

Trans-Surgical Restoration of Extensive Class IV Defects in The Anterior Dentition

Newton Fahl, Jr., DDS, MS



Direct bonding is the most commonly utilized treatment for conservative aesthetic restoration of the anterior dentition. Class IV defects require special attention due to their high incidence, particularly in young patients. One of the major challenges for the clinician in treating defects in this category is selecting the appropriate restorative composite resin material that emulates the physical and optical characteristics of dentin and enamel and conceal the fracture line at the tooth/composite interface. Class IV defects with margins violating the biologic width present another concern, since this violation often impedes the attainment of the correct anatomic contours. The learning objective of this article is to describe a technique for achieving a correct integration of the periodontium, the tooth structure, and the restorative composite resin material to achieve a high level of aesthetic excellence.

The achievement of aesthetic anterior restorations has always been a concern for aesthetically aware patients and meticulous clinicians.

The objective is to achieve restorations, direct or indirect, that emulate the artistry and beauty of nature, while imparting strength and reinstating function. The incidence of fractured anterior teeth is high, and their restoration constitutes a significant percentage among all treatment modalities.¹ Reattachment of a fractured tooth fragment is the therapy of choice, provided the fragment is available and sufficiently intact to allow a functional and aesthetic reconstruction.²⁻⁴ However, when the fragment



Figure 1. Preoperative view of a fractured maxillary right central incisor 1 month following the injury.

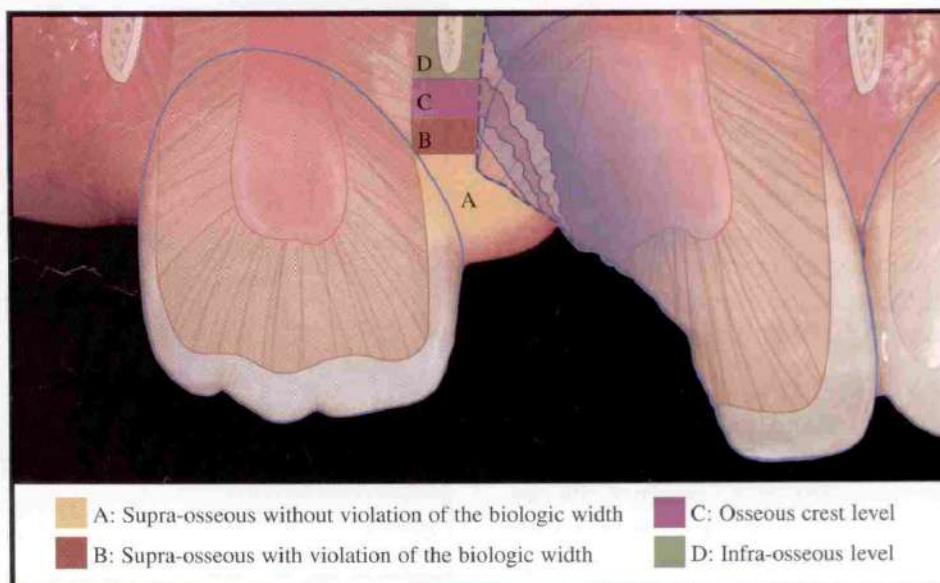


Figure 2. Drawing depicts the role of gingival extension of the fracture in determining the need for a surgical or nonsurgical therapy.

Newton Fahl, Jr., DDS, MS, maintains a private practice, emphasizing Restorative and Aesthetic Dentistry, Curitiba, Brazil. Dr. Fahl is a founding member and Vice President of the Brazilian Society for Esthetic Dentistry. He lectures internationally and conducts continuing education seminars on Aesthetic Dentistry in Brazil and other South American countries.

Address correspondence to:

Newton Fahl, Jr., DDS, MS
Av. Candido de Abreu, 526-1606/B
80530-905 Curitiba
Brazil

Tel: 011-55-41-254-4338 and
011-55-41-252-3749

Fax: 011-55-41-252-3749

is lost or a previous fracture or defective restoration is present, these instances demand the selection of direct restorative materials and techniques to restore the fractured dentition.

Considerable progress has taken place since the early reports on the repair of fractured anterior teeth.⁵⁻⁷ Advancements in adhesive technology and composite resin materials have enabled the clinician to create restorations that preserve and reinforce tooth structure and present superb aesthetic results. The artist/dentist can incrementally sculpt a restoration with spatulas and brushes to its final form and color. Using a build-up technique, the evolving aesthetic result can be scrutinized from shade selection to final polishing; using free-hand bonding, the clinician has absolute control over each restorative step. A thorough and methodic protocol has been proposed for the incremental application of composite resins in the restoration of anterior teeth.⁸⁻¹⁰

Fractures that occur in the maxillary anterior dentition can be of subgingival nature, impeding the achievement of acceptable restorations. When the biologic width is not violated,¹¹ non-surgical methods of tissue retraction and manipulation can be utilized.¹² If the biologic width has been compromised by a supra- or infraosseous fracture, a trans-surgical restorative approach must be employed. Unless a periodontist is immediately available, the restorative dentist must be able to perform the restorative therapy of the subgingival defect at the same appointment. This article presents a clinical implementation of such a procedure, with emphasis on the major concerns when performing Class IV restorations, ie, shade selection and correlation with the composite resins, concealment of the fracture line at the tooth/composite interface, and blending the various composites with the tooth structure.

CASE EVALUATION

An accurate dental/medical history is obtained and radiographic and clinical examination of the fracture site performed to determine the extent of the trauma, periodontal involvement, pulpal injury, and treatment required to resolve any acute pathology. The degree of root

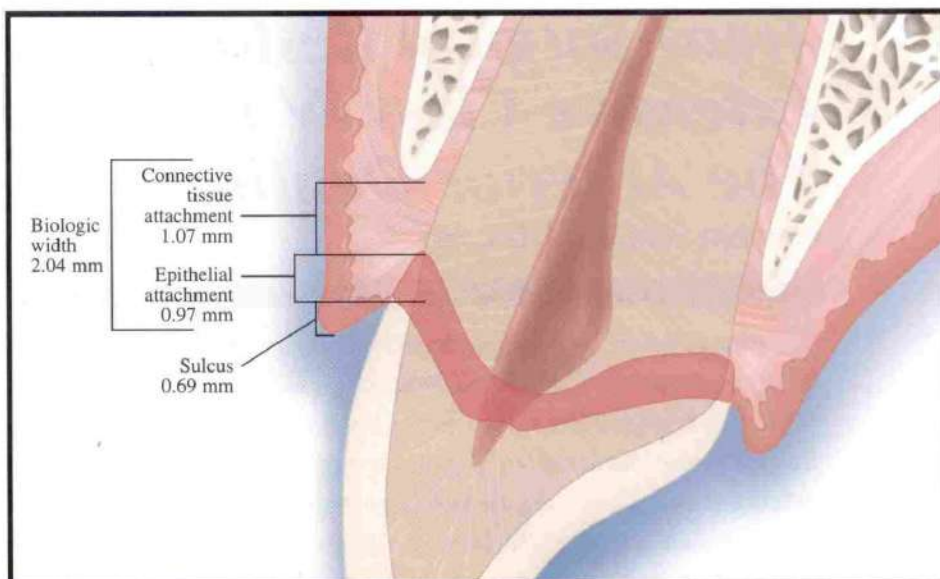


Figure 3. The biologic width is a dimension encompassing the epithelial attachment (0.97 mm) and the connective tissue attachment (1.07 mm), existing in any periodontium.



