Restoring Central Incisors

The Synergy and Pathway to Predictable Esthetics

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> **"The dentist and ceramist must have excellent communication and work as a team to obtain optimal results."**

Introduction

The most predictable esthetic restorations revolve around the interaction and communication among the dentist, the patient, and the ceramist. Once the treatment pathway is selected, a comprehensive step-by-step plan must be followed to ensure the ultimate success of the case.

There have been many advances in the art and science of dentistry, and introduction of new techniques such as metal-free restorative materials. IPS e.max (Ivoclar Vivadent; Amherst, NY) is one such innovative material. e.max is an all-ceramic lithium disilicate glass ceramic ingot with 400 MPa flexural strength. This makes it possible to provide high-strength, thin restorations with conservative tooth preparations.[1-3]

The ingots of e.max were designed to replicate the opalescence and translucency of natural tooth structure. A wide variety of e.max ingots are available to obtain the final desired shade. The dentist and ceramist must have excellent communication and work as a team to obtain optimal results.

Case Presentation

A 35-year-old female presented with discolored bonding on the facial incisal area on tooth #8. Tooth #9 had incisal edge wear. The patient was self-conscious about her two front teeth, which created a reverse smile line. She wished to lengthen them and make the permanent restorations more color-stable and lifelike to improve her smile **(Figs 1-3)**.

Medical and Dental History

After a thorough examination, no medical contraindications or allergies were found. A comprehensive dental examination revealed soft tissue health, and results of radiographic and oral cancer examinations were within normal limits. There was a history of endodontic treatment in addition to some missing teeth and restorative fillings. The muscles of mastication were asymptomatic, and temporomandibular function was within normal limits, displaying no joint noises or deviations.

Diagnosis and Treatment Plan

A detailed examination included radiographs, the 12 required AACD images; and dental shade analysis, diagnostic models, and bite records. This allowed for communication with the ceramist, who could address the patient's desires. A treatment plan was developed to obtain a predictable result.[4]

The patient's chief complaints about her teeth were as follows:

- poorly blended composite on #8
- disproportionate length of #8 and #9
- reverse smile appearance.

Treatment

Preoperative

An all-ceramic IPS e.max lithium disilicate crown was selected for #8. This tooth had the old stained composite present. An all-ceramic IPS e.max lithium disilicate veneer was chosen to restore #9. These materials were selected to correct the color discrepancy and improve the length-to-width ratio. The central dominance and symmetry between #8 and #9 could be improved by increasing the length of these teeth. Increasing the length of these teeth in relation to the upper canines along the incisal plane would allow for the creation of a harmonious smile, eliminating the appearance of the patient's reverse smile line.[5-6] The goal was to create proportional restorations that matched the patient's natural dentition.

A diagnostic wax-up was made from a preoperative model. This served as a guide and aid in the communication process between the ceramist, dentist, and patient. Preoperative models were sent to the laboratory along with the required images, bite records, and a clear explanation of the patient's desires for the fabrication of a diagnostic wax-up.[7]

Figure 1: Full face, 1:10 view; self-conscious patient displaying reverse smile.

Figure 2: Frontal retracted 1:1 view; discolored bonding on #8.

Figure 3: Retracted 1:2 view; #9 showing incisal edge wear.

The patient was happy with the shape, length, and midline of the proposed wax-up. A silicone matrix was then made to be used by the doctor on the day of preparation to fabricate the temporaries exactly as the wax prototype **(Figs 4-6)**.

At the beginning of the restorative appointment, shade selection was performed and photographs were taken. This was done with and without shade tabs at various angles to show the laboratory as much surface texture and height of contour as possible.

Once the shade was verified, the teeth were prepared **(Fig 7)**.

Chamfer margins were created up to the free gingival margin and enough space was ensured for the proper shape of the porcelain. Retraction cords were placed around the prepared teeth. The stump shade was recorded, photographed, and sent to the ceramist **(Fig 8)**.

Final impressions were taken using Genie VPS impression material (Sultan Healthcare; Hackensack, NJ). The bite registration and photographs were sent to the ceramist along with a complete laboratory prescription detailing the required outcome and patient desires.

In the Laboratory

The ceramist read the prescription, reviewed the images, and examined the mounted models of the provisional restorations and prepared tooth models. The laboratory process began by making a silicone matrix of the provisional restorations that had been approved by the patient.

