Incorporating Glass Ionomers into Everyday Dental Practice

Todd Snyder, DDS, FAACD, FIADFE

Introduction

General dentists in private practice place numerous direct tooth colored resin restorations because of patient demand for more aesthetically pleasing restorations. In other instances, they utilize tooth colored adhesive dentistry because of its benefits of minimally invasive preparation design and adhesive retention to preserve tooth structure. The placement of these indirect and direct tooth colored restorations is very time consuming and may pose technique challenges particularly for resin adhesion to dentin while enamel is very easy to adhere to.

There are many different tooth colored resin restorative materials available on the market with more additions and improvements every year. Resin based restorative materials make up the majority of direct tooth colored restorations placed. The current trend of materials is showing a lot of promise with more and more tooth colored bioactive materials becoming available. These bioactive materials help reduce the risk of secondary caries that occurs with the placement of direct resins, spread from microleakage due to bond failure. Composite microleakage is the leading cause of failure for direct resin restorations. It can be due to many things such as but not limited to: placement techniques, shrinkage issues, moisture isolation, matrix systems, poor polymerization, polymerization stress, bond failure, matrix metalloproteinases (MMPs), capthesins, and hydrolytic break down of hydrophilic resin materials.

There are still so many challenges when using direct resin restorations that many dentists are frustrated in utilizing them. Some of the biggest drawbacks that plague resin restorations are the poor long-term adhesion to dentin and secondary caries due to microleakage. Enamel adhesion is very durable and long lasting by comparison. However, when restoring large defects that extend into the superficial, middle and deep dentin, adhesion and microleakage become an issue. Amalgams and direct gold restorations are still excellent long-lasting options for those that don't mind the appearance. So, what other direct resin options can we entertain, well direct tooth colored restorations are limited to composite resin, bioactive resins, ormocers and glass ionomers.

Glass ionomers are often underutilized and misunderstood by dentists and yet they offer some exceptional restorative capabilities. So, how can glass ionomers be used as a tooth colored direct restorative material to replace dentin and enamel? Let's see some of the many ways that glass ionomers can be utilized in everyday practice without the necessity of bonding agents and risks of C-factor polymerization stress, resin shrinkage, etc.

Glass ionomers offer numerous unique benefits to the user. The placement is far easier as they are placed in a bulk fill technique utilizing a weak acid cavity conditioner typically, and are more forgiving than composites. At the same time the patient's dentition benefits as well. Glass ionomers unique interaction with the tooth is totally different from composite resin's mechanical interaction with the dentin.

The hybrid zone created when using resin adhesives, is a network of resin that penetrates into the dentin lattice where it is solidified making it difficult to pull out because of its mechanical retention. While there are a few adhesives currently that have some chemical adhesion most function by mechanical retention only.

Glass ionomers have some mechanical retention but they create a true chemical union with the tooth by forming ionic bonds. Hence glass ionomers offer minimal microleakage potential when compared to resin adhesion. Furthermore, their ability to remineralize and hypermineralize the dentin with the exchange of ions from the glass ionomer makes the dentin more resistant to acid attacks from cariogenic bacteria than normal healthy dentin. This is a huge advantage should microleakage occur. Conventional glass ionomers have physical properties that are very similar to dentin with comparable compressive strengths and coefficients of thermal expansion.

Case 1

Sealant or Preventive Restoration – after cleaning out the grooves with air abrasion, lasers or a fissurotomy bur, a low viscosity conventional glass ionomer is used to seal the tooth.

Clinical Cases

Sealants and Non-Invasive Preventive Restorations

The first areas where glass ionomers can easily be incorporated within the dental practice are as non-invasive preventive restorations, sealants and quick provisional fillings. The utilization of glass ionomers as preventive sealants on teeth has been documented to be every bit as good as a resin sealant but without the complications. They have higher moisture tolerance, less microleakage and provide protection from caries attack. Glass ionomers are hydrophilic and are attracted to moisture. They work well to get into the occlusal anatomy and remineralize the tooth. Partially erupted molars can be easily sealed with the use of glass ionomers compared to the dry field isolation that is required with resin sealants. In high wear areas, glass ionomers may experience more of a visible wear compared to resins but still seal the tooth effectively down within the pits and fissures where they are needed.

When placing glass ionomer sealants or preventive restorations the grooves should be cleaned with air abrasion, lasers or a fissurotomy bur and then a low viscosity conventional glass ionomer can be used to seal the tooth **(Case 1)**.

