SUCCESSFUL CUSTOM SHADE MATCHING of a single central tooth presents the greatest challenge for dental technicians. Often, the host of variables with which they must contend are of larger concern to them than to the patient or dentist. When a patient presents with a single central tooth that must be matched and the intrinsic stump shade is very dark, the challenge of shade selection can be significant. Adding to this difficulty may be other variables such as the lack of prepared tooth structure and minimal opacity of the surrounding natural dentition.

Even the most skilled and knowledgeable technician can be presented with a case that challenges his or her technical abilities. The author possesses two decades of experience with custom shade-matching, but occasionally is confronted with a problem that tests his expertise.

The case outlined here is an example of such a situation and resulted in a restoration that blended seamlessly with the patient’s surrounding dentition. Because of this, the author would like to share the struggles he overcame and the approach he took when working on this particular case.

Case Report
When the case for a female patient arrived in the laboratory, the author evaluated the accompanying photographs and the fabricated study model. Several problems were immediately evident. The tooth being restored— tooth No. 8 central—was minimally prepped on the facial aspect. Lingually, the preparation was adequate, but facially the author knew he would need to overcome issues involving lack of space for creating optimal opacity. His approach to fabricating the restoration took this tooth-preparation variable into account.

Adding to the difficulty in this case was the tooth’s stump color, which was very dark, nearly black. Compared with tooth No. 9, which exhibited a high transparency color with mamelon, tooth No. 8 displayed less opacity in the core with which to match tooth No. 9. The author knew that he would need a sufficient amount of opacity in the coping in order to mask the black stump shade and deliver a color match.

The last problem the author noted was the width of the space for restoring tooth No. 8. It was larger than the space occupied by tooth No. 9. He concluded the size of the lobe and the contour of the prosthesis could perhaps create a reflection for matching of the appearance between the two teeth.

He then studied the results of his custom shade analysis and created a strategy for the final restoration.

Case Study
After the temporary restorations had been removed, the author seated the patient for a custom shade appointment, and a postoperative photo of the stump color was taken. The author immediately noticed the dark stump shade (Figure 1), and divided the tooth into three segments—the gingival, middle, and incisal—in order to note all colors and characteristics he saw within the dentition. He noted translucency

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Fig 1. The author noted the dark color of tooth No. 8 stump when the temporary restoration was removed.
Fig 2. A custom shade of the post-operative stump was recorded.
Fig 3. A wax-up of the coping was created.
with heavy opacity in the mesial-distal corner and body area, with heavy mamelon in the incisal one-third. The noted colors were a dark beige/tan mixture with tan and grey lines between the teeth. The color was not solid but cloudy, and changed with the intensity of hydration or dehydration. Typically, the author has found that when he tries to describe the mamelon color, it is difficult to trust his eyes for the final analysis. It can often appear to be the chroma or dentin, but it’s sometimes not and is actually lighter than it appears to be. Just like a cloud, the translucency fades into the chroma/enamel color, but it is a heavy or a darker shade elsewhere. At times, it defies explanation.

The author checked the stump color against the shade tabs (Figure 2), a tool for guidance to establish the best map for his custom coloration. Next, he waxed up the coping for proper design and contour (Figure 3). He also had to consider proper esthetics and function in his design. He chose a high-opacity ingot for pressing (Figure 4) and, before the first bake, applied dentin and enamel to create the needed translucent

Fig 4. A high-opacity ingot was selected for pressing the coping.
Fig 5. The high opacity pressed coping before the first bake.
Fig 6. Translucency was created using Translucency Modifier No. 5.
Fig 7. Mamelon preparation was created using an inside sand color.
color—grey Enamel Opal No. 5 (GC America, gcamerica.com) (Figure 5). He then created translucency with Translucency Modifier No. 5, which is a dark grey in the image (Figure 6). The blue seen in the image is dentin.

For mamelon preparation, he created an inside sand color (Figure 7). Next, he applied Enamel Opal light blue No. 3 (Figure 8) and then Translucency Neutral (Figure 9), then Enamel No. 59 (Figure 10), after which he applied Cervical Translucency No. 23 (Figure 11). Enamel No. 11 is bright white and slightly grey in tone (Figure 12). A crack line application (Figure 13) was created during the bisque bake stage. The author painted glazing liquid onto the restoration (Figure 14) to better see the color. When the crown was assessed at a try-in appointment, the dental team determined that the author needed more mamelon and a grey/pink tone addition for a better match (Figure 15).

Again, the restoration was tried in the mouth with the use of custom shade tabs to determine which additional steps were needed to create a custom shade match (Figure 16). He evaluated the lower enamel in order to see the harmony of the color (Figure 17). The crown was removed and placed on the die in order to grind the incisal one-third and create a better appearance for the mamelon (Figure 18). Figure 19 shows how the restoration looked after grinding away the incisal one-third.

Certain areas of the crown were higher in shape. To address this, the author added Flo Dentin No. 93 to counterbalance the lines of the restoration (Figure 20). Next, he applied more mamelon with different enamel colors (Figure 21) and Cervical Translucency No. 22 (Figure 22). After baking, the restoration had

**After-preparation color, matching adjacent teeth, mamelon, and the demands from a patient seeking a perfect single anterior restoration all become critical.**
Fig 14. At Try-in a glazing liquid was used to better assess color match.

Fig 15. It was determined that more mamelon and a grey/pink tone needed to be added to achieve a perfect match.

Fig 16. On the second try-in custom shade tabs were used to assess the color match.

Fig 17. Custom shade tabs were used to assess color harmony with mandibular teeth.
this appearance on the model as noted in Figure 23. With another enamel application, he added TMO 5 and TMO 4 for improved color-matching harmony (Figure 24) and then a pinkish color to the gingival area (Figure 25).

On the model, after baking, the author double-checked the color (Figure 26) and then again in a mirrored view (Figure 27). Once more, the crown was tried in the patient’s mouth (Figure 28) for a color and fit check and this time with more pleasing results. The next views of the restoration in the mouth are of various side, close-up, and in/out angulations with edge-to-edge positioning, demonstrating the changes in mamelon color (Figure 29 through Figure 32).

**Conclusion**

One of the biggest issues the author confronted when trying to create this patient’s color match was tooth hydration and dehydration and the effect this had on the opacity of the restoration and on the mamelon color. This was of continuing concern and was addressed several times while working on the restoration.

For the best possible results, a technician should know the behind-the-scene methods for dealing with cases of this type before he or she begins to work on them. After-preparation color, matching adjacent teeth, mamelon, and the demands from a patient seeking a perfect single anterior restoration all become critical. Without the technician having this understanding, it would be difficult to mimic nature. While the opacity in this case is not a perfect match, it was as close as the author could achieve. This case was difficult and time consuming, with much effort put into the ceramic work before the author was able to call it completed.

The author asked the patient to return in 3 months after cementation for a photo, but she did not. In his opinion, this means she was happy with the results. That is, in the end, the best technicians can hope for or expect from the patient.
Fig 20. Flo Dentin 93 added to address high areas.

Fig 21 through Fig 23. More mamelon with different enamels, and cervical translucency added and crown fired.

Fig 24 and Fig 25. TMO 5 and TMO 4 were added for improved color matching harmony and a pinkish tone to the gingival area.

Fig 26 and Fig 27. The crown on the model and a mirrored view for a final color check.

Fig 28. On the third try-in the fit and color were checked.

Fig 29 through Fig 32. Various in/out, close-up, and angled views of the final restoration in the mouth.