

Using Opaquers under Direct Composite Resin Veneers: An Illustrated Review of the Technique

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ABSTRACT

In restorative dentistry direct composite resin materials can be used to conservatively resolve many esthetic problems. Opaque resins are often necessary to mask discolorations and/or dark backgrounds when restoring anterior teeth. This article presents a direct composite resin veneer technique using opaquers. Potential problems with the tone of restorations after the use of opaquers are discussed. Advantages, limitations, and the clinical technique are presented. Training, as well as attention to the technique, contributes to an acceptable result.

CLINICAL SIGNIFICANCE

Resinous opaquers can be used as a valid adjunct to the direct composite resin veneer technique when conservatively restoring dark teeth.

(J Esthet Restor Dent 15:327–337, 2003)

Resin-based composite materials have evolved substantially over the past 20 years. Composites' physical properties, as well as their potential to bond to substrates using resin adhesives, have improved considerably when compared with the early generations of composite materials. As a consequence of these improvements, composite application has expanded from small conservative restorations to more extensive but still conservative restorations in fractured anterior teeth and direct composite veneers.^{1–3} In addition to improvements

In the material's physical and mechanical properties, clinicians have developed better composite application techniques, including a better perception of color matching of composites to natural teeth.^{4–6} Direct composites are currently used successfully for the correction of minor esthetic defects such as unsightly anterior teeth with poor color and shape, faulty restorations, and minor lack of alignment.⁷ Knowledge of dental materials and their application, hand skills, and an artistic eye are necessary to restore

proper contour, shape, and surface texture to the involved teeth.^{8–11} These requirements are especially demanded when the procedure involves a dark background such as the conservative restoration of a dark tooth.^{12,13} A good understanding of hue, chroma, value, translucency, opalescence, and opacity is an important requirement.^{14,15} Effective masking of the axial/pulpal wall of the preparation when restoring a dark tooth is a great challenge in the use of esthetic

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direct composites in particular. Direct composites have inherent limitations when it comes to their opacification ability. Opaquers are fluid dimethacrylate (BIS-GMA) resins, typically light cured, that contain strong pigments to give them a distinct hue, saturation, and opacification potential. Opaquers are used to mask a dark axial wall that would otherwise be visible or to incorporate subtle tones in the restoration. The opacification technique Baratieri and I have described makes it possible to mask such dark backgrounds and obtain appropriate surface tone with direct composites.^{1,2} Without the use of opaquers, a thicker increment of restorative material is necessary to mask the dark color of the tooth. This can only be achieved by either cutting more tooth (increasing the depth of the preparation) or by overcontouring the restoration.

The purpose of this article is to describe the use of opaquers when restoring anterior teeth with a composite resin veneer. Limitations commonly encountered when using opaquers are discussed, and an illustrated clinical protocol is presented.

LIMITATIONS: HOW TO OVERCOME COMMON ERRORS WHEN USING OPAQUERS

Because opaquers have a great opacification potential even in thin layers, they allow for a good opacification effect with a conservative tooth preparation and proper con-

tour of the veneer. However, there are limitations in the use of opaquers. Some of the most commonly observed errors result in a grayish composite surface tone, matte composite surface, and/or spotted composite surface.

Grayish Surface Tone

A grayish restoration can be the result of one or both of the following:

- Inefficacy of the opaquer to mask a dark background, or lack of opacity. Not all available opaquers offer the same opacification potential. When a tooth is heavily discolored, strong opaquers offer better results (eg, OA1-ARTglass[®], Heraeus Kulzer, Irvine, CA, USA).¹

Because composite resins are efficient only when used with marked thickness, there is generally a lack of efficacy in thinner areas, with the outcome being a grayish tone. To increase the efficacy of the opaquer in challenging cases, it is possible to mix powder opaque pigments with the liquid opaquer. Opaque pigments can also be mixed with composites on a paper pad.¹⁸

