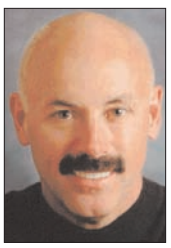
Uncovering Poorly Performed Cosmetic Dentistry

An All-Ceramic Case Report



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From time to time, clinicians may encounter patients who present to their office after recently undergoing what they thought was a cosmetic restorative procedure. These patients may express extreme dissatisfaction with the appearance, fit, or function of the restorations they've received, and they may now want new restorations in order to correct what they perceive to be problems.

While we may all have encountered problems with indirect restorations that require remakes, typically only 4.4% of remakes of all-ceramic inlays/onlays, veneers, and crowns occur prior to cementation, and most of those are veneers (6.6%).[1] Research on post-cementation remakes focuses on survival rates—not patient perceptions or satisfaction. The overall 2-year rate of remakes is only about 1%, suggesting a survival rate of ceramic restorations of 99%, with inlays/onlays demonstrating a 99.8% survival rate, and crowns demonstrating a survival rate of 98.4%.[1]

The patient's goals and objectives must be thoroughly understood, the treatment alternatives and what is involved with each must be fully and clearly explained to the patient, and the patient's approval must be received at each stage to ensure that subsequent steps will ultimately lead to overall acceptance of the process and satisfaction with the final treatment outcome.

However, when we are called upon to remake what the patient deems to be unaesthetic restorations, we must examine all of the facts of the case first to determine the nature of the dissatisfaction, and second to identify what went wrong with the original process so that we can avoid the same mistakes ourselves. Essential to this investigation—and to ensuring that we achieve successful aesthetic restorative outcomes—are open and candid communication with and education of the patient; thorough visual and diagnostic assessment of the patient; careful treatment planning; and precise clinical execution.[2]

The following case report illustrates the steps that were necessary to treat an emotionally distraught patient who recently received poorly designed and unaesthetic all-ceramic restorations for her anterior maxillary dentition. It demonstrates clearly the need for the clinician who encounters a disappointed patient to understand completely the patient's goals and expectations.[3] It also demonstrates the need to help the patient better understand the aesthetic restorative treatment process and what can and cannot be reasonably anticipated.[3,4]

CASE PRESENTATION

A 37-year-old female presented following the placement by a "cosmetic" dentist of 4 new all-ceramic crowns on her anterior maxillary dentition (Figures 1 and 2). She was emotionally distraught and upset over the aesthetics, contour, and overall appearance of the restorations, especially since a friend told her they looked like "denture teeth." She admitted that the previous dentist did not educate her about the types of materials that could be used to fabricate the crown restorations, nor did he explain aspects of color matching or determining the appropriate size and shape of the crowns. She explained that her natural teeth were discolored, which was the reason she originally sought cosmetic restorations.

In further detailing her original experience, she explained that the dentist prepared her teeth and subsequently cemented the new crowns in place. The patient's only opportunity to preview the aesthetics and contour was when she was numb and held the restorations in place with her fingers so they wouldn't fall out.

TREATMENT PLANNING

Paramount to treating this patient successfully was educating her about the steps, materials, and tools necessary to ensure that clinical and aesthetic expectations would be met. Various types of all-ceramic alternatives were discussed, and the patient was informed of the need to obtain full-mouth radiographs and other tangible information prior to proceeding. Additionally, a complete and thorough examination including bite records, centric relation, and occlusal analysis would be performed.

A custom shade of her teeth would be

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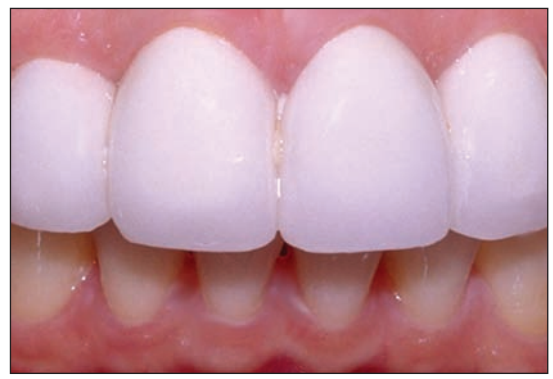

Figure 1. Closeup preoperative view of the patient's 4 maxillary all-ceramic crown restorations that had been recently placed by a "cosmetic" dentist.

