

Ultimate Aesthetics With Composites: When Art and Science Merge

By Newton Fahl Jr, DDS, MS

Anterior aesthetic restorations have long been an area of concern both for the aesthetically conscious and demanding patients as well as for extremely meticulous practitioners. Demanding patients urge us to provide them with state-of-the-art aesthetic restorations. The ultimate goal of the restorative dentist is to create restorations, be it direct or indirect, that will mimic all the artistry and beauty of nature while imparting strength and function.

Unfortunately, the prevalence of fractured anterior teeth is increasingly high and constitutes a significant percentage among all treatment modalities in many dental practices.¹ Much progress has taken place since the early reports on the repair of fractured anterior teeth.^{2,3} Various materials and invasive techniques that elicited unsightly results have been advocated in the past.⁴ Presently, advancements in adhesive technology and composite resin materials have enabled us to create restorations that not only preserve and reinforce tooth structure, but also unquestionably present truly superb aesthetic results. With the aid of spatulas and brushes, the artist-dentist can incrementally sculpt a restoration to its final shape and color. Hence, by means of an incremental technique, the aesthetic result of a restoration can be scrutinized from shade selection to its final polishing, and the free-hand bonder has absolute control of each restorative step.

Several reports of special interest have been published that propose a thorough and methodical protocol for the incremental application of composite resins in the restoration of anterior teeth.^{5,6} This article addresses common clinical challenges when restoring class IV defects, namely, selecting the shade and correlating it with the restorative resins, disguising the fracture line at the tooth-composite interface, and blending the composite restoratives with the tooth structure to achieve a life-like restoration.

INITIAL CASE EVALUATION

After an accurate history has been obtained, initial radiographic and clinical examination of the palpal

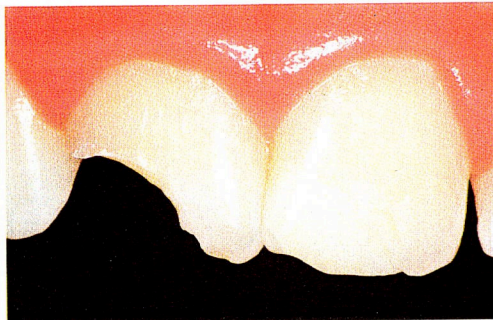


Figure 1.

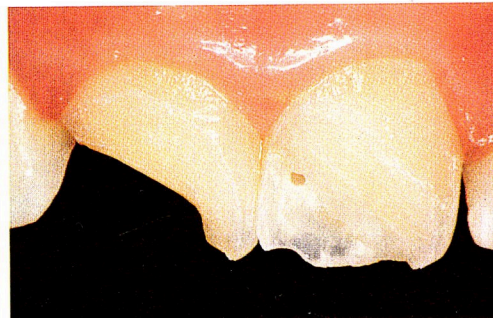


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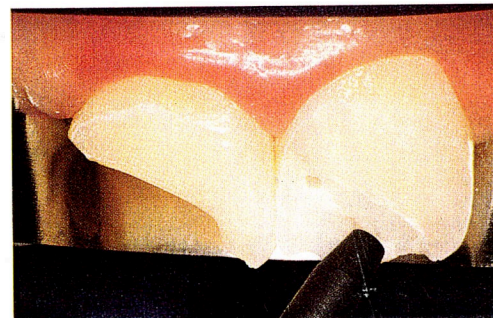


Figure 5.

injury, and any necessary action must be taken toward solving probable acute pathologies present. Next, for restorative purposes, a thorough visual assessment should be carried out to determine occlusion, the morphologic, histologic, and optical characteristics of sound adjacent teeth, and the polychromy of sound adjacent teeth.

Occlusion

It is of paramount importance to

evaluate, in the case of a large fracture, if the composite restoration will be under great occlusal stress. Depending on the situation, a stronger restorative material, such as a laboratory processed composite restoration or an all-ceramic crown, should be preferred.

