Laboratory Realities

Replicating Natural Tooth Structure: Achieving Light Dynamics via Aesthetic Porcelain Stratification

Sang K. Jun, CDT*
David B. Love, DDS†

In recent years, the industry has developed innovative restorative materials for use in aesthetic dentistry. The continued evolution of these materials, as well as the further advancement of restorative techniques and laboratory fabrication procedures, have yielded the necessary tools for dental professionals to treat patients requiring either the replacement or enhancement of natural teeth.

While certain ceramic materials appear to have inherent advantages over others, it is predominantly the ability of the dental technician that drives the selection of the final restorative modality. For some professionals, porcelain-fused-to-metal (PFM) restorations may not seem as aesthetic as those created with all-ceramic systems. Yet with meticulous design, and exacting fabrication procedures, optimal aesthetics and long-term durability may be achieved with a PFM crown. The results of such procedures have been demonstrated throughout the dental literature and provided a visual context for the aesthetic expectations for both patients and professionals.

Nevertheless, laboratory technicians must continually educate themselves in order to understand the indications and limitations of a given restorative material. This allows each ceramist to maximize the material's full potential in fabricating a restoration with natural form, function, and optical properties that diffuse and reflect light similar to the natural dentition. Generally, this also requires the technician to blend and contrast color into the definitive restorations, whether they be PFM or all-ceramic, throughout the laboratory procedure.

Case Presentation

A 35-year-old male patient presented with unaesthetic restorations on teeth #9(21) and #10(22). Upon clinical examination, it was determined that the existing restorations were over 10 years old and demonstrated a poor fit along the margins. The patient desired to improve the aesthetics, and the clinician sought to achieve this goal while restoring the patient to proper function. Following discussion of the available techniques, the clinician and laboratory technician elected to pursue these treatment objectives via two full-coverage PFM restorations.

Figure 1A. Preoperative facial appearance of the patient. Note the severely compromised fit and aesthetics of the existing restorations.

Figure 1B. Postoperative appearance of the definitive PFM restorations on teeth #9(21) and #10(22). The patient was pleased with the improved aesthetics and function.

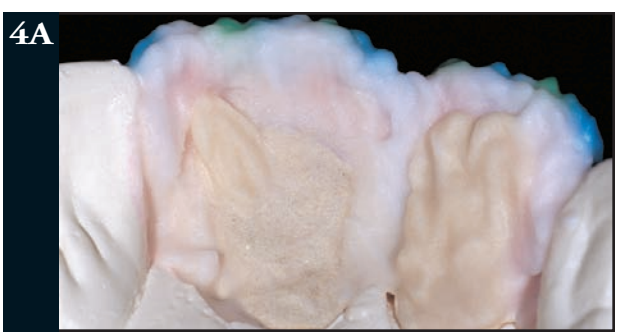
Laboratory technician and owner, Bay Dental Laboratory, Monterey, California.
†Private practice, Palo Alto, California.

