Achieving Aesthetic and Functional Direct Posterior Restorations With a Polyglas® Material

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Direct posterior composite restorations occupy a unique position in restorative dentistry, since they enable preservation and reinforcement of the remaining tooth structure and provide enhanced aesthetics, all in a single appointment. The need for a simplified clinical protocol, supported by sound scientific evidence, has resulted in the development of a new material for direct posterior placement. This article discusses the innovative Polyglas® technology (Heraeus Kulzer, Inc., South Bend, IN) designed to achieve time-saving, easy-to-perform, and physiologically sound Class II restorations.

Composites were introduced to dentistry in the mid-1960s by Ralief Bowen. Since then, they have gained universal acceptance by clinicians and have undergone significant improvements in their chemical, physical, and clinical properties. Their popularity is attributed primarily to the aesthetics that they impart to restorations—a characteristic so highly regarded that most clinicians and patients are in agreement in selecting composite resins as the material of choice for direct anterior and posterior restorations.

Since conventional composite resins do not handle like amalgam, attempts to implement an amalgam-associated technique for the placement of composites were often met with failure. To avoid complications, such as marginal gaps induced by material shrinkage, higher-than-acceptable rates of secondary caries, and postoperative sensitivity, intrinsic layering techniques were developed. A controversy still exists, however, regarding the benefits of incremental layering to minimize marginal gap formation, and the extended time requirement also presents a barrier. Only clinicians willing to invest the time required to place, contour, and finish an incremental polymeric restoration could ensure an optimal level of clinical success.

It has become evident that the more composite resins emulate the viscosity, injectability, and condensability of amalgam, the easier the restorative protocol will be, with greater potential for clinical success. To incorporate these beneficial properties, some manufacturers increased the filler content; however, substantial increases in porosity ensued.

Innovative Material Development

An innovative posterior composite (Solitaire®) Heraeus Kulzer, Inc., South Bend, IN, was introduced in 1997 and presents excellent characteristics other than true amalgam-like condensability. Its innovative chemistry and advanced technology position Solitaire as a restorative material that combines a unique filler with a highly cross-linked matrix. Two elements compose the direct restorative: a multifunctional inorganic Polyglas monomer resin which, following polymerization, provides a glass-like structure, and unique filler particles with irregular surfaces that contribute to condensability (Table 1). The particles ranging in size from 2.0 μm to 20.0 μm are porous and facilitate penetration by the resin matrix to produce a more uniform mass under condensation (Figure 1). In combination with microglass fillers and Al-F-Si glass components, the SiO2 glass fillers occupy

<table>
<thead>
<tr>
<th>Filler</th>
<th>Charisma®</th>
<th>Solitaire®</th>
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<tbody>
<tr>
<td>Ba-Al-B-F-Si-glass</td>
<td>.</td>
<td>26%</td>
</tr>
<tr>
<td>D90 0.7 μm, D99 2.0 μm</td>
<td>.</td>
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</tr>
<tr>
<td>Ba-Al-B-Si-glass</td>
<td>67%</td>
<td>.</td>
</tr>
<tr>
<td>D90 0.7 μm, D99 2.0 μm</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>Pyrogenic SiO2</td>
<td>5%</td>
<td>.</td>
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<tr>
<td>0.01 μm to 0.04 μm</td>
<td>.</td>
<td></td>
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<tr>
<td>Highly porous SiO2 glass</td>
<td>.</td>
<td>30%</td>
</tr>
<tr>
<td>D90 8.0 μm, D99 22.0 μm</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>Al-F-Si-glass</td>
<td>.</td>
<td>5%</td>
</tr>
<tr>
<td>D90 8.0 μm, D99 2.0 μm</td>
<td>.</td>
<td></td>
</tr>
<tr>
<td>Fluoride Salt D90 1.0 μm</td>
<td>.</td>
<td>5%</td>
</tr>
<tr>
<td>Filler content by weight</td>
<td>−72%</td>
<td>−66%</td>
</tr>
</tbody>
</table>

Table. Filler composition of Solitaire® in comparison to Charisma®.
6.6% (by weight) of the material and release fluoride ions that can be exchanged over time utilizing a fluoride-containing dentifrice.8

