Conservative Aesthetic Enhancement of the Anterior Dentition Using a Predictable Direct Resin Protocol

Marcos Vargas, DDS, MS*

Aesthetic enhancement of the maxillary dentition can be accomplished using a variety of direct and indirect methods. Composite resin procedures enable the clinician to follow a predictable, conservative, and reliable chairside protocol for improving patients' smiles. Combined with advances in adhesive materials themselves, these procedures can be used successfully in the daily practice of restorative aesthetic dentistry. This article will demonstrate the protocol used to enhance the appearance of a patient who presented with concern regarding short crown length.

Learning Objectives:

This article discusses a conservative approach to providing a predictable aesthetic outcome to the anterior dentition using direct composite resin. Upon reading this article, the reader should:

- Understand how the bevel preparation allows the practitioner to create a seamless, natural-looking restoration.
- Become more familiar with the lingual shell approach toward predictable composite resin buildup.

Key Words: direct, composite resin, anterior, microhybrid, lingual shell, matrix

**Associate professor, Department of Family Dentistry, University of Iowa, Iowa City, IA.*

Marcos Vargas, DDS, MS, Department of Family Dentistry, University of Iowa, Iowa City, IA 52242
Tel: 319-335-7208 • E-mail: marcos-vargas@uiowa.edu

Since the introduction of composite restorative materials and adhesive bonding procedures in the 1960s, various resins have been developed in the industry's attempt to enhance their longevity, clinical performance, and color compatibility with the natural dentition.[1,2] The earliest of these materials, self-cured composite resins, faced well-recognized limitations that included their inadequate polishability, color stability, and durability.[3,4] With the advent of light-cured composites in the following decades, however, adhesive bonding evolved considerably, enabling predictable resin placement in anterior and posterior regions.[4,5] These materials overcame many of the limitations of the first materials and gained favor in direct bonding techniques. Numerous reports confirmed the improved mechanical and optical properties of hybrid and microfill resins, respectively, in such procedures.[6,7]

While still applied in the initial "sandwich" technique by many clinicians, the use of hybrid and microfill materials has yielded to microhybrid resins, nanocomposites (eg, Filtek Supreme Plus, 3M Espe, St. Paul, MN), and resin technologies that incorporate nanofillers into microhybrid composites (eg, Premise, Kerr/Sybron, Orange, CA). As a result of their composition and small-particle fillers, these new materials provide improved strength, wear resistance, handling, and polishability in a single resin material.[8,9] Additionally, they have handling properties that are extremely conducive to direct resin stratification techniques. Further demonstrating their aesthetic potential, some clinicians have reported on the similarities that exist between stratified porcelain restorations and direct composite resins.[7,10,11]

Similar developments have occurred in adhesive technology, allowing clinicians to achieve success with enamel and dentin bonding. Not only does this reinforce the tooth structure and improve stress distribution at the margin between the composite resin and the tooth,[12] but it also reduces the potential of microleakage, staining, and subsequent caries.[4,13] As the bond strength between acid-etched tooth surfaces and bonding agents has improved, the longevity and popularity of direct resin restorations has grown in kind.

Before applying any restorative material, however, it is first imperative for the clinician to conduct a thorough patient evaluation, to arrive at a single diagnosis, and to formulate a treatment plan (Table). Since there are

Figure 1. Preoperative smile and anterior view of patient who had undergone previous tooth whitening for aesthetic enhancement.

Figure 2. The length, occlusion, and contour of the central incisors were determined in a diagnostic waxup.

Figure 3. A polyvinylsiloxane impression was made of the waxup and used intraorally for a mock up and patient communication.

Table

Sequential Aesthetic Checklist

- Incisal length
- Tooth width
- Tooth proportions
- Embrasures
  - Incisal
  - Cervical
  - Facial and lingual
- Facial crest of contour
- Developmental depressions
- Surface characterization
- Occlusion
- Surface gloss

Figure 4. After a matrix was created, preparation of the four central incisors was performed following shade matching and rubber dam isolation.

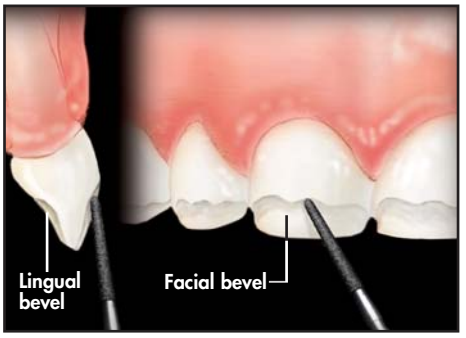

Figure 5. Diagram of the scalloped bevel design used to conceal the margin between the natural teeth and the resin materials.

Figure 6. Application of the adhesive agent (ie, OptiBond FL, Kerr/Sybron, Orange, CA) following acid etching of the teeth.

numerous restorative options available to treat a given condition, it is important to uncover the etiologic and biologic factors before recommending the course of therapy. As composite resins represent a more conservative alternative to achieving aesthetic enhancement,[14] it is important that clinicians have a reliable technique for delivering such restorations with success and predictability. Demonstrated here is an effective technique that allows the clinician to preview the intended outcome prior to treatment, to establish a guideline for tooth contour and proportion, and to deliver the restoration accordingly.

