

Achieving Ultimate Anterior Esthetics With a New Microhybrid Composite

Abstract: Direct bonding is one of the most commonly used forms of restoration for the conservative esthetic improvement of anterior teeth. The major challenges involve selecting composites that have adequate strength as well as provide lifelike optical properties that render the restoration functionally sound and esthetically pleasing. Properties such as high sculptability, wide shade range, varying opacities and translucency, as well as high polishability are essential for gaining absolute control over the restorative process and the attainment of natural-looking results. This article discusses a new composite restorative system and its application in the direct esthetic and functional rehabilitation of the anterior dentition.

Since the advent of acid etching in 1955, a slowly evolving yet steady revolution has taken place in dentistry. The introduction and further development of hydrophilic dentin bonding agents have added a new horizon to restorative possibilities. Since then, more conservative approaches to restorative solutions based on adhesive technology are taking place, causing practitioners everywhere to choose "augmentation" over "amputation" of the remaining sound tooth structure whenever indicated.

Composite resins have been a portrayal of this preservation-oriented philosophy for decades. Their almost limitless applications have included direct and indirect restorations in the posterior as well as in the anterior segments. However, it was only in the mid-1990s that the dental industry became fully aware of the necessity of having composite resin systems that truly replicated the natural dentition in all of its optical and physical properties, bringing forth systems with a wider shade and opacity range. Several reports of special interest have been published that share a common vision, proposing a thorough and methodical protocol for the incremental application of composite resins in the restoration of anterior teeth to predictably achieve a truly lifelike, polychromatic restoration.¹⁻⁴ As a result of the coexistence of an emerging direct restorative concept and newly improved composite systems (such as Point 4^{TM,a},

^a Kerr[®] Corporation, Orange, CA 92867



Newton Fahl, Jr., DDS, MS
Private Practice
Curitiba, Brazil

Learning Objectives:

After reading this article, the reader should be able to:

- describe a thorough and methodical protocol for the incremental application of composite resins.
- discuss a new process for measuring inorganic filler.
- explain how lifelike restorations become integrated in a more comprehensive functional and esthetic scenario.
- describe shade selection and color mapping.
- discuss tooth preparation.

ESTHET•X^{®,b}, 3M[™] Z250^c, Vitaescence^{™,d}, and Tetric[®] Ceram^{™,e}), a need for a paradigm shift has taken place where the operator has to think of himself or herself as the artist-scientist who must fully understand the rules and principles of nature and correlate them with the restorative systems available to be able to

^b Dentsply[®]/Caulk[®], Milford, DE 19963

^c 3M Dental Products, St. Paul, MN 55144

^d Ultradent Products, Inc, South Jordan, UT 84095

^e Ivoclar Vivadent, Amherst, NY 14228



Figure 1—The Point 4™ Optimized Particle System is the first restorative combining the strength of a hybrid with the polish of a microfill.

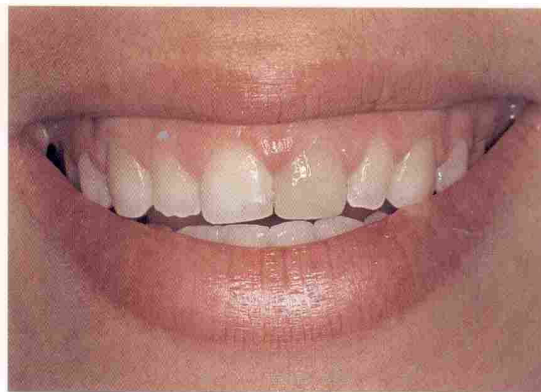


Figure 2—Excessive gingival display associated with inadequate tooth form and proportion compromised the smile esthetics.



Figure 3—A close-up view of the anterior dentition shows a need for esthetic and functional improvements.



Figure 4—The 7-day postoperative view after the crown-lengthening procedure.

reproduce all the beauty and naturalness present in the natural dentition.