Figure 4. Preoperative view of a fractured maxillary right central incisor at presentation (1 month following the injury).



Figure 5. A close-up preoperative view of the fractured incisor. The tooth fragment could not be recovered.

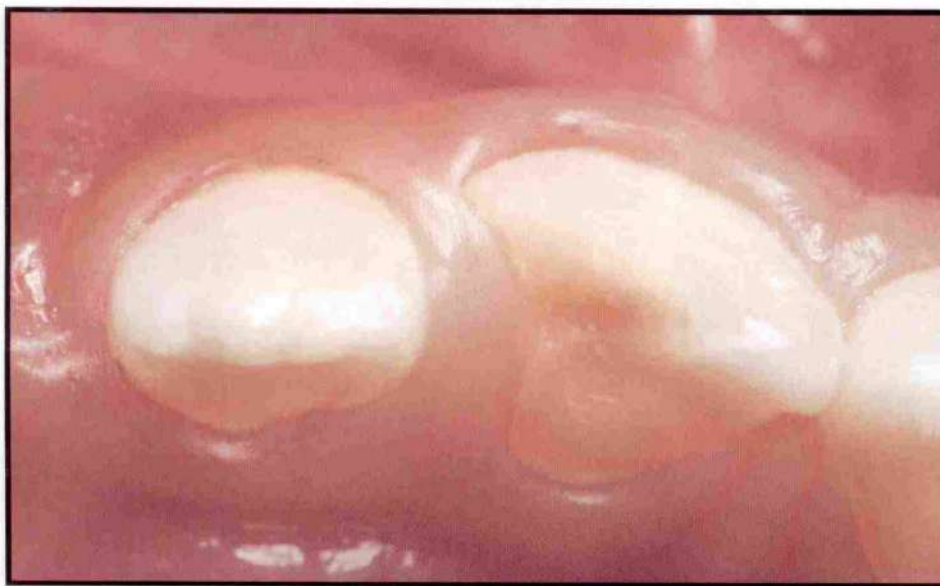


Figure 6. Incisal view of fracture site, exhibiting a polypoid growth of the papilla — nature's way of compensating for the hard tissue loss on the distocervical aspect.

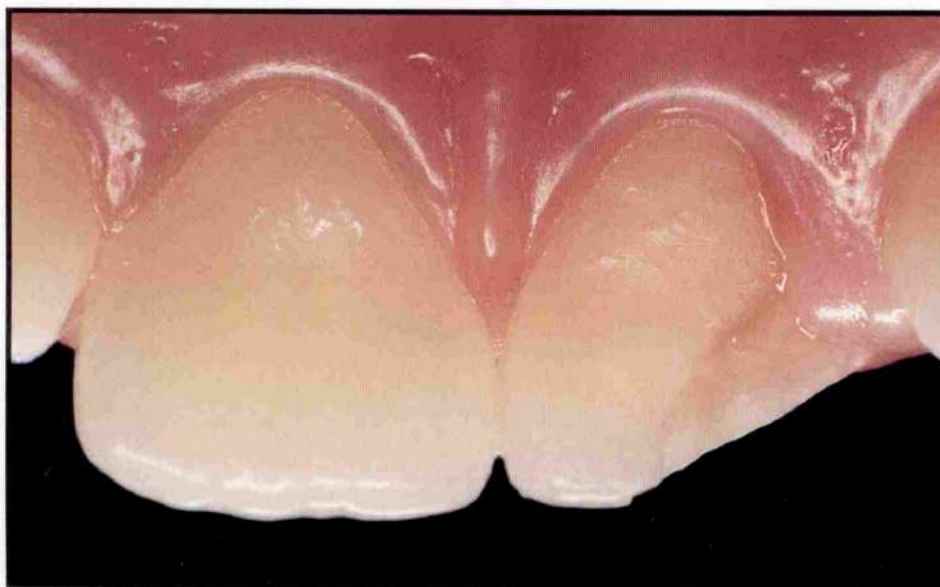


Figure 7. Palatal view of the fracture site and the polypoid growth.



Figure 8. Radiographic examination revealed a fracture margin at the osseous crest, which was corroborated by clinical probing under local anesthesia.

formation and chronologic stage of tooth eruption must be obtained for treatment planning. A thorough clinical examination of the occlusion, gingival extension of the fracture, the morphologic, histologic, and optical characteristics of sound adjacent teeth, and the polychromy of intact adjacent teeth must be performed.

Occlusion

In case of an extensive fracture, it is of paramount importance to assess whether the anticipated composite restoration will be subjected to occlusal forces of any magnitude. Depending on the particular circumstances, a stronger restorative material, eg, metal/ceramic, all-ceramic, or a high-strength composite crown restoration may be required.

Gingival Extension of the Fracture

According to the level of the fracture, this evaluation determines a surgical or nonsurgical approach to the restorative therapy (Figures 1 and 2). The location of the subgingival margin of the fracture can be assessed through periapical radiographs and probing and classified as follows:

- Supraosseous without violation of the biologic width.
- Supraosseous with violation of the biologic width.
- At the osseous crest level.
- Infraosseous.

The biologic width is a physiologic dimension encompassing the epithelial attachment (0.97 mm) and the connective tissue attachment (1.07 mm), which exist in any periodontium (Figure 3).¹³ When the biologic width is violated by margin placement, inflammation and bleeding ensue, resulting in loss of attachment with apical migration of the junctional epithelium and periodontal pocket formation.¹⁴ Maintaining the integrity of this dimension is of paramount importance in any restorative modality. When diagnosing and treatment-planning a fractured tooth crown, nonsurgical restorative therapies are indicated only for supraosseous margins, without impingement on the biologic width. All other circumstances require pre-restorative surgery or trans-surgical restorative procedures.

