

Achieving Predictable And Esthetic Posterior Restorations Using a Nanoparticle Universal Composite



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Understanding the Benefits of Nanoparticles to Composite Restorations

The inclusion of particles in the nanoscale range (10^{-9} mm) optimizes the properties of the overall composite in sustained polishability and lower wears, specifically.^{1,5,6} Additionally, when different types of nanoparticles are used in a single composite resin, each incorporates a specific benefit to its use and resulting restorations.⁶⁻¹²

Ceramic fillers of a smaller size can enable faster and easier polishability, high gloss and low wear.^{1,7,13,14} Composite materials containing ytterbium trifluoride offer higher levels of radiopacity.⁶ Additionally, the proportion of ceramic fillers will affect the manner in which a nanobased composite resembles the quality and esthetic properties of a dental ceramic, rather than those of early composite resins.⁶

If spherical fillers are present, they contribute to a reduction in wear, but also to optimal composite consistency for easy handling, as well as lifelike translucency.^{6,7} When fillers have been precured, preshrunk, and ground into small particles before inclusion in the final composite formulation, the result is a notable reduction in the overall composite's shrinkage and shrinkage stress when placed and light-cured in the oral environment.^{6,14-17}

Nanosized pigments adjust the shade of a resulting restoration to the surrounding teeth and enhance its chameleon effect.^{8,11} On the

For the past 20 years, this author has been placing anterior and posterior composite restorations and watching the evolution of this category of dental materials. Throughout the years, dentists have placed microfills in the anterior region, primarily because of their high polishability. Unfortunately, their lack of material strength precluded their use for posterior restorations.¹ While hybrid composites provided the improved strength for posterior indications, esthetics suffered.¹

To accomplish universal applications, manufacturers introduced quality microhybrid direct composites. While many have proven successful, there has remained room for improvement in handling, optical properties, and physical characteristics.¹

Clinicians have had to become skilled in using and placing these materials.² From layering techniques that replicate the ceramic fabrication process (accounting for the interplay of light with the physical structure of natural teeth),³ to incremental sandwich techniques,⁴ placing earlier generations of composites to achieve the strength and lifelike esthetics required is a challenging proposition.

When building composite restorations, clinicians have had to account for every aspect of natural tooth structure (fluorescence, opal-

escence, translucency, hue, chroma, and value). These are for archiving the esthetics necessary to create an invisible restoration compared to adjacent teeth.³⁻⁵ In this author's experience the use of multiple shades of a composite—if not a combination of composite types (ie, microfills and microhybrids) to achieve appropriate esthetics, strength, and polishability—has been necessary.

For this author's preferences, an ideal posterior composite should demonstrate nonsticky and flexible handling properties, enabling it to be sculpted and shaped readily and easily. Polishability, reliable wear resistance, and consistent color

the mouth—simplicity and ease of use are desirable qualities. Simplicity translates to ease of shade matching and ease of placement protocol to achieve a predictable restoration. A truly universal composite—for anterior and posterior applications—that can inherently replicate the appearance, wear, and optical properties of natural tooth structure is necessary.

The advent of nanofilled and submicron filled composites is enabling dentists to place a single composite—and a single composite shade—for predictable and esthetic restorations in both the anterior and posterior regions that blend seamless-

As more patients demand natural-looking esthetics using composites—regardless of the location in the mouth—simplicity and ease of use are desirable qualities.

quality are also important. Additionally, the availability of transparent incisal shades is also beneficial. They should demonstrate not too much translucency and not too much opacity. Resistance to polymerization shrinkage and shrinkage stress is also essential.

As more patients demand natural-looking esthetics using composites—regardless of the location in

ly with adjacent natural dentition.^{1,5,6} This is a result of the particles contained in the composite contributing to a chameleon-like blending of the material with the tooth, as well as strength and improved physical properties.^{1,6} As a result, a simple layering technique can be used—especially for posterior restorations—without the need for excessive shades or placement protocol steps.⁶



Figure 1—Preoperative view of the failing amalgam restorations after placement of the rubber dam.



Figure 2—The amalgam restorations were removed with a No. 1557 bur in a high-speed handpiece.



Figure 3—View of the finished preparations with all decay removed.



Figure 4—The AdheSE primer was applied to the prepared surfaces.



Figure 5—The AdheSE bonding agent was applied to the prepared surfaces.



Figure 6—The bonding agent was light-cured using the BluePhase curing light.



Figure 7—The floor of the preparation was covered with a thin 0.5 mm increment of a flowable composite in shade A3.



Figure 8—An explorer was used to spread the flowable composite, after which it was light-cured for 10 seconds per tooth.

other hand, nanosized modifiers provide desirable modeling properties and, simultaneously, increase the stability of a composite material and prevent stickiness to placement instruments.^{6,11,18}

Case Presentation

A 26-year-old woman presented with 12-year-old occlusal amalgam restorations on teeth Nos. 14 and 15 that showed signs of recurrent decay. It was determined the failing restorations could be replaced with direct nanocomposite restorations (Tetric EvoCeram, Ivoclar Vivadent, Inc) in shade A3. Other nanocomposites that could have been used include Filtek Supreme (3M ESPE) and Gradia (GC America Inc) [QA: Gradia Direct?].