Class V with Resin Modified Glass Ionomer

Two categories of glass ionomers can be used as direct tooth colored restorative materials. The first group is the conventional glass ionomer, which utilizes a self-curing mechanism in setting. They can be used in large bases, buildups, Class I, II, III, and V restorations due to their good compressive strength. They are also moisture tolerant unlike composite resins and thereby more forgiving when placed against deep dentin or subgingival defects that have some moisture present. Self-cure glass ionomers have an excellent ability to recharge fluoride when in contact with toothpaste, saliva and remineralization products.

The second group includes the resin modified glass ionomers, which offer high flexural strengths but weaker compressive strengths. Resin modified glass ionomers have a dual cured chemistry in that the material will self-cure but can also be light cured for faster conversion of the material. Resin modified glass ionomers can also hypermineralize the tooth (though to a lesser extent), are moisture tolerant, have great flexural capabilities, polishability and aesthetics.

Resin modified glass ionomers are excellent in class III and class V restorations. They can also be used as liners under deep composite restorations but should be kept thin, as they do not have high compressive strengths. Due to their chemical makeup they will bond to composites and bonding agents.

An abfraction lesion that has no decay present should have the tooth surface roughened with a bur, laser or air abrasion but no retention added. Then a low viscosity resin modified glass ionomer can be used to restore the defect **(Case 2)**.

Class V restorations are notorious for composite microleakage and failure. The failure is often due to a lack of circumferential enamel at the cavosurface and due to the presence of moisture typically from sulcular fluids, blood and saliva. This is one of the most difficult areas to bond to properly and yet bonding agents and composite resin technology is typically used for class V defects.

The numerous steps that are necessary to place a composite can be eliminated with less concern for microleakage, recurrent decay and restoration failure, if a resin modified glass ionomer is used instead. One of the easiest materials to place and extremely forgiving in the presence of moisture is the resin modified glass ionomer utilized in a class V defect. The tooth does not require big bevels, undercuts or retentive grooves.

Simply remove any decay, plaque or debris with a diamond bur, laser or air abrasion and follow with a cavity conditioner (a weak acid). Rinse off the conditioner without desiccating the tooth. The resin modified glass ionomer is then triturated and syringed into the defect. Going into the defect as a runny

Case 2

Class V Abfraction – an abfraction that has no decay present can have the tooth surface roughened with a bur, laser or air abrasion but no retention added. A low viscosity resin modified glass ionomer is used to restore the defect.

Case 3

Class II Sandwich – a conventional glass ionomer is placed as a first increment over the dentin followed by a bonding agent and composite. Notice the radiographic display of the glass ionomer sandwiched under the composite.

material it adapts very easy with only minor surface manipulation and wiping away of any excess. The material is hydrophilic and will seek out moisture under the gum line and down into dentin and cementum. Gross excess is wiped away and there is some contouring with dental hand instruments followed by light curing. Any additional adjustments must be performed with fine diamonds and water spray, followed by polishing cups or discs with water spray. Glass ionomers are susceptible to dehydration, which damages their physical structure and chemistry so they should always be kept moist when adjusting and polishing.

Class II Sandwich Technique

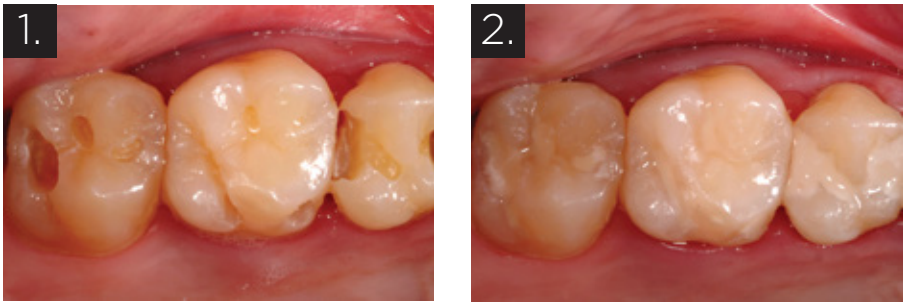
Conventional glass ionomers are excellent when restoring deep defects where dentin adhesion is typically more challenging and postoperative sensitivity is a concern. With high compressive strengths and the ability to thrive in moist deep dentin it is the first choice when doing large direct posterior restorations.

In the sandwich technique, a conventional glass ionomer is used as a build-up material. One large increment of glass ionomer is followed by a traditional bonding agent and a single layer of composite **(Case 3)**.

on page 31

from page 28

Case 4



Class I – a conventional glass ionomer is placed to restore numerous teeth quickly.