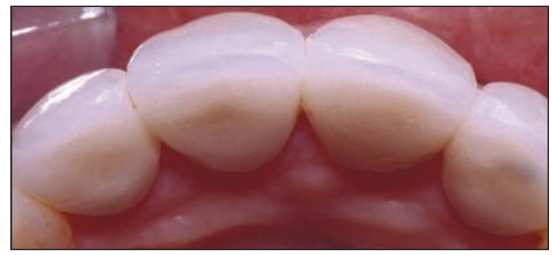

Figure 2. Preoperative incisal view of the patient's original all-ceramic restorations demonstrating the excessive thickness and contour of the restorations.

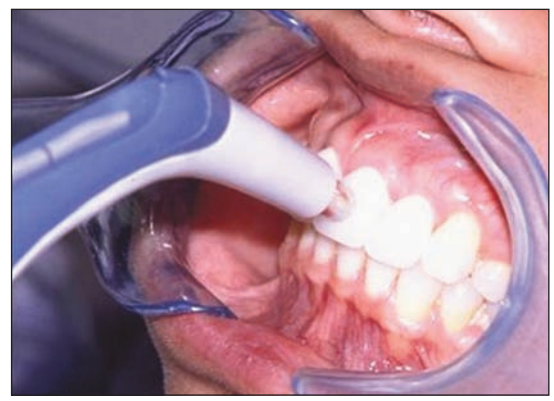

Figure 3. A spectrophotometer was used to develop a custom shade for the patient's new all-ceramic restorations.

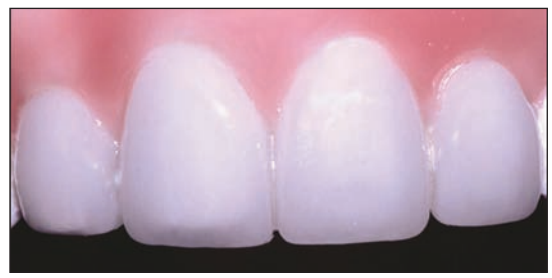

Figure 4. The aesthetic, anatomically corrected wax-up.

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Figure 5. A duplicate model of the wax-up was made for use in fabricating the provisional restorations.

Figure 6. The wax-up impression.

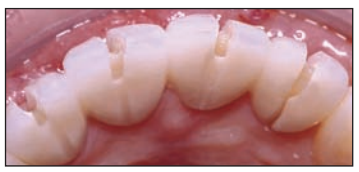

Figure 7. Bur cuts through the existing porcelain restorations demonstrated the excessive buildup and overcontouring.

Figure 8. Cross-sectional view of the existing restorations to demonstrate the excessive ceramic thickness, particularly at the incisal edge.

Figure 9. View of the existing all-ceramic crowns following removal.

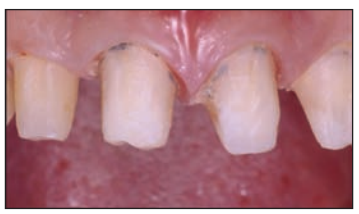

Figure 10. Upon removal of the crowns, bacterial invasion was observed on teeth No. 8 and No. 9.

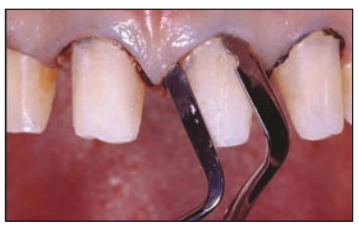

Figure 11. Retraction cord was placed into the gingival sulcus for impression taking.

taken using a spectrophotometer (Vita Easyshade [Vident]) and conventional shade mapping, and she would have input into the shade she desired (Figure 3). Combined, these 2 methods would enable the clinician to work with the laboratory to establish the tooth shade in terms of its value (ie, brightness), chroma (ie, color intensity), and hue (ie, basic color based on wavelength of visible light).[5] It would also allow the laboratory ceramist to ultimately apply the selected ceramic porcelains (Vita VM9 [Vident]) in such a way that they would appropriately influence the basic color and shade of anticipated restorations.[5] Additionally, the patient was informed that a bisque bake try-in was recommended, as was custom staining of the crowns in the mouth, so that she could be involved in the aesthetic design of her restorations at every stage.

It was also explained to the patient that study models would be necessary in order to understand her current condition; in other words, they would be used for diagnosis and treatment planning.[4] The study models would then serve as the basis for developing a wax-up of what the proposed size and shape of the new restorations would be.[4] Any anatomical corrections necessary would be reflected in the wax-up (Figure 4). This, of course, would be shared with her for her approval.

