceramist. To contact Dr. Trinkner, call 803-772-9628 or e-mail trinkner@gmail.com.