Point 4™

Point 4 (Figure 1) is a light-cured composite resin restorative containing approximately 76.5% by weight (57.2% by volume) inorganic filler with an average particle size of 0.4 μm (hence its name). The fillers are measured by a new process called *laser measured tumbling*, which is reported to be more accurate than the sedigraph. Point 4 is the result of years of research “aimed at bridging the gap between microfill and hybrid composites,” according to the manufacturer. A proprietary grinding process combined with sophisticated thixotropic additives and rheological modifiers allow Point 4 to polish to a very high, long-lasting gloss similar to microfills, while providing strength equivalent to today’s microhybrids. These modifications on the material’s physical properties have accounted for a vast improvement in handling characteristics, making Point 4 a true sculptable composite similar to or even better than some microfills.

Point 4 blends in very naturally with the

adjacent dentition, reportedly because its average particle size lines up with the wavelength of light, which is 0.5 μm , resulting in more efficient scattering of the energy.

Anterior Esthetics

The anterior segment of the mouth is perhaps the one that presents the greatest esthetic-restorative challenge because the slightest smile or lip movement can reveal any anatomic or color discrepancies. Anterior esthetic restorations have long been an area of concern both for esthetically conscious and demanding patients as well as for extremely meticulous practitioners. Demanding patients urge us to provide them with state-of-the-art esthetic restorations. However, the ultimate goal of the restorative dentist is to create lifelike restorations—direct or indirect—that become integrated in a more comprehensive functional and esthetic scenario by incorporating important concepts of smile design and occlusion into the treatment planning of a case.

Case Study

A 19-year-old woman presented requesting esthetic enhancement of her anterior den-



Figure 5—After healing, home tooth whitening was performed for color enhancement of vital and nonvital teeth.



Figure 6—The ideal length-width ratio was calculated and measured with a caliper.



Figure 7—Initial mock-up of the central incisors was performed to display the ideal length-width ratio.



Figure 8—The anterior segment was mocked-up to allow objective and subjective esthetic and functional assessment.

tition. She had undergone orthodontic treatment but the need for esthetic and functional improvements was obvious (Figures 2 and 3). The esthetic and functional rehabilitation of this case involved the following:

Prerestorative Stage

Excessive gingival display—A crown lengthening with osseous resection and apically repositioned split flat technique was performed while preserving the papillae to establish proper tissue display (Figure 4).

Home whitening—A 7.5% hydrogen whitening gel was used in a tray with 1-hour applications twice a day, for 14 days, on both upper and lower arches. Tooth No. 9 was simultaneously whitened to improve the dark discoloration caused by the endodontic treatment by leaving the palatal access open and the canal lumen sealed (Figure 5).

Incisal edge position—Using the 75% to 80% length-width ratio, the correct proportion of the clinical crown was established for the upper central incisors and mocked-up with composite (Figures 6 and 7).⁵ The proper incisal edge-lower lip relation was assessed,

and minor length and shape alterations made.

Tooth-width proportion—The remaining upper anterior teeth were mocked-up with composite to achieve ideal tooth-to-tooth width proportion while establishing ideal length and incisal edge position (Figure 8).

Occlusion—Centric stops and excursive movements of the mandible were checked for proper occlusion and anterior and canine guidance. The importance of this step cannot be stressed enough to ensure the thorough clinical success of final restorations. A lack of willingness to spend the extra time necessary to foresee sound anterior and lateral guidance often will result in catastrophic failure of the final composite restorations. This might lead to the discouragement of the practitioner who wants to ingress in the thrilling area of direct esthetic restorative dentistry.

Phonetics—The patient was taken through phonetic exercises for the evaluation of speech comfort and clarity.

Personality and subjective assessment—The patient was given a hand mirror and asked to pinpoint the areas that she thought could be enhanced according to her own per-



Figure 9—Final anatomical refinements were waxed-up on the palatal aspect of the upper model.



Figure 10—A silicone matrix was fabricated to accurately reproduce the palatal anatomy and incisal edges of the upper anterior dentition.