The matrix was seated on the working model with a small hole on the incisal edge. The matrix was then placed over the tip of the wax injector and the cavity was filled with beige Thowax (Yeti Dental; Engen, Germany), transferring the shape, form, and function from the provisional. After the wax-up was finalized, it was separated using a thin blade (Tanaka Dental; Skokie, IL), spread, and invested in a 100-gram ring, allowing the investment to set **(Fig 9)**.

After bench time was finished, the ring was placed in a burn-out furnace. The case was pressed in the Programat EP 5000 porcelain furnace (Ivoclar Vivadent), cooled, and divested. IPS e.max impulse series Value (V2) ingot was used. This ingot was chosen based upon the patient's stump shade (ND1) and to achieve the final desired shade of BL4 **(Fig 10)**.

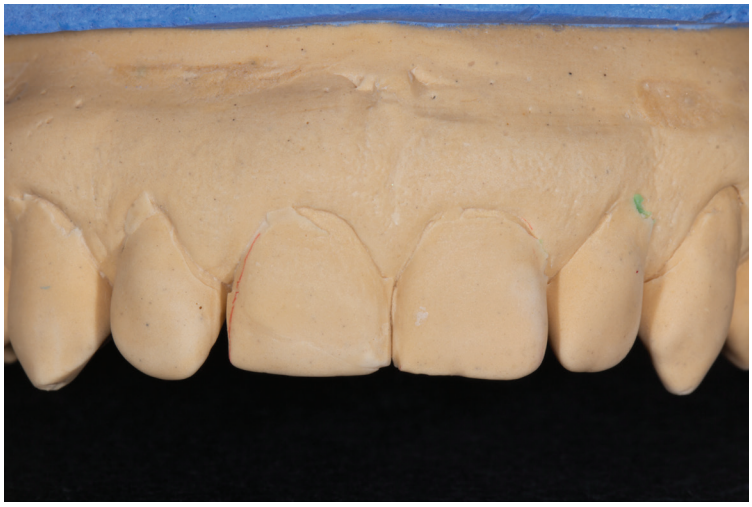

Figure 4: Preoperative model.

Figure 5: Diagnostic wax-up, showing proposed shape, length, and midline.

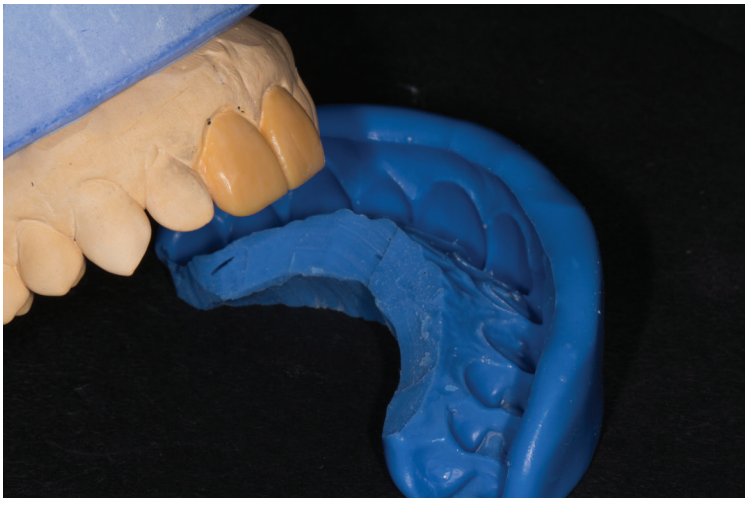

Figure 6: Silicone matrix, made for the doctor to make temporaries.

Figure 7: Prepared teeth.

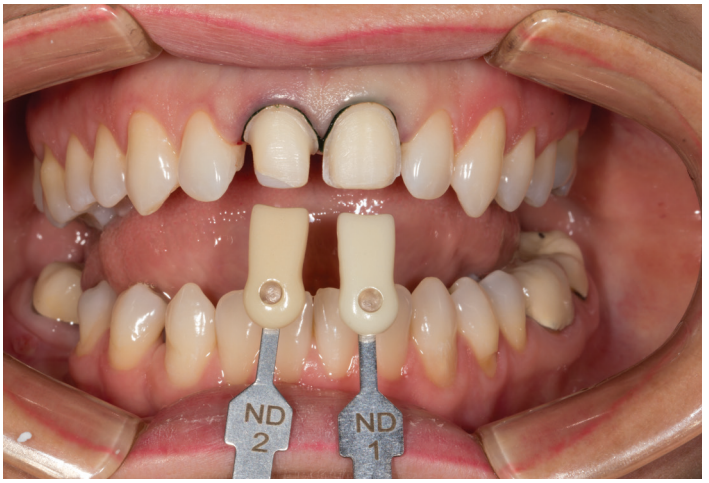

Figure 8: Stump shade selection.