Clinical Technique

Diagnosis and Treatment Planning

A 26-year-old female presented for aesthetic enhancement of her smile (Figure 1). Comprehensive clinical and radiographic examinations were performed, revealing that the patient—herself a dentist—had previously undergone tooth whitening, yet had short clinical crown lengths and excessive gingival display in the anterior maxilla. The patient was already aware of the available treatment options and selected direct resin bonding to restore teeth #7(12) through #10(22) due to its aesthetic potential and its minimally invasive nature.

Models of the patient's existing dentition were subsequently mounted in a semi-adjustable articulator, where the four central incisors were waxed up to ideal length, occlusion, and contour (Figure 2). This waxup was captured in an impression and used by the clinician to mock up the planned restorations intraorally. This step allowed the practitioner to check the patient's incisal position, length, and occlusion with the planned restorations. It also facilitated patient feedback regarding the anticipated result and the related aesthetic goals. In the author's experience, this technique proves invaluable to establish patient expectations and enables a comparison to the restorative treatment plan. A polyvinylsiloxane impression of the diagnostic waxup was also made and would be used by the clinician throughout the resin buildup (Figures 3 and 4).

Figure 7. A thin-bladed composite instrument was used to contour the material over the lingual matrix.

Shade Selection

The desired shade for the composite resin buildup was then determined using a shade-matching system (ie, Vitapan Shade Guide, Vident, Brea, CA). Since a halo effect was desired in the restoration, an XL1 shade was selected and would be used as a lingual increment. A shade with dentin-like opacity was selected to replace the natural dentin, and a translucent layer was selected to create translucency in the incisal third. Ochre and white stains would be utilized to instill maverick colors and natural characterizations for the composite stratification; enamel replacement would then be created using B1 body-shaded resin. All shade selection was accomplished after pumicing and prior to tooth isolation, which could have negatively influenced assessment as a result of tooth dehydration.

Preparation Design and Conditioning of the Tooth Surfaces

The procedure was performed under rubber dam isolation to ensure the control of moisture throughout the direct resin buildup. The required preparation design was simply facial and lingual beveling of the remaining tooth structure, which would help conceal the transition line between the natural tooth structures and the resin materials upon placement and polymerization.[14,15] The scalloped facial bevel served as a "functional-aesthetic bevel," which began slightly inside the dentin-enamel junction (DEJ) at a 75° angle, and disappeared towards the cervical area. The lingual bevel was a "functional bevel," and was a 45° angle of the enamel thickness (Figure 5). The bevels were also extended through the interproximal areas for harmonious blending of the resin into these regions.

Contouring disks were used to render the margin imperceptible. Once the enamel and dentin had been acid-etched and rinsed, a primer and an adhesive (ie, OptiBond FL, Kerr/Sybron, Orange, CA) were applied over the tooth surfaces and light cured for 20 seconds (Figure 6).

Composite Stratification

A small quantity of resin (shade XL1) was placed in the lingual bevel to form the lingual shell for the buildups. This particular shade was selected to facilitate the reproduction of the desired incisal halo. Once this increment had been adapted to each lingual bevel to ensure a

Figure 8. An artist's brush was used to smooth the lingual layer (ie, shade XL1) of resin.

Figure 9. A small increment of resin was placed against the metal matrix to permit buildup of the interproximal aspects.

Figure 10. The IPC instrument was again used for shaping of the incisal embrasures.

Figure 11. All lingual shells and proximal walls were finished accordingly for the anterior teeth.

Figure 12. An opaque resin material was selected to replicate the dentin layer and contoured to place.

Figure 13. The shape of the dentin lobes was made with a thin-bladed composite instrument.

Figure 14. To replicate natural characterizations in the buildups, white and ochre stains were added incisally.

Figure 15. Translucent resin (ie, shade Super Clear) was placed to create the desired incisal translucency.

marginal seal, the matrix was then inserted. The material was spread over the matrix using a thin-bladed interproximal carver (IPC) instrument. It was important to monitor the thickness of this layer, as an average thickness of 0.3 mm was required. A thinner increment could have resulted in a weak layer and fracture during subsequent layer placement; a thicker layer may have been too opaque and could have prevented proper light transmission (Figures 7 and 8). The incisal halo was created in this layer by extending the increment to the incisal edge, where thickness further increased the opacity and value of the incisal edge.

To ensure customization of each tooth, the buildups did not touch one another during the layering process. Each tooth was cured for 20 seconds, and the matrix was removed. Since the occlusion was planned in the semi-adjustable articulator and translated from there to the mouth by the lingual matrix, future occlusal adjustments would be minimal once the restoration was completed, thus saving considerable chairside time compared to other freehand techniques.

