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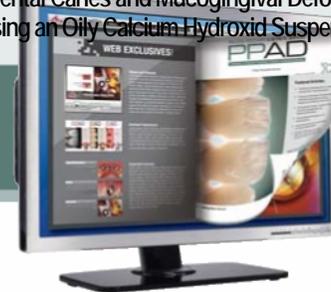
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An advertisement for Hu-Friedy Restorative Instruments. It features a dark blue background with a splash of colorful paint on the left. Several dental instruments are shown in the foreground. The text reads: "THE ART OF RESTORATION. *The Art of Instrumentation.* Hu-Friedy Restorative Instruments." The Hu-Friedy logo is in the bottom right corner.

COLLABORATIVE DEVELOPMENT OF A NATURAL-LOOKING SMILE: CASE PRESENTATION

James Fondriest, DDS*
Matt Roberts†



Sophisticated patients want their dental concerns treated without appearing as if they have been restored. This case presentation describes the planning and treatment steps for the recreation of an aesthetic smile. The patient had dento-facial asymmetries and an elevated occlusal risk of fracture due to bruxism. Lithium disilicate glass ceramic in a pressed version with stacked veneering porcelain was selected as an ideal restorative material for natural aesthetics and to fulfill the strength requirements for the maxillary anterior restorations.

Learning Objectives:

This article discusses the use of a collaborative treatment planning method in order to provide aesthetic improvement for facial asymmetries in high-stress areas. Upon completing this article, the reader should:

- Understand the communication protocols involved in including both the patient and the laboratory technician in the entire treatment planning and restorative phase.
- Be aware of the role of strength requirements when treating patients with proven bruxism and destructive wear patterns.

Key Words: porcelain, aesthetics, facial asymmetries, bruxism

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Practical Procedures & AESTHETIC DENTISTRY

Successful delivery of indirect restorations is predicated upon a concise understanding of the patient's existing facial architecture, his or her restorative needs and desires, and thorough communication with the laboratory. Particularly when restoring patients with dentofacial asymmetries, care must be taken to carefully determine where to create proper angulation and integration in order to develop a natural-looking result. The following case presentation details the steps required to facilitate thorough documentation, treatment planning, and communication with the technician in the treatment of a patient with asymmetrical features.

Case Presentation

A 52-year-old female patient presented following a history of having significant dentistry previously performed. Every tooth had a full-coverage restoration or large intra-coronal restorations fabricated from numerous materials. The existing porcelain-fused-to-metal (PFM) restorations on teeth #6 through #9, and #13 through #15 were opaque and unnatural in shape, texture and appearance (Figures 1 and 2). The dentition without full-coverage prostheses had restorations that were chipped and leaking, and these teeth displayed different colorations. The axial inclinations of the maxillary central incisors pointed towards the patient's right hip. The left maxillary teeth had super-erupted and were hanging lower than the occlusal table. They had super-erupted to make occlusal contact when dentistry had been performed on the mandibular left many years earlier. There was a mild reverse smile line. Much of the dentistry that had been previously performed was a result of fracture to the natural teeth or the large restorations. The wear that was created on the existing 16-month-old nightguard suggested that the patient was a heavy bruxer.

The patient desired improved symmetry within her smile and improved exposure of the uneven gingival tissue in order to provide a more homogenous and natural appearance to her teeth. The patient wanted to be involved in the treatment decisions; because she felt that the mandibular teeth did not display in her smile, she desired to limit treatment to the maxillary arch. She had previously been restored in many small "installments" by several dentists with no comprehensive planning toward a final, pleasingly aesthetic result. Overall, she desired this result.

Treatment Sequencing

To even the gingival height discrepancies and to reduce the gingival display, crown lengthening was planned for teeth #6 and #7, and #11 through #13 (Figure 3). Tooth #14 was a pontic. A surgical template which



Figure 1. Preoperative appearance displays an uneven occlusal table, asymmetric gingival display, and varied color, texture, and opacities.



Figure 2. Patient appearance at initial presentation with facial and dental asymmetries.

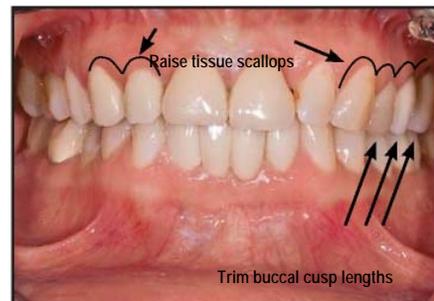


Figure 3. The occlusal plane hung down on left side and the axial inclination of the central incisors was slanted.