Case 5

Class II Standalone – a conventional glass ionomer can be placed when the opposing cusp does not impact on the marginal ridge.

To place a conventional glass ionomer simply clean off any decay, plaque or debris with a diamond bur, laser or air abrasion. Follow with the cavity conditioner (a weak acid) provided by the manufacturer. Rinse off the conditioner without desiccating the tooth. Triturate and syringe the glass ionomer into the defect. Wipe the excess with a ball or egg burnisher.

Compared to the difficulty of bonding to deep dentin, the potential postoperative sensitivity and the layering of composites resins, glass ionomers are a much simpler solution.

If the dentin is replaced with a conventional glass ionomer and then layered with a tooth colored enamel replacement material (bonding agent and nanohybrid composite) we have achieved protection of the dentin, durable resin adhesion to tooth structure, and resistance to occlusal forces.

Standalone Restorations (Class I and Class II)

Conventional glass ionomers can be used as standalone restorations in such areas as class I defects that are less than half the intercuspal distance and are not under heavy occlusal forces **(Case 4)**. These restorations are a fast and effective way to manage many defects quickly or in individuals with a have a high caries rate.

Additionally, small class II defects that are less than half the occlusal table can also be restored entirely with glass ionomers depending on occlusal forces and opposing cusps. A conventional glass ionomer can be placed when the opposing cusp does not impact on the marginal ridge **(Case 5)**.

Core Buildups

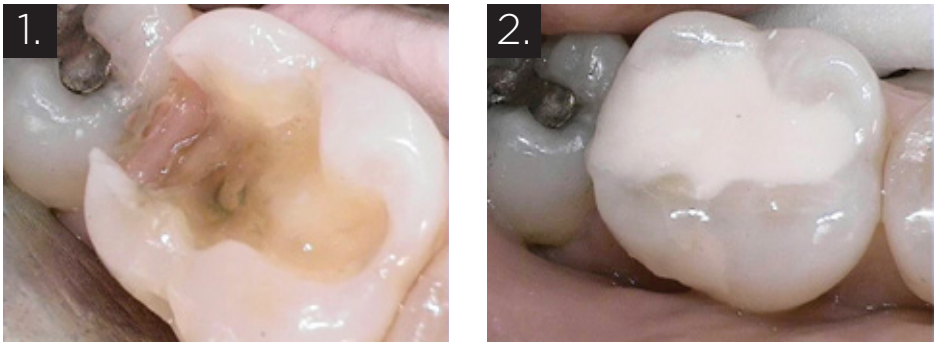
Large core buildups on deep, sclerotic dentin using conventional glass ionomers have been shown to offer greater longevity than resin adhesives and composite core materials.

Case 6 illustrates a glass ionomer core buildup. After preparing the tooth a cavity conditioner is applied and rinsed, followed by the insertion of a high viscosity conventional glass ionomer.

