Complete Oral Rehabilitation: A Case Report

Using a Combined Surgical/Ceramic Approach

Authored by Robert A. Lowe, DDS; Charles Maragos, CDT; and Jenny L. Wohlberg

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Effective Date: 9/1/2013    Expiration Date: 9/1/2016

ABOUT THE AUTHORS

Dr. Lowe graduated magna cum laude from Loyola University School of Dentistry in 1982 and served there as an assistant professor in operative dentistry until its closure in 1993. Since January 2000, he has been in private practice in Charlotte, NC. Dr. Lowe received Fellowships in the AGD, International College of Dentists, Academy of Dentistry International, and American College of Dentists, and is a Diplomate of the American Board of Aesthetic Dentistry. He lectures internationally and publishes on aesthetic and restorative dentistry and is a clinical evaluator of materials and products. He also received the 2004 Gordon Christensen Outstanding Lecturers Award. He can be reached at (704) 364-4711 or at boblowedds@aol.com.

Disclosure: Dr. Lowe reports no disclosures.

Mr. Maragos received his associate degree in dental technology from Milwaukee Technical College in 1971. He is a member of the Oral Design Group led by Willi Geller. He is also one of 3 privileged dental artisans (technicians) to be accredited by the American Society for Dental Aesthetics. Mr. Maragos is chief executive officer of Valley Dental Arts and Valley Dental Technologies and chairman of the Amara Institute. He has received numerous innovation awards and has published various articles on aesthetics, implant dentistry, and coauthored the book Aesthetic and Restorative Dentistry: Material Selection and Technique. He also lectures internationally on the profitability of aesthetic dental materials. He is an active consultant and product evaluator to dental manufacturers in the area of research and development. He can be reached via e-mail at chuckm@valleydentalarts.com.

Disclosure: Mr. Maragos reports no disclosures.

Ms. Wohlberg is senior vice president of Valley Dental Arts and a master ceramist who heads the training program for the ceramics department. Her unique perspective and eye for color, while researching the latest in state-of-the-art technology, make her training techniques invaluable. She is an accredited member of the American Academy of Cosmetic Dentistry, and served as the Lab Technician Accreditation chairperson from 2003 to 2005. Through Valley Dental Arts’ pursuit of education and excellence, Ms. Wohlberg has been fortunate to study with many world class ceramists, including: Enrico Steger, Lee Culp, Claude Sieber, Pinhas Adar, Taki Nishihata, Matt Roberts, Thilo Voch, and Willi Geller. Beginning in 1992, she spent nearly 8 years under the instruction of Dr. Robert Nixon in a number of hands-on seminars. In 1998, she participated in a live-patient series through PAC-live, working under the instruction of Dr. David Hornbrook and master ceramist Matt Roberts. She is actively involved in ceramic design of complex aesthetic and restorative cases. She can be reached via e-mail at jenny@valleydentalarts.com.

Disclosure: Ms. Wohlberg reports no disclosures.

INTRODUCTION

Many of our patients with Angle Class I or Class II malocclusions can go through life expecting to maintain a rather “normal” functional and aesthetic occlusion if no correction is performed. It is true that when teeth are not in an “ideal” Class I relationship (with anterior guidance and canine disclusion, including immediate separation of posterior teeth in any movement from the centric occlusion/relation position) that accelerated tooth wear and tooth loss may occur. However, due to the tremendous adaptability of the stomatognathic apparatus, and contrary to clinical
opinion, a patient's occlusion does not have to be “textbook” perfect in order for one to enjoy a lifetime of dental and occlusal health. However, Angle Class III patients are usually not so fortunate. This type of patient, if left untreated, usually breaks down at an accelerated rate, losing form and function at an early age and, in some cases, many of the teeth as well. And, treating a Class III malocclusion is a difficult challenge to achieve a clinical result that satisfies both the doctor and the patient.