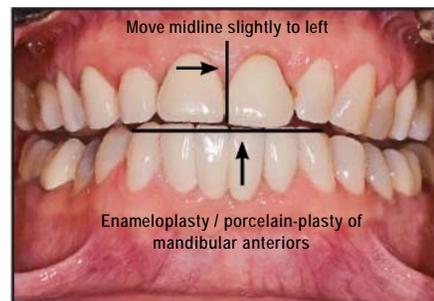


Figure 4. The occlusal plane had an exaggerated Curve of Spee, and the mandibular incisal edges were canted and uneven.



Figure 5. Extra-oral view of the acrylic provisionals on teeth #6 through #15.



Figure 6. The provisional restorations on teeth #6 through #15 with corrected tooth alignment and flattened occlusal plane.



Figure 7. The edges of teeth #22 through #27 were flattened to allow for smooth transitions with anterior guidance.



Figure 8. The crown lengthening allowed a longer length-to-width ratio of the teeth and a more feminine appearance, which the patient was unsure about.

indicated the desired post-surgical tissue heights was constructed and delivered to the periodontist.¹⁻³

Ten weeks subsequent to the perio-plastic surgery to align and provide symmetry to the gingival scallops, new records were taken and a trial equilibration was performed on stone models of the patient's mouth articulated in maximum intercuspation.⁴ This trial run was performed to evaluate how much tooth contour would have to be removed to create an aesthetic appearance and less abusive anterior guidance (Figure 4).

This was the reductive part of the planning phase. It was determined from this exercise that a flatter occlusal plane could be created without exposing the metal substructure of the anterior mandibular PFM bridge. The patient was informed of the possibility of pulpal exposures of the maxillary left teeth when the occlusal plane was raised to the planned level. The vertical dimension of occlusion was maintained because the entire maxillary arch was not being treated.⁵ The clenching, bruxing and existing occlusal scheme had caused the musculature to be guarded and spastic. Because significant occlusal modifications were planned for one or both arches and because of the lack of absolute surety of her hinge axis,⁶⁻⁸ a new night appliance was constructed to relax the musculature prior to the actual equilibration.

The occlusal equilibration provided the patient with equal-intensity, non-deflective vertical occlusal stops around the arch while hinged in centric relation.⁹⁻¹¹ An anterior guidance was created so that immediate disclusion of the posterior teeth in excursive movements occurred. All excursive movements from centric relation, including the tooth-to-tooth transitions in cross-over, were smoothed. Due to the history of destructive bruxism, the guidance was shallowed to reduce the forces on the teeth and future restorations.^{12,13} The significant enameloplasty and porcelain removal performed on teeth #11 through #15 and #22 through #27 did not cause sensitivity or discomfort. The patient expressed delight with the increased freedom and ease of lateral movement that the equilibration provided.

The Provisional Stage

Impressions were taken for a waxup following equilibration. From the aesthetic perspective, the purpose of the waxup was more than just as a guide for the laboratory to complete the project. The waxup was the first visual rendering of the patient's goal. The patient requested some modifications to the buccal embrasures. Putty impressions of the modified waxup were fabricated by the laboratory and used as tooth reduction guides to assist with tooth preparation and serve as the template for the provisionals.¹⁴⁻¹⁶ The putty impressions could be used to fabricate the provisionals directly in the mouth

or indirectly in the laboratory.¹⁷ The provisionals were made from two layers of acrylic (Jet, Lang Dental MFG, Wheeling, IL) with a dentin layer followed by a translucent enamel layer (Figure 5). Because the restorative materials had not been determined at this time, the tooth preparation for the provisionalization was as conservative and supra-gingival as the previous tooth preparations would allow. The material choice would, however, ultimately affect how the final preparations would be designed.

The provisionals created for teeth #6 through #15 corrected the axial inclinations and helped to further flatten the occlusal plane (Figures 6 and 7). It was important not to take final impressions and send the case to the laboratory at this time. It is rare that a patient does not have some modification in mind when the patient sees how the amended length, occlusal plane and incisal embrasures of the teeth look behind the drape of their own lips. Often these modifications are restrained, easy to perform, and pertain to embrasure shapes.