Morphologic and Optical Characteristics

A sound contra-lateral tooth must be used as a reference to guide the

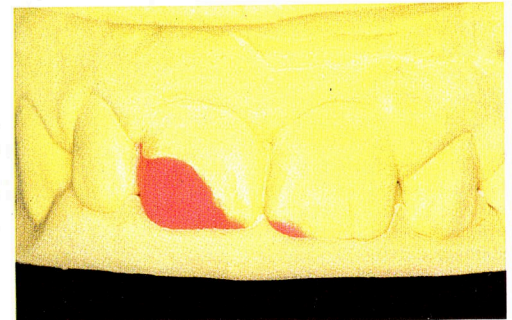


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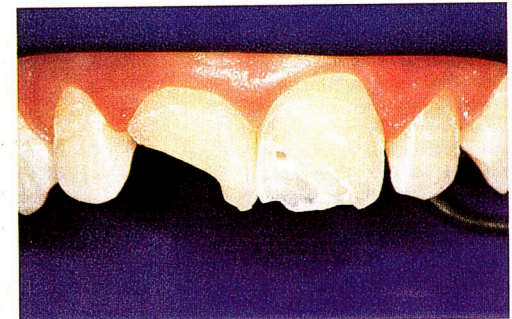


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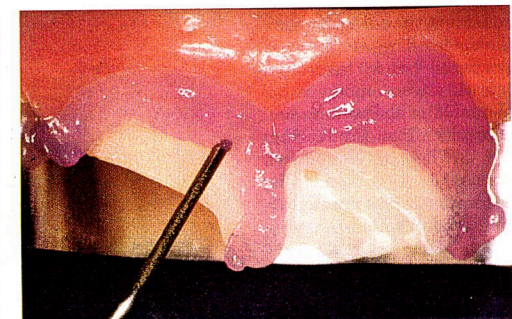


Figure 6.

restorative dentist in gathering as much information as necessary to enable the attainment of a natural-looking restoration. All this information must be collected and recorded in a chart. The primary, secondary, and tertiary anatomy can be deduced from a natural tooth. For central incisors, absolute symmetry is the key to morphologic success. One central incisor must be a mirror image of the other. The form of the lobes, depth and length of the developmen-

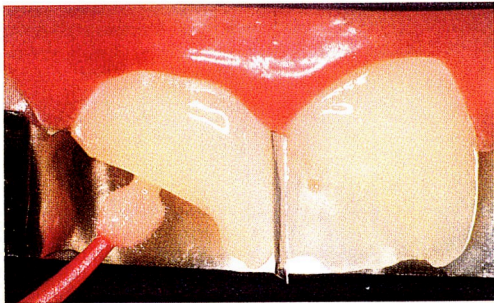


Figure 7.



Figure 8.

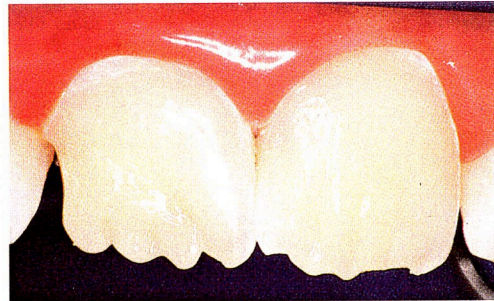


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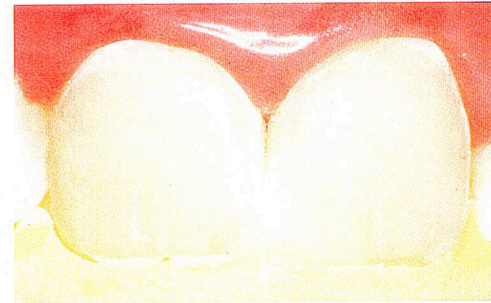


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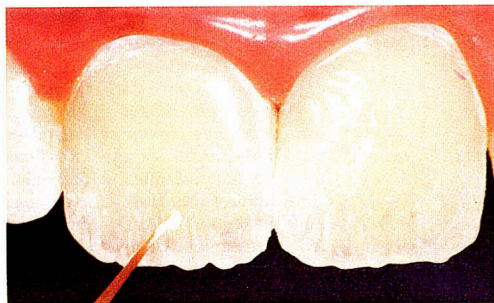


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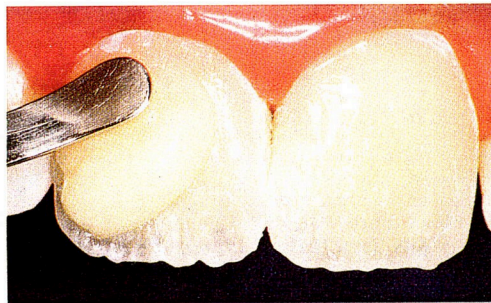