Morphologic, Histologic, and Optical Characteristics

A sound contralateral tooth must be used as a reference and guide in achieving a natural-appearing restoration. The primary, secondary, and tertiary anatomy can be deduced from a natural tooth. The geometric form of a tooth is projected according to the principle of symmetry. For central incisors, absolute symmetry is the key to morphologic success. One central incisor must be a mirror image of the other, while slight asymmetric discrepancies between lateral incisors are regarded as aesthetically pleasing. The form of the lobes, depth and length of the developmental grooves, and surface texture ought to be assessed with the magnifying loupes and charted in a schematic drawing.

A precise determination of the amount of lost enamel and dentin aids in the selection of the restorative composite

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resins to replace the missing tooth structure according to the varying degrees of translucency, opacity, strength, and polishability. As a ceramist uses various porcelains bearing different optical characteristics, so must the clinician 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 the Sound Adjacent Tooth Structure

Variations in hue, chroma, and value render the tooth polychromatic. When the facial aspect of the anterior dentition is thoroughly examined, the tridimensional color system of Munsell¹⁵ can be readily perceived. Even though monochromatic teeth exist, polychromatic nuances are thought to be more attractive to the aesthetic eye. A fourth color dimension can also be encountered, as described



Figure 9. A labial and palatal intrasulcular incision was performed mesiodistally, touching the osseous crest. Facial view.

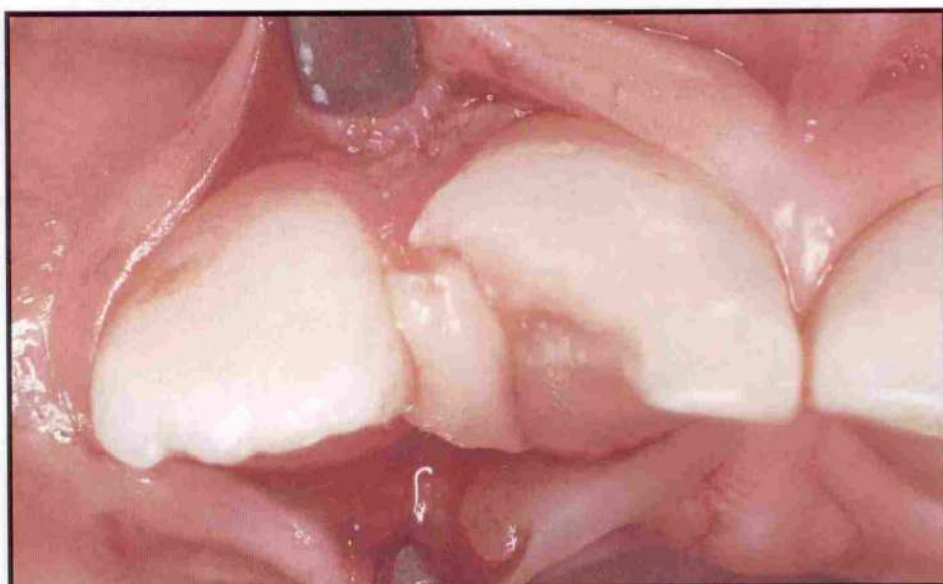


Figure 10. A full-thickness flap was elevated labially and palatally approximately 2 mm apical to the osseous crest. Incisal view.

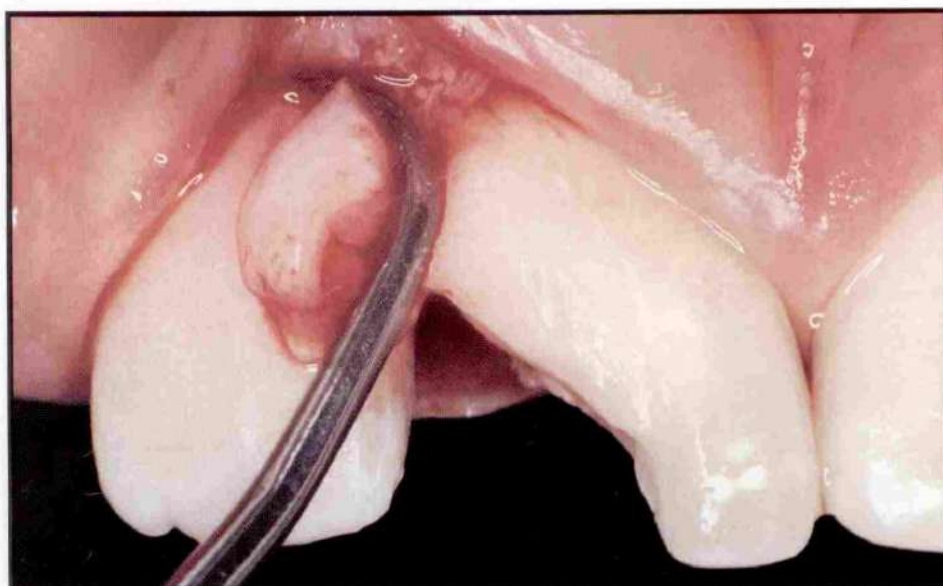


Figure 11. Using a sharp periodontal scaler, the interdental papilla and connective tissue debris were excised.

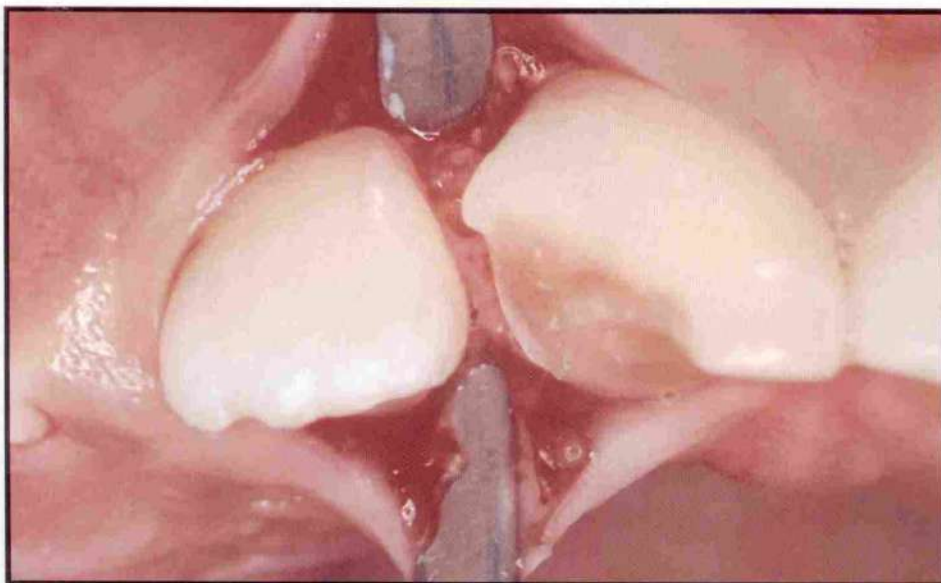


Figure 12. Incisal view of interproximal osteotomy, performed to create a proper osseous architecture.