The patient approved the aesthetic, anatomically enhanced wax-up, from which a duplicate model was made for the purposes of creating provisional restorations (Figure 5). A polyvinyl siloxane impression was made of the wax-up model for use in fabricating the provisionals (Figure 6).

Prior to definitively selecting materials for the replacement full-coverage crown restorations, the patient was educated about various all-ceramic options. One option that was particularly appealing to her was the combination of an all-ceramic zirconium oxide coping fabricated with CAD/CAM processes (Lava [3M ESPE]) that would be layered with natural-looking porcelains and stains (Vita VM9).[6] It was explained that due to the nature of the materials to be used, the crowns would be made sufficiently strong, yet not overbuilt, and demonstrate the aesthetic characteristics she desired.

It is important to note that upon removal of the original restorations, the gingiva surrounding the restoration margins was inflamed, most likely as a result of the overcontouring.

CLINICAL PROTOCOL

The patient was anesthetized, and a series of burs (Brasseler USA) were used to remove the existing all-ceramic restorations. Bur cuts made into the facial, incisal, and lingual aspects of the restorations demonstrated the extent to which the restorations had been overbuilt (Figures 7 and 8).

Upon complete removal of the crowns (Figure 9), bacterial invasion along the gingival margins of teeth No. 8 and No. 9 was observed (Figure 10). This may have resulted from the improper use of adhesive dentin bonding agents (which alone cannot predictably prevent long-term microleakage[7]), incomplete removal of the superficial smear layer,[8] or improper margin placement.[9] This necessitated the immediate application of an antimicrobial scrub (chlorhexidine 2%) to aggressively remove the bacteria. It could also have been possible to use rotary instrumentation; however, mechanical trauma caused by frictional heat could damage the pulp.[8]

The teeth were thoroughly cleaned of any residual debris, and retraction cord was placed into the gingival sulcus in anticipation of impression-taking (Figure 11). To accommodate the provisional restorations, which would be based on the aesthetically enhanced and anatomically corrected wax-up, it was necessary to reduce the incisal edge to allow sufficient clearance (Figure 12). The cord was removed, and a new polyvinyl siloxane impression of the preparations was taken.

It is important to note that upon removal of the original restorations, the gingiva surrounding the restoration margins was inflamed, most likely as a result of the overcontouring (Figure 13). Additionally, it is likely that the margins were placed in violation of the biologic width. It has been shown that the location of the restoration margins within the zone of the biologic width may impair the periodontal health of the restored teeth.[10]

Provisional restorations were created from the wax-up impression and seated (Figure 14), and the patient was reappointed for the bisque bake try-in 3 weeks later. In the meantime, the laboratory was provided with the study models, preoperative photographs and shade maps, impressions of the preparations, and the patient-approved wax-up.

RESTORATION FABRICATION

Using the materials provided, the laboratory ceramist fabricated CAD/CAM zirconium oxide copings (Lava) for the crown restorations for teeth Nos. 7 through 10. Then, based on the patient's shade selection—120 gingival and 040 incisal—the Base Dentine and Enamel porcelains (Vita VM9) were applied in a 2-powder and 3-powder cut-back and build-up technique (Figure 15). Effects and enamels—including Mm1 Mamelon over the dentin, EE9 Blue on the incisal corners, E01 Opal for the facial line angles, EP1 Pastel yellow on the incisal center, and EE5 Sunlight (all Vident shades) on the interproximal areas—were applied and baked.

At the bisque bake try-in appointment the initial provisional restorations were removed and the preparations were cleaned. The soft tissue was examined; noticeable healing had been achieved (Figure 16).

In order to accommodate the try-in of the bisque baked

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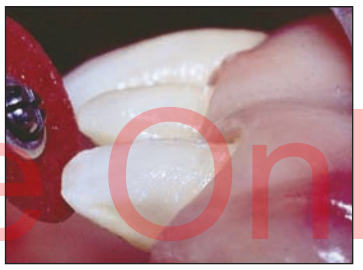

Figure 12. The incisal edges were reduced to provide sufficient clearance for the provisional restorations.

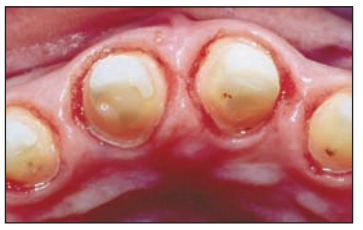

Figure 13. View of the preparations and gingival tissue following impression taking. Note inflammation of the tissues and overcontouring from the previous porcelain restorations.