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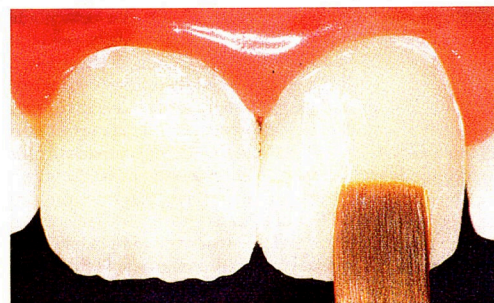


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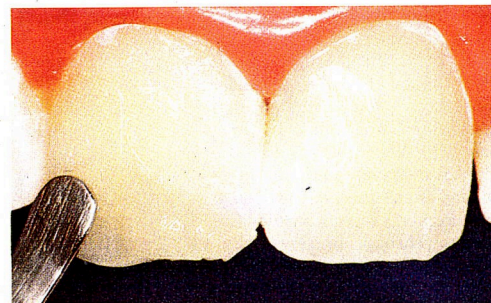


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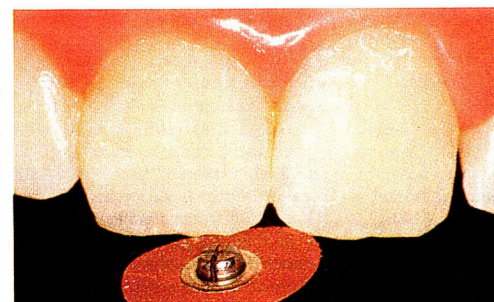


Figure 15.



Figure 16.

tal grooves, and surface texture ought to be assessed, preferably, with the aid of magnifying loupes, and charted accordingly in a schematic drawing.

A precise determination of the amount of lost enamel and dentin will help the operator in the selection of the restorative composite resins that will be employed to substitute the missing tooth structure according to the varying degrees of translucency and opacity. Just as a ceramist will use different porcelains bearing different optical characteristics, so must the dentist understand the histologic and optical properties of a natural tooth and the way they correlate with the restorative composites to incrementally build up the missing tooth structure.

Polychromy of Sound Adjacent Teeth

A variation in hue, chroma, and value is what renders the tooth polychromatic. When the facial aspect of the anterior dentition is thoroughly examined, the tridimensional color system of Munsell can be readily perceived. Even though monochromatic teeth are found, polychromatic teeth nuances are generally thought to be more attractive to the aesthetic eye.^{7,8} Subtleties in color variation — generally not perceived from a conversation distance — are perhaps one of nature's greatest wonders and become a challenging goal when restoring the anterior dentition with fidelity.

PREOPERATIVE CONSIDERATIONS Establishing Tooth Contour

The optimal length of the central incisors must be determined first. The correct ratio suggests a width of 75% to 80% of the length of the clinical crown. A composite mock-up may be used for further subjective aesthetic assessment. A caliper should be used to record the length and width measured. Another helpful device to guide the dentist in reconstructing the tooth to its right proportions is a polyvinylsiloxane matrix made from an impression of the mock-up.⁹ This aids in building each composite increment to its exact contour, without trespassing the boundaries of the desired tooth form.

Shade Selection

Shade selection must be performed invariably before rubber dam isolation, since tooth dehydration results in an elevated value and may cause the selection of an incorrect shade. Prior to shade selection, the teeth must be thoroughly cleaned to rid all the plaque and superficial discoloration that may interfere with the perception of color. If the tooth to be restored presents with severe discol-

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oration, or there is much structure lost, a sound central or lateral incisor, or even the incisors of the lower arch, may be used as a reference for shade selection. Since most composite resins are coded according to the Vita shade guide, the following steps should be followed for proper shade selection:

Value Selection

The Vita shade guide must be rearranged according to the value (from B1 to C4), and divided into thirds by imaginary lines; the third closest in value to the tooth being used as a refiner is selected.

Hue Selection

The basic hue of the tooth, which can be best seen in the middle and cervical thirds, is selected according to the Vita shade guide: A (brown), B (yellow), C (gray), and D (reddish-brown).

Compartmentalization of the Tooth

Horizontal and vertical imaginary lines are pictured along the thirds of the clinical crown for the purpose of compartmentalizing the surface area. This facilitates for a much more detailed visualization of the intricate polychromatic characteristics of each area of the crown.

Chroma Selection

Subtle or striking chroma variations can be perceived for each individual compartment. Usually the cervical third presents a higher chroma (more saturated hue) than the middle third.

