

# Esthetic Restorative Treatment Options for the Broken Anterior Ceramic Restoration

Wynn H. Okuda, DMD

*Esthetic dental problems* can happen every day. Broken ceramic restorations in the anterior region is a common problem that can occur in the general practice (Figure 1 [View Figure](#)). Because of the visual nature of the problem, patients call the dental practice distressed and want immediate correction. When this occurs there can sometimes be more than one option for correction. This article will look at this common esthetic problem and the clinical treatment options for its correction.

## Clinical Scenario

### Broken Incisal Edge on an Existing Anterior Ceramic Restoration

In correcting this problem it is first important to understand the issues that surround the reason for the broken restoration. The clinician must ask why the ceramic restoration broke. First, it must be determined if the broken ceramic is a recent or older restoration. In a recently placed restoration, the problems associated with breakage could be related to functional issues, faulty construction of the restoration, or faulty placement. In addition, there could be material failure-related implications.

The treatment options for this problem depend on the degree of failure and the overall strength of the remaining ceramic restoration. Treatment options could include placing a Class IV composite restoration to recreate the broken/missing area. If the ceramic restoration was recently placed, it may be prudent to consider replacing the entire restoration.

If it is an older ceramic restoration, the failure could be related to stresses in the ceramic as a result of years of service. Micro-cracks can lead to weakening in the ceramic restoration that would require replacement of the entire restoration as the optimal solution. However, if the ceramic structure appears intact, the life of the restoration can be extended with a Class IV resin restoration or composite veneer. Depending on the situation, these may be considered a short-term solution.

### Developing Natural Tooth Coloration

In natural dentition, two factors directly influence tooth coloration: dentin and enamel. Enamel acts as a fiber-optic structure that transmits light through its rods and into the underlying dentin. The primary source of tooth color is beneath the enamel layer. Internal color contributes greatly to the depth and vitality of natural dentition. As light reflects, refracts, and absorbs in different areas of the tooth, having a restorative material that mimics dentin is important.

Ceramic restorations use shaded porcelain powders and modifiers to mimic tooth coloration. Therefore, in situations where broken ceramic restorations need to be repaired, a composite resin with a “chameleon effect” is needed to esthetically blend to the porcelain restoration. In addition, having a composite material that has little to no

polymerization shrinkage provides a seamless restorative interface between the ceramic and composite resin material (Figure 2 [View Figure](#)).

### Progress in Material Science

Recently, dental science has responded with new advancements in composite resin technology. With the latest generation of nano-hybrid composite resins a new plateau in cosmetic-restorative dentistry has been reached (Figure 3 [View Figure](#)).

With tremendous improvements in material chemistry, this new generation of composite resins includes a new and improved high-density radiopaque (HDR) filler. In addition, in collaboration with DuPont Corporation, a new proprietary monomer that provides low shrinkage and low shrinkage stress was created. Clinically, this improves marginal integrity to reduce microleakage.

The new HDR filler directly enhances the surface hardness (low wear), upgrades handling properties (non-sticky/non-slumping), provides excellent polishability, and amplifies the radiopacity of the material. The result is a composite resin that is highly radiopaque, easy to handle and polishes to a mirror finish with very little effort. Moreover, the new composition has many different refractive index fillers so it has a chameleon-like match capability to the surrounding color of the area being restored. Clinically, this makes it easier to attain an invisible restoration, especially for Class IV and porcelain repairs leading to highly esthetic clinical results.

### Treatment Option 1—Minimally Invasive Dentistry

If the majority of the ceramic restoration is intact and viably strong, a minimally invasive (MI) restoration can be a viable long-term solution (Figure 4 [View Figure](#)). A Class IV composite resin restoration can correct this problem in one appointment. There are several critical steps in performing an invisible Class IV restorative repair. Correct preparation design is one of the keys to success in creating an invisible composite resin restoration. A long bevel is placed along the facial margin so there is a good transitional blending of the composite resin to the ceramic surface.

Next, micro-etching with aluminum oxide (eg, Micro-etcher II, Danville Engineering, San Ramon, CA) is completed on the porcelain surface to be restored to create micro-mechanical retention. Then acid-etching with 32% phosphoric acid is done to acidify the bonded surface (Figure 5 [View Figure](#)). An adhesive with a silane coupling agent (eg, Porcelain Repair Kit, BISCO Inc, Schaumburg, IL; Clearfil® Repair, Kuraray America, New York, NY; RelyX® Ceramic Primer, 3M ESPE, St. Paul, MN) should be used to chemically adhere the composite resin to the sand-blasted ceramic restoration (Figure 6 [View Figure](#)).

Then, a nano-hybrid (eg, Aelite™, BISCO; Filtek™ Supreme Plus, 3M ESPE) composite resin material is used to regain both strength and esthetics. In a Class IV restoration, composite resin with a good depth of shade and chameleon effect are crucial so that an invisible margin can be achieved. Using technologically advanced materials are important for ease of finishing and polishing. By using predictable finishing carbides (eg, Composite Finishing Kit system, Brasseler USA, Savannah, GA), finishing strips (eg, Epitex, GC America) and polishing discs (eg, Soflex Extra-Thin [XT] finishing discs, 3M ESPE; EP Esthetic Polishing

System, Brasseler USA) a natural surface finish can be created (Figure 7 [View Figure](#)). Finally, aluminum oxide polishing pastes (eg, Micro-diamond polishing paste, Ultradent Products, South Jordan, UT; Tru-Luster, Brasseler USA; Enamelize™, Cosmedent, Chicago, IL) with a soft goat-hair chamois (eg, LusterPro, Brasseler USA) can recreate a natural luster on the restorative surface (Figure 8 [View Figure](#)).