Powder pigments are ideal for this function, being available in ceramic systems. Nally and Meyer have described opaque porcelain as a ceramic powder containing 15% opacifying metal oxides (eg, titanium, zirconium, tin, rubidium, barium, and zinc

oxides).¹⁹ The function of the metal oxides is to mask highly reflective underlayers by scattering incident and reflected light. These ferric oxides are the same ones used in liquid pigments sold for composites (Ceranco B[®], Ceranco Inc., East Windsor, NJ, USA; WillCeram[®], Williams Gold Co., Buffalo, NY, USA).²⁰ The tone is guided by the color selection for the tooth; for instance, if the expected result was a shade B1, the powder pigment of choice would be white or opaque-B1. If the desired color was A4, the powder pigment would be more saturated. This method is expected to produce a homogeneous final mixture, free from voids and/or air bubbles.¹⁸

- Insufficient amount of opaquer: The use of a strong opaquer may result in a grayish surface when the amount used is insufficient. The use of opaquers requires experience, training, and a feeling for cause and effect. Too little opaquer results in not enough opacification, and too much opaquer gives a matte (lifeless) appearance. There are indications in the literature that the opaquer should mask not more than 70% of the dark area.^{17,19} It is recommended that the clinician practice the use of opaquers in a supervised laboratory setting to achieve a reasonable level of comfort with the technique; one should not use a trial-and-error approach while providing patient care.²¹

Composite resins are limited in their capacity to hide a dark prepared tooth (Figure 1). A relatively thick composite layer (1.0–1.5 mm) is required to obtain a restoration with adequate color and not to let the darkness of the substrate be seen through the composite layer.^{12,22–24} Nevertheless, in this clinical example a gray tone is still present, showing the influence of a dark tooth through the resin layer applied. Hybrid opaque composites used in layers of < 1.0 mm over preparations intensively discolored do not usually solve the problem either (see Figure 1). These dark preparations can only be properly masked using opaquer.

Matte Surface

A matte or very opaque composite surface can result from the use of opaquer. Unlike the grayish surface, the matte surface occurs when the opaquer is too strong for the selected case, is too close to the surface of the tooth, or is applied in too thick a layer. Matte surfaces are more often seen in situations of high translucency and opalescence of the anterior teeth. In opaque dentitions the matte surface becomes less apparent. The translucent condition of teeth also defines the technique to be used for esthetic treatment. The brighter and more translucent the teeth, the harder it is to esthetically treat a dark tooth. In such cases techniques using less conservative preparations such as full crowns might be a more adequate alternative.²⁵ Matte surface tones occur as a result of the following:

- Excessive opacity. Even when used in thin layers, strong opaquer can result in a matte surface. Strong opaquer can be diluted with BIS-GMA or fluid resin, without any solvent. Some of the opaquer kits come with the diluter enclosed.
- Opaquer proximity to the surface. Not only must the opaquer be applied in a thin layer; it must also be relatively far from the restoration's surface. It is necessary to invest the opaquer with a layer of hybrid or microhybrid composite that has a minimum thickness of 0.3 mm. This resin layer serves as a filter for the opaquer layer, preventing the latter from being seen through at the surface and characterizing the matte appearance. The use of grayish or bluish pigments at the proximal and incisal regions helps to subdue the matte effect.
- Excessive amount of opaquer. Too much opaquer can cause



Figure 1. Case 1. Facial view of teeth showing strong discoloration. The patient in this case was treated with direct composite resin veneers.

excessive opacity even with mild opaquer. It is necessary to establish a balance between opacity level, amount, and proximity to the surface. As a general rule, two thin layers of the opaquer applied with a brush suffice. In cases in which more layers are deemed to be necessary, the professional may use a stronger opaquer.

“Spotted” Surface

A spotted surface appearance is usually worse than a grayish or matte surface. It results from a nonuniform application of the opaquer to the dark axial wall of the tooth preparation. Any dark area not covered with a homogeneous layer of the opaquer may become apparent from the surface, giving the appearance of grayish spots. To prevent this problem, extra care is necessary at the time the opaquer is applied to ensure that a homogeneous layer covers the axial wall uniformly. It is advisable to step

away (1–2 m) from the tooth to have a more general view of the working field in an effort to localize those points not properly covered by the opaquer.