Selection of Maverick Colors

Maverick colors, as well as hypoplastic spots and mottled enamel, which normally contribute to a pleasing hue variation, must be observed.

Charting the Polychromatic Characteristics

A schematic drawing, depicting the tooth four-dimensional color pattern, should be used as a reference for the reconstructive stage, especially in cases of severely impaired teeth.

Selection of the Restorative Composite Resins

Correlating the color chart with the restorative materials to select the composites employed as the "artificial dentin" and "artificial enamel" is perhaps the most important phase. There are basically two approaches to the selection of the restorative composites. One uses a hybrid composite core for strength and opacity, veneered with a microfill composite for polishability. The other uses a hybrid composite system throughout. Regardless of the technique employed, one requisite must be met

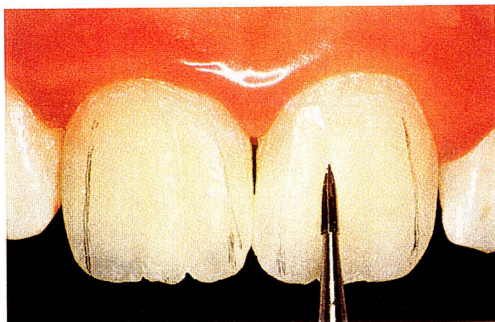


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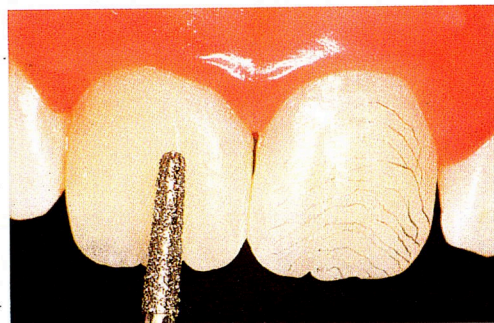


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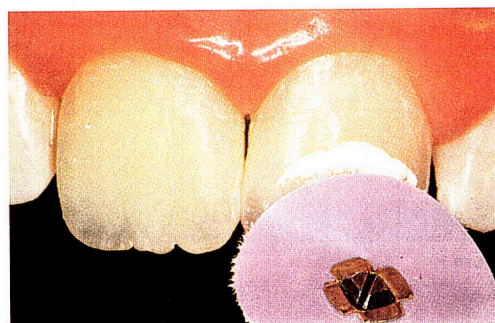


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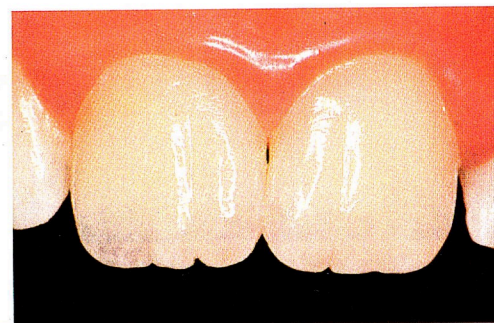


Figure 20.

by both, which involves achieving tooth polychromy imparted by restorative composites of varying shades and opacities. This article describes the use of one such hybrid system (XRV Herculite, Kerr) in association with tints and opaquer (Kolor-Plus, Kerr) for the restoration of fractured maxillary central incisors.

Selection of the Artificial Enamel

The artificial enamel is a translucent resin layer that covers the entire restoration, and must be selected first. The basic shade selected with the Vita shade guide is the body enamel shade and may be of only one or more hue variations depending on the polychromy presented by the tooth being restored. A small increment of the enamel composite selected is placed onto the middle third of the tooth, polymerized, and moistened with the patient's saliva to simulate the appearance of a highly polished composite. It should be remembered that hybrid composite resins are usually "lighter" (of higher value) at an unpolymerized stage, becoming darker (of lower value) after polymerization. If a chroma variation is perceived cervicoincisally, the same process must be repeated for each specific third or other more compartmentalized areas of the tooth.

The amount of incisal translucency and its nuances should be observed and the corresponding

incisal shades selected. The incisal third usually presents the greatest restorative challenge due to its frequent variation in hue, chroma, translucency, opacity, and the presence of maverick colors and, often, an opalescent halo. Examination of the intact incisal third of the sound tooth being used as reference, reveals the pattern to be followed restoratively. Any morphological and intricate color variations must be charted accordingly.