Figure 11—The silicone matrix is a practical adjunct in helping to foresee the amount of composite to be built-up.

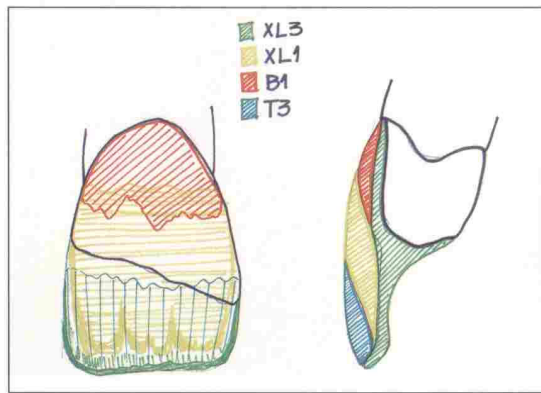


Figure 12—A schematic drawing depicts the correct composite layering according to the previously selected shades.

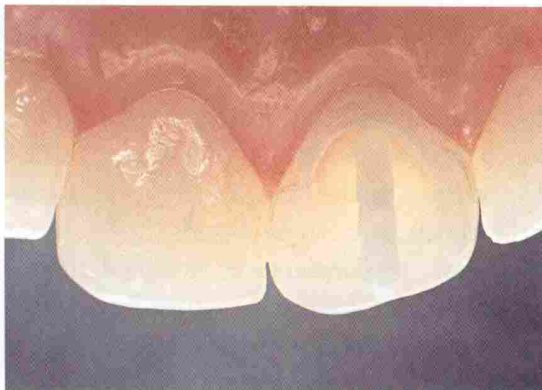


Figure 13—An esthetic fiber post was required to reinforce the severely impaired central incisor.



Figure 14—Tooth preparation included placing a longer facial bevel and a shorter lingual bevel along the fracture line.

ception. This usually includes tooth form and length, embrasure form, incisal evenness, etc.

Fabrication of a matrix—After minor modifications in tooth length, form, and incisal embrasures were performed per the patient's request, alginate impressions were made of the upper and lower arches and stone models were fabricated. Final occlusal and anatomical refinements were waxed-up on the palatal aspect of the upper model (Figure 9), and a silicone matrix was made to accurately reproduce the palatal anatomy and incisal edges of all upper anterior teeth (Figure 10). The use of a

matrix is mandatory for the precise clinical reproduction of the ideal form of the dentition obtained through the mock-up and aids in building each composite increment to its exact contour without trespassing the boundaries of the desired tooth form (Figure 11).

Restorative Stage

Restorative alternatives—The restorative strategy included direct veneering and augmentation of the central and lateral incisors, and the augmentation of the canines by direct placement of "snowcaps."

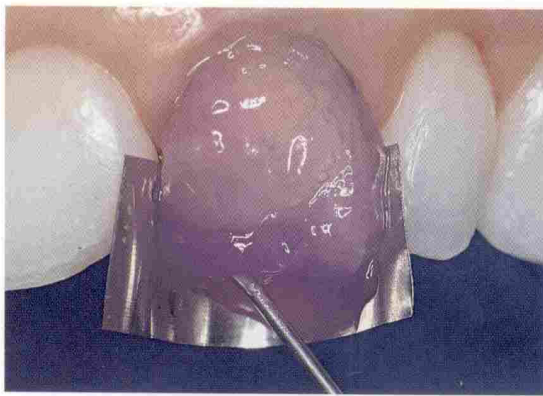


Figure 15—A gel etchant was applied to all tooth surfaces to ensure proper bonding.

