Maxillo-Mandibular Atrophy

Success Through Interdisciplinary Planning

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INTRODUCTION

Patients who have undergone severe atrophy from trauma, removable prosthetic erosion, surgical bone removal, or pathological processes require careful treatment planning to facilitate successful outcomes. With more general practitioners (GPs) involved in doing implant surgeries and prosthetic treatment, it is incumbent on GPs to select cases for which their training, skill, and judgment are suitable. Even with advanced credentialing through the American Academy of Implant Dentistry, the American Board of Oral Implantology/Implant Dentistry, or the International Congress of Oral Implantologists, the difficulty of certain conditions warrants collaboration with specialists who have extensive advanced surgical training for complex cases.

The rehabilitation of severe atrophy is something that is seen and oftentimes ignored. This article will detail the treatment planning and prosthetics of a patient with severe maxillo-mandibular atrophy. Complex surgical treatment planning, collaboration before and during surgery, and prosthetic management will be highlighted. Prosthetic treatment planning as well as dynamic treatment changes due to aesthetic, phonetic, and anatomic complexities require realistic treatment discussions prior to surgical intervention. While this article may seem to be more appropriate for an implant-centered journal, it will highlight communication with the specialists and how it starts with the GPs. The GP (as the restorative dentist) should act as the quarterback for complex care and understand how to expose patients to the dentistry that they may require. Co-partnering in complex implant restoration necessitates collaboration, communication, evaluation, and implementation of advanced grafting and implant surgical techniques.

CASE REPORT

This patient presented to our general practice for a consultation with a limited budget and the desire to restore his smile (Figures 1 and 2). The patient's medical history was unremarkable, and his dental deterioration was quick. He drank a lot of soda and frequently was told that his teeth were chronically deteriorating and would require extraction. After taking a health history with records and photographs, the author consulted with an oral surgeon and discussed a myriad of treatment options including ridge spreading, block grafting with symphyseal grafts, and sinus augmentation and hip grafting in combination with the above.

Advanced Treatment Planning

A CBCT was ordered and reformatted through 3DDX.com (3D Diagnostix) and reformatted within 24 hours and returned to our office. Images were uploaded on SimPlant software (Dentsply Sirona Implants) for implant manipulation, bone density evaluations, as well as assessment of anatomic landmarks and identification of safety zones.

Implant foundation development would require bilateral subantral sinus augmentation and hip grafting with titanium mesh cages to create a substructure for 10 BioHorizons tapered internal implants in the maxilla and 5 mandibular BioHorizons implants. BioHorizons was chosen due to the Laser-Lok technology for holding bone and soft tissue, a thread design that optimizes bone-implant contact, a titanium alloy formulation, and for the flexibility of prosthetic options allowed. The inclusion of abutments with the implants would also facilitate impressions and help control costs for the patient.

The patient drank a lot of soda and frequently was told that his teeth were chronically deteriorating....

Final Surgical Preoperative Conference

At the final preoperative meeting with the oral surgeons, Dr. Richard Winter, as the restorative dentist in this case, arrived with mounted diagnostic casts, mounted casts of the first set of dentures, and the SimPlant plan with all implants placed for ideal anterior-posterior (A-P) spread corresponding to proper tooth positioning. This plan would be recreated after the sinus lifts and block grafts were completed so that surgical guides could be ordered. Prior to this meeting, budget issues were discussed with the patient, and financial arrangements had been estimated and completed.

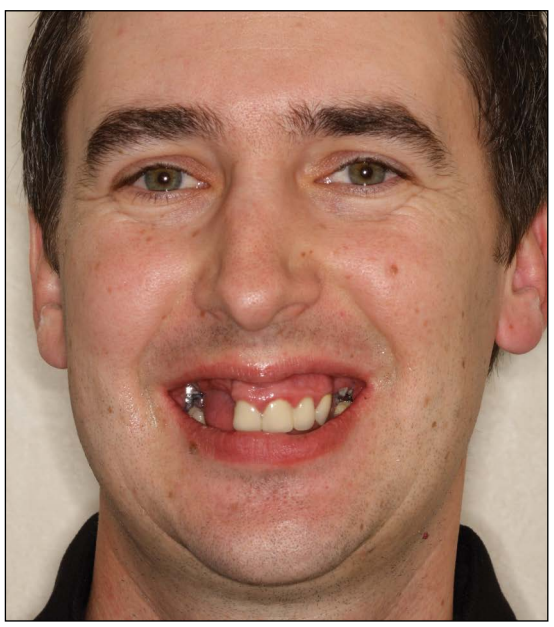

Figure 1. Pre-op full-face photo.

Figure 2. Pre-op retracted view.

Surgical Protocol

The surgeons, Drs. Alan Kimmel and Peter Wagner, invited Dr. Winter to observe in the operating room, and feedback was given as to the amount of bone harvested and optimal recipient sites during the surgery, and intraoperative photos were taken.

Editor's Note: The following is a description of the surgery involved, in the words of the surgeons.