Figure 13. Dental floss ligatures were used to position the rubber dam to allow clear visibility and access to the fracture site. Facial view.



Figure 14. Palatal view of rubber dam positioning, permitting access to the fracture site.

by Muia, known as maverick colors.¹⁶ In addition, when evaluating the polychromatic characteristics of a tooth, age factors should be considered and will reveal variations in chroma (higher), value (lower), and hue.¹⁷ Subtleties in color variation — generally not perceived from a conversation distance — present the most difficult challenge 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 approximately 75% to 80% of the length.¹⁸ A composite mock-up may be used for further subjective aesthetic assessment, and a caliper should be used to record the length and width measured. Another helpful device is a polyvinylsiloxane mold made

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from an impression of the mock-up¹⁹ to aid 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 prior to 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 cleaned with a prophyl cup and a slurry of pumice and 2% to 4% chlorhexidine. If the tooth presents with severe discoloration or extensive structure loss, a sound central or lateral incisor may be used as a reference for shade selection. A “blinder” — a small piece of neutral gray cardboard with a cut-out in its center of the size of a maxillary central incisor — can be used as a practical adjunct in shade selection.²⁰ The “blinder” is

held against the dentition with the tooth visible through the cut-out portion; any color interference is eliminated. Since most composite resins are coded according to the Vita shade guide (Vident, Brea, CA), the following steps should be followed for proper shade selection:

- The shade guide must be rearranged according to the value (from B1 to C4) and divided into three-thirds by imaginary lines. With the aid of a color-corrected shade selection light (eg, Esthelite, Efes, Amherst, NY), the third closest in value to the tooth used as a reference is selected.
- The basic hue of the tooth, best seen in the middle and cervical thirds, is selected according to the shade guide: A (brown), B (yellow), C (gray), and D (red).
- Horizontal and vertical imaginary lines are pictured along the thirds of the clinical crown for the purpose of compartmentalizing the surface area. This provides an improved visual access to the intricate polychromatic characteristics of each area of the crown.
- Subtle or striking chroma variations can be perceived for each section. The cervical third generally presents a higher chroma (more saturated hue) than the middle third.
- Maverick colors, hypoplastic spots, and mottled enamel contribute to a pleasing hue variation and must be observed.
- A schematic drawing, depicting the four-dimensional color pattern of a tooth, should be used as a reference for the reconstructive stage, particularly in cases of severely impaired teeth.

Selection of the Restorative Composite Resin Material

Correlating the color chart with the restorative materials to select the composites to be used as the "artificial dentin" and "artificial enamel" is one of the most important phases in pre-planning the restorative protocol.

The artificial enamel is a translucent microfilled resin that covers the entire



Figure 15. Occlusal/incisal view of the isolation secured in the site of operations. Note total visibility of cervical margins.



Figure 16. All enamel and dentin surfaces were sandblasted. Facial view.



Figure 17. Enamel and dentin were etched with a 37.5% phosphoric acid gel.

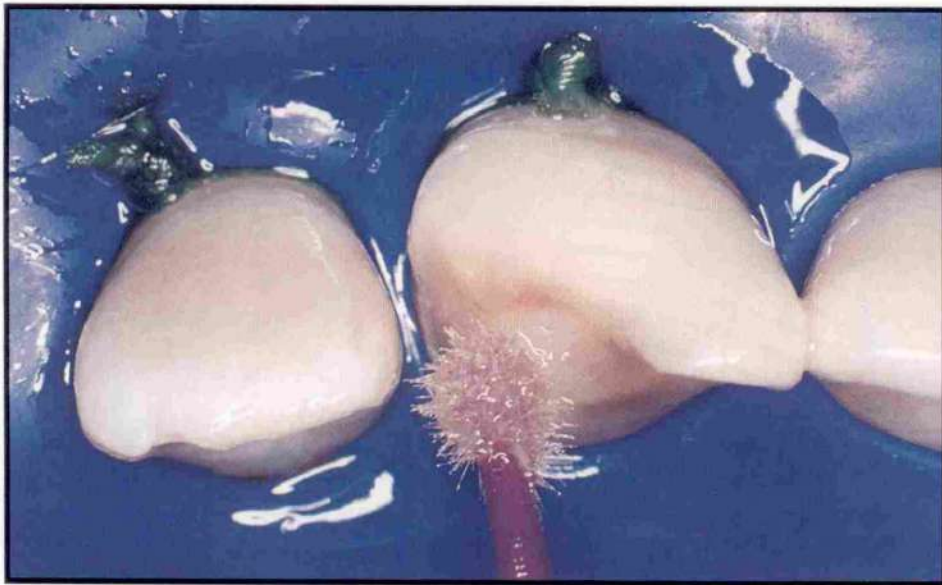


Figure 18. A hydrophilic single-component adhesive was applied with the wet technique to ensure proper dentin bonding.



Figure 19. The artificial dentin was built up in small increments to retain control of the desired anatomy.



Figure 20. A translucent hybrid incisal composite was laid along the incisal ridge to achieve strength and optical effects.

restoration and must be selected first (eg, Durafill VS, Heraeus Kulzer, Irvine, CA; Renamel, Cosmedent, Chicago, IL; Amelogen Microfill, Ultradent, South Jordan, UT). A small increment of the microfilled composite of the same shade as the shade tab selected is placed onto the middle third of the tooth, polymerized, and moistened with the patient's own saliva to simulate the appearance of a highly polished composite. It should be remembered that microfilled composite resins are usually "darker" (of lower value and higher chroma) at an unpolymerized stage, becoming lighter (of higher value and lower chroma) following polymerization. If a chroma variation is perceived cervicoincisorally, the same process must be repeated for each specific third or other more compartmentalized areas of the tooth.

The artificial dentin is the core of the restoration. A hybrid or microhybrid resin, bearing a chroma one degree higher (more saturated) than that of the microfill corresponding to the artificial enamel, should be selected. Several excellent composite resins are available for the artificial dentin build-up, including the following:

- Herculite XRV dentin and enamel shades, Kerr, Orange, CA
- Renamel Hybrid, Cosmedent, Chicago, IL
- Tetric, Ivoclar Vivadent, Amherst, NY; Amelogen Universal Opaque, Ultradent, South Jordan, UT
- Clearfil AP-X, J. Morita, Tustin, CA; Glacier, Southern Dental, Bayswater, Australia).