Excellent marginal adaptation is another significant characteristic of the Polycarb material (Solitaire). With conventional composite resins, the stress load placed on the cavity wall increases rapidly upon initiation of light activation. Due to the "integrated soft-start polymerization," Solitaire presents a delayed development of high-shrinkage stresses as the polymerizing interface of the restorative and bonding agents and within the restoration itself. This phenomenon results in optimal contact between the restorative and tooth surfaces, promoting enhanced marginal integrity.7 The viscoelastic properties and physiological wear resistance enable this material to withstand masticatory forces and render it suitable for Class I and II restorations and in Class V abrasion lesions.8

Clinical Advantages
Solitaire is available in five Vita dentin shades (A10, A20, A30, B20, B30) and one incisal shade, and is packaged in an assortment of syringes or preloaded (PL) unit-dose tips, with written and illustrated instructions. The Polycarb material may be applied and molded utilizing standard composite instruments or conventional amalgam condensers. It is packable and not sticky. Since the material does not "skump," it facilitates an easy formation of surface morphology, minimizing the finishing procedures. Thin conventional or sectional metal matrices may be utilized to develop proximal contacts and contours. Although Solitaire responds similarly to freshly mixed amalgam under condensation, effective wedging is still required to ensure physiologically tight interproximal contacts.

Placement Protocol
Placement of direct adhesive posterior restorations requires time and care. A technique for the replacement of an existing defective amalgam restoration (Figure 3) with Solitaire, using a single-component, acetone-based fifth-generation bonding agent (Excite® One Bond, Heraeus Kulzer, Inc., South Bend, IN), is presented.

Shade Selection
Shade selection is the first step; for Solitaire, two shades are sufficient. Using the manufacturer's or a Vita® shade guide (Vident, Brea, CA), the shade is selected from the cervical third of the tooth to be restored, ie, the high-chroma dentin replacement shade to be used internally. The incisal shade is used as the final layer to emulate the appearance of natural enamel. Correct isolation is essential to the success of all bonded restorations, and placement of a rubber dam is required. When properly applied, a rubber dam will enhance visual acuity, eliminate saliva-blood contamination, protect the patient, and save treatment time.

Preparation
Cavity preparation involves removal of the defective amalgam material and all caries and is best accomplished with the aid of a caries-detecting dye (Figure 5). Sound enamel margins (at least 0.6-mm thick) should be refined with rotary and hand instruments, retaining the cavosurface margins at a 90° angle to provide proper material bulk. The use of metal matrices is preferable, since they are thinner and more easily handled. A simplified technique requires the use of thin precutioned sectional metal matrices. The matrix is adapted interproximally and secured with a wedge that promotes tight cervical adaptation and slight tooth separation. Using rubber dam forceps, a ring is placed in position to determine appropriate tooth separation and matrix contour (Figure 4).

To dislodge the cavity, a bicarbonate solution, such as 2% chlorhexidine or 1% benzalkonium chloride, may be used. The etchant (Excite®-10G, Heraeus Kulzer, Inc., South Bend, IN) is applied initially on all enamel margins (Figure 5) and then injected into the cavity to remain in contact with the dentin for 15 seconds (Figure 6). The preparation is then thoroughly rinsed with water spray for five seconds and briefly air-dried. The dentin surface should appear moist, with no pooling of water. The adhesive is now dispensed into a well to prevent unwanted evaporation of the adhesive solvent and thickening of the resin monomers. Two or more coats are applied with a disposable brush or an applicator to ensure saturation of the dentin (Figure 7). The preparation is then gently spread with a stream of air for five seconds to evaporate the water and solvent. If the cavity surface is not uniformly shiny following this application, additional coats are required. The adhesive is then polymerized for 20 seconds.

Incremental Technique
An increment of the selected dentin shade restora- tive is manipulated into a convenient bulk shape and attached to the instrument for placement, amalgam carriers or preloaded tips may be utilized. The first increment is placed carefully into the cavity preparation and adapted against the cavity walls using fast tapping movements (Figure 8). The absence of airiness in the Polycarb material (Solitaire) prevents pull back with the instrument. Solitaire may be placed in increments of up to
Figure 12. Correct proximal contour and contact are evident upon removal of the matrix, wedge, and ring.