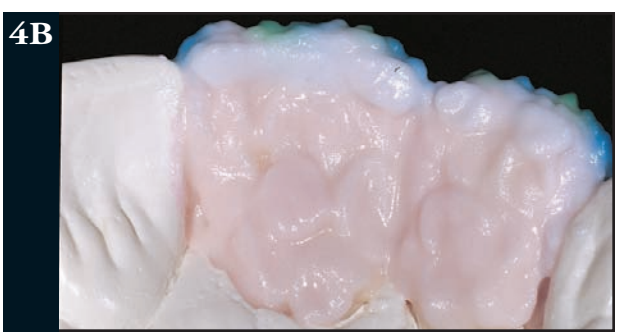

2A

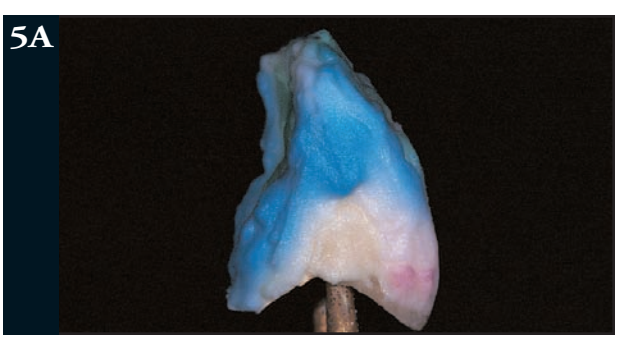

2B


3A


3B


4A

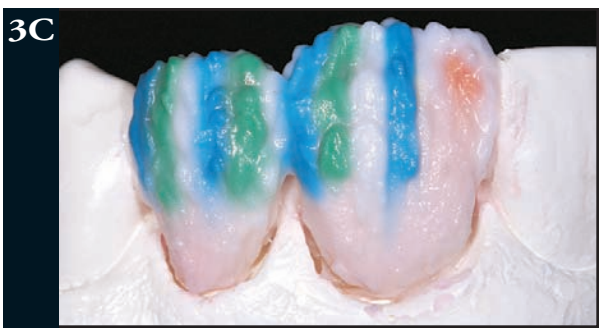

4B

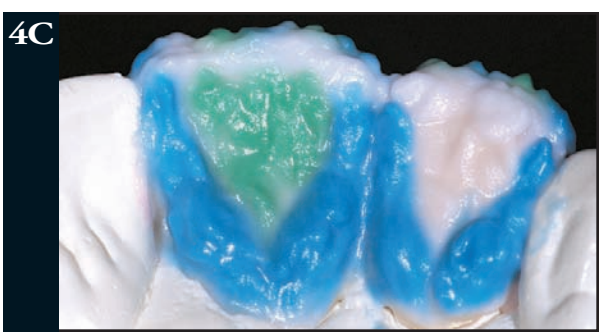

5A


5B


6A


6B





Figures 2A,B,C. Once the existing restorations were removed and the teeth were re-prepared, all patient-specific data was forwarded to the laboratory. In this stage, the substructure was first accomplished via electroforming (Gramm Technology, Woodbridge, VA). The first and second layer of opaque and porcelain margins were built up. A thin layer of whitish, opaque dentin was mixed with orange-colored opaque dentin and applied to increase the value. This would compensate for the eventual loss of value that would occur from multiple firings or aggressive use of translucent powders. The opaque dentin layer was slightly roughened with vertical lines so that light would be scattered naturally. The opaque dentin was baked, and these grooves were filled with clear translucent material.

Figures 3A,B,C. The dentin was built to final shape and contour, then cut back to provide space for the incisal and translucent effects, while simultaneously shaping the mamelons. Using an effect powder, incisal characteristics were rendered. After the internal stains were completed, the incisal layer was filled and extended with opalescent translucent ceramics to emphasize the effect by contrast and compensating for firing shrinkage. Layering different colors of enamel on the facial aspect only created an illusion of depth by contrasting light-dark and medium layers.

Figures 4A,B,C. The facial aspects of enamel layer were completed, at which time the palatal area was created. Saturated orange-colored opaque dentin was layered 1 mm to 1.5 mm above the tip of the coping to reflect light and to conceal the metal substructure, which could have caused the restorations to appear slightly gray when exposed to light. These areas were covered with dentin and built up with marginal ridges and anatomical features using enamel materials.

Figures 5A,B,C. Once the enamel layer was completed and the restorations had been removed from the working model, a reverse "V" shape was cut from gingival interproximal area and filled with a saturated orange-colored opaque dentin and covered with dentin and enamel. After the first firing was accomplished, the internal "live staining" technique was utilized to mimic natural decalcification (Noritaki, Aichi, Japan) and then fired at 820°C. The line angles were highlighted with bright enamel and layered with different colors of translucent ceramic to further enhance the illusion of depth.

Figures 6A,B,C. The definitive PFM restorations were polished to natural luster and returned to the clinician. The two full-coverage crowns were cemented and excess material was removed. The final restorations met the goals of both the patient and the clinician.

Address correspondence to: Sang K. Jun, CDT,
Bay Dental Laboratory
484 Lighthouse Avenue, Ste. 201, Monterey, CA 93940
Tel: 831-375-7338 • Fax: 831-375-7339
E-mail: sangjuncdt@yahoo.com