Hybrids are usually "lighter" (of higher value and lower chroma) at an unpolymerized stage, attaining a darker tone (of lower value and higher chroma) after polymerization. To determine the shade, the artificial dentin try-in is performed in the same method as for the microfill. At this stage, the shape of the mamelons is established and charted through direct clinical observation and transillumination.

The incisal third presents the greatest restorative challenge, due to its frequent variation in hue, chroma, translucency, and opacity, and the presence of maverick colors and an

opalescent halo. Examination of the intact incisal third of the sound tooth used as a reference, reveals the pattern to be followed. Any morphologic and intricate color variations must be charted accordingly.

CLINICAL PROCEDURE

A 9-year-old male patient presented with a fracture on a maxillary right central incisor (Figures 4 and 5). The tooth fragment could not be recovered, and dental treatment was not sought until 1 month following the injury. Clinical examination revealed a polypoid growth of the papilla, compensating for the loss of hard tissue in the distocervical aspect of the tooth (Figures 6 and 7). Radiographic examination revealed a fracture margin at the osseous crest, which was corroborated by clinical probing under local anesthesia (Figure 8).

Surgical Phase

Local anesthesia was administered. A labial and palatal intrasulcular incision

Using a build-up technique, the evolving aesthetic result can be scrutinized from shade selection to final polishing.

was performed mesiodistally, touching the osseous crest. Careful dissection was performed, and a full-thickness flap was elevated labially and palatally approximately 2 mm apical to the osseous crest (Figures 9 and 10). When performing a trans-surgical restoration, it is important that the flap be sufficiently relieved in order to allow a passive adaptation of the rubber dam during the restorative phase. Using a sharp periodontal scaler, the interdental papilla and connective tissue debris were excised (Figure 11). Dull-edged instruments should be avoided, since they will frequently tear instead of cut the soft tissue. Interproximal osseous resection was initiated with rotary instruments at low speed, and the osseous surface was further refined to a proper architecture using Wedelstadt and Ochsenbein chisels, thereby creating a

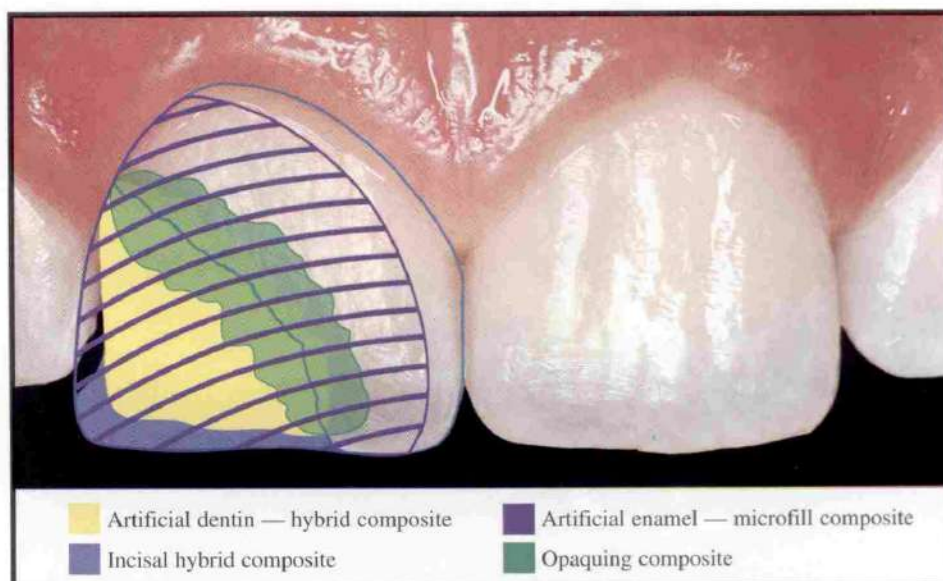


Figure 21. A drawing depicts the correct placement of an opaque microfilled composite over the junction of artificial dentin with the labial beveled enamel to mask the fracture line.

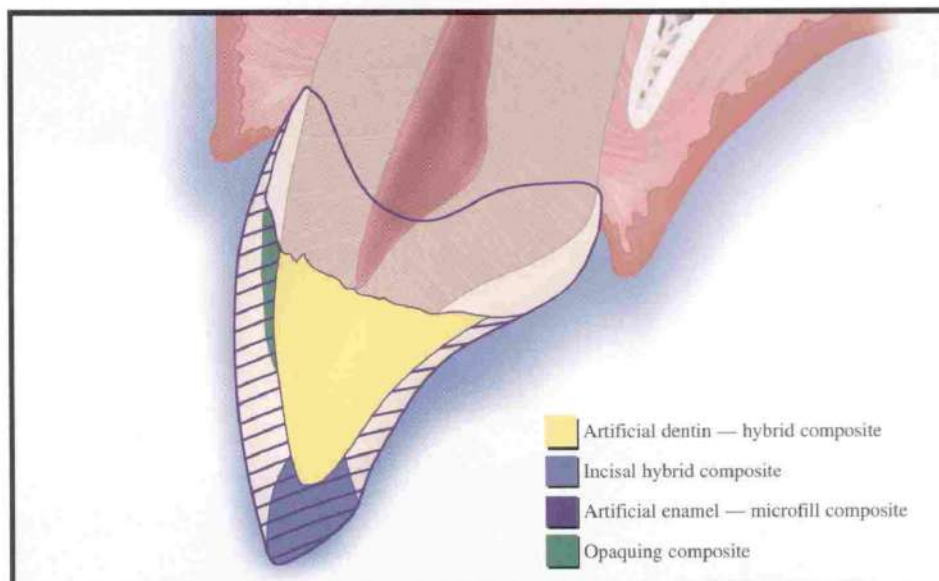


Figure 22. A drawing of composite build-up. Interproximal view. The opaquer composite must conceal the fracture line while allowing sufficient space for the artificial enamel.



Figure 23. To emulate decalcification spots, a mixture of opaquer was applied on the incisal and facial aspects of the built-up core.



Figure 24. Opaque microfilled composite was applied over the junction of the artificial dentin with the labial enamel to mask the fracture line until it no longer projected through.



Figure 25. The artificial enamel was sculpted past the translucent incisal hybrid composite, attaining a longer cervicoincisal dimension.



Figure 26. Optimal contours were achieved at the gingival margins, minimizing finishing procedures.

clearance of approximately 2 mm from the osseous crest to the margin of the fracture. By so doing, sufficient space for the connective tissue attachment and junctional epithelium was generated (Figure 12).