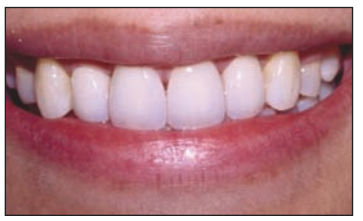

Figure 14. View of the provisional restorations with the patient in natural smile. Note the immediate improvement in terms of aesthetics, shape, and contour compared to her previous porcelain restorations from Figure 1.

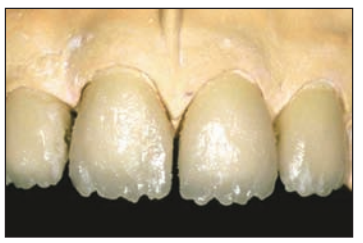

Figure 15. At the laboratory, Base Dentine and Enamel porcelains were applied to the zirconium oxide coping in 2-powder and 3-powder cut-back and build-up techniques.

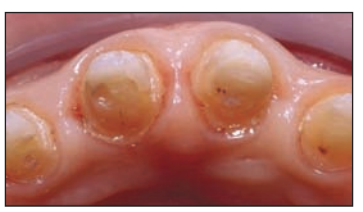

Figure 16. When the initial provisional restorations were removed, the gingival tissue demonstrated considerable healing.

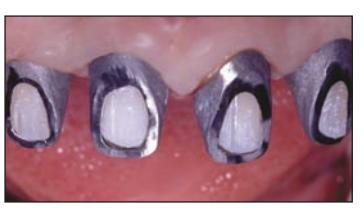

Figure 17. A reduction coping based on guidelines provided by the laboratory ceramist was used to direct further preparation design.

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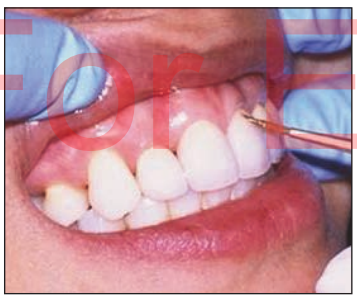

Figure 18. During the bisque bake try-in, custom stains were applied directly to the restorations while in the patient's mouth.

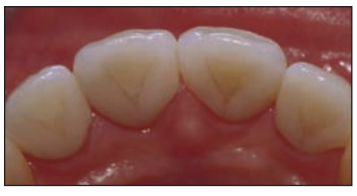

Figure 19. Postoperative incisal view of the patient's new restorations. Note the obvious improvement in form and contours compared to Figure 2.

restorations, reduction copings were used to modify the preparation design to ensure sufficient room for the coping and porcelain buildup (Figure 17). As indicated by the reduction copings, greater axial reduction was necessary. It's important to note that communication between the clinician and laboratory ceramist—as an example, discussing and guiding the preparation design—was essential to completing the case successfully.

The bisque baked restorations were tried in, and the ceramist applied custom stains to the restorations while they were still seated in the patient's mouth (Figure 18). After all stains were applied and the patient approved of the aesthetics of the restorations, they were removed and left with the laboratory for final glazing and firing.

The provisional restorations were relined and reseated, and the patient was reappointed for delivery of the final restorations.

FINAL PLACEMENT

At the definitive seating appointment, the provisional restorations were removed and the preparations were cleaned with an antimicrobial scrub (Consepsis Scrub [Ultradent Products]) to decontaminate them. Then a hemostatic gel (Tissue Goo [CLINICIAN'S CHOICE]) was placed along the gingiva to prevent hemorrhage, and suitable isolation was achieved.

The crowns were tried in to verify the interproximal and centric contacts as well as marginal adaptation. However, this had already been established during the bisque bake try-in appointment, so no adjustments were necessary. For definitive cementation, zirconium-based restorations such as these may be placed using glass ionomers, resin-modified glass ionomer luting cements, or self-etching adhesive resin cements.[11] The internal aspects of the crowns were cleaned and dried, the cement loaded into them, and the crowns seated. Upon review by the patient, the final aesthetic restorative outcome completely satisfied her expectations and renewed her self-confidence in the appearance of her smile (Figures 19 and 20).

DISCUSSION

The primary and ultimate goals when treating this patient were ensuring that her aesthetic expectations were met while simultaneously satisfying the clinical requirements that would set the foundation for long-term, predictable function. The inherent sequence of clinical protocol—from removal of the unsatisfactory restorations, to shade-taking, to preparation—provided an opportunity to "forensically" determine what went wrong with her case originally to lead to such a poor and emotionally disturbing outcome.