**CASE REPORT**

**Team Consult and Treatment Plan**

The patient presented with an Angle Class III malocclusion with the maxilla totally confined within the mandible in centric occlusion (Figure 1). From a dentofacial standpoint, she had lost vertical dimension in the lower third of her face, had a concave facial profile, and mandibular prognathism. A discussion was arranged among the oral surgeon, orthodontist, dental ceramist, and the restorative dentist to decide on the best, most expeditious course of treatment for this case. Due to the maxilla being totally “confined” within the lower arch, jaw surgery was inevitable for this patient. The decision was whether or not both jaws would need to be moved. In order to create the proper Class I skeletal relationship with the mandible being confined within the maxilla, the upper arch would need a midsagittal split and lateral expansion to correct the bilateral crossbite. Correction of the Angle Class III skeletal relationship could be accomplished with either forward advancement of the maxilla, a bilateral split and set back of the mandible, or both. As seen in Figures 2 and 3, there were also problems with the posterior occlusal plane because of early loss of the permanent mandibular first molars, and 90° rotation of the second premolars bilaterally. For most orthognathic cases, preoperative orthodontics is done first to correct tooth positions so that when the jaws are moved, the teeth articulate in a more ideal Class I position. Once the surgery heals, another round of orthodontics may still be needed to fine-tune the interocclusal relationships. Finally, an assessment of the dentition for the restorative phase is done to determine which of the teeth will need restoration of all or a portion of the tooth surface due to tooth decay, previous restoration failure, or advanced occlusal wear.

After a review of the clinical and radiographic findings, including a cone beam computed tomography scan, with the restorative team, the following assessments were made regarding the course of treatment for the patient:

1. The posterior teeth were all in need of restoration due to...
decay, missing teeth, and/or failing restorations. Four of the 6 maxillary anterior teeth were already crowned, and the mandibular anterior teeth badly worn due to the malocclusion.

2. Surgical repositioning laterally and anteriorly of the maxilla, without a mandibular set back, can get the posterior crossbite either corrected or can place the buccal maxillary and mandibular posterior buccal cusps in an end-to-end relationship. The anterior tooth position would be at best end-to-end (edge-to-edge).

3. The LaForte maxillary surgery would be less traumatic, healing faster than a mandibular surgery and with no possible complication of paresthesia.

4. Orthodontics, while improving the micropositioning of the teeth, was probably not necessary since the final tooth positions could be fully corrected in the restorative phase.

5. The working treatment plan consisted of first having the maxillary surgery completed. A midsagittal split would cause a diastema between teeth Nos. 8 and 9; this would then have to be dealt with in the restorative phase of treatment.

Once the maxillary surgery was sufficiently healed (Figure 4), impressions for study models and a face-bow transfer were taken and sent to the dental laboratory team. At the lab, a master diagnostic model (MDM) (wax-up) was fabricated with the positional corrections for the teeth incorporating functional and aesthetic parameters as well (Figure 5).

**The Master Diagnostic Model: A Definitive “Road Map”**

The MDM is the “road map” on how to bioengineer a successful reconstructive case. After orthognathic surgery and consultations between the doctor and the ceramist, a plan was developed for the patient to be restored to a Class I occlusion from the postsurgical jaw positions. By angling the maxillary clinical crowns slightly toward the facial aspect, and simultaneously angling the mandibular clinical crowns lingually, a Class I relationship with proper overbite and overjet was possible from the current jaw relationship. A white wax-up was bioengineered for the patient’s preview, and a gray wax-up was made for the doctor, to better understand and visualize the final heights of contour and line angles as related to reflective and deflective zones of the teeth. The patient’s smile was designed with an aggressive height of contour for a more reflective surface, since such a “high value” shade was selected. It was thought that this approach would make the teeth look more visually anatomic. A stent made from the MDM would be used as a preparation guide, so that the teeth would be altered in the proper dimensions to create the optimal space on the proper areas of the teeth to correct the clinical crown positions while being as conservative as possible in preparation design.

Upon its completion, the MDM was reviewed by the restorative dentist and the patient to ensure that the wax-up met all functional and aesthetic goals for the case. Next, impressions of the MDM were taken and poured in dental stone. Once the stone models were set and trimmed, .020 mm clear plastic (Essix Tray Rite [DENTSPLY Raintree Essix]) vacuum-formed stents were made to be used later in the fabrication of the provisional restorations.
Restorative Treatment Phase 1: Preparation and Provisionalization