CLINICAL CASE 1

Case 1 involved the restoration, with direct composite veneers, of the maxillary central incisors depicted in Figure 1. The patient was a 45-year-old female, and the planned treatment was to replace the existing class III composites with new composite restorations, extending the composite to the facial surfaces to improve the overall outcome. A small overbuild in contour for both incisors was planned also.

Tooth Preparation

The facial enamel was only slightly roughened with a diamond bur to render it more receptive to the adhesive procedures. This no-preparation approach was possible owing to the evolution of the technique to apply opaquers under direct composite veneers, making possible a solution with only an average thickness of 0.3 mm.¹ As a result, a slight 0.3 mm overcontour was created on the restored teeth.

To avoid damage to the soft tissue, a gingival protector instrument was used (Zekrya[®] Gingival Protector; Maillefer, Switzerland), along with a retraction cord (Ultrapack[®] no. 00, Ultradent, South Jordan, UT, USA).

The tooth was cleaned with an air-water spray and adhesive pro-

cedures were started, with the adjacent teeth protected with a Mylar[®] matrix strip (DuPont, Wilmington, DE, USA). After etching with phosphoric acid, the tooth was washed and gently dried; a one-bottle adhesive system was then applied and light cured for 20 seconds (Adper Single Bond[®], 3M ESPE, St. Paul, MN, USA) (Figure 2). Note that the application of the adhesive made the underlying discoloration more evident.

Opacification Procedures

In our efforts to create a restoration with enhanced physical properties, the masking procedure step was of utmost importance. The opaquer used had to have chemical compatibility with the restorative composite resins, be capable of being light activated, and have conditions to mask dark tones with relative ease. In addition, the opaquer had to have a consistency that allowed for easy placement. Various adequate opaquers are now available. For our purpose, a mixture of opaquer A1 (Heraeus Kulzer) and white powder (VITA[®] white stain, Vita Zahnfabrik, Bad Sackingen, Germany) was selected. As these products are composed of ferric oxides and BIS-GMA, their use with composite resins was feasible.¹⁸ A thin brush (Torrax[®] no. 000-409, Condo, Jaraguá do Sul, Brazil) is a good tool to apply the opaquer in a very thin layer. Following the hybridization step the material was applied and light activated for 60 seconds (Figures 3 and 4).¹⁹ To prevent reversion of

the final outcome, the opaquer was applied incrementally. When excessive amounts of the opaquer are applied, the restoration exhibits a color that is as artificial as that of an acrylic temporary. The opaquer should not be allowed to pool, nor should it be placed on the margins of the restoration.

Composite Placement

Following application and proper cure of the opaquer, an opaque hybrid composite was applied (Charisma, A-20, Heraeus Kulzer) (Figure 5) using brushes (Torrax no. 2-412) and spatulas. Small stratified increments of the hybrid composite were applied, covering the veneer preparation in its entirety (Figure 6).

Blue and gray tints (Tetric Color[®], Ivoclar Vivadent, Schaan, Liechtenstein; Creative Color System[®], Heraeus Kulzer) were used to modify the incisal resin, improving the aspect of the incisal third of the tooth (Figure 7). Using great care, increments of a microfill composite resin (Filtek[®] A110, 3M ESPE) and incisal translucent microfilled resin (Micronew Incisal[®], medium gray, Bisco, Itasca, IL, USA) were applied (Figure 8). Only brushes and spatulas were used for final contouring and surface texturing (Figure 9).

In the gingival areas of the restoration, a scalpel blade was employed to remove any flash or excess composite material. Aluminum oxide



Figure 2. Case 1. Close-up view of the one-bottle adhesive system applied on the enamel surface. Burs were not used to reduce the facial surfaces. Class III composite was replaced because it was not considered acceptable.