When there is a significant change in the appearance of the provisionals from the original smile, it is common for patients to be startled by the changes. Patients are frequently tempted to limit the modifications made to their smile. Sometimes the patient's vision is very different from what is created in the provisionals and cannot be achieved. Because the case had not been sent to the laboratory yet, the differences between the unrealized vision and the actual appearance were able to be discussed and addressed prior to fabrication of the definitive restoration.^{18,19}

It was decided to pause with further treatment and to allow the patient to wear and become accustomed to the new appearance of her smile for some time. The duration was not defined at the time of the decision but it could have been a period of several months while the patient developed an understanding of what could be accomplished aesthetically and what delivered the most ideal result (Figure 8). For this patient, time was initially spent on developing the aesthetic shapes of the provisionals, including slenderizing the incisors to make them appear more feminine. After much discussion, the patient preferred more square teeth, and it was agreed to increase the contour of the gingival emergence profiles in the final restorations and to partially fill the incisal embrasures (Figure 9).

Wearing the provisionals also allowed for patient adaptation to changes in the phonetic interplay between the teeth and to any occlusal changes that had been created by the prosthetic reorientation of teeth prior to the delivery of the final restorations.²⁰ If the patient could not adapt to these changes, it was certainly good to know this and to be able to make needed modifications prior to finishing the case. The patient wore the provisionals for eight weeks prior to feeling comfortable



Figure 9. Portrait showing the final patient-approved provisionals that were modified to be more square.



Figure 10. The prepared tooth stumps were dark and unevenly colored. This required significant masking by the restorative material.



Figure 11. A full-contour wax-up was created and then cut back prior to pressing



Figure 12. After surface finishing and fit verification, the pressed restorations were ready for fluorescent staining and application of enamel layering ceramics.



Figure 13. Internal incisal effects were established with the fluorapatite veneering porcelain and translucency patterns were evaluated.



Figure 14. The final result of the internal effect buildup was evaluated prior to over-layering with opal enamel porcelains.



Figure 15. Opal enamel ceramics were used to fill out the restorations to ideal contour, internalizing the preestablished effects.



Figure 16. Restorations were glazed and polished to produce an appropriate surface luster.

with and adapting to the phonetic changes caused by modifications done to both the maxillary and mandibular incisal edges.

When the provisionals had been accepted for aesthetics, function, phonetics, and cleansability, it was time to finalize the case. The accepted provisionals were documented photographically and with mounted models so that the lab could duplicate the contours. A critique of the provisionals (both the clinician's and the patient's) was created that would be helpful to the technician. The technician was advised that no artistic license could be exercised with shapes, edges, or rotations but that the patient was open to a natural expression of surface texture, translucency, chroma, value and gloss.

Material Selection

A porcelain-fused-to-gold restorative was selected for the maxillary left posterior region to fulfill the need for strength due to the bruxism with positive wear characteristics. This segment was finished before the anterior teeth. Pursuant to the patient's agenda, all-ceramic crowns were planned for the maxillary anterior teeth. The high chroma and heterogeneous coloration of the prepared teeth required porcelain with significant masking ability (Figure 1 0). A high-strength lithium di-silicate glass ceramic (IPS e. max Press, Ivoclar Vivadent, Amherst, NY) with a stacked veneering porcelain (IPS e. max Ceram, Ivoclar Vivadent, Amherst, NY) was chosen as an appropriate material for this case.²¹ Final preparation of the maxillary anterior teeth was performed, avoiding sharp transitions, inner angles, and feather edges.

Laboratory Sequence

Although the underlying color was different than the final shade desired by the patient, sufficient restorative material thickness was available to allow the use of a high translucency ingot, limiting the need for layering to the incisal third. The full contour waxup was, therefore, cut into the shape of the dentin lobes that would exist in natural teeth in the incisal third of the restorations and left at full contour in the gingival two thirds prior to investment (Figures 1 1 and 1 2). Contour and surface morphology were finalized in the unlayered gingival portions of the restorations. Shading ceramics were applied prior to re-establishing the incisal contour with layered ceramic (Figures 1 3 through 1 5). Once full contour was achieved, subtle improvements in surface morphology and contour were placed while following the essence of position, length, width and angulations accomplished by the provisional restorations. The restorations were glazed, polished to an appropriate surface luster, and etched prior to delivery (Figure 16).



Figure 17. Varying the surface texture, gloss, translucency, opalescence, chroma, and value made these symmetrical teeth appear natural.



Figure 18. Postoperative facial view demonstrates improved facial symmetry and integration.