The first several appointments on the restorative side involved the removal of the old restorations, decay, and doing a few post and core buildups in endodontically treated teeth. Following tooth preparation, provisional restorations would be placed based upon the MDM and evaluated in the patient's mouth (the best articulator in the world!) for functional and aesthetic precision. First, the maxillary arch was prepared and foundation restorations placed. The clear maxillary provisional stent (Figure 6) is first used as a “prep guide” to gauge whether or not adequate tooth reduction in all areas has been accomplished. It is important to note the patient's original vertical dimension of occlusion (VDO) has not been altered in the fabrication of the MDM. The axial inclinations of the maxillary clinical crowns were angled slightly facial to help create the proper overbite-overjet relationship. The mandibular clinical crowns were slightly angled toward the lingual aspect as well to complete the correction of the maxillary teeth being facially positioned in relation to the mandibular teeth. Figure 7 shows the maxillary provisional restoration in place. Note that the mandibular left buccal cusps were slightly out of occlusion. While they can be added to with flowable resin, if so desired, the maxillary lingual cusps had firm centric stops on the opposing occlusal surfaces of the mandibular provisional restoration. Since this was a long day for both the doctor and the patient, it was decided to leave the mandibular provisional restoration “as is” for the time being.

Restorative Treatment, Phase 2: Master Impressions and Interocclusal Records

After evaluation of the provisional restoration in function over the course of several appointments and getting feedback from the patient concerning aesthetic parameters, it was decided to move forward with taking the master impressions. A double cord technique was used; first placing a No. 00 cord at the base of the sulcus around each preparation; then, a No. 1 cord level with the preparation margins, so that it was visible around the entire circumference of the tooth (Figure 10) (UltraPak [Ultraent Products]). After placing cheek retractors, the preparations were dried, the No. 1 cords pulled, and light-bodied impression material (Honigum [DMG America]) was syringed into “the moat around the castle” (retracted gingival sulcus). The impression tray was loaded with heavy-bodied material (Honigum), and then placed in the patient's mouth to set per manufacturer's instructions. It should be noted that it is important to syringe light-bodied material over all the occluding surfaces, both on the prepared arch and opposing arch, so that the models will be as accurate as possible. This avoids a lot of excessive occlusal adjustment at the try-in and delivery appointments.
**Laboratory Fabrication of the Definitive Restorations**

Using the provisional restorations made from the MDM (Valley Dental Arts) as our guide, the technician proceeded to fabricate the definitive all-ceramic restorations. Note the patient had chosen OM1 as the final “really white” shade.

First, a silicone mold was made of the approved provisional restoration. The mold was then transferred to the master prepared model and wax was injected. The mold of injected wax was placed on the articulator and verified for proper form and function. The interfaces were then sealed and the units set for investing and pressing. Detailed contouring and finishing of the ceramics were completed using diamond burs (medium long taper 85.11.023 [Brasseler USA]). Lithium disilicate (IPS e.max [Ivoclar Vivadent]) LT BL2 ingots were chosen to create the desired shade for this patient’s crowns.

Next, the incisal one third of all of the restorations were cut back for proper enamel layering. Porcelain layering powders (IPS e.max Ceram [Ivoclar Vivadent]) were used to attain a lower translucency and a higher reflective value (Figure 13).

Finally, the restorations were finished using a 850.11.016 diamond (Brasseler USA) to achieve reflective and refractive natural-appearing tooth surfaces.

**Delivery of the Definitive Restorations**

The delivery appointment should always be scheduled as a
try-in, in case changes need to be made. The restorations are to be finished by the lab team so that, if all is satisfactory, they can be delivered. This is especially true of a “high value” case. If the provisional restorations are made from an MDM, and a face-bow transfer with accurate interocclusal records are taken, usually only a color mismatch can prevent a case from being delivered at the try-in visit. Note that this is not the case with complex multiunit bridge frames and implants that require dedicated try-in appointments prior to ceramic addition. Figure 14 shows the finished restorations on the master models with a soft-tissue mask. A soft-tissue mask will allow the ceramist to develop more accurate emergence profiles since the soft tissue can be slightly displaced, unlike dental stone.