Clearly, the overbuilt restorations were partially the product of inadequately reduced preparations. In order to deliver predictable function and strength, the placement of all-ceramic restorations requires that clinicians create a 90° full shoulder with a rounded gingival-axial line angle or deep chamfer, reduce the axial surfaces by 1.0 mm to 1.5 mm, and reduce the occlusal aspect or incisal edge by 1.5 mm to 2.0 mm, with specific margin designs and/or other recommendations being dependent upon the material used.[12]

Upon removal of the original restorations and examination of the preparations, it appears the teeth were not adequately prepared. When the dental literature has explored various innovative and conventional tooth preparation designs that were completed on teeth, it was observed that approximately 63% to 72% of the coronal tooth structure was removed when teeth were prepared for all-ceramic crowns.[13] While it could be argued that this level of tooth structure removal may be excessive, it demonstrates that the standard practice is to remove sufficient structure to support and enable aesthetic fabrication of the proposed restorations.

Also worth noting is the fact that this level of inadequate preparation was allowed to remain. In other words, the laboratory technician fabricating the original case obviously did not clearly communicate the preparation requirements of the proposed restorations to the prescribing dentist.[4]

The problem of overbuilt restorations could also have originated from the impressions. Research has shown that providing dental laboratories with an accurate replication of the hard and soft tissues of a patient is important.[14,15] However, laboratories routinely receive and accept impressions from clinicians that have one or more visible errors.[14,15] Such impressions can lead to the fabrication of questionable restorations.[14,15]

It is also important to consider that a pleasing dental appearance encompasses the subjective appreciation of the shade, shape, and arrangement of the teeth and their relationship to the gingiva, lips, and facial features.[2] Additionally, one of the most important tasks in aesthetic restorative dentistry is creating harmonious proportions between the widths and lengths of the maxillary anterior teeth when restoring them.[16,17] Recently, however, the entire dento-facial specificities of each individual have also been advocated as essential to restoring a patient's smile to ideal aesthetics.[16]

Figure 20. Postoperative view of the patient in natural smile. Note the natural-looking transition of the contours, color, and characterization among the restorations and her natural dentition.

Clearly, this patient's stature and petite frame were not taken into consideration. This was evident based on the fact that the original restorations with which she presented were overpowering; essentially, the teeth demonstrated too much bulk for the size of her head and were disproportionate. In fact, they were too elongated and were digging into her lip. The occlusal and centric relation examination, in fact, revealed that tooth No. 7 had virtually no clearance. What's more, the original restorations demonstrated no feminine qualities or individuality.

Material selection is also a factor in what can and cannot be accomplished in terms of achieving a patient's desired aesthetic results when placing all-ceramic restorations. The new restorations the patient received could be fabricated appropriately given the mechanical and aesthetic properties of the zirconium oxide coping material (Lava) and the ability of the layering porcelain (Vita VM9) to control color and simulate natural tooth structure.[6,18] Specifically, the teeth could be suitably prepared—yet as much tooth structure as possible could be conserved. This was achievable because the coping shade and layer thickness of the veneering porcelain enabled the ceramist to create the patient's desired results without overbuilding the restorations.[18]

Finally, where the health of the patient's hard and soft tissues were concerned, oversights were clearly made during her original treatment in terms of adhesive protocol, margin placement, and overall management of soft tissues. Without question, an adequate understanding of the relationship between periodontal tissues and restorations is paramount to ensuring adequate form, function, aesthetics, and comfort.[19] Yet there were infringements upon the biologic width, improper margin location, and poorly contoured restorations that resulted in gingival inflammation, bacterial infiltration onto the tooth substrate, and a generally unaesthetic appearance. Given the fact that the cervical margins of single-unit all-porcelain crowns are considered one of the weakest areas of this type of aesthetic restoration, careful attention must be paid to margin placement and the cementation agent used.[9]

CONCLUSION

It has been noted in the literature that when a patient's aesthetic expectations are not met, clinicians have few alternatives other than redoing the case, convincing the patient that the outcome really is to his or her liking, or refunding the patient's money.[4] Communication, proper treatment planning, and patient involvement from the beginning are keys to ensuring that none of those scenarios occur. Specifically, the patient's goals and objectives must be thoroughly understood, the treatment alternatives and what is involved with each must be fully and clearly explained to the patient, and the patient's approval must be received at each stage to ensure that subsequent steps will ultimately lead to overall acceptance of the process and satisfaction with the final treatment outcome.[3]

Acknowledgment

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