A thin metal strip was inserted between tooth #9(21) and #10 to permit the formation of the interproximal walls. Once in position, an increment of resin was placed against the strip and shaped with the IPC to the correct incisal embrasure (Figures 9 and 10); sable brushes were used to smooth the surface of the buildup prior to light curing for an additional 20 seconds. The procedure was then repeated, inclusive of the polymerization step, for the mesial aspects as well. The remaining maxillary incisors were then completed in a similar manner (Figure 11). This technique ensured proper proximal contour and proximal contact; the use of wedges was avoided to prevent any potential tissue recession in this patient, who had a thin gingival biotype.

Development of the lingual-proximal shells consequently reserved space within each lingual shell for the placement of additional resin materials and stains. Inadequate space could have required excessive and undesired finishing along the facial aspect of the restoration or prevented subsequent layers to be placed in proper thickness. This could have negatively affected the translucency and resulted in an overly opaque result. A microhybrid resin with dentin-like opacity (ie, Premise, Opaque B1, Kerr/Sybron, Orange, CA) was applied for dentin replacement and feathered over the bevel to imperceptibly blend it over the tooth structure (Figure 12).

Figure 16. A roller was used to spread the enamel composite material without entrapping voids in the resin.

Figure 17. A flat stiff brush was used to smooth the final increment of enamel-shaded resin.

Figure 18. A flame-shaped finished bur was used for initial contouring of the direct resin buildup.

Figure 19. Rubber cups and polishing brushes were used to render the final appearance of the resin restorations.

Once dentin lobes had been created and evaluated in the buildup of tooth #9, the dentin for the adjacent restorations was built up similarly (Figure 13). The dentin thickness was evaluated prior to polymerization from the incisal edge. To instill the proper translucent effects in the incisal third of the restorations, minute white and ochre stains (ie, Kolor+, Kerr/Sybron, Orange, CA) were also added to the dentin layer (Figure 14). With these characterizations complete, a translucent layer of resin was added to the buildups, ensuring that the invaginations between the dentinal lobes were filled (Figure 15). Upon light curing and final polishing, this layer would create the desired incisal translucency for the restorations.

The final enamel increment of composite was added to the facial surface in one increment of resin. This increment was contoured to a round, ball shape and picked up with the composite resin instrument for simple application that would prevent the undesired entrapment of air or voids that could compromise the completed restoration (Figures 16 and 17). The side of the brush was used to create developmental grooves, and the material was extended to produce the desired facial embrasures. The thin-bladed instrument prevented excess material from accumulating in the cervical and interproximal regions. A gold almore instrument was subsequently used to produce developmental grooves in the resin buildup; this final increment of enamel resin was polymerized for 40 seconds.

Contouring and Polishing Protocol

While the value of the restoration has the greatest affect on success, ensuring proper shape and facial anatomy is also important for a successful restoration. The incisal length was evaluated and any adjustments were made with a polishing disk. Incisal embrasures were evaluated and consistently opened distally to match the mesial embrasure of the canine. The facial embrasures and facial crest of the contour were evaluated from an incisal view, and the cervical embrasures and proximal contact were evaluated

Figure 20. Postoperative facial view of the completed restorations showing enhancements made to the anterior maxilla.

and modified as necessary. The proximal areas were subsequently polished with thin plastic strips (ie, Epitex, GC America, Alsip, IL). A flame finishing bur was used to further define facial developmental depressions (Figure 18). A tapered diamond bur was used to produce surface characterizations and the rubber dam was removed. The occlusion was verified in centric occlusion followed by protrusive and lateral movements before polishing cups and brushes were used to polish the restoration and provide a final finish, respectively (Figures 19 and 20).

The patient returned two weeks postoperatively for a follow-up examination, at which time no problems were discovered and the patient confirmed her satisfaction with the smile enhancement achieved with the direct resin procedure.

Discussion

When contemporary resin materials will be used for the restoration of the anterior maxilla, several direct techniques can provide significant opportunities for aesthetic enhancement. Freehand techniques offer a great deal of creativity to the attending clinician and have been demonstrated throughout the dental literature. The lingual matrix technique can be extremely effective in guiding the clinician's reproduction of the ideal proportions, shapes, and anatomy created in the diagnostic waxup and saving invaluable chairside time.

Several resin restorative systems and techniques are available to the dental practitioner to build imperceptible anterior aesthetic restorations. The practitioner should match the material and technique to the anticipated restorative result and the patient's desires and expectations. The matrix technique is an excellent choice when several large multilayered restorations are desired. Inversely small, single–shade-opacity restorations can be readily accomplished without the use of a matrix.

Conclusion

This multilayered lingual matrix technique represents a highly predictable and repeatable method for building up the direct resin restoration. This restorative technique can be used successfully with the available multiple shades and opacities. As composite resins are used for aesthetic enhancement, the procedure represents a valuable framework on which to develop a rich stratification of natural tooth colors and shades, all built to a natural final appearance that achieves the expectations of both patient and professional.

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