Figure 3. Case 1. View of the opaquer. The hue, chroma, value, and opacity were specifically calculated for these surfaces. To achieve greater efficacy, it is possible to mix opaque pigments with the composites. Powder pigments, ideal for this function, are available in ceramic systems.

finishing disks (Sof-Lex™ Pop-on, 3M ESPE) were used to finish the surface of the restoration. Only the less abrasive disks from the series were used to avoid removing the surface texturization created with the brushes. Excess resin was removed interproximally with

fine-grit diamond strips (Enhance Strip, Dentsply/Caulk, Milford, DE, USA), with care taken not to tamper with the interproximal contact. To prevent the veneer from breaking, the interproximal resin flashes were eliminated. To give the veneer surface a higher

gloss and still preserve surface texture, a composite polishing paste (Opal® no. 520-000, Renfert, Germany) was used with a buffing disk (Flexibuff®, Cosmedent, Chicago, IL, USA). Figures 10 and 11 show immediate postoperative views of the completed restoration.



Figure 4. Case 1. The opaquer was applied incrementally in two separate layers, each one being cured for 60 seconds.



Figure 5. Case 1. The masking process sequence uses an opaque hybrid composite. Small stratified increments of the hybrid composite must be applied, layering the veneer preparation in its entirety.



Figure 6. Case 1. View of the hybrid composite layer. The three conditions causing a “dead surface” are evaluated at this stage: (1) an overly strong opaquer, (2) opaquer too close to the surface, (3) an excessive application of the opaquer.



Figure 7. Case 1. Blue and gray tints were used to modify the incisal resin. If the tooth seems to be too opaque at this moment, it is possible to apply the tints in the middle third too.



Figure 8. Case 1. View of the increments of a microfill resin and incisal translucent microfilled resin. The translucent resin covers the tint details. Brushes and spatulas were employed for the final shaping and surface texturing.



Figure 9. Case 1. Facial view of the teeth prior to polishing procedures. The surface texture and contour would be enhanced with the use of specific brushes. In many cases, no finishing procedures are necessary.



Figure 10. Case 1. Lateral view of the direct resin composite veneers. The advantages proposed by the technique are reduced tooth preparation, less weakening of the tooth, and a lesser chance of creating an overcontour in the veneer.



Figure 11. Case 1. Frontal view of the direct resin composite veneers after polishing procedures.

CLINICAL CASE 2

A 12-year-old girl came to the office to have her maxillary left central incisor treated. The tooth presented a defect that is common in enamel hypoplasia (Figure 12). In addition, its mesiodistal width was smaller than that of the adjacent central incisor. After agreeing on the treatment alternative with the child's parents, a diagnostic restoration was proposed using composite resin. No adhesive procedure was used for this step. The idea was to solve the problem without the need for tooth preparation.

The opaquer and the resin were applied on the cleaned and dry facial surface of the tooth. A series of mixtures of opaques were made and tested on the defect to obtain an ideal opacity that is, mask the stain, and at the same time not leave the opaquer visible on the surface of the restoration. This masking procedure took a long time. A thin layer of a microfilled composite resin was applied over the opaquer to obtain surface texture and shine. The diagnostic restoration, once completed, was approved by the patient and her parents (Figures 13 and 14). The restora-

tion was carefully removed with the aid of dental floss (Figure 15).

For this particular case, the diagnostic restoration was saved and bonded permanently to the tooth on a subsequent appointment. It is recommended that the restoration be cemented at the initial appointment, when bond strength is better. The previously fabricated resin veneer was luted with the same microfill resin that covered the opaquer. The resin was diluted in adhesive to reduce its viscosity. The final view is presented in Figure 16.



Figure 12. Case 2. Preoperative view of a central incisor with hypoplasia defects. The width of the tooth was also compromised.



Figure 13. Case 2. View of the inner surface of the restoration. The opaque layer can be seen.



Figure 14. Case 2. The superficial view of the restoration. The opaque layer is difficult to observe.



Figure 15. Case 2. The diagnostic restoration was removed with the aid of dental floss.



Figure 16. Case 2. Final view of the restoration luted as a semidirect restoration. The procedure solved the problem without the need for tooth preparation.