Complex implant rehabilitation is dependent upon proper communication between the restorative and surgical dentist. In the case outlined, co-diagnosis and treatment planning were essential to completing this severely atrophic case. Dr. Winter brought in a mounted set of study models,

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Figure 3. Interim immediate dentures.

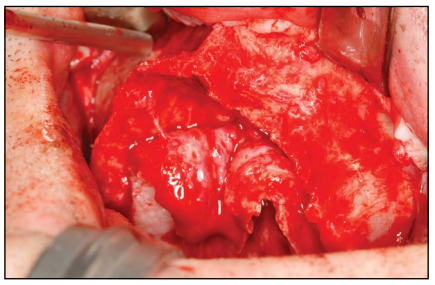

Figure 4. Maxillary atrophy "D" ridge.

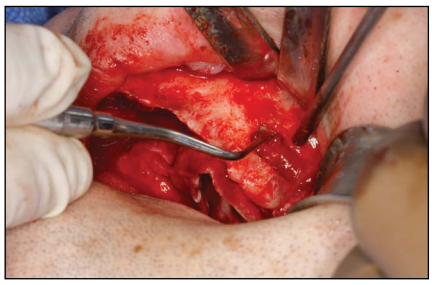

Figure 5. Sinus augmentation window.

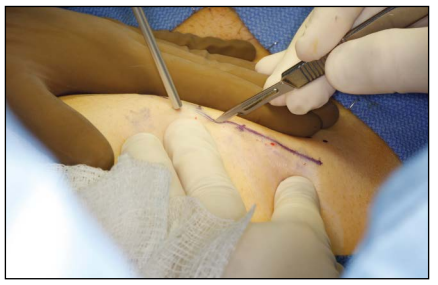

Figure 6. Exposure of iliac crest.

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a mounted diagnostic setup with teeth, a reformatted CBCT scan with implants placed, and a budget the patient had approved. The severe lack of bone necessitated a volume of bone grafting from an extraoral donor source. The use of titanium mesh cages to fixate the autogenous bone and provide space for bone development as well as tension-free primary closure were paramount in establishing a base of bone for implant placement. Iliac crest cortical and trabecular block grafts were chosen, as studies have shown that the resorption pattern associated with hip grafts goes down with endosseous implant placement.[1,2]

The surgeries were broken up as follows: edentulation with immediate denture placement (Figure 3); bilateral subantral sinus augmentation with block grafting and titanium cage guided tissue augmentation (Figures 4 to 9); and, lastly, virtual implant planning with SimPlant CBCT software facilitated ordering bone-braced surgical guides (Figures 10 to 12). Dr. Winter was present for all the surgeries, and dynamic treatment planning was done intraoperatively as the surgeons were able to visualize bone volume and placement and prioritize bone placement decisions.

Uncovery was done concomitantly with connective tissue grafts using AlloDerm acellular dermal matrix (BioHorizons) to increase the zone of keratinized gingiva. The advantages of working with a restorative dentist who had presented with a complete diagnosis and treatment plan cannot be overstated. The time from inception to surgery was minimal, as all treatment and finances had been preapproved before our surgical consultation visit. Furthermore, the ability to discuss the prosthetics allowed for a mutually satisfactory prosthetic outcome because the surgeons and restorative dentist were able to discuss all options and prosthetic limitations *prior to the surgery, with the patient present.* The ability to step back from a fixed metal-ceramic or zirconia bridge option—due to cantilevers, inadequate lip support, and prosthetic design limitations—highlights the value of co-partnering toward a successful resolution of a complex series of problem sets.

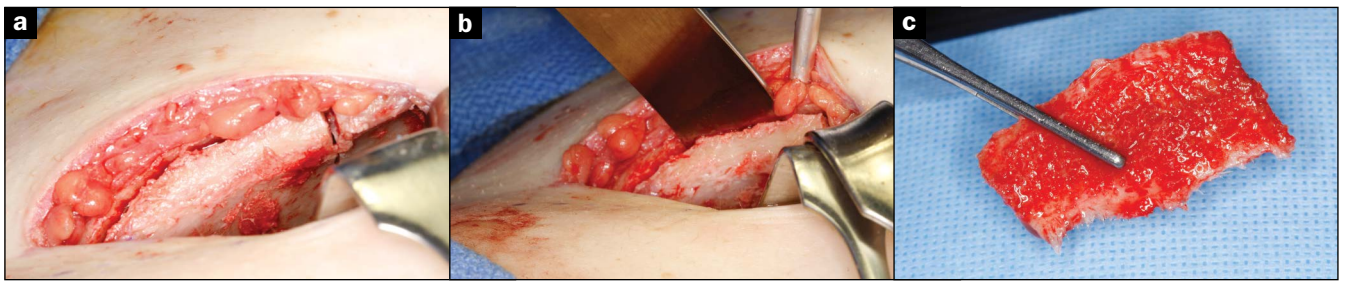

Figure 7a. Outline of hip graft. **Figure 7b.** Chiseling donor graft. **Figure 7c.** Donor block from hip.