After local anesthesia was given, the provisional restorations were removed (Figure 15). Next, the preparations were cleaned using PrepStart Microetcher (Danville Materials). The restorations were tried-in individually to evaluate marginal fit, and then together to evaluate collective fit. Contacts were adjusted with porcelain polishers as needed and evaluated with dental floss. Then, precementation digital radiographs were taken to ensure complete seating. Actual cementation started with the maxillary central incisors; these restorations were cemented into place; the excess cement on the proximal aspects was removed with a sable brush; and then the lateral incisors were placed on the preparations without cement to hold positional space while the cement cures. This process was repeated, 2 teeth at a time, progressing distally until all of the maxillary restorations were cemented to place (Figure 16). Next, the mandibular central and lateral incisors were placed on the corresponding preparations and the patient is asked to “close lightly until all teeth touch” (Figure 17). If these restorations contact the opposing palatal surfaces of the maxillary incisors while at the same time, the terminal molars contact (“3-legged stool”), this verifies the laboratory mounting of the case was correct and mandibular posterior units can be tried-in and cemented in the same fashion as described previously. If the mandibular incisors touch prematurely, either adjust the incisal edges of the mandibular restorations or the palatal concavities of the maxillary teeth (restorations) until the posterior molars contact. Again, with good record making, this adjustment, if needed, will be slight. Figure 18 shows all of the maxillary and mandibular restorations delivered and the patient closed into a centric occlusion position. Figure 19 shows a lateral view of the patient’s preoperative smile. Notice the underdeveloped maxilla and prominent mandible as well as the concavity in the facial profile between the patient’s nose and chin. Figure 20 shows the same lateral view after delivery of the complete rehabilitation. The concave facial profile as well as the overbite-overjet relationship is corrected to an Angle Class I occlusion.

POSTOPERATIVE FOLLOW-UP AND CLOSING COMMENTS

After a few weeks’ “vacation” from the dental office, the patient returned to have the 2 mandibular second molars completed. Figures 21 and 22 show posterior retracted views of the patient’s
teeth in centric occlusion. Note the excellent health of the tissues in harmony with the beautiful anatomic structure of the ceramics. Precise buccal overjet and overbite were achieved with one jaw surgery, no orthodontics, and precisely created ceramics. Maintenance and home care are a very important part of the success of this case. The patient was placed on a strict home care regimen using a Philips Sonicare Diamond Clean Toothbrush and Air Floss, (Philips Oral Healthcare) 1.5 on a daily basis to expedite plaque removal and maintain the highest quality of gingival health around the ceramic restorations. Figure 23 shows a full-mouth retracted view at 3 years after insertion. The before and after smile photos for this case (Figures 24 and 25) tell the story: a happy patient, and a successful rehabilitation.

This entire process took a fraction of the time that a double jaw surgery with orthodontics and full-mouth restoration would have taken. It would be hard to argue that the extra time and additional procedures could have produced a better result.

Figure 17. Mandibular incisor restorations were tried-in to verify the centric occlusion relationship.

Figure 18. The anterior pressed and layered lithium disilicate restorations were cemented (Embrace Resin Cement [Pulpdent]). All posterior teeth (and bridges) had zirconia understructures and were cemented with Ceramir Crown and Bridge (Doxa).

Figure 19. A preoperative lateral facial view showing the Class III jaw relationship and concave lower third of the face.

Figure 20. The same view as Figure 19 with the definitive ceramic restorations in place. Note the difference in upper lip support and facial profile.

Figure 21. A right quadrant retracted view after placement completion of the mandibular right second molar. Note the excellent tissue health and interocclusal relationships.

Figure 22. A left quadrant retracted view after placement of the mandibular left second molar.

Figure 23. A 3-year postoperative retracted view of the completed case. Tissue health and interocclusal relationships were as nice as the day the case was delivered.

Figure 24. The preoperative smile.

Figure 25. The completed case. Note the larger smile on this very happy patient!
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POST EXAMINATION QUESTIONS

1. Angle Class III patients, left untreated, usually break down at an accelerated rate, losing form and function at an early age and, in some cases, many of their teeth as well.
   a. True  b. False

2. Correction of the Angle Class III skeletal relationship could be accomplished with either forward advancement of the maxilla, a bilateral split and set back of the mandible, or both.
   a. True  b. False

3. For most orthognathic cases, pre-operative orthodontics is not an effective part of the treatment protocol.
   a. True  b. False

4. The Master Diagnostic Model (MDM) is the “road map” on how to bio-engineer a successful reconstructive case.
   a. True  b. False

5. If using a really high-end lab team, review of the MDM by the restorative doctor and the patient is not necessary.
   a. True  b. False

6. The provisional restorations held the vertical dimension of occlusion in the posterior of one side of the mouth as “prep to prep” interocclusal records were taken on the opposite side.
   a. True  b. False

7. In this patient case, zirconia full-contour (monolithic) restorations were used to achieve a lower translucency and a higher reflective value.
   a. True  b. False

8. If the provisional restorations are made from an MDM, and a face-bow transfer with accurate interocclusal records are taken, usually only a color mismatch can prevent a case from being delivered at the “try-in” visit.
   a. True  b. False
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