

Predictable Esthetic Results From the Placement of an Anterior 3-Unit, All-Ceramic CAD/CAM Restoration

Abstract

The drive for all-ceramic or metal-free dentistry has had its ups and downs over the past decade. However, computer-aided design/computer-aided manufacturing (CAD/CAM) materials have been introduced into the marketplace for the fabrication of 3- and 4-unit bridges. These materials hold promise for predictably satisfying the need for esthetic and strong restorations for such indications. Proper case selection for such all-ceramic restorations—as well as adhering to standard clinical protocol for preparation design, impress-taking, and cementation—is essential. This article presents a case in which an anterior, 3-unit, all-ceramic CAD/CAM bridge (Lava™ All-Ceramic System) was used to replace a previously placed porcelain-fused-to-metal bridge.



Michael Davenport, DMD,
MAGD

Private Practice
Lexington, SC

Faculty member

[Author: Please provide exact position for each.]

Medical College of Georgia
Augusta, GA

Palmetto Richland Memorial Hospital,
Columbia, SC

The LD Pankey Institute,
Key Biscayne, FL

have resulted in more predictable multiple-unit cases.¹ Although currently available technology precludes the reliable fabrication and subsequent placement of restorations [Author: Not sure what you mean by “precludes” here. Please clarify.] comprised of more than 4 units, 3- and 4-unit bridges can now be created and seated with confidence.

Material Description

In recent years, computer-aided design/computer-aided manufacturing (CAD/CAM) materials have been introduced into the marketplace for the fabrication of 3- and 4-unit bridges. One of the more promising materials, Lava™ All-Ceramic System^a, became available in 2003. Lava is a zirconia oxide product milled from various blocks,

^a3M ESPE, St. Paul, MN 55144; 800-216-9502

Over the past decade, some materials used for all-ceramic or metal-free dentistry have fared favorably, while others have failed miserably. Although most problems have occurred in multiple-unit restorations, single-unit cases have not been immune to failures.

Recent advancements in the composition and processing of all-ceramic materials and restorations



Figure 1—Preoperative facial view of the patient in full smile.



Figure 2—Preoperative right lateral view of the patient showing the existing porcelain-fused-to-metal bridge restoration between teeth Nos. 5 and 7.



Figure 3—Preoperative left lateral view of the patient.



Figure 4—Retracted view of the patient in centric occlusion.



Figure 5—Retracted right lateral view of the patient. Note the diastema mesial of tooth No. 7 and poor margins with associated inflammation.



Figure 6—Retracted left lateral view of the patient.



Figure 7—Close-up preoperative view of the patient's anterior dentition. Note the surface texture and high gloss of the central incisors.



Figure 8—Close-up preoperative left lateral view of the patient's dentition.



Figure 9—Close-up preoperative right lateral view of the patient's existing porcelain-fused-to-metal bridge restoration.

depending on the number of units desired. As a result of its proven record in other industrial areas, zirconia oxide is emerging in the dental industry and, when combined with CAD/CAM technologies, holds promise based on its material properties and clinical performance for use in the fabrication of bridge restorations.¹

Clinically speaking, when Lava restorations are prescribed, a traditional impression is taken and stone models are poured. The dies are then scanned in the laboratory and, ultimately, the core of the desired restoration(s) is milled by the CAM milling process. The resulting framework is then sin-

tered for 11 hours at 1,500°C. The framework can then be colored with seven different dentin or stumpf shades, which allows for a greater spectrum of base colors. Surface porcelains are then layered accordingly, providing the technician with the ability to create lifelike restorations. Because the sintered substructure is so thin—only 0.4 mm—laboratory ceramists have another 1 to 1.5 mm available with which to impart the desired color and esthetic qualities.

Lava is extremely strong, demonstrating a flexural strength of more than 1,200 MPa. It is important to note that for successful long-term, multiple-unit

bridge restorations, the strength necessary in all-ceramic materials is only achieved with alumina or zirconia bridges that have a flexural strength of approximately 100 MPa.²

Case Report

A 47-year-old woman presented desiring replacement of a porcelain-fused-to-metal (PFM) bridge between teeth Nos. 5 and 7, which replaced a congenitally missing cuspid (Figures 1 through 4). This fixed partial denture had been in place for more than 20 years and showed signs of wear and poor margination. The facial gingival tissue also demonstrated signs of



Figures 10 and 11—Preoperative shades were taken for shade mapping.



Figure 12—View of the preparations of teeth Nos. 5 and 7 after removal of the porcelain-fused-to-metal bridge.



Figure 13—A stump shade was taken against the preparations.



Figure 14—The pontic site was prepared with diamonds and treated with ViscoStat Plus.



Figure 15—After tooth preparation, a preoperative tooth shade against the central incisors was again taken and photographed.



Figure 16—A 1:1 photograph of the central incisors was taken to demonstrate for the laboratory the internal and external tooth characterizations.



Figure 17—Postoperative view of the maxillary arch form.