Restorative Phase

A rubber dam was placed, with punch holes of a smaller diameter to fit around the cervical area and prevent blood seepage. Dental floss ligatures were used to position the rubber dam to allow clear visibility and access to the fracture site (Figures 13 through 15). To ensure adhesion, the operating field must remain free of any contaminants throughout the entire procedure. A long facial bevel (approximately 3 mm in length), extending from the dentin-enamel junction to the outer surface of the tooth, and shorter lingual bevel (1 mm to 1.5 mm) were placed with a medium grit diamond or flame-shaped 12-fluted bur. The larger the fracture, the longer the bevel must be.

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The surface of the tooth was cleaned with a slurry of pumice and 2% chlorhexidine on a prophyl cup, rinsed thoroughly, and dried. All enamel and dentin surfaces were sandblasted (Figure 16) (Microetcher II, Danville Engineering, San Ramon, CA),²¹ and rinsed with copious water spray to remove the aluminum oxide powder. The enamel and dentin were etched with a 37.5% phosphoric acid gel (Gel-Etchant, Kerr, Orange, CA) (Figure 17). The etchant was first applied on enamel surfaces, then on dentin, and was rinsed off thoroughly for approximately 15 seconds after the dentin was completely covered. Excess water was removed with a short blast of oil-free air, leaving the enamel and dentin surfaces slightly moist. An alternate technique advocates lightly air-drying the dentin, followed by remoistening. A water-HEMA solution (Aqua-Prep, Bisco, Itasca, IL), or

solutions bearing bactericidal properties (eg, Tubulicid Red, Global Dental Products, North Belmore, NY; Consepsis, Ultra-Etch, Ultradent, South Jordan, UT) may be efficacious. If additional bactericidal effects are desired, gel etchants containing a bactericide can be used (eg, Uni-Etch 32% with BAC, Bisco, Itasca, IL; Ultra-Etch AB 35%, Ultradent, South Jordan, UT). A hydrophilic single-component adhesive (Single Bond, 3M, St. Paul, MN) was applied with the wet technique to ensure proper dentin bonding (Figure 18).

Using the preselected hybrid resin, the artificial dentin was built up in small increments (no thicker than 2 mm) to retain control of the desired anatomy (Figure 19).²² Each increment was polymerized (Optilux 500, Demetron/Kerr, Danbury, CT) for 20 seconds to harden the restorative material. In extensive anterior composite restorations, a build-up of the mesiodistal width 1 mm short of the proximal contact is achieved first, followed by a full build-up of the desired cervicoincisal length of the tooth with the artificial dentin, yet allowing sufficient space for the artificial enamel. In such manner, a "frame" of material is built to establish a point of reference for the subsequent layers of composites to be applied labially, proximally, and palatally. The artificial dentin must be slightly feathered onto the beveled facial and lingual enamel to initiate blending-in of the composite resin. The desired shape of the dentin mamelons should be achieved at this stage.

Since free-hand bonding relies on the artistry of sculpting composites into a precise anatomic form, the clinician must have a way of determining the exact size and shape of each increment prior to its placement. A suggested technique is to place some composite onto a clean glass slab. The amorphous mass of composite can be manipulated and carved with a thin, semi-flexible, sharp-edged composite instrument to the desired shape and thickness. The author recommends a carving instrument (Carver #2, Thompson Dental, Missoula, MT), which can also be successfully used for sculpting gingival embrasures and other areas. Another instrument (The Golden Composite Instrument, Almore, Portland, OR) is recommended for most of the initial



Figure 27. A periapical radiograph was taken to detect any marginal ledges or irregularities.



Figure 28. The gingival flap was repositioned and sutured.

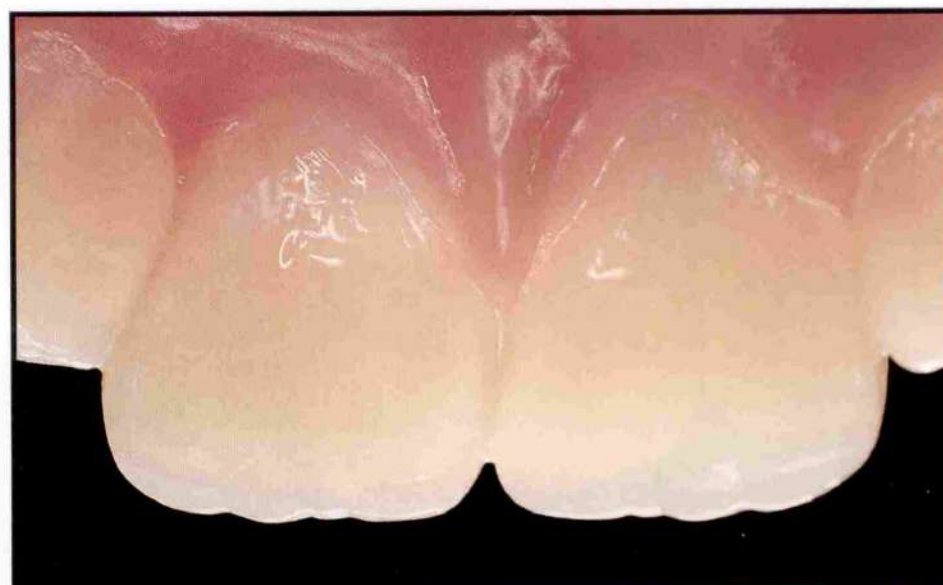


Figure 29. Postoperative palatal view of the completed restoration of the fractured maxillary right central incisor.

Table

Conversion Table of Vita Shade Guide To Opaque Restorative Composite For Use in Dental Restorations

<u>Silux Plus O*</u>	<u>Vita Equivalent</u>
UO	A1, B1, D2
YO	A2, B2
DYO	A3, A3.5, B3, D4
YBO	A4, B4
GO	C1, C2
DGO	C3, C4

*Shades most frequently utilized.

