

# Laboratory Realities

## SHADE MATCHING FOR A SINGLE TOOTH USING AN ALL-CERAMIC CROWN: LABORATORY PROTOCOL

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Dental professionals can use various materials and techniques to restore patients who present for treatment of discolored dentition. When this discoloration will be treated with indirect restorations, each available alternative (eg, metal-ceramic or all-ceramic systems) has its own respective advantages and indications, which must be carefully weighed by the clinician and the laboratory technician. Although various techniques have been developed in recent decades to improve the results achieved with porcelain-fused-to-metal (PFM) restorations, these materials—in spite of their recognized strength and durability—can be challenging to use in the anterior region, where their lack of translucency and inhibition of light transmission can be limiting factors. As an alternative, all-ceramic systems have grown increasingly popular due in large part to the natural translucency and aesthetics they provide in a dental restoration. Whether using PFM or all-ceramic restorations, accurate color matching in the anterior maxilla can be challenging, particularly for a single tooth. Communicating to the laboratory technician the correct shade needed to

provide an aesthetic restoration is just as important as shade mapping. This article highlights a successful shade matching case using an all-ceramic restoration.

### Case Presentation

A 48-year-old male presented with gingival recession and a severely discolored crown on tooth #8(11). Clinical examination revealed a loose provisional acrylic crown with solid and caries-free underlying tooth structure. Evaluation of the pulp revealed its health and normal vitality. A treatment plan was formulated whereby the clinician would provide a pressed all-ceramic restoration for the maxillary right central incisor. After fabrication, the provisional crown would be removed so the preparation could be cleaned prior to try-in and shade evaluation. The internal surface of the crown would then be conditioned; the tooth preparation would be etched and a bonding agent would be applied for final cementation. Ultimately, the all-ceramic restoration would be seated using a translucent resin cement (ie, Calibra, Dentsply, York, PA).



**Figure 1A.** Preoperative facial view of the patient who presented with gingival recession and a severely discolored provisional restoration on tooth #8(11).

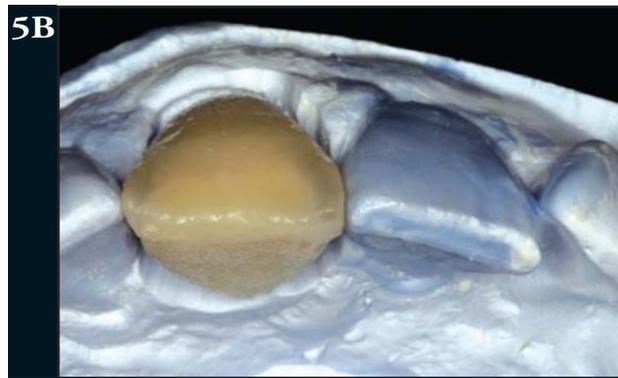
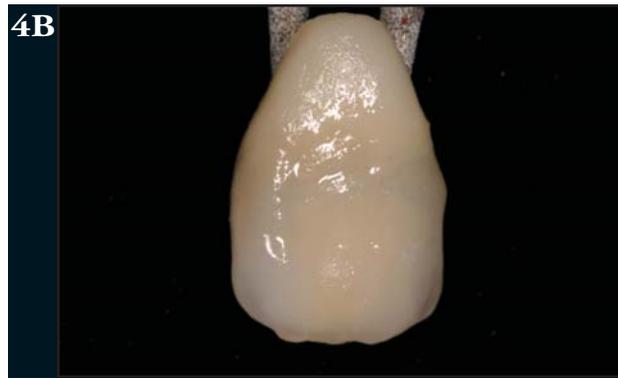


**Figure 1B.** Postoperative view of the definitive restoration of tooth #8. Note the color match and improved emergence profile of the all-ceramic crown.

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# Laboratory Realities





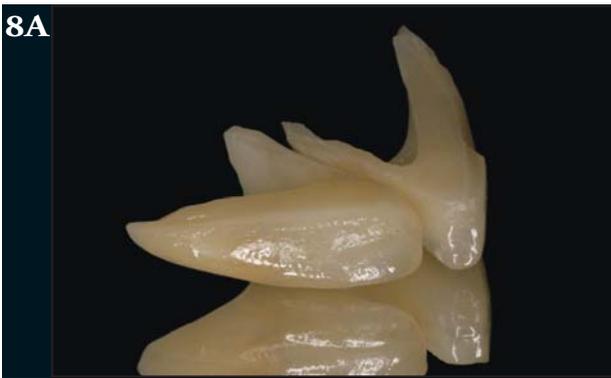
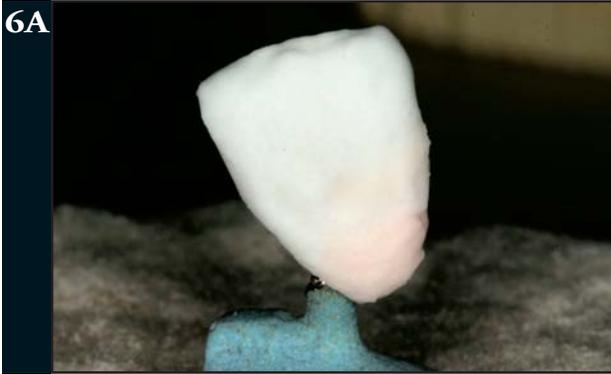
**Figures 2A,B.** Following the completion of the clinical examination, the tooth was prepared to receive an all-ceramic restoration. Shade mapping was performed by comparing shade tabs to the underlying dentin of this maxillary central incisor. Once this shade was recorded, the shade of the adjacent left central incisor was also determined. Photographs of the preparation shade were also taken and forwarded with a vinylpolysiloxane impression (ie, Aquasil, Dentsply Caulk, Milford, DE) of the prepared tooth to the dental laboratory. A provisional acrylic crown (ie, Integrity, Dentsply, Milford, DE) was placed at the site of tooth #8 while the definitive restoration was fabricated. Ensuring that each step was properly conducted would enable the authors to create a durable restoration that met the aesthetic expectations of the patient.