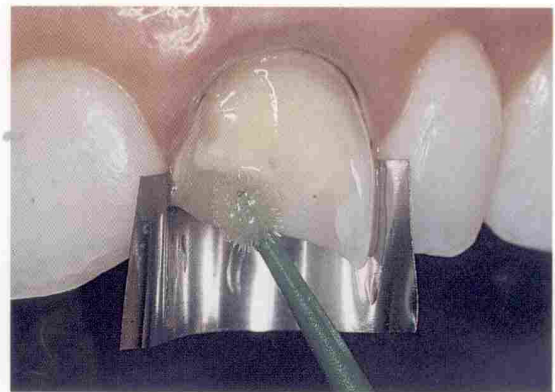


Figure 16—A hydrophilic, single-component adhesive (OptiBond™ Solo Plus²) was applied to the etched surfaces.



Figure 17—The silicone matrix was tried-in for accuracy of fit and to allow assessment of the three-dimensionality of the composite build-up.



Figure 18—A 1.5-mm-thick lingual shell of opaque composite (Point 4 XL3) was sculpted using the matrix as a rampart.

Shade selection and color mapping—Shade selection was performed before rubberdam isolation because tooth dehydration results in an elevated value and may cause the selection of an incorrect shade. Before shade selection, the teeth were thoroughly cleaned to rid them of all plaque and any superficial discoloration that might interfere with the perception of color.

The shade-selection process comprised electing the Point 4 shades according to the different areas of the tooth to be restored. The right upper central incisor and the opposing dentition were used as references to gather as much information as necessary for the emulation of polychromatic nuances (hue, chroma, and value) on the restorations. The amount of incisal translucency and its nuances were observed and the corresponding translucent shades were selected. Using a Vita[®] shade guide^f, the body and cervical hue and chroma were selected, followed by the incisal translucent shades, and the corresponding Point 4 shades were tried-in for accuracy. After a sat-

isfactory color blend was achieved, a schematic drawing (color map), depicting the tooth's four-dimensional color pattern (hue, chroma, value, and opacity/translucency) was charted to serve as a guide during the actual anatomical reconstructive steps (Figure 12).

Tooth preparation—A modified rubberdam technique was used to retract lips, cheeks, and tongue, and allow access to the gingival portion of the anterior dentition, thus facilitating the execution and finishing of the direct veneers. All teeth required minimal or no tooth preparation, except for the left central incisor, which needed a more invasive preparation because of its discoloration.

The noninvasive nature of the preparation was attributed to the fact that the upper anterior segment needed to be projected further labially to attain a proper overjet. Because it was severely destroyed, the left central incisor required reinforcement of the coronal portion with an esthetic fiber post (FibreKor Post System^{®g}) (Figure 13). The root canal and pulp chamber were prepared and cleaned of debris leaving only a small

^f Vita Zahnfabrik, Germany, distributed in US by Vident[®], Brea, CA 92621

^g Jeneric[®]/Pentron[®], Inc, Wallingford, CT 06492



Figure 19—The initial increment was slightly feathered onto the facial bevel with contouring instruments and artist brushes.



Figure 20—An even color value was achieved with a second increment before subsequent layers of composite were applied.



Figure 21—High chroma tints were applied to the cervical third to enhance color warmth and saturation.



Figure 22—A body shade (Point 4 B1) was applied to the cervical third and feathered out toward the middle third.

incisal portion of a sound, existing composite restoration in place. Next, all dentin, enamel, and composite surfaces of the root canal and pulp chamber were etched with 37.5% phosphoric acid gel (Gel Etchant^a) for 15 seconds, rinsed with water for 10 seconds, and gently air-dried. A dual-cure bonding agent (OptiBondTM FL^a) was applied and the post was adhesively luted with a light shade of a dual-cure luting resin (Nexus^a). The palatal cavity was then incrementally restored with a light, opaque shade of composite (Point 4 XL3) to ensure proper light reflection and color value. Each increment was no thicker than 2 mm to ensure optimal polymerization⁶ and was polymerized with a halogen light (Demetron Optilux 500^{TM,a}) for 40 seconds.