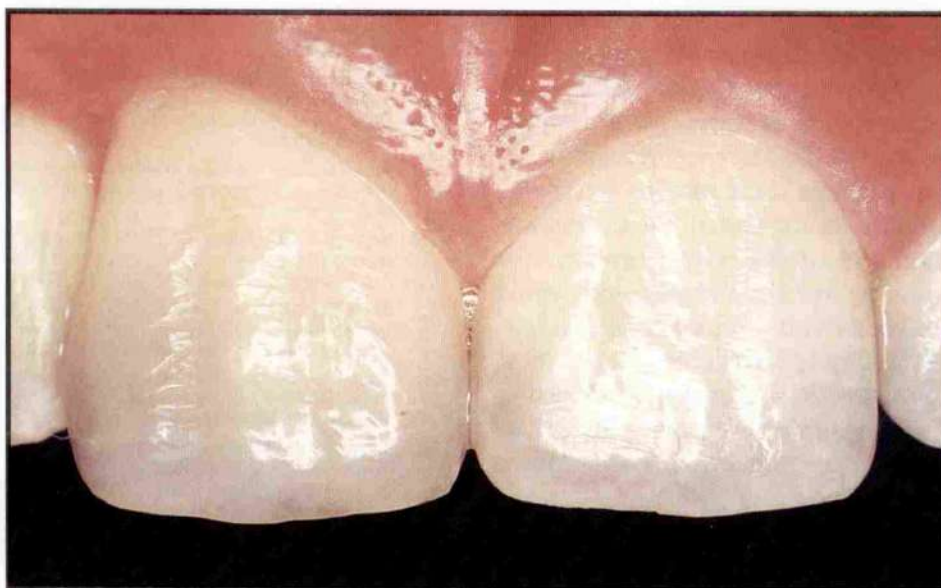


Figure 30. Postoperative facial view of the completed restoration of the fractured maxillary right central incisor.

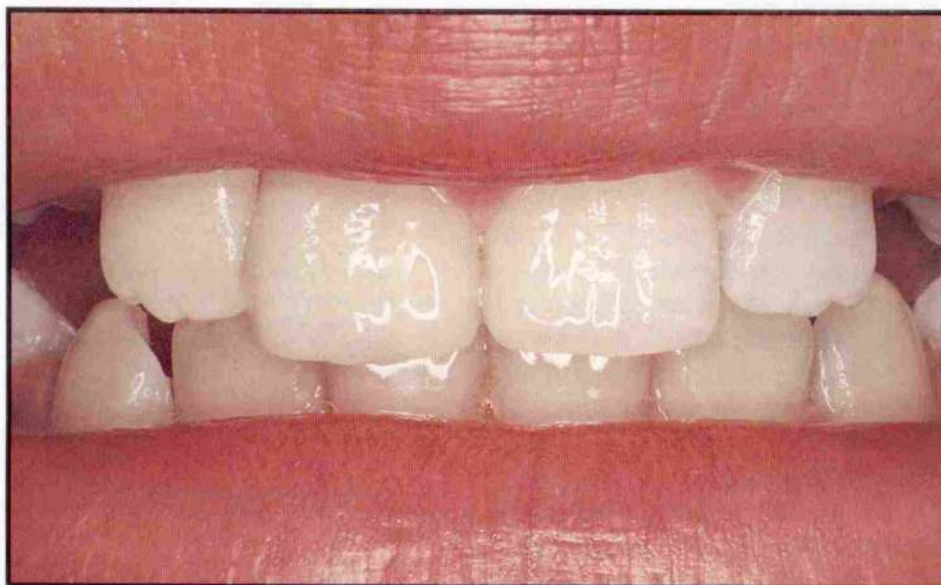


Figure 31. Postoperative facial view of the patient's natural appearance at conversation distance. Note surface texture and color harmony of the completed restoration.

increment placement and sculpting. Its one end is spoon-shaped and slender; the other is a thin, flexible spatula that allows a great tactile sense.

Once each layer of composite is tacked down and sculpted with instruments, a series of nylon or sable artist brushes (eg, Fine-tipped: #00 Takanishi, Renfert, Hilzingen, Germany; #0, #1, #2, #4 Loew-Cornell, Teaneck, NJ) were used to contour the buildup to a smooth and precise morphology. A sharp-ended caliper, set at the predetermined final crown length, was used to ascertain that the artificial dentin/mamelon buildup had not trespassed the desired length.

To achieve the necessary translucency and strength at the incisal third, a translucent hybrid incisal composite was laid along the incisal ridge, between the mamelons and around the incisoproximal edges, slightly covering the mamelon lobes labiopallatally, and sculpted accordingly (Figure 20). A thin layer of an opaque microfilled composite (Silux Plus Opaque, 3M, St. Paul, MN) was applied over the junction of the artificial dentin with the labial enamel to mask the fracture line until it no longer projected through (Figures 21 and 22).^{23,24} Resin opaques²⁵ (Creative Color, Cosmedent, Chicago, IL) can also be used in masking, either alone or with the opaque microfill composite. These materials should be of the same shade (basic hue, chroma, and value) selected for the microfilled artificial enamel. The opaques (Creative Color, Cosmedent, Chicago, IL) are selected according to the shade guide; the restorative microfill (Silux Plus Opaque, 3M, St. Paul, MN) has to be selected according to a shade conversion table (Table). For a successful aesthetic result, the fracture line must now be completely invisible (Figure 23).

To emphasize the polychromy and brilliancy of the incisal third, tints and opaques (eg, Creative Color, Cosmedent, Chicago, IL; Kolor Plus, Kerr, Orange, CA) were sparingly applied. To emulate whitish decalcification spots, a mixture of opaques was applied on the incisal and facial aspects of the built-up core (Figure 24).

The artificial enamel was applied in a single increment to the facial aspect. To obtain appropriate facial contour and proximal contact, the golden instrument

was used to spread the microfill, veneering the underlying "frame" of artificial dentin cervicoincidentally and mesiodistally. The artificial enamel was sculpted to its anatomic form and brushes were used to refine the primary anatomy of the labial aspect. The lingual marginal ridge and proximal contact were refined, using the mylar strip "pull-through" technique. Further refinement and adaptation of the microfilled resin was carried out with fine-tipped brushes, particularly at the distocervical aspect of the restoration, where ledge-free margins are imperative to minimize plaque accumulation during and following the healing period. The labial and lingual aspects of the restoration were additionally light cured for 60 seconds.

The restoration was evaluated for primary morphologic refinement, width, and volume. The artificial enamel was sculpted past the translucent incisal hybrid composite, attaining a longer cervicoincisal dimension; the "tooth frame" had been previously established (Figures 25 and 26). With the rubber dam still in position, contouring was initiated with coarse aluminum oxide discs (Sof-Lex XT, 3M, St. Paul, MN) until the desired primary anatomy was established. The isolation was removed, and a periapical radiograph was taken to detect any marginal ledges or irregularities (Figure 27). To ensure future periodontal health, this step must be taken prior to suturing procedures. The gingival flap was repositioned and sutured (Figure 28). The patient was dismissed, returning 1 week postoperatively for suture removal and evaluation.

