FIVE THINGS YOU NEED TO KNOW ABOUT GLASS Ionomers

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Amalgam fillings have been around for almost two centuries, and they are the go-to restoration material for good reason – they are easy to place and reliable, among other virtues. But they left a lot to be desired, esthetically speaking. Composites helped with the esthetics problem, giving teeth a natural, smooth, unblemished look, but they are notoriously finicky. Their challenges include polymerization shrinkage, postoperative sensitivity, and demand perfection and technique proficiency of clinicians.

Glass ionomers address the shortcomings of both – and more.

The best of both worlds

These restorative materials are cements created by mixing an acid (usually a polyalkenoic acid) and a base (glass powder) to form a salt – the resulting glass ionomer.

“In order for a glass ionomer reaction to take place, the glass has to be aluminum-containing,” Dr. Joel Berg, DDS, MS, Dean and Lloyd and Kay Chapman Chair for Oral Health and Professor, Pediatric Dentistry, University of Washington School of Dentistry, says. “Quartz glass, which is just silicon and oxygen, wouldn’t participate in a glass ionomer reaction. But once you’ve set the material and it forms a hardened salt, it’s a material that’s quite useful for a variety of reasons in restorative dentistry.”
Glass ionomers can be used for several types of applications, but it’s most often applied as a cement.

“It’s one of the most commonly used cements for cementing crowns, both in children and adults,” Dr. Berg says. “It’s useful as a restorative material in the more viscous forms, where it has more glass (filler), so it’s a little bit stronger version of glass ionomer. It can be used in fillings for children and adults.”

Biocompatibility is another strong trait of glass ionomers.

“It’s the only dental material that we have available to us which chemically bonds to tooth structure,” Dr. Berg notes. “All the other materials have a physical bond, so you have to prepare the surface with etching and priming and bonding with various materials. You have this interlocking physical bond, which is a very strong bond, but it’s still not a chemical bond, so there is a difference there.”

The Best Uses for Glass Ionomers

While glass ionomers are used mostly as a cement, there are specific instances where they can help the patient in ways beyond simply bonding restorations to dentition. These traits include providing a constant supply of fluoride to working well in moist environments.

Best Practices

A remarkable feature of glass ionomers is their ability to heal caries lesions. As such, they can be strategically placed in patients with other restorative needs.

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Coast University, says. “This assists in making the tooth less susceptible to acid challenge. GIs act as a continuing fluoride reservoir in the mouth by taking in salivary fluoride from toothpaste, mouthwash, and professional topical fluoride products. In essence, this serves to recharge the GI material to continue to release fluoride.”

Dr. Berg anticipates that glass ionomers will play an important role in the evolution of dental therapies, thanks to its fluoride-delivering abilities.

“They’re going to become more versatile and useful as we develop better detection tools to see caries lesions much earlier,” he says. “So if you can see a lesion before it forms a cavity, then you might place a glass ionomer restoration next to it (in the adjacent tooth that might have a cavity) that could impart the fluoride into that tooth, and therefore heal it, before it forms a cavity. So I think the usefulness of glass ionomers will become greater over time as we develop better diagnostic tools.

Glass ionomers also benefit from an attribute known as the “compatible coefficient of thermal expansion”. That is, when the temperature in the mouth changes, the glass ionomer restorations expand and contract at the same rate/amount as the dentition.

“Every material in the world expands or contracts with temperature,” Dr. Berg says. “So if you put a filling in the tooth, then the filling should expand or contract at the same rate and in the same amount that the tooth does, because if the filling expanded more and contracted more with temperature changes, then where the restoration resides would eventually crack, because they’re not expanding and contracting at the same rate/amount. Glass ionomers expand and contract at the same rate/amount as the tooth around them, so they’re very highly compatible in that way.”
Dentists are not the only members of the care team that can use glass ionomers. Hygienists can also add it to their collection of patient care tools.

“Many dental hygienists use GIs as sealants where resin sealants are contraindicated, such as in high caries risk children with deep pits and fissures in primary molars or in permanent molars that have not fully erupted, and isolation is difficult,” Dr. Hurlbutt says. “There is a learning curve with using GIs. Initial handling of the material may prove challenging at first due to the lack of flowability, compared with sealant material. With most GIs there are several more steps to the application process vs. traditional sealant application. As preventive specialists and tooth preservationists, dental hygienists’ advocate for GI use because of the obvious fluoride-releasing capabilities, but also because GI restorations require less removal of tooth than conventional restorations, such as amalgam.”