CLINICAL CASE 3

The patient in case 3 presented with a dark endodontically treated tooth. The endodontic treatment had been performed a long time previously (Figure 17). For this patient it was deemed necessary to create space for the composite veneer by slightly preparing the facial aspect of the tooth. After the typical facial reduction for veneer was completed (Figure 18), the

opaque mixture was applied to the hybridized surface of the tooth. Severely discolored teeth, as presented in this article, do not respond well when treated with internal bleaching; however, the opaque layer masked all the dark spots regardless of their intensity (Figure 19). Following application of the opaquer, hybrid composite resin was applied to give the tooth pertinent tones. A white composite

was applied to the middle third of the tooth. The cervical resin was modified with red pigments to obtain a better transition to the soft tissue. Finally for the incisal third, blue and gray pigments were mixed and applied to create a natural aspect (Figure 20). A color diagram exhibiting the different tones used in this case is presented in Figure 21. A close-up view is presented in Figure 22, and the final result can be observed in Figure 23.



Figure 17. Case 3. Preoperative view of the darkened central incisor.



Figure 18. Case 3. A depth reduction of 0.5 mm was performed. A direct composite resin veneer was planned for the tooth, of which the darkened dentin can be seen. The old restoration was considered acceptable in the biologic and mechanical aspects; to illustrate the potential of the technique, the restoration was not replaced.

DISCUSSION

When a dentist tries to give a tooth back its natural color, great challenges are faced using direct composite resin restorations over severely discolored teeth. Indirect restorations can frequently offer advantages over direct restorations for various reasons. Artistry can be exerted by a technician capable of realistically imitating the restorations with stronger and more stable materials such as dental porcelain.¹ The natural translucency of a tooth can be uniquely mimicked with ceramics when applied by a trained technician.²⁶ Nevertheless, indirect techniques are bound to be considerably more expensive fees and typically more time consuming when compared with direct restorative techniques.

Composite resins have been proved to have many excellent aspects, such as reduced cost, versatility, advantageous chairside control, and potential for repair.²³ Composite materials are substantially



Figure 19. Case 3. An opaque layer was applied and cured in small separate increments.



Figure 22. Case 3. Close-up of the composite veneer.



Figure 20. Case 3. After application of the opaque layer, hybrid translucent resin was applied to give the tooth a natural aspect. Different tones were applied to the cervical, middle, and incisal thirds (red, white, blue, and gray tints were used for this purpose).

improved when compared with previous generations of similar materials. Restorations made with contemporary composites maintain surface texture and anatomic form better than did former composite resins.

²⁷

A significant limitation, however, is the lack of skill some practitioners demonstrate in handling the material; however, proper training under supervision can overcome this problem. ²⁵ An improved technique and a good understanding of the concepts of color;

translucency, opacity, and optical and physical properties of composite resin restorative materials, as well as their relationship to the optical aspects of a sound natural dentition, can be developed through training. ²⁸

The technique presented in this article offers an esthetic and extremely conservative solution for the restoration of dark anterior teeth. This technique is adequate only for selected cases in which it is possible to increase tooth



Figure 21. Case 3. A color diagram can be used to guide the clinician through the color reproduction sequence.



Figure 23. Case 3. Final view of the composite veneer and adjacent teeth.

thickness or to create a slight over-contour of about 0.3 mm and not compromise periodontal health. Perfectly aligned smiles are not suitable candidates for the procedure. Less conservative preparations and restorative techniques should be considered in cases not suited for the described technique.^{1,7}

CONCLUSIONS

The composite resin veneer technique described in this article makes it possible to restore a tooth's color with minimal or no tooth preparation. However, one must be aware of problems that can be brought about with the use of opaquers. When using this technique, it is important to impart the correct degree of opacity to the restoration. An easier and swifter outcome can be achieved when these characteristics are duly considered.

ACKNOWLEDGMENTS

The authors wish to thank Rui Pastre and dental student Robson J. Sampietro for their significant assistance in the clinical procedures for case 1. Our thanks also to dental student Amanda Dixon Di Cerqueira (University of North Carolina School of Dentistry, NC, USA) for the English review

DISCLOSURE

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