Figure 18—Postoperative occlusal view. Note the occlusal anatomy and staining.

chronic inflammation (Figures 5 through 9). The patient was not interested in orthodontic treatment or implants, so the treatment plan included replacement of the 3-unit bridge with a more esthetic alternative.

A thorough occlusal examination was performed that revealed a class I molar relationship with a slight centric relation-centric occlusion (CR-CO) discrepancy, which was equilibrated. Because a smooth group function in lateral excursion could easily be achieved and maintained, it was possible to place a 3-unit bridge restoration

fabricated with an all-ceramic material. After conferring with the dental laboratory about this case, Lava was chosen as the ideal restorative material.

Necessary preoperative shade mapping was completed, and photographs were taken to document the adjacent tooth morphology and texture (Figures 10 and 11). After removing the existing PFM bridge, slight tissue contouring was performed using electrosurgery.

Because a bridge had already been in place, the preparation design for this case was limited to refining the existing prepara-

tions (Figure 12). Normally, however, a 1.5-mm, 360° reduction would be completed, with a 1.5-mm to 2-mm reduction on the incisal or occlusal aspects. As with any all-ceramic fixed partial denture, all angles were kept rounded and smooth. A dentin or “stumpf” shade was taken (Figure 13), and the pontic site was prepared with diamonds and treated with ViscoStat[®] Plus^b (Figure 14).

A final impression was taken using a combination of Imprint[™] II^a heavy body and Provil[®] novoc^c

^bUltradent Products, Inc, South Jordan, UT 84095; 800-552-5512



Figure 19—RelyX Unicem cement was used to definitely seat the Lava 3-unit bridge restoration.



Figure 20—Postoperative occlusal view of the final Lava 3-unit, all-ceramic restoration.



Figure 21—Postcementation close-up 1 week postoperatively. Note the positive tissue response. Also note the surface texture and characterization; the pontic of tooth No. 6 appears like a natural tooth.

light body polyvinylsiloxane materials. A lower arch impression, facebow, and bite registration also were taken, as well as digital photographs indicating the preoperative tooth shade (Figures 15 and 16). The photographs not only facilitated shade matching but also assisted the technicians in determining the appropriate contour, texture, and value of the anticipated Lava all-ceramic restoration.

Cementation Appointment

The laboratory returned 2 bridges for try-in because of questions regarding surface coloration. Both bridges were tried in, and the patient—guided by

¹Heraeus Kulzer, Inc, Armonk, NY 10504; 800-431-1785

the dentist—ultimately decided on one of the two. Marginal integrity was excellent, as were texture, contour, and color. Most importantly, the correct value of the restorations was obtained. It is this author's opinion that value is much easier to match with all-ceramic restorations.

Slight occlusal adjustments were made to ensure group function on the bicuspid and the cuspid and to achieve a smooth crossover (Figures 17 and 18). When a patient presents with a missing cuspid, the guidance must be shared in immediate rise as well as in crossover. By sharing the excursive movements with 1 or 2 bicuspids and the incisors, the stress to the restora-

tion is lessened. With less stress, the success of an all-ceramic system is much more predictable.

After polishing, the bridge was then cemented with RelyX™ Unicem^a resin cement (Figure 19). This cement was selected because it enables cleaning of the margins at cementation, especially subgingival margins. When seating Lava restorations, adhesively bonded cements are not always necessary.³

Conclusion

The availability of materials that enable the dentist to give his or her patients the best possible esthetics with reliable strength is now a reality with Lava All-Ceramic restorations.

Continued on Page 8

Lab Process

Michelle Robinson
Team Aesthetic Seminars
Idaho Falls, Idaho

Before a substructure can be fabricated, the prepped case must be evaluated for adequate reduction and the pontic site needs to be modified on the model. For the bicuspid, occlusal and buc-

cal reduction of 1.5 mm to 2 mm and a 1-mm shoulder are ideal to obtain the desired results. For the cuspid and lateral, a 1-mm shoulder, 1 mm to 1.5 mm facially, and 1.5 mm to 2 mm incisally should be obtained (Figures 1 and 2).

The substructure is 0.5 mm thick with a connector size of 9 mm² for the posterior bridges and 7 mm² for the anterior bridges.

After receiving the Lava™,^a bridge substructure, the coping

³3M ESPE, St. Paul, MN 55144; 800-216-9502

fit was checked back to the pinned and the solid models. The occlusal clearance was checked on mounted models and the connector size was slightly adjusted to its minimal thickness, moving the connectors lingually where possible to allow for interproximal embrasures. After evaluation and adjustments of the framework, stump dies were made to duplicate the underlying dentition (Figure 3).