The rationale for the preparation of a discolored tooth should involve providing adequate space for the translucent composite resins, as well as for the opaque resins. Depending on the severity of discoloration, it may be necessary to reduce more facial enamel, although dentin may be exposed, to generate more space for the restorative resins. If not enough tooth structure is removed, thicker

layers of opaques and resins will have to be used to mask the discoloration, resulting in a lifeless, bulky restoration.

Before labial preparation, a retraction cord (UltraPak[®] #0^d) was placed intrasulcularly to retract the labial gingival margin about 0.5 mm apically and to protect the tissue from scarring during preparation. A metal matrix strip was inserted mesially and distally to provide better visualization of the preparation area, as well as to prevent nicking of the adjacent teeth. Facial reduction was achieved with a long, tapered diamond (BluWhite Diamond Bur No. 765^a). A long facial bevel and shorter lingual chamfer were placed with No. 765 and No. 630 diamonds, respectively, along the fracture line (Figure 14).

All of the enamel and dentin surfaces were sandblasted with an intraoral sandblaster (MicroetcherTM II^b) to enhance adhesion,⁷ and rinsed thoroughly with water to remove the aluminum oxide powder. The dentin and enamel were etched with a 37.5% phosphoric acid gel with the etchant being placed on enamel first then on dentin so that it was

^b Danville Engineering, San Ramon, CA 94526



Figure 23—Intricate mamelon anatomy was created using the silicone matrix as a guide.



Figure 24—Mamelon polychromy was further enhanced by the application of high chroma tint and opaquer.



Figure 25—A youthful translucent effect was achieved with the application of blue tint.



Figure 26—A slightly gray translucent shade (Point 4 T3) was laid along the incisal ridge, in between the mamelons and around the incisoproximal edges.

rinsed off thoroughly 10 to 15 seconds from completion of the etching procedure (Figure 15). Excess water was blotted with a cotton pellet to avoid desiccation. A single-component hydrophilic adhesive was applied to ensure proper dentin bonding (OptiBond™ Solo Plus^a, Prime & Bond NT™,^b Single Bond^c, and EXCiTE®^e) (Figure 16).

The silicone matrix was again tried-in for accuracy of fit and to assess the three-dimensionality of the restoration to be built-up (Figure 17). An initial layer of a high-opacity, high-value shade of composite (Point 4 XL3) was squirted onto the lingual aspect of the preparation and a 1.5-mm-thick lingual shell of material was sculpted with a contouring instrument (Microfill Composite Instruments¹) using the silicone matrix as a rampart (Figure 18). The initial increment was feathered onto the facial bevel with contouring instruments and artist brushes to blend in the composite resin (Figure 19). This increment was polymerized with a halogen curing unit for 40 seconds. Each composite or tint/opaquer layer was light-cured for a minimum of 40 sec-

¹ Almore, Portland, OR 97298

onds. The incisal third of the composite shell was built-up 1 mm short of the proximal contacts and the incisal edge to allow space for translucent shades to be applied.

A second increment of the same shade was applied facially until an even color value was perceived between the discolored tooth surface and the lingual shell and light-cured (Figure 20). To prevent overbuilding this layer, which would compromise the final esthetic result, contouring of the composite resin was constantly monitored from an incisal view through indirect vision.

Disguising the fracture line might require the application of an opacous material over and along the tooth-composite interface. Point 4 shades are usually well coordinated with the optical properties of the natural dentition, thus imparting very lifelike optical characteristics to the restoration. However, in instances where more opacity is required, opaques or opaque microfill composites can be used to block out the light shine-through.⁸

Next, ochre and yellow tints (Kolor + Plus™^a) were mixed in equal proportions and applied to the cervical third, imparting



Figure 27—A cervicoincisal, mesiodistal “tooth frame” is attained with the aid of the silicone matrix.