Figure 9: Wax injector.

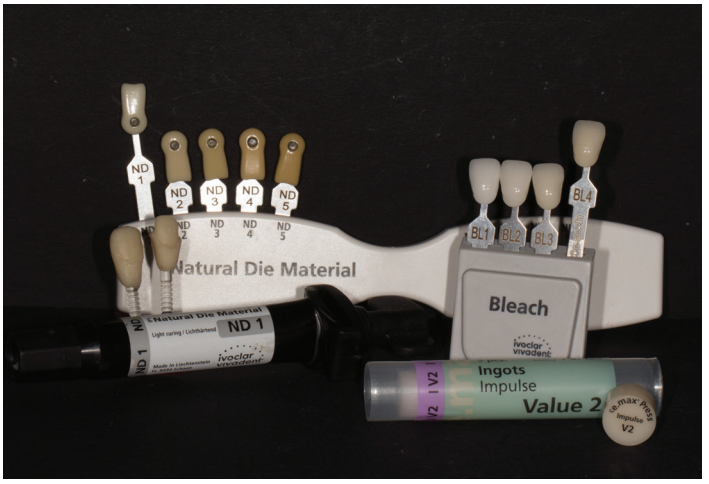

Figure 10: Material shade selection (stump ND1, final shade BL4).

Figure 11: Pressed restoration.

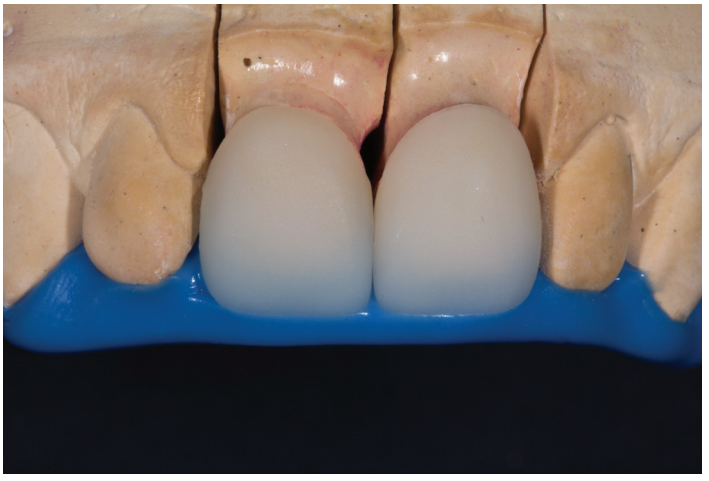

Figure 12: Incisal edge silicone matrix, helping maintain desired incisal length.

Once divested, the restoration was fitted to the working model. Occlusion, and excursive and protrusive movements were checked. An extra solid model was made to check the margins and contacts, and reshape it to the final contour **(Fig 11)**.

Prior to the incisal cutback, an incisal edge silicone matrix was made to keep the incisal length desired for this case **(Fig 12)**.

The images served as a guide to determine how much incisal cutback was needed. Due to the low level of translucency on the incisal third, a bleach color of BL4 was chosen for the final shade. This allowed for similar translucency in the incisal area between the central and lateral incisors.

A cut was made from the buccal incisal one-third surface toward the lingual and 1 mm from the incisal edge. Mesial and distal slots were created to enhance some of the translucency of the tooth **(Fig 13)**. Once the cutback was ready, the restorations were sandblasted, steam-cleaned, and dried. IPS Natural Die Material was made to fabricate and replicate the prepared teeth using stump shade ND1 **(Fig 14)**.

After placing the restorations on the stump die, a stain bake was needed before the first buildup **(Fig 15)**. A mixture of IPS Empress Universal Stain chroma B with a small amount of pink stain was used for the cervical third. Blue stain was used on the mesial/distal incisal corners for translucency effects. The restorations were fired at 725 °C with a one-minute hold.

When the technician was satisfied with the shade, the first layer was made by applying a small amount of IPS e.max Ceram (OE1) on the mesial/distal slots to create translucency, exactly on top of the blue stain **(Fig 16)**.