Although there was not a great deal of translucency of the framework, a small amount of

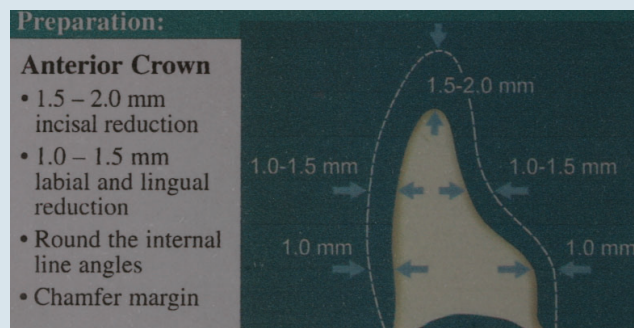


Figure 1

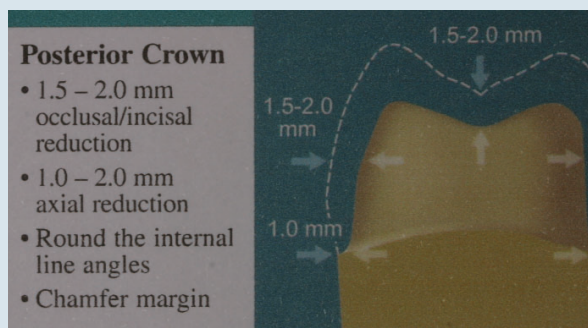


Figure 2



Figure 3

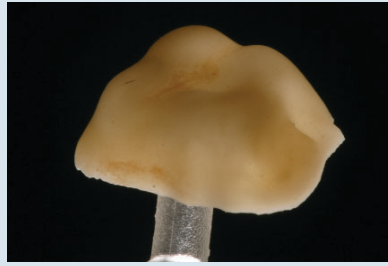


Figure 4



Figure 5

light passed through that would allow for illumination of the gingival tissue. Figure 4 is an example of the illumination of a substructure.

The substructure was then sandblasted with a 50- μ m aluminum oxide and steamed to remove any contaminants. The stump dies were wetted with Lava™ Ceram[®] stain/glaze liquid so that there was no air trapped between the dies and the framework. This ensures that any influence of the underlying shade will be accounted for when doing an initial stain of the framework. A framework modifier was applied in an even coat, approximately 0.1 mm to 0.2 mm thick, over the entire surface of the structure. This created the base shade for the final restorations (Figure 5).

The modifier was placed into the interproximal areas for added depth and onto the neck areas to blend the restorations into the natural dentition, making the margin areas less noticeable if there is any future gingival resorption. The framework was then fired. The dentin porcelain was mixed with distilled water on a wet tray and applied by brush. An incisal edge matrix of the provisionals was used to monitor the placement of the dentin material. A combination of diluted dentin and incisal porcelains was then layered onto the dentin around the incisal, buccal, and interproximal areas, building the

restorations to full contour (Figure 6).

The matrix was removed from the opposing model and function was checked. The occlusal surface of the bicuspid was created using a small amount of the Lava Ceram No. 15 magic intensive in the fossa area for depth and the E5 enamel over the top to create the primary and secondary anatomy. Centric and excursive movements were checked and the bridge was removed from the model work. Interproximal surfaces were touched up with the dentin porcelain and the bridge was then fired (Figure 7).

On the final build, additional chroma was added around the neck of the units; deficient areas of the pontic were corrected; and the entire surface was layered over with a combination of enamels and clear porcelains to form the final shape (Figure 8).

After firing, the final contours, contacts, and occlusion were touched up and a slight tuning of the surface anatomy was done. The restorations were then glazed and polished to match the adjacent surface luster (Figures 9 and 10).

Before the case was sent for delivery, the internal areas of the framework were cleaned by using the 50- μ m aluminum oxide.

Acknowledgment

Figures 1 and 2 were provided by 3M ESPE.



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 22—Right lateral view of the Lava 3-unit, all-ceramic bridge restoration in centric occlusion.



Figure 23—View of the patient's right working movement. Note the use of group function to remove stress from the cuspid pontic.



Figure 24—View of the patient's right crossover. Note that the lateral and central incisors are picking up the lateral excursive movement.

Through the use of this truly CAD/CAM system, the laboratory's fabrication time is shortened as a result of a milling center that creates a framework for subsequent surface porcelain application.⁴ The end result is a strong, very esthetic nonmetal alternative for single- and multiple-unit cases.

The strength of Lava restorations, in this author's experience, has been excellent, and all restorations have demonstrated a good fit. Additionally, the esthetics demonstrated by these restorations has been significantly better than that of PFM restorations (Figures 20 through 26).

Choosing the best cases for which to place Lava restorations is essential. For fixed partial dentures, Lava is indicated for 3 units and up to 4 units, and con-



Figure 25—Postoperative right lateral view of the patient's smile exposing the new Lava 3-unit, all-ceramic restoration.



Figure 26—Postoperative view of the patient in natural smile.

siderations for such cases include the occlusion and location in the mouth. Lava bridge restorations are suitable from bicuspid to bicuspid. Additionally, there must be sufficient gingivo-incisal height and buccolingual width to ensure proper strength. Therefore, cases in which there are very short teeth or where there is substantial buccal or lingual tooth loss should not be chosen for Lava restorations.

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