Natural Beauty

This patient aggressively pushed for symmetry in her smile due the lack of symmetry in her other facial features. When symmetrical dentistry is fabricated, it becomes far more difficult to disguise as believably natural. There are many parameters of a good match that are not shape related.²² The technician skillfully varied the surface texture, value, translucency, opalescence, chroma, and gloss to create the appearance of real teeth (Figures 17 and 18).

Respect for Bruxism

This patient showed heavy wear facets and chipping on the previous porcelain restorations that aligned only in extended right and left cross-over positions and with edge-to-edge protrusive patterns. A restorative material with a strong fracture resistance was, therefore, required, and a non-traumatic and stable occlusal scheme was necessary.^{9,10} In order to avoid potential fracture, guidance transitions were no steeper than with the original restorations and smooth.²³ The incisal edges had flat facets that were parallel in three dimensions to the opposing facets on the opposing edges as found in nature. The opposing anterior teeth were also evaluated to ensure that they were able to transition in all directions on these flat parallel edges without catching porcelain.

Conclusion

There is a strong and growing demand from patients to

create symmetry in their dentistry that is divergent from a believably natural appearance. In the case presented herein, the patient presented with significant dento-facial asymmetries and a strong bruxism habit. She had a goal to create a very symmetrical smile. The occlusal risk required high-strength porcelain. Flattening and correcting the occlusal table improved the symmetry issues and allowed for a more desirable and forgiving occlusal scheme.

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CONTINUING EDUCATION (CE) EXERCISE No. 1



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Collaborative development of a natural-looking smile: Case presentation" by James Fondriest, DDS and Matt Roberts. This article is on Pages 17-22.

1. The patient's facial asymmetries were a result of unaesthetic axial inclinations of the maxillary central incisors. The left maxillary teeth were also super-erupted and hung lower than the occlusal table.
 - a. Both statements are true.
 - b. Both statements are false.
 - c. The first statement is true, the second statement is false.
 - d. The first statement is false, the second statement is true.
2. The purpose of the trial equilibration performed on the stone models was to:
 - a. Evaluate the records in maximum intercuspation.
 - b. Determine the amount of tooth contour that would require removal.
 - c. Ensure development of an improved anterior guidance.
 - d. All of the above.
3. In order to relax the musculature prior to equilibration:
 - a. The provisional restorations were modified into optimum anterior guidance.
 - b. A new night appliance was constructed.
 - c. Occlusal modifications were not made.
 - d. The hinge axis was identified and improved.
4. In the case presented herein, the provisionalization phase allowed the patient to:
 - a. Communicate her expectations on the desired shape of the final restorations.
 - b. Adapt to changes in the phonetic interplay between the teeth and improved occlusal patterns.
 - c. Evaluate any occlusal modifications that were made in the proposed restorations.
 - d. All of the above.
5. While in centric relation, the patient was:
 - a. Maintained in an equal-intensity position.
 - b. Observed with non-deflective occlusal stops around the arch.
 - c. Both a and b are correct.
 - d. Neither a nor b are correct.
6. Which of the following is not considered a temporary anchorage device (TAD)?
 - a. Creation of proper angulation.
 - b. Aesthetic integration of the restoration.
 - c. Both a and b are correct.
 - d. Neither a nor b are correct.
7. A durable restorative material was required for this case because:
 - a. The patient was a heavy bruxer.
 - b. The underlying dentition were very opaque.
 - c. The patient was prone to tooth cracking.
 - d. None of the above.
8. The patient's preexisting condition was a result of:
 - a. Failed preexisting PFM restorations.
 - b. Chipping and leakage of preexisting prostheses.
 - c. Unaesthetic coloration of the previous restorations.
 - d. All of the above.
9. The patient's guidance was shallowed in order to:
 - a. Ensure consistent force on the anticipated restorations.
 - b. Prevent potential degradation of the restorations as a result of the patient's history of destructive bruxism.
 - c. Eliminate potential sensitivity and discomfort.
 - d. Restrict the degree of lateral movement performed.
10. Because the patient desired extreme symmetry that did not mimic natural tooth contours:
 - a. The laboratory technician compensated for this exaggerated symmetry by varying surface texture, value, translucency, opalescence, chroma, and gloss in the definitive restorations.
 - b. The patient received unaesthetic, unnatural looking restorations that did not appear well-integrated with her facial structures.
 - c. The shape of the restorations were altered to create a more feminine appearance without the patient's approval, dismissing her desire for square shapes in lieu of more aesthetic, natural-looking prostheses.
 - d. None of the above.