Glass Ionomers: A Therapeutic Alternative to Direct Composite Restorations

Daniel H. Ward, DDS

Years ago, the restorative material options for the dental practitioner were limited. Direct placement materials available were either amalgam or silicate. Amalgam has long been recognized as a forgiving restorative material that works well in a variety of circumstances. Advantages of amalgam include cariostatic properties, the ability to work in varied moisture conditions, and quick bulk placement.1 Through the years tooth-colored materials have been developed with improved physical properties, enhanced optical qualities, and quicker use, eliminating the use of silicate restorations.

The public has increasingly demanded non-metallic esthetic alternatives resulting in a decrease in the placement of amalgam restorations. In ideal situations, composite often may be the non-metallic direct placement material of choice. With ample time, moisture control, appropriate size, ideal enamel margins, and a cooperative patient, excellent results can be achieved with composite restorations. The color, translucency, polishability, and smoothness of the material make it ideal in areas that are clearly viewed. However, limitations of composite material exist which were not present with amalgam. These include polymerization shrinkage and the resulting stress, susceptibility to moisture contamination, post-operative sensitivity, increased placement time, and technique sensitivity subject to operator variability.2-6 Composite materials are not cariostatic and rely on sealed margins to prevent recurrent decay. Dentin bonding can be unpredictable with significant variability of bond effectiveness.

The number of medications taken by our patients has increased significantly. In a published study of 131 different prescribed medications the most common side effect cited was xerostomia.7 A significant result of xerostomia can be root caries.8 Patients often take so many medications that they may be confused as to their proper regimen. This was recently demonstrated when a patient brought in a chart with actual pills taped to the paper and the timing of the dosages displayed. (Figure 1) Dietary changes have occurred as well with the increased consumption of refined carbohydrates. Many adolescents consume beverages with high levels of sucrose, especially the popular “energy drinks.” Also the use of illicit drugs can cause rampant caries to develop. (Figure 2) The result has been an increase in high caries risk patients and the need for a therapeutic esthetic restor-
ative material that can help to reduce potential recurrent decay. Often the practitioner is placing restorations in areas with limited access, non-ideal preparations, and in areas susceptible to recurrent decay. These areas may not be clearly visible and longevity may be more important than appearance. A material is needed that does not contain objectionable materials, is not technique sensitive, reduces post operative sensitivity, helps reduce recurrent decay, and can be predictably and rapidly placed in less than ideal conditions.

Glass ionomer direct restorative materials are an excellent alternative which solves many of the challenges associated with composite materials. (Table 1)

They set with an acid/base reaction resulting in a long term stable ionic bond. An ionic exchange continues through the lifetime of the restoration resulting in a dynamic bioactive interaction between the material and the tooth. Their fluoride release has been well documented and anti-microbial properties recognized. A significant decrease in post-operative sensitivity following placement in deep restorations has been reported compared to traditional composite bonding techniques. Long-term stable bonding to tooth structure results in extremely low adhesive failures. Glass Ionomers exhibit increased wear rate compared to composites on occlusal surfaces of teeth which can be reduced by placing a filled surface sealant on the outer surface of the exposed restoration.

**USE IN CERVICAL DECAY PATIENTS**
The increased incidence of patients taking multiple medications (often 10-20 different each day) has created difficult restorative situations. Alterations to salivary flow and composition have increased the incidence of cervical root caries among our elderly patients. Often multiple carious lesions exist requiring extensive restorations.

Polymerization shrinkage stress may create microgaps along the dentin margins if restored with traditional composite restorative materials. Restorations

<table>
<thead>
<tr>
<th>COMPOSITE PLACEMENT CHALLENGES</th>
<th>GLASS IONOMER SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor cariostatic properties</td>
<td>Fluoride release</td>
</tr>
<tr>
<td>Require dry field</td>
<td>Prefer slight moisture</td>
</tr>
<tr>
<td>Larger restorations require layered placement</td>
<td>Bulk placement</td>
</tr>
<tr>
<td>Technique sensitivity</td>
<td>Simple technique</td>
</tr>
<tr>
<td>Higher incidence of post-operative sensitivity</td>
<td>Low incidence of post-operative sensitivity</td>
</tr>
<tr>
<td>Unstable long term bond to dentin</td>
<td>Predictable long term bond to dentin</td>
</tr>
</tbody>
</table>
relying totally on the bonds strengths of micro-mechanical re-
tention associated with resin bonding are known to decrease
over time and may become dis-
lodged. The presence of fluoride in glass ionomer helps to reduce
recurrent decay and staining along dentin margins.