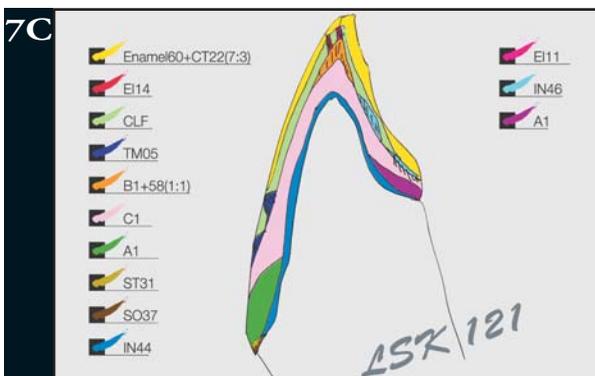
**Figures 3A,B,C,D.** Due to the complex coloring of the contralateral incisor, the clinician had requested the development of a custom shade for the restoration. In the dental laboratory, a pressed coping (shade B2) was first created for the all-ceramic restoration (ie, Initial, GC America, Alsip, IL). The coping was then examined to ensure that sufficient space would exist for the subsequent porcelain buildup. Internal characterizations of blue and gray stain were added to the incisal region, and the buildup was fired for 1 minute and held at 770° C. In the cervical third of the tooth, ceramic was added in consideration for the desired value of the restoration. A dentin-shaded C1 body ceramic was then added to the buildup. Application of a cervical porcelain A1 and a gingival body translucent modifier followed in accordance with the intended morphology of the definitive restoration.

**Figures 4A,B,C.** The buildup was fired for 1 minute and held at 770° C to achieve the desired body and translucency shades. At this stage of fabrication, six different shades of porcelain were evident in the buildup. Additional porcelain CLF was added to the cervical and incisal thirds of the restoration prior to the second firing in order to replicate the effects and characterizations evident in the adjacent natural tooth. Throughout the process, all shades were carefully matched through extensive communication between the laboratory technician and the clinician.

**Figures 5A,B,C.** The dentin was fired for a second time for 1 minute and held at 765° C. Following the completion of this bake, the laboratory technician verified the contour of the tooth to ensure that sufficient space existed for the final porcelain powders and the addition of mamelons. Once final colors TM 05 were added to the cervical buildup, additional ceramic powders EI 14 and EN 60 + CT22 (7:3) were added to the incisal third of the restoration.

# Laboratory Realities





**Figures 6A,B,C.** The appearance of the buildup was again evaluated prior to firing, which was subsequently completed at a temperature of 760° C for 1 minute in a porcelain furnace. The fired restoration was then tried on the patient's model so that its contour could be verified. This represented an important step, because it not only confirmed the correct fit, but it also demonstrated the final shade of the all-ceramic crown.

**Figures 7A,B,C.** The completed all-ceramic crown (ie, Initial, GC America, Alsip, IL) demonstrated a smooth surface texture that would, upon seating and cementation, be imperceptible from the patient's existing dentition. The full-coverage crown would be adhesively bonded to the prepared tooth following conditioning of its intaglio surface, further enhancing the long-term prognosis of this treatment. Through the use of a detailed shade mapping protocol and meticulous procedures in both the clinical setting and laboratory environment, the restoration would be seamlessly integrated with the natural teeth.

**Figures 8A,B,C.** The author created a spare crown to show the segmentation of the porcelain layer and its importance. The definitive crown restoration was remounted on the model in preparation for final polishing. Diamond paste was applied using a Robinson brush to render the final luster and appearance of the crown. Silver powder was placed on the maxillary central incisors in order to permit more efficient evaluation of the restoration's line angles and to enable the technician to confirm that all functional and aesthetic requirements were achieved prior to forwarding the crown to the clinician for cementation.

**Figures 9A,B,C.** The provisional crown restoration was removed, and the preparation was cleaned prior to try-in of the all-ceramic restoration for fit and shade match. Once the internal surface of the crown was prepared, the abutment tooth was etched and covered with a bonding agent in preparation for final bonding. The all-ceramic restoration was seated with a translucent-shaded resin cement (ie, Calibra, Dentsply Caulk, Milford, DE). Excess cement was removed after a partial cure, and the margins were cleaned and polished. Occlusion was evaluated in centric relation and centric occlusion, and the treatment was completed. Matching a single anterior crown to the shade of the natural dentition is regarded as one of the most difficult challenges in aesthetic dentistry. As demonstrated by the final outcome of this case, however, successful results can be achieved through the proper use of contemporary restorative materials, laboratory protocols, and clinical techniques.

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