Glass Ionomers Can Do Things That Resin Composites Can’t

Resin composites resolved the major shortcoming of amalgams – namely, poor esthetics. But solving that problem brought new complications. Glass ionomers improve a lot of those challenges.

Glass ionomers vs. resin composites

An important performance improvement over resin composites is that glass ionomers tend to work well in moist environments. Resin composites require a very dry location, and the presence of even a small amount of moisture can lead to failure.

“Although resin composites are very esthetically desirable and very strong and durable and they’re great materials, they have the disadvantage of being very technique-sensitive and moisture intolerant,” Dr. Berg says. “Resin composites
are intolerant of any moisture. So if the tooth gets wet, or even if humidity condenses on the restorative surface after preparation, it might make the filling not bond well. It might look good at the time, but there might be failure or leakage because there was moisture. These materials are very hydrophobic by design, and so they don’t tolerate even a little bit of moisture. The isolation requirements are much more stringent during the procedure.

“With glass ionomer, on the other hand, they contain water. It’s a necessary ingredient for the acid-base reaction. Not only is it not moisture-intolerant it’s moisture-needing. It needs water. You can’t have a flood in the tooth, but a little bit of moisture, like you might have with kids (particularly in the form of condensation from the humid environment), might be better tolerated by a glass ionomer than a resin.”

Types of Glass Ionomers

There are two major styles of glass ionomer:

- **Pure** – Simply the acid and base components.
- **Resin-modified** – Pure glass ionomer plus some resin component(s).

Pure glass ionomers require no etching. The tooth simply needs to be cleaned (with a mild acid). However, the resin-modified glass ionomer does require etching/priming.

“Because it has resin in it, you do have to do some surface treatment, beyond the cleaning that you would do for a pure glass ionomer,” Dr. Berg says.

Glass ionomers are more esthetically pleasing than amalgams, but they are not quite as esthetically desirable as resin composites, and are therefore used mostly on posterior teeth. However, if need be, they can be used on anterior teeth.
“You wouldn’t want to do that unless you absolutely could get no moisture control with a resin composite, because they are slightly opaque,” Dr. Berg observes. “They do have the disadvantage of being opaque, unlike the translucent, more tooth color-appearing resin composites, which are moisture sensitive. The shading is there, and you can get pretty good colors, especially for the posterior teeth.”

A Great Restorative Tool For Pediatric Dentistry

Glass ionomers are an exceptional product for helping children. Many of the challenges that are present when treating children are mitigated with glass ionomers.

Pediatric use

“GI restorations are ideal for high caries-risk children, as they are considered a therapeutic restoration,” Dr. Hurlbut observes. “Interim therapeutic restorations (ITRs) are a type of restoration that does not require local anesthetic or rotary handpieces and are indicated for infants, children, and adolescents as well as in special needs children when conventional restorative treatment is not available or needs to be deferred. Besides the obvious benefit of fluoride release from a GI restoration, a decrease in oral cariogenic bacteria has also been shown – making it a win-win restoration in pediatrics. GI restorations offer patients and families an interim solution for tooth repair, which may be the best option in cases where treatment may be compromised due to problems with access to a dental office, parent’s attitudes about treatment, high costs of various treatment plans, or the child’s behavioral or developmental status.”

While glass ionomer restorations may not have as long a life as resin-composites, their flexibility can often be just what the doctor needs to treat a child.
“Especially with kids that are five, six, seven years old where the primary molar is going to be in the mouth for four or five years – maybe even less – the need for longevity of the restoration is not as great as it is for a permanent tooth, where you want it to last for 20 or 30 years,” Dr. Berg observes. “Therefore, you can use a material, like glass ionomer, though not as strong from a material standpoint as resin composite, but you’re more likely to get good results in the short run for the time period that you need it.”

Moisture management is one of glass ionomers’ best traits, and one that’s especially useful with children.

“Even with rubber dams, sometimes you have a rubber dam that’s not as perfect as you would get with an adult, and you might have a little bit of humidity and condensation onto the tooth, so I often choose glass ionomers or resin-modified glass ionomers for my restorations in primary teeth,” Dr. Berg says. “Certainly if the dentist didn’t use a rubber dam, then I would strongly recommend glass ionomers. Even the humidity of the mouth would get on the prepped tooth before you could fill it, so that condensation could prevent a resin from sticking. Whereas with the glass ionomer, that thin film of moisture would be welcome to the material. It can tolerate it.”

Resin-composites solved amalgam’s biggest weakness, but in the process introduced new challenges. Glass ionomers solve many of those problems, and can be a great addition to the doctor or hygienist’s treatment collection.