The patient was taking multiple medications and was evalu-
ated every three months for car-
ies. He routinely required
numerous restorations at each
visit. Cervical lesions were noted
on multiple anterior teeth. The
patient was anesthetized and the
lesions evaluated. (Figure 3). The
coronal portion of the tooth was
prepared first and then the shap-
ing extended towards the gingiva.
A slow speed handpiece with a
round bur was used to remove the
carious dentin. A pre-contoured
matrix strip was inserted along
the gingival margins and held.
The primer (GC Cavity
Conditioner) was applied for 10
seconds, washed and excess mois-
ture removed. The glass ionomer
restorative material (GC Fuji IX
Extra) was mixed and syringed
into the preparation. The mate-
rial was allowed to cure for 2½
minutes. The excess material was
shaped, the restorations polished
and a sealant (GC G Coat Plus) applied. (Figure 4)

LONG-TERM PROVISIONAL
RESTORATIONS
During this difficult economy, pa-
tients may not be able afford a
crown yet are looking for a resto-
ration that will allow them to
keep a fractured tooth. (Figure 5)
Glass Ionomer restorative materi-
als can serve as excellent long
term interim restorations. With
no polymerization shrinkage
stress and an expansion/contrac-
tion ration similar to tooth struc-
ture, the remaining tooth struc-
ture is not strained by the
restoration.

A new system of fast-setting
glass ionomer restorative mate-
rial along with filled resin surface
sealant has been introduced. The
Equia system (GC) (Figure 6)
packages a highly filled glass ion-
omer (GC Fuji IX Extra) with a
filled resin surface sealant (GC G
Coat Plus). The filled resin helps
to seal the margins, reduce wear
and increase fracture toughness.
The material can be used for
Class I, II and V restorations.

The patient was anesthetized
and the decay and old restoration
removed. The conditioner was ap-
plied for ten seconds, washed and
lightly dried to remove excess
moisture. The glass ionomer ma-
terial capsule was activated, me-
chanically mixed for ten seconds
and the material inserted into the
tooth. After 2½ minutes the ex-
cess was removed and the restora-
tions smoothed, polished, and
sealed. (Figure 7) Teeth restored
in this manner will easily enjoy a
3-8 year lifetime.

CROWN BUILDUPS
The removal of decay and old re-
storative material prior to the
shaping of a tooth for a crown of-
ten results in significant expo-
sure of tooth structure. Post-
operative sensitivity becomes a
greater concern the deeper the
restoration. Amalgam core build-
ups require time for the amalgam
to set and result in an additional
office visit which may be undesir-
able for dentist and patient alike. Non-bonded amalgam cores can frequently become dislodged during treatment. Composite core buildups require bonding techniques that may increase sensitivity. When using conventional resin bonding, the deeper the restoration, the lower the bond strengths to dentin. Long term bond strengths of composite to dentin can be quite variable. Stained and affected dentin gives unpredictable bond strengths as well. The difference in bond strengths of glass ionomer to tooth structure compared to traditional composite resin to tooth structure has not been observed by the author to be clinically relevant in deep crown buildups. The majority of loosened crowns with the core material inside the crown have been observed to contain amalgam or composite, not glass ionomer.

The preliminary crown preparation was performed and the old composite restoration removed. Significant cracks within the dentin were discovered under the excavated composite. (Figure 8). The carious area was excavated thoroughly using a round bur in a slow speed handpiece. A glass ionomer core was used to eliminate the negative effects of polymerization shrinkage stress associated with composite cores. The primer was applied for ten seconds, washed and excess moisture removed. The glass ionomer was mixed, placed, and allowed to set for 2½ minutes. The crown preparation was completed. (Figure 9)

USE IN DEEP POSTERIOR CLASS II RESTORATIONS

Deep or wide Class II restorations are often a source of significant post-operative sensitivity. As the tooth is shaped further sub-gingivally, the convex shape of the interproximal surface results in the preparation becoming closer in proximity to the pulp. As the preparation becomes wider buccally/lingually, polymerization shrinkage can pull inward on the cusps creating internal stresses. Restoring the tooth with a glass ionomer decreases the likelihood of patient complaints to air, water, temperature sensitivity and biting pressure.

The patient was advised that crowns should be placed on the upper premolar and molar. (Figure 10) She stated that she could not afford two crowns at the present time but could afford one. Both teeth were excavated. The premolar was restored with a glass ionomer material and the molar was shaped for a crown and a glass ionomer buildup placed. The premolar was shaped using finishing burs in a method to provide proper occlusal anatomy. The restoration was lightly polished, dried, and a filled surface sealant applied. (Figure 11) Patient complaints are rare. Restorations placed in this manner have a longer lifetime than expected and rarely result in fractured cusps resulting from polymerization shrinkage stress inherent with composite restorations.

CONCLUSION

The glass ionomer restorative material is an invaluable part of the restorative dentists armamentarium. In the busy practice, the material can be useful in a number of situations on a daily basis. As a non-metallic restorative material with ease of use, good retention, reduced post-operative sensitivity, and anti-cariogenic properties, it is a therapeutic alternative to composite resin materials.

Dr Ward is an Assistant Clinical Professor in the Department of Restorative and Prosthetic Dentistry at The Ohio State University College of Dentistry and is in private practice in Columbus, Ohio. He is a Diplomate of the American Board of Aesthetic Dentistry, a Fellow of the American Society for Dental Aesthetics, and serves as editor of the ASDA Journal. He has lectured internationally and authored pioneering articles in the field of proportional smile design. Email: dward@columbus.rr.com

Oral Health welcomes this original article.

REFERENCES

7. Smith RG, Burtner AF. Oral side-effects of the most frequently prescribed drugs. Spec Care Dent. 1994;14:96-102.