#### Treatment Option 2—Composite Resin Veneer

For a broken ceramic restoration that also needs to have refurbishment of the facial surface, a composite resin veneer is a viable treatment option (Figure 9 [View Figure](#)). This would still be considered a MI procedure. The preparation design is similar to the Class IV; however, it also includes a light preparation on the entire facial surface. Approximately 0.2 mm to 0.4 mm of preparation should be done to properly restore the tooth.

After micro-etching and placement of a ceramic repair adhesive, composite resin is carefully sculpted on the prepared porcelain surface to mimic the esthetics of the adjacent teeth. Free-hand sculpting techniques are used to properly develop the shape and form of the composite veneer. Careful adaptation of the composite resin is done so that a uniform layering is created.

With the use of finishing discs as well as finishing and polishing burs, the composite veneer can be properly finished to the existing ceramic restoration. In the same way as the Class IV restoration, the composite veneer can be a long-term conservative treatment solution in the repair of a moderately damaged ceramic restoration (Figure 10 [View Figure](#)).

#### Treatment Option 3—New Ceramic Restoration

In cases where the majority of the restoration is broken and the remaining ceramic restoration is compromised, a full replacement of the ceramic restoration should be considered (Figure 11 [View Figure](#)). Replacing a single ceramic restoration can be more difficult than repairing it with a conservative composite resin. Therefore, careful assessment should be taken before considering replacement of the ceramic restoration. However, if a new ceramic restoration is treatment planned, there are several important factors that need to be contemplated.

Whether color matching to a natural adjacent tooth or blending the new restoration to existing restorations, proper shade selection must first be done. Through a series of high-resolution photographs, the hue, value, and chroma of the adjacent dentition are conveyed to the ceramist. In addition, during treatment, the remaining ceramic pieces should be carefully removed and submitted to the laboratory for shade analysis. Having an experienced ceramic artist is extremely important so that the right color blend as well as the correct size, contour, and characterization can be attained in the new restoration.

Color may be modified using internal luting resin (eg, Choice™ 2, BISCO) or custom staining of the ceramic restoration. Then, final bonding is accomplished using a dental adhesive (eg, All-Bond 3™, BISCO) and a light-cure-only luting resin (eg, Choice 2, BISCO; RelyX® Veneer Kit, 3M ESPE). Light-cure (eg, G-Light™, GC America; Sapphire™, DenMat, Santa Maria, CA; Optilux® 501, Kerr Corporation, Orange, CA), then finish the restoration with a series of fine diamond burs (eg, Porcelain Finishing Kit, Brasseler USA) and polishers (eg, Intraoral

Diamond Polishing Kit, Brasseler USA). Finally, a micro-diamond polishing paste (eg, TruLuster, Brasseler USA) with a polishing wheel can give the new ceramic restoration a luster that is next to nature (Figure 12 [View Figure](#)).

### Conclusion

Broken ceramic restorations in the anterior region are a common problem. In correcting this problem it is always important to understand the issues that surround the reason for the broken restoration. After proper assessment of failure is completed and a treatment selection is made, careful informed consent should be attained so that the patient fully understands the treatment options available as well as the lifespan of each modality of correction. Using good techniques and quality materials is the best approach to achieving long-term success with cosmetic-restorative dentistry.



**Figure 1** Chipped porcelain in the anterior region is a common problem that can occur in the general practice.



**Figure 2** A nano-hybrid composite resin is placed and sculpted to repair the chipped porcelain.



**Figure 3** The ceramic restoration is restored with a minimally invasive composite resin restoration.



**Figure 4** The ceramic restoration is chipped from excessive lateral excursive stress.



**Figure 5** Conditioning of the ceramic restoration with phosphoric acid acidifies and cleanses the restorative surface before placing porcelain repair adhesive.



**Figure 6** An adhesive with a silane coupling agent is used to bond the composite resin to the ceramic restoration.



**Figure 7** After restoring the chipped ceramic with a nano-hybrid composite resin, finishing carbide burs are used to refine the restorative surface.



**Figure 8** With the next generations of nanohybrid composite resins, an invisible restoration can easily be achieved.



**Figure 9** A broken and discolored ceramic restoration can be repaired with minimally invasive treatment.



**Figure 10** A minimally invasive composite veneer was used to refurbish this ceramic restoration.



**Figure 11** Careful assessment of a

**Figure 12** For long-term cosmetic

severely broken ceramic restoration is done before determining the optimal clinical treatment option.

restorative success the ceramic restoration was replaced. Esthetic principles were used to naturally match the adjacent porcelain veneer and natural dentition.

### **About the Author**

#### **Wynn H. Okuda, DMD**

Past President and Board Accredited Member

American Academy of Cosmetic Dentistry

Fellow, International College of Dentists

Private Practice

Honolulu, Hawaii