Selection of the Artificial Dentin

The artificial dentin is the core of the restoration bearing a chroma one to two degrees higher (more saturated) than that of the enamel shade selected. To determine the shade of the artificial dentin a try-in step is performed in the same method as for the artificial enamel. At this stage, the shape of the mamelons are established through direct clinical observation and transillumination and charted.

CASE PRESENTATION

A 13-year-old male presented with fractured maxillary central incisors. The fragment of the right central incisor had been reattached a few months before and exhibited sound bonding to the remaining tooth structure. Both teeth presented pulp vitality (Figure 1).

To properly establish tooth morphology during the restorative procedure,

a silicone mold was made off a waxed-up model (Figure 2). This aided in helping visually determine the length of the dentinal mamelons and the extent of the surrounding translucent incisal shades.

A long facial bevel that extended from the dentin-enamel junction (DEJ) to the outer surface of the tooth, and shorter lingual chamfer were placed with a bullet-nose medium grit diamond. Generally, the larger the fracture, the longer the bevel. The reattached discolored tooth fragment on the upper left central incisor was preserved for palatal guidance, while the bevel encompassed the entire facial aspect of the fragment extending beyond the fracture line (Figure 3).

Isolation was accomplished with rubber dam, using a modified technique for adequate field control (Figure 4).

All enamel and dentin surfaces were sandblasted (Micro-etcher II, Danville Engineering) to enhance adhesion,¹⁰ and rinsed thoroughly with water spray to remove the aluminum oxide powder (Figure 5).

The dentin and enamel were etched with a 37.5% phosphoric acid gel (Gel Etchant, Kerr) with the etchant being placed on enamel first then on dentin so that it was rinsed off thoroughly approximately 10 to 15 seconds from completion of the etching procedure. Excess water was blotted with a cotton pellet to avoid desiccation (Figure 6).

A hydrophilic adhesive was applied to ensure proper dentin bonding (Optibond FL, Kerr) (Figure 7). Regardless of the adhesive system employed, the bonding agent must be used following a strict protocol to ensure penetration and thorough saturation of the partially demineralized zone of the dentin for high bond strengths to be achieved and microleakage minimized.

The artificial dentin was built up in small increments (no thicker than 2 mm) for better control of the desired anatomy and to ensure optimal polymerization.¹¹ The initial increment was slightly feathered onto the beveled facial and lingual enamel to start blending-in the composite resin (Figure 8). Each increment was polymerized with a halogen curing unit (Optilux 500, Demetron/Kerr) for only 10 seconds to harden the restorative material. A build-up of the mesial-distal width 1 mm short of the proximal contact was achieved first. The desired shape of the dentin mamelons was achieved at this stage, allowing sufficient room for the artificial enamel along the incisal edge and around the mesial and distal point angles. The highly sculptable features of this hybrid composite allowed for the attainment of proper dentin morphology with virtually no slumping (Figure 9).

Disguising the fracture line requires the application of an opacous material over and along the tooth-composite interface. XR-V Herculite dentin shades are usually opaque enough to mimic the opacity of the natural dentin, thus imparting very life-like optical characteristics to the restoration. However, in instances where more opacity is required, opaquer or opaque microfill composites can be used to block out the light shine through.¹²

The desired cervico-incisal length of the tooth was achieved using the silicon mold as a reference. First, a more translucent incisal shade (XR-V Herculite Medium Incisal) was laid along the incisal ridge, between the mamelons and around the incisoproximal edges, slightly covering the

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mamelon lobes labiopallatally, and sculpted accordingly. Following this step, an opalescent halo effect was achieved by the application

of a translucent milky-white shade of material (XRV Herculite B1 enamel) around the translucent incisal shade. Thus, a "frame" of material was built to establish a point of reference for the subsequent layers of composites to

be applied labially, proximally, and palatally (Figure 10).

To emphasize the polychromy and brilliancy of the incisal third, tints, and opaques (Kolor+Plus, Kerr) were sparingly applied. Blue tint was applied around and

in between the mamelons where translucent effects needed to be further emphasized and A1 opaquer was dispersed along the incisal edge in order to emulate hypoplastic spots (Figure 11). The artificial enamel was

implemented in one increment and tacked to the facial aspect (Figure 12). To obtain proper facial contour and proximal contact, the enamel shade was spread to veneer the underlying "frame" cervico-incisally and mesio-distally, sculpted and finessed to its proper anatomical form with the aid of artist brushes (Figure 13).