Thirty days postoperatively, the patient returned for the refinement of the restoration. For secondary anatomy (developmental grooves, lobes, cingulum, and marginal ridges), a combination of medium-grit diamonds and 12-fluted carbide finishing burs were used. Surface texturization was accomplished with coarse-grit bullet-nosed diamonds.²⁶ To guide the attainment of symmetric light-reflecting areas, lines were drawn along the ideal position of the proximolabial line angles. Diamond (Compo-Strips, Premier, Norristown, PA) and plastic strips (Epitex, GC America, Chicago, IL) were used for interproximal finishing and polishing.

The entire restoration was buffed with polishing cups and points

(Flexi-Cup and Flexi-Point, Cosmedent, Chicago, IL) to eliminate some of the accentuated texturization. Composite polishing pastes (Enamelize, Cosmedent, Chicago, IL) with buffing discs (Flexibuff, Cosmedent, Chicago, IL) and felt wheels were used to impart a high gloss to the restoration surface, while retaining the desired surface texture. The convex areas of the restoration (ie, labial lobes, line angles, marginal ridges, incisal edges) were "highlighted" with superfine aluminum oxide discs (Sof-Lex XT, 3M, St. Paul, MN). Following final polishing, the restoration was further light cured for 60 seconds.

DISCUSSION

While there are other therapies suitable for reestablishing the biologic width in cases of infraosseous fractures, such as orthodontic extrusion,²⁷ several key points indicated a trans-surgical restorative approach of the case presented. First, since the cervical margin of the fracture was at the osseous crest level, and the young patient's dentition was still undergoing active eruption, it is possible that the biologic width would be reestablished once a complete apex formation occurred. Second, and most important, the large subgingival fracture (with near pulp exposure) required an immediate solution. A first-stage crown lengthening therapy would solve one but not the major concern. The patient would have had to endure a prolonged healing period prior to the actual restorative procedure. The end result was a biofunctional, aesthetic restoration, presenting a sound periodontium/restorative interface that complied with physiologic demands and the patient's aesthetic expectations (Figures 29 through 31).

CONCLUSION

Direct bonded restoration is one of the few areas in restorative dentistry where the achievement and evaluation of the results are immediate. This is an advantage of superior importance, particularly when associated periodontal surgery is required. Trans-surgical rehabilitation of fractured teeth where margins violate the biologic width permits the attainment of physiologic, ledge-free, highly polished contours. Such rehabilitation promotes an uneventful healing period and ultimate biofunctional and aesthetic success.

REFERENCES

1. Baratieri LN. *Estética - Restaurações Adesivas Diretas em Dentes Anteriores Fraturados*. 1st ed. São Paulo, Brazil: Quintessence Publishing, 1995.
2. Chosak A, Eidelman E. Rehabilitation of a fractured incisor using the patient's natural crown: Case report. *J Dent Child* 1964;71:19-21.
3. Dean JA, Avery DR, Swartz ML. Attachment of anterior tooth fragments. *Pediatr Dent* 1986;8(3):139-143.
4. Baratieri LN, Monteiro Junior S, de Albuquerque FM, et al. Reattachment of a tooth fragment with a "new" adhesive system: A case report. *Quint Int* 1994;25(2):91-96.
5. Buonocore MG, Davila J. Restoration of fractured anterior teeth with ultraviolet-light polymerized bonding materials: A new technique. *J Am Dent Assoc* 1973;86(6):1349-1354.
6. Roberts MW, Moffa JP. Repair of fractured incisal angles with an ultraviolet-light-activated fissure sealant and a composite resin: Two-year report of 60 cases. *J Am Dent Assoc* 1973;87(4):888-891.
7. Ellis RG, Davey KW. *The Classification and Treatment of Injuries to the Teeth of Children*. Chicago, IL: Year Book Medical Publishers; 1970:65-90.
8. Fahl NJ, Denehy GE, Jackson RD. Protocol for predictable restoration of anterior teeth with composite resins. *Pract Periodont Aesthet Dent* 1995;7(8):13-21.
9. Fahl NJ. Predictable aesthetic reconstruction of fractured anterior teeth with composite resins: A case report. *Pract Periodont Aesthet Dent* 1996;8(1):17-31.
10. Vanini L. Light and color in anterior composite restorations. *Pract Periodont Aesthet Dent* 1996;8(7):673-682.
11. Maynard JG Jr., Wilson RD. Physiologic dimensions of the periodontium significant to the restorative dentist. *J Periodontol* 1979;50(4):170-174.
12. Khara SC, Fahl N Jr., Murgel CA. Shortie matrix and complex Class IV composite resin restoration. *Compend Cont Educ Dent* 1989;10(8):426-432.
13. Garguilo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. *J Periodontol* 1961;32:261-267.
14. Rufenacht CR. *Fundamentals of Esthetics*. Carol Stream, IL: Quintessence Publishing, 1990.
15. Munsell AH. *A Color Notion, an Illustrated System Defining All Colors and Their Relations by Measured Scales of Hue, Value, and Chroma*. 8th ed. Baltimore, MD: Munsell Color, 1936.
16. Muia PJ. *Four Dimensional Tooth Color System*. Carol Stream, IL: Quintessence Publishing, 1993.
17. Singer B. *Current Opinion in Cosmetic Dentistry*. 2nd ed. Philadelphia, PA: Current Science, 1994.
18. Chiche GJ, Pinault A. *Esthetics of Anterior Fixed Prosthodontics*. Carol Stream, IL: Quintessence Publishing, 1994.
19. Dietschi D. Free-hand composite resin restorations: A key to anterior aesthetics. *Pract Periodont Aesthet Dent* 1995;7(7):15-25.
20. Ubassy G. Shape and color: The key to successful ceramic restorations. Hong Kong, China: Quintessence Publishing, 1993.
21. Roeder LB, Berry III EA, You C, Powers JM. Bond strength of composite to air-abraded enamel and dentin. *Op Dent* 1995;20(5):186-190.
22. Rueggeberg FA, Caughman WF, Curtis JW Jr., Davis HC. A predictable model for the polymerization of photo-activated resin composites. *Int J Prosthodont* 1994;7(2):159-166.
23. Fahl N Jr., Swift EJ Jr. The invisible Class IV restoration. *J Esthet Dent* 1989;1(4):111-113.
24. Fahl N Jr. Optimizing the esthetics of Class IV restorations. *Canad Dent Assoc J* 1997;63:108-115.
25. Renamel restorative system: The illustrated technique guide. Cosmedent Inc, Chicago, 1992.
26. Croll TP. Simulating irregular enamel surface texture in composite resin restorations. *Quint Int* 1988;19(4):311-312.
27. Potashnick SR, Rosenberg ES. Forced eruption: Principles in periodontics and restorative dentistry. *J Prosthet Dent* 1982;48(2):141-148.