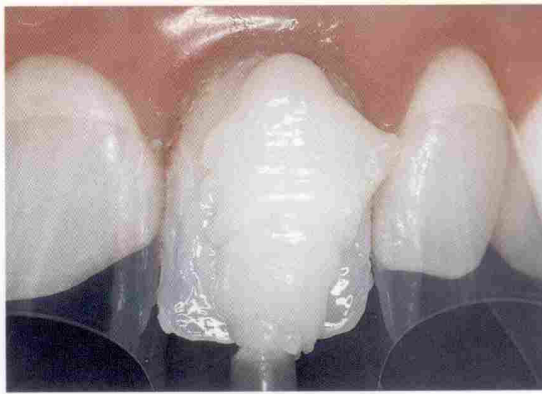


Figure 28—A large increment of an enamel-like, light shade of composite is applied to the facial aspect.



Figure 29—The facial anatomy is sculpted to almost final contour, leaving only the incisal third undercontoured.



Figure 30—Incisal translucency was emphasized with a thin layer of a translucent shade (Point 4 T3) over the incisal third.

warmth while accentuating the chroma in that area, and light-cured (Figure 21).

A base (body) shade (B1) was applied to the cervical third, sculpted to full emergence-profile contour, and feathered out toward the middle third to create a discrete chroma variation (Figure 22). Next, mamelon anatomy was created with the XL3 shade, still using the silicone matrix as a guide (Figure 23). The high viscosity of the composite makes it very operator-friendly in creating proper form and contour of even the tiniest increment.

After light-curing, a mix of ochre tint and A3 opaquer (Kolor + Plus™) was sparingly applied to the mamelon tips to further emphasize the polychromy of the incisal third (Figure 24). Blue tint was applied up the incisal embrasures, and around and in between the mamelons to create a youthful translucent effect (Figure 25). Each tint or tint/opaquer application was light-cured separately to prevent their mixing.

A slightly gray translucent shade (T3) was laid along the incisal ridge, in between the mamelons and around the incisoproximal edges, slightly covering the mamelon lobes

labiopalatally, and sculpted (Figure 26). A “tooth frame” was achieved with the application of this translucent composite increment to determine a point of reference for the subsequent layers of composites to be applied labially (Figure 27). The silicone matrix was again used as a guide to attain full proximal and incisal edge contours.

After the cervicoincisal and mesiodistal boundaries were established, composite (shade XL1) was applied, sculpted to almost final labial contour, and light-cured (Figures 28 and 29). To emphasize translucency in the incisal third, a thin layer of T3 translucent shade was placed and contoured to the desired final labial morphology (Figure 30). After light-curing, contouring was initiated with coarse aluminum oxide disks (3M™ Sof-Lex™ XT^c) until the desired primary anatomy was established and the incisal edge morphology conformed to that of the silicone matrix (Figure 31).

At this point, a visibly polychromatic restoration showing beautiful mamelon anatomy, brilliant incisal translucency, and a natural opalescent halo could be perceived (Figure 32). To avoid bonding the adjacent restora-



Figure 31—The silicone matrix is once again used to assess proper restoration contour.



Figure 32—A visibly polychromatic restoration showing mamelon anatomy, incisal translucency, and a natural opalescent halo.

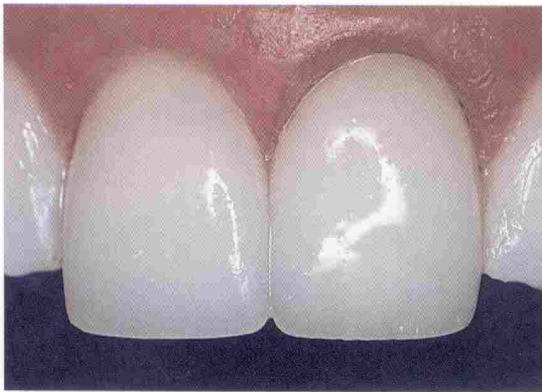


Figure 33—After initial finishing and polishing, both central incisors presented beautiful esthetics and symmetry.