To impart an enamel-like translucency to the restorations, a final layer of incisal composite (XRV Herculite Incisal Light) was applied to the incisal third and sculpted to the desired morphology (Figure 14).

The labial and lingual aspects of the restoration were additionally light-cured for 60 seconds.

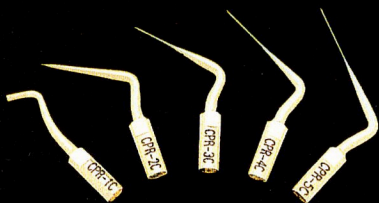
To avoid bonding the two adjacent restorations together, one was thoroughly finished and polished proximally using strips (ie, Eptax, GC America) and fine aluminum oxide disks (ie, Sof-Lex Pop-on XT, 3M) until the desired primary anatomy was established (Figure 15). To guide the attainment of symmetrical light-reflecting areas, lines were drawn along the ideal position of the proximo-labial line angles (Figure 16). For secondary anatomy (developmental grooves, lobes, cingulum, and marginal ridges), 12-fluted carbide finishing burs were used (Figure 17). Surface texturization was accomplished, using medium-grit bullet-nosed diamonds¹³ (Figure 18). Diamond (Compo-Strips, Premier) and plastic strips (Eptax, GC America) were used for interproximal finishing and polishing.

The whole restoration was buffed with polishing cups and points (Flexi-Cup and Flexi-Point, Cosmedent) to eliminate some of the undesired accentuated texturization. composite polishing paste (Foto-Gloss, Kota), with buffing discs (Flexibuff, Cosmedent) were used to impart a high shine to the restoration surface while still retaining the designed surface texture (Figure 19). After final polishing, the restoration was further light-cured for 60 seconds. The result was a highly aesthetic, biofunctional restoration that presented total integration with the surrounding natural tooth structure

TIP OF THE DAY

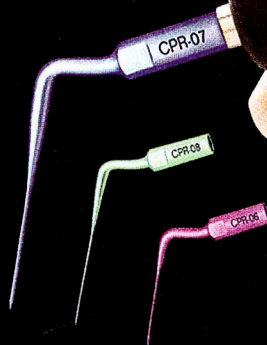
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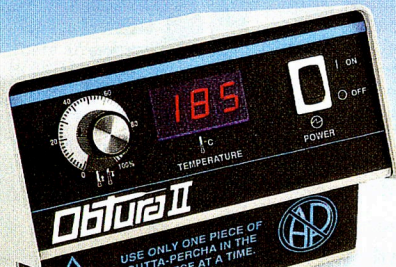


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CONCLUSION

Restoration of extensive class IV defects with composite resins is a feasible undertaking and is not as puzzling as it may seem. However, the ultimate aesthetic result will hardly ever be achieved without adequate training and the implementation of a proper armamentarium. Aesthetic dentistry demands keen observation, patience, and meticulous application of existing technique protocols learned through motivation and intensive training. Creativity is also part of our lives as dentists and letting it flow as we perform our direct-bonding restorations will make our profession even more enjoyable.

This article described how to achieve aesthetically pleasing and functionally sound class IV restorations based on the concepts of morphologic, histologic, and optical characteristics as well as polychromy of sound teeth, and their relation to shade selection and physical properties of a currently available highly aesthetic hybrid restorative system. ♦

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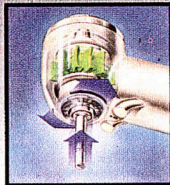
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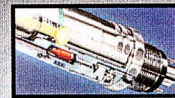
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Dr. Fahl received his DDS degree from Londrina State University, Brazil, in 1987, and his MS degree and Certificate in Operative Dentistry from the University of Iowa College of Dentistry in 1989. Dr. Fahl lectures internationally and gives continuing education programs worldwide. He is a member of the American Academy of Cosmetic Dentistry, the European Academy of Aesthetic Dentistry, and is a founding member and past president of the Brazilian Society of Aesthetic Dentistry. He is also a member of the editorial board of the *Reality, Practical Periodontics and Aesthetic Dentistry* and is editor of the new product review section of the *American Academy of Cosmetic Dentistry Journal*. Dr. Fahl is a featured instructor on direct bonding at the Las Vegas Institute for Advanced Dental Studies. He maintains a private practice in Curitiba, Brazil.



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