Class V Defect Adjacent to a Class II Preparation

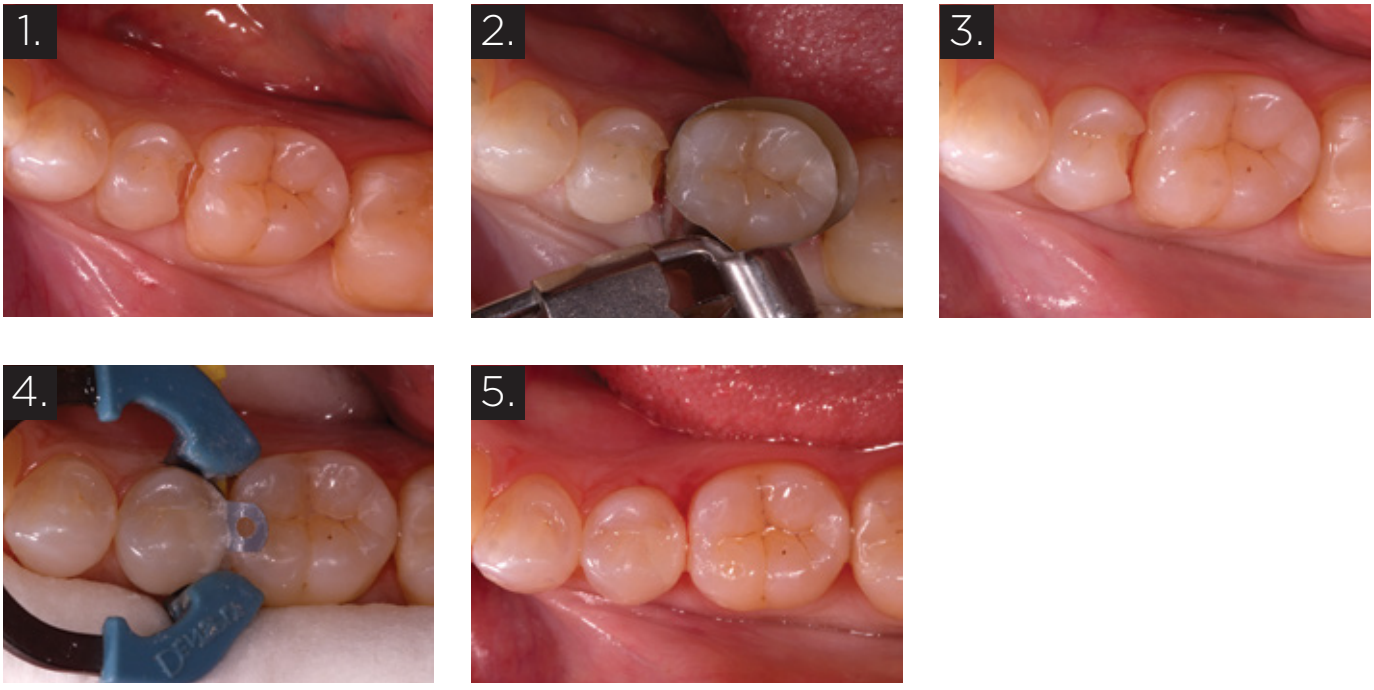
Unique preparation designs that implement glass ionomer restorative materials allow us to be more conservative and offer minimally invasive dentistry to our patients. For example, interproximal class V defects can be easily treated to conserve

Case 6



Core Buildups – after preparing the tooth a cavity conditioner is placed and rinsed followed by the application of a high viscosity conventional glass ionomer.

Case 7



Class V defect adjacent to a Class II preparation – prepare the larger cavity with a Class II preparation design. The Class V preparation is limited to removal of pathology only. No additional reduction, bevels or retention are required. Either a conventional glass ionomer or a resin modified glass ionomer can be used.

tooth structure, maintain occlusion and not weaken the tooth. Rather than doing back-to-back Class II restorations, a class II preparation design can be used in the larger of the two cavities followed by direct access to perform a Class V preparation on the adjacent tooth.

In **Case 7** the larger cavity is prepared conventionally with a Class II preparation design. The adjacent Class V preparation is limited to removal of pathology. No additional reduction, bevels or retention are required. Either a conventional glass ionomer or a resin modified glass ionomer can be used.

Case 8

Accessing interproximal defects from the buccal or lingual allows for injection of glass ionomer into the preparation conserving tooth structure.

Accessing Interproximal Defects from the Buccal or Lingual

When interproximal cavities occur towards the facial or lingual surfaces of the tooth a tunnel preparation allows the defect to be restored without damage to the occlusion or sound tooth structure **(Case 8)**. The lesion is accessed from the buccal or lingual and a low viscosity conventional glass ionomer or resin modified glass ionomer is flowed into the defect. Resin modified glass ionomers must be left to self-cure. Light curing units can only be utilized when clear matrices are applied to restore the defect. Glass ionomers can have a potential benefit on adjacent teeth when placed interproximally through remineralization that helps reduce or ward off further damage to the proximal surface.

Direct composite resins are the go-to material for direct tooth colored restorations. They are excellent materials that work well for the majority of cases.

Conventional and resin modified glass ionomers provide the dentist with options for tooth colored alternatives to direct composite resin restorations. In cases where moisture control, deep dentin, high caries risk and or microleakage are concerns, glass ionomers can be employed since they may not have the same limitations. Having more options available can simplify the placement procedures and provide better long-term results for patients.

It is important to understand the limitations of all products and techniques. Glass ionomers are an important addition to the dental armamentarium. **OH**

Oral Health welcomes this original article.

Dr. Todd Snyder received his doctorate at the UCLA School of Dentistry and has trained at the F.A.C.E. institute. He is an Accredited Fellow of the American Academy of Cosmetic Dentistry and is a member of Catapult Education. Dr. Snyder was on the faculty at UCLA where he created and co-directed the first two-year graduate program in Aesthetic and Cosmetic Restorative Dentistry. In addition to lecturing internationally, he has authored three books and numerous articles in publications around the world.Dr. Snyder owns two software companies, is a professional racecar driver and entrepreneur.