# OPERATIVE 2019/2020

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# LUORIDE RELEASING MATERIAL

**The value of topical fluoride in preventative care is** well-established. **Fluoride offers protection by replacing the ions lost during demineralization with fluoride, thereby forming fluorapatite, which is a larger and stronger crystal than hydroxyapatite. Prolonged fluoride exposure increases the amount of fluoride acquired**

## FLUORIDE VARNISHES

**Fluoride varnishes and gels are available and are successful in preventing caries. Varnishes provide a high uptake of the fluoride ion into the enamel, yet provide a lower dosage of fluoride than gels or rinses. These are professionally applied, yet may provide the most cost-effective means of delivery of fluoride to the teeth. They are effective bacteriocidal and caries prevention agents.**

## GLASS IONOMERS [1]

**Glass ionomers are materials consisting of ion-cross-linked polymer matrices surrounding glass-reinforcing filler particles. The earliest glass-ionomer materials for restorations were based on a solution of polyacrylic acid liquid that was mixed with a complex alumino-silicate powder containing calcium and fluoride. The acidic liquid solution (pH = 1.0) dissolves portions of the periphery of the silicate glass particle, releasing calcium, aluminum, fluoride, silicon, and other ions. Divalent calcium ions are quickly chelated by ionized carboxyl side groups on polyacrylic acid polymer chains, cross-linking the chains and producing an amorphous polymer gel. During the next 24 to 72 hours, the calcium ions are replaced by more slowly reacting aluminum ions to produce a more highly cross-linked matrix that is now mechanically stronger.**

**The same carboxylic acid side groups also are capable of chelating surface ions on the glass particles, or calcium ions from the tooth**

**structure. This process generates true chemical bonds at all internal and external interfaces when the reaction conditions are correct. Set materials have modest properties compared with composites, but have relatively good adhesion and the ability to release fluoride ions from the matrix for incorporation into the neighboring tooth structure to suppress caries.**

**The following list summarizes the characteristics of traditional glass-ionomer materials:**

**Advantages**

- **Form a rigid substance on setting**
- **Good fluoride release (bacteriostatic, inhibit caries)**
- **Low exothermic reaction on setting**
- **Less shrinkage than polymerizing resins**
- **Coefficient of thermal expansion similar to dentin**
- **No free monomers**
- **Dimensional stability at high humidity**
- **Filler–matrix chemical bonding**
- **Resistant to microleakage**
- **Non-irritating to pulp**
- **Good marginal integrity**
- **Adhere chemically to enamel and dentin in the presence of moisture**
- **Rechargeable fluoride component**
- **Good bonding to enamel and dentin**
- **High compressive strength**

**Disadvantages**

- **Susceptible to dehydration over lifetime**
- **Sensitivity to moisture at placement**
- **Poor abrasion resistance**
- **Average esthetics**
- **Less tensile strength than composites**
- **Technique sensitive powder-to-liquid ratio and mixing**
- **Less color-stable than resins**
- **Contraindicated for Class IV or other stress-bearing restorations**
- **Poor acid resistance**

## Resin-modified glass-ionomer cement[2]

This is achieved by adding a water-soluble monomer, such as hydroxyethyl methacrylate (HEMA), to the liquid of a water-soluble polyacrylic acid.

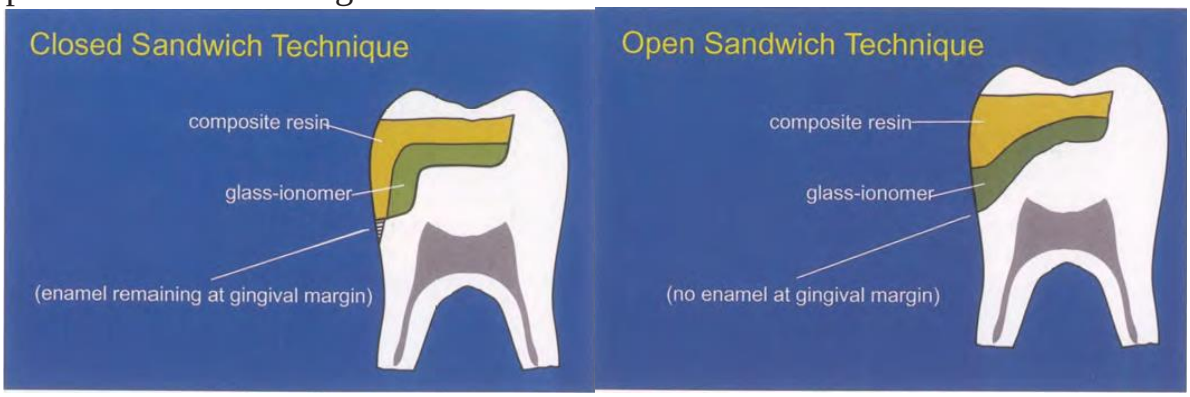
Two separate setting reactions occur one common to conventional glass ionomers and the other common to photoinitiated resin composites. The photoactivation may affect the material's final properties, depending on the strength of the glass-ionomer cure.