Line angles were enhanced by the application of Opal enamel 4 (OE4) and then fired at 750 °C **(Fig 17)**. After the restorations cooled they were ready for the full layer. The veneering layer was applied to full contour **(Fig 18)**. Based upon the low level of incisal translucency in the adjacent teeth, Opal Enamel 2 (OE2) was used. The restorations were placed on a honeycomb tray and fired at 750 °C with a one-minute hold. A second incisal was fired using the same OE2 enamel to fill in the final contours and deficient areas and fired again at 750 °C with a 30-second hold.

After the restorations were cooled, they were fitted on the working model to make sure all excursive and protrusive movements and contours were satisfactory. The restorations were placed back on the solid model and a diamond bur was used to

Figure 13: Cutback technique.

Figure 14: Stump die material selection (ND1).

Figure 15: Internal stain bake.

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Figure 16: Mesial/distal (OE1).

Figure 17: Application of Opal Enamel (OE4) on the line angles.

Figure 18: Full veneering layer.

Figure 19: Bisque bake.

Figure 20: Shade verification on stump die.

adjust the contacts as well as the occlusion, size, shape, middle line, and line angles.

After reviewing the images and study models, it was noticed that there was a smooth surface on the upper incisors and defined line angles. Very little texture was needed based upon the study model.[8]

When everything was satisfactory, the restorations were prepared for the final glaze. They were carefully sandblasted on the inner surface and cleaned in an ultrasonic unit. They were then placed on the stump die, and a small amount of stain liquid was applied to the facial surface to expose the color for shade verification **(Figs 19 & 20)**.

The shade guide and the images were compared. Based on this comparison, a mixture of Empress Universal Stain, chroma B with a small amount of pink stain, was applied on the cervical area and baked at 725 °C. Shades were compared for accuracy, and then the units were glazed by applying a thin layer of luster powder (GC America; Alsip, IL) mixed with liquid. The restorations were then baked at 725 °C. After glazing the restorations, they were placed on the solid model again to recheck the fitting. The restoration line angles were polished with a pink rubber wheel (Dedeco; Long Eddy, NY) and Diashine paste (VH Technologies; Lynnwood, WA) with a white bristle brush.

To finalize, the restorations were sandblasted with aluminum oxide (50µ) and etched with 5% hydrofluoric acid for 20 seconds, rinsed, steam-cleaned, and dried. The restorations were properly packaged and delivered to the doctor's office for cementation **(Fig 21)**.

Cementation

The patient was anesthetized and the temporary restorations were removed. The final restorations were evaluated for proper fit and esthetics. Silane (Kerr; Orange, CA) containing resin was applied to the internal portions of the restorations, lightly air-thinned, and placed in a light-proof box.

The teeth were etched with 37.5% phosphoric acid (Gel Etchant, Kerr) for 15 seconds, rinsed thoroughly, and lightly air-dried. The dental adhesive (OptiBond Solo Plus, Kerr) was applied to the enamel and dentin surfaces with an applicator tip for 15 seconds in a light brushing motion and light-cured for 10 seconds.

Both restorations were filled with the luting cement (NX3 Universal Resin Cement, Kerr) and

Figure 21: Frontal view of finished case on model.

Figure 22: Full-face postoperative 1:10 view.

Figure 23: Frontal postoperative 1:1 view.

seated gently on the teeth, allowing the cement to slowly flow from all margins. The veneer was spot-cured into place on the facial surface for 10 seconds. The crown was light-cured for five seconds on the buccal and lingual. After removing the excess cement, all surfaces were light-cured for 20 seconds per surface. The margins were finished with a fine diamond bur. The occlusion was checked and the lingual surface of the veneered tooth was adjusted and polished with Jiffy polishing points (Ultradent Products; South Jordan, UT).[9]

Summary

Anterior restorations in the maxillary region challenge the dentist and the ceramist to match the restorations to the natural dentition. Like any relationship, communication between the dentist, the patient, and the ceramist is crucial to properly plan the restorative case. The dentist and the ceramist must work well together and share a great knowledge of materials and techniques for the successful completion of a functional and esthetic restoration.

The success of this case revolved around the concept of placing the patient in provisional restorations that were identical in form, function, and appearance to the definitive restorations. The synergy between the dentist's and ceramist's abilities to reproduce the form and position achieved lifelike restorations that not only satisfied the patient, but also increased her self-confidence **(Figs 22-25)**.[10-12]

Figure 24: Retracted 1:2 view.

Figure 25: Ms. Villagrana; the patient, Imelda Medina; and Dr. Kurt.

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