Figure 34—A panoramic view of the anterior segment after achieving primary tooth anatomy.

tions together, the proximal aspects were thoroughly finished and polished using diamond (FlexiDiamond™ Strips¹), aluminum oxide strips (Epitex™²), and superfine aluminum oxide disks (3M™ Sof-Lex™ Pop-on XT^c).

Next, the right central incisor was restored in a similar fashion. No packing of retraction cord was necessary because the margin of the restoration would be placed slightly supragingivally. Since no discoloration of the tooth structure was present, there was no need for a veneer type of preparation. Preparation merely involved placement of a facial and lingual bevel to accommodate more material at the fracture line and sandblasting all of the enamel with an intraoral sandblaster (Microetcher™ II). The remaining steps were carried out precisely in the same manner as for the left central incisor.

After completion of the restoration, both central incisors were checked for symmetry and the necessary anatomic corrections were performed. Initial finishing and polishing was realized according to the same protocol used for the left central incisor (Figure 33).

The lateral incisors were restored following the protocol used for the right central incisor. No bevel was placed because a labial offset was present. The composite resin was applied facially, lingually, and incisally to create proper tooth morphology and proportion.

Because much of the desired form and color were present, the canines received a more conservative restorative approach than the incisors. To reestablish proper canine guidance, the canine cusps needed to be lengthened accordingly. A moderate lingual bevel was placed to generate enough space for composite placement and to account for resisting the biomechanics involved in strong lateral movements of the mandible. The composite-layering sequence used all the previously cited shades in the same order of application, except for the B1 base shade because no contour modification was necessary at the cervical third (Figure 34).

The occlusion was checked with Accu-Film® II¹, and the restorations were further finished and polished. Because direct restorations such as these require long appointments, it is usually advisable to appoint the patient

¹ Cosmedent, Chicago, IL 60640

² GC America, Inc, Alsip, IL 60803

¹ Parkell®, Farmingdale, NY 11735



Figure 35—After secondary and tertiary anatomy was achieved, final polishing was performed while retaining a natural, enamel-like surface texture.



Figure 36—A beautiful smile showing biofunctional restorations that present total integration with the surrounding tooth structure, gingiva, and lips.

another time for final anatomical refinements. The value of this action is twofold—it allows the patient time to subjectively evaluate the esthetic and functional results while permitting the practitioner to perform the artistic refinement with better visual acuity and more accurate three-dimensional perception.

At the following appointment, the patient expressed no desires other than to round off the incisal edges of the lateral incisors and slightly open the incisal embrasures. These modifications were completed and accentuation of the secondary anatomy (developmental grooves, lobes, cingulum, and marginal ridges) was done with 12-fluted carbide and sintered diamond finishing burs (Art & Science Composite Finishing System^a). Surface texturization was accomplished to emulate that of the opposing dentition.

When the finishing was completed, the restorations were once again checked for morphological refinement, width/length ratio, embrasure forms, and line angles, and were ready to be polished. The restorations were lightly buffed with abrasive polishing cups and points (Composite Finishing System^a) to eliminate some of the undesired accentuated texturization. Composite polishing paste (Enamelize^{TM,j}) was used with a buffing disc (Flexibuff^{TM,j}) to impart a high shine to the restoration surface while still retaining the designed surface texture (Figure 35). After final polishing, the restorations were further light-cured for 60 seconds from the labial and palatal aspects. The result was a highly esthetic, biofunctional restoration that presented total integration with the surrounding natural tooth structure, gingiva, and lips (Figure 36).

Conclusion

Esthetic dentistry demands keen observation, patience, and meticulous application of existing technique protocols. However, the ultimate esthetic result will not be achieved without adequate training and implementation of a proper armamentarium learned through motivation and intensive training. Composite resin technology has and will still undergo the most changes in dentistry in the present age. Advancements in material physical and optical properties will summon an ever-growing number of practitioners to incorporate and, perhaps, prefer direct over indirect techniques whenever indicated. As improved resin systems continue to be introduced, immeasurable benefits will be realized in the exciting field of dentistry.

Disclosure

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