Figure 13. Disks are essential for the refinement of embrasures.

Figure 14. Diamond and carbide burs are used to impart secondary and tertiary anatomy.

Figure 15A and B. Finishing is performed with silicone points, and polishing completes the restoration.

Figure 16. Optional tints are applied into the pit and fissure areas to impart natural polychromatic to the definitive restoration.

Figure 17. Postoperative view of the finished Solitaire® restoration. Note the bifunctional and aesthetic integration achieved.

5.0 mm, depending upon shade. Each increment is light cured for 40 seconds. If the cervical cavo-surface margin is at the gingival level or slightly subgingival, a second increment of dentin shade should be applied and light cured. Ideally, the first increment is retained short of the proximal contact area to enable placement of the incipient shade increment (Figure 9).

A final increment of the incisal shade is then placed into the cavity and condensed to create occlusal morphology—the triangular and marginal ridges, sulci, and fossae (Figures 10 and 31). Placement of excess material should be avoided to minimize finishing procedures. As a result of Solitaire’s handling properties, surface morphology is easily created. Following final increment polymerization, the matrix band is removed, and the restoration is further light cured from the buccal and lingual aspects of the proximal box. Upon removal of the matrix band, wedge, and ring, the correct proximal contours and contacts are evident (Figure 12).

Finishing
The proximal margins and occlusal embrasures are refined utilizing contouring discs (Figure 13). A #12 scalpel blade is used to carve away excess material at the gingival portion of the proximal box, and medium-grit diamond and carbide burs are used to create fissure and sulci and to refine triangular ridge anatomy (Figure 14). A 7903 2-fluted carbide bur (Brasseler USA, Savannah, GA) is utilized to create pits and fissures; silicone points of varying abrasiveness finish and polish the restoration surfaces and margins (Figure 15). To polish the groove areas, diamond and aluminum oxide pastes may be used either alone or in conjunction with silicon carbide brushes.

If enhanced polychromatic effects are desired, tints may be applied sparingly in the pit and fissure areas. Following finishing and polishing, the entire occlusal portion of the restoration is acid-etched beyond the margins for 15 seconds, rinsed, and dried. If desired, ochre and brown tints may be flowed into the deep anatomical areas and light cured (Figure 16). To fixate the tints and to seal any surface imperfections, a surface sealant is applied and light cured for 20 seconds.

Upon removal of the rubber dam, the occlusion is evaluated and adjusted. If placement and carving of the restorative material have been performed correctly, only minor adjustments may be required. The final restoration should exhibit proper contours, tight proximal contacts, and occlusal anatomy that closely resemble natural dentition (Figure 17).

Conclusion
Solitaire is an aesthetic posterior restorative material for clinicians who have utilized amalgam successfully over the years and have been reluctant to change to composite resin due to the more intricate clinical protocol required. With handling properties that enable an easier manipulation than either amalgam or conventional composite resins, Solitaire may be readily incorporated into most practices. Although more time is required to place Polyest, there is a definite time gain—67%—when compared with conventional composite placement techniques. As more restorative materials are introduced that resemble the polymers used in solitaire, clinicians and patients will abandon amalgam and realize the benefits of bifunctional and aesthetic integration.

References
6. Data available from Heraeus Kulzer

**Characteristics of Solitaire®**

**Advantages/Benefits**
- Optimal packability
- Soft-start polymerization
- Enhanced marginal adaptation
- Easy interproximal contact points
- Absence of stickiness
- Superior handling characteristics
- Excellent wear resistance
- Fluoride release

**Available in five Vita® dentin shades and one incisal shade**

**Clinical Indications**
- Posterior resin material
- Class I and II restorations
- Class V abrasion lesions

**Newton Fahl, Jr., DDS, MS, maintains a private practice, emphasizing Restorative and Aesthetic Dentistry in Cumbria, Brazil. Dr. Fahl is a founding member and President of the Brazilian Society of Aesthetic Dentistry, and lectures and conducts continuing education seminars on Aesthetic Dentistry in Brazil and internationally.**