In general, the RMGICs appear to perform well in terms of retention. Secondary caries, as well as postoperative sensitivity, are not a problem. However;

- RMGICs found that the marginal adaptation was poor at 18 months and likely to deteriorate over time.
- From the limited data that the RMGICs exhibit some loss of anatomic form and surface wear, particularly in the mid to long term.
- While the initial color match may have been favorable relative to tooth structure, it appears that these materials change over time. This may be related to the surface changes within the materials as manifested in the form of loss of anatomic contour and wear
- The RMGICs cannot be considered biocompatible to the same extent as conventional glass-ionomers.

When restoring Class V non-carious cervical lesions with RMGI, it was found that the dentin should be lightly roughened and prepared with a rotary instrument to create a uniform dentin smear layer and clean dentin surface. It is also important to use a cervical matrix to provide for 100% leak-free restorations. Clinically the cervical matrix allows the material to be adapted to the margins of the preparation under pressure as compared to adapting the restorative with a hand instrument, which can have the tendency to pull the restorative away from the margin. Another study investigated marginal adaptation of RMGI and recommended that restorations be finished in a separate appointment to allow for water sorption to improve marginal adaptation. Whenever placing Class V restorations, potential contamination with sulcular fluid or moisture is a risk factor. It has been reported that when bonding RMGI to slightly moist dentin the restorative material exhibits moisture tolerance with no reduction in shear bond strength.[3]

Glass ionomer and resin modified glass ionomer restorative materials have the highest levels of fluoride release and good recharge, which increases long-term fluoride release. These are useful for the high caries risk patient, but their poor wear resistance and low fracture toughness limits their usefulness as a posterior restorative. However, glass ionomers are useful as a liner or extended base and should be used in deep cavity preparations, especially when the proximal margin is subgingival (sandwich technique). A conditioner or primer is provided with glass ionomer restorative materials. These conditioners are weak inorganic acids and clean rather than etch the tooth surface prior to bonding. They effectively improve the bond of the glass ionomer to the tooth structure.




Recently, nanofillers have been added to a resin modified glass ionomer (RMGI) (Ketac Nano) to reduce the filler particle size, producing a smoother, more esthetic restoration. All glass ionomers should be bonded to moist tooth structure, after the conditioner is applied and rinsed off or light-cured, depending upon the brand used, and the mixed resin modified glass ionomer applied to the moist tooth and light-cured. After curing, the resin modified glass ionomer is wet-finished.

**Polyacid-modified resin composites**

Polyacid-modified resin composites, which are more widely known by the name “compomers,” attempt to combine the best properties of glass ionomers and composite resins. A major reason for their success is that they are user-friendly: they are soft, nonstick, do not need to be mixed, and are easy to place. They are easy to inject into a cavity, simple to shape, quick to cure, and readily polished after curing. They are used in anterior proximal restorations and in cervical restorations. In almost all other areas, composites and glass ionomers are preferred.

Compomers have nominal adhesion to tooth structure and, therefore, are always attached with resin-dentin bonding agents. Compomers provide less fluoride release than glass ionomers, and the small amount they do release may be of limited value since the resin bonded interface prevents the fluoride from entering the tooth. Nevertheless, the surface fluoride release from compomers can affect the surrounding tooth structure.

The advantages of compomers include the following characteristics:

- No mixing required
- Easy to place
- Easy to polish
- Good esthetics
- Excellent handling
- Less susceptible to dehydration
- Radiopaque
- Higher bond strengths than resin-modified glass ionomers
- Stronger than glass ionomers

The disadvantages of compomers include the following characteristics:

- Bonding agent required
- More leakage than resin-modified glass ionomers
- Expand from water sorption over time
- Wear more easily than composites
- Longevity difficult to predict because of an enormous variety of products
- Physical properties weaker than those of composites, and they decrease over time
- Limited fluoride uptake

**Ionomer-modified resins**

Ionomer-modified resins, or fluoride-containing composite resins, are materials that contain glassionomer fillers but no polyacids. They have been in the dental market for a long time and represent they suspend ionomer-glass or reacted glass-ionomer components in a resin system, and hence are also known as suspension systems

Unfortunately, whereas compomers absorb water, which gives them the potential for acid-base reactions and significant fluoride release, suspension

systems have no such potential. The only avenue for fluoride release from an ionomer suspension system is the diffusion of ionomer particles entrapped in voids that fill with water after placement.

References


1. Ritter, A.V., *Sturdevant's art & science of operative dentistry-e-book*. 2017: Elsevier Health Sciences.
2. Albers, H.F., *Tooth-colored restoratives: principles and techniques*. 2002: PMPH-USA.
3. Strassler, H.E. and F. FADM, *Glass ionomers for direct-placement restorations.* Dental Economics, 2011. **14**.