After administering a local anesthetic, the teeth were isolated with a rubber dam (Figure 1). The amalgam restorations were removed with a No. 1557 bur in a high-speed handpiece, and care was taken to smooth the cavosurface margins with a fine diamond (Figure 2). When replacing failing amalgam restorations, it is this author's opinion that no unsupported enamel should be left at the cavosurface margin. For this reason, fine finishing of the preparations is advised with a fine diamond. When the preparations were finished, all decay was removed (Figure 3).

A self-etching adhesive (AdheSE, Ivoclar Vivadent, Inc) was used in this case to help streamline the clinical protocol by eliminating separate etching, rinsing and drying, and bonding steps, as well as to help reduce postoperative sensitivity.¹⁹ The self-etching primer was applied to the prepared surfaces, starting at the enamel margins and conditioning them for 30 seconds (Figure 4). The primer was then evaporated with a strong stream of air until movement of the liquid



Figure 9—The dentin replacement layer (shade A3 of a nanohybrid composite) was added to the preparation.



Figure 10—A composite placement instrument was used to condense the dentin replacement layer, which was placed about 0.5 mm short of the cavosurface margin.



Figure 11—The triangular edges of the molars were built up with a transparent shade and shaped with a pointed composite instrument.



Figure 12—After placement of the transparent shade, the restorations were ready for finishing.



Figure 13—Excess composite was removed, and the surface smoothed with a Christmas tree shaped finishing diamond.

was no longer visible.

The bonding agent was then applied to the preparations in a uniform, homogeneous layer, without pooling (Figure 5). The bonding material was then light-cured with a light emitting diode (LED) curing light (BluePhase, Ivoclar Vivadent, Inc) for 10 seconds (Figure 6). Other self-etching adhesives that could have been used include, but are not limited to Adper Prompt L-Pop (3M ESPE), Clearfil SE Bond (Kuraray America, Inc) and iBond (Heraeus Kulzer, Inc).

The floor of the preparations was then lined with a thin, 0.5 mm increment of flowable composite (Tetric Flow, Ivoclar Vivadent, Inc) in shade A3 (Figure 7). This was spread throughout the preparations with an explorer, after which it was light-cured for 10 seconds per tooth (Figure 8). Other flowable composites that could have been used include Revolution 2 (Kerr Corporation) and Filtek Flow (3M ESPE).

Shade A3 of the nanohybrid composite was then added to each preparation as the dentin replacement layer (Figure 9). To condense the composite, a modeling instrument with elastic tips (OptraSculpt Globe, Ivoclar Vivadent, Inc) was used keeping the A3 composite approximately 0.5 mm short of the cavosurface margin (Figure 10). This layer was light-cured for 20



Figure 14—Astropol points and cups were used for final polishing of the finished composite restorations surfaces.



Figure 15—Immediate postoperative view of the completed nanoparticle composite restorations.



Figures 16 and 17—View of the completed nanoparticle composite restorations 2 days postoperatively.



seconds per tooth.

Placing Tetric EvoCeram's transparent shade of Tetric EvoCeram on the occlusal aspects of the teeth created the molars' triangular edges. An OptraSculpt Point instrument (Ivoclar Vivadent, Inc) was used for shaping (Figure 11). This layer was light-cured for 10 seconds per tooth.

After placement of the transparent composite layer, the restorations were ready for final anatomical contouring. In this case, the basic anatomy of the teeth was obtained using the existing tooth structure as a guide (Figure 12). At this time, each restoration received a final overall light-cure for 20 seconds.

Excess composite was removed, and the restoration surfaces smoothed using a "Christmas tree" shaped finishing diamond (Figure 13). Final polishing was completed using polishing points and cups (Astropol, Ivoclar Vivadent, Inc) (Figure 14), and the occlusion was verified.

Conclusion

There have been many composite placement techniques written about achieving functionally predictable and esthetic restorations in the posterior region. Recent advancements by manufacturers to the physical, handling, and esthetic properties of direct composites, however, have simplified these techniques to the extent that consistent and reliable results can be achieved without technique sensitivity or other challenging difficulties, similar to the case presented here (Figures 15 through 17). ■

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Product References

Products: Tetric EvoCeram, AdheSE, BluePhase, Tetric Flow, Optrasculpt Globe, Optrasculpt Point, Astropol
Manufacturer: Ivoclar Vivadent, Inc
Address: 175 Pineview Dr.
 Amherst, NY 14228
Phone: 800.533.6825
Fax: 716.691.2254

Products: Filtek Supreme, Adper Prompt L-Pop, Filtek Flow
Manufacturer: 3M ESPE
Address: 3M Center/275-2SE-03
 Maplewood, MN 55144-3275
Phone: 800.634.2249
Fax: 800.782.0956

Product: Gradia
Manufacturer: GC America Inc
Address: 3737 W. 127th St.
 Alsip, IL 60803
Phone: 800.323.7063
Fax: 708.371.5103

Product: Clearfil SE Bond
Manufacturer: Kuraray America, Inc
Address: 101 E. 52nd St.
Phone: 800.879.1676
Fax: 212.867.3543

Product: iBond
Manufacturer: Heraeus Kulzer, Inc
Address: 99 Business Park Dr.
 Armonk, NY 10504
Phone: 800.431.1785
Fax: 914.273.9379

Product: Revolution 2
Manufacturer: Kerr Corporation
Address: 1717 W. Collins Ave.
 Orange, CA 92687
Phone: 800.KERR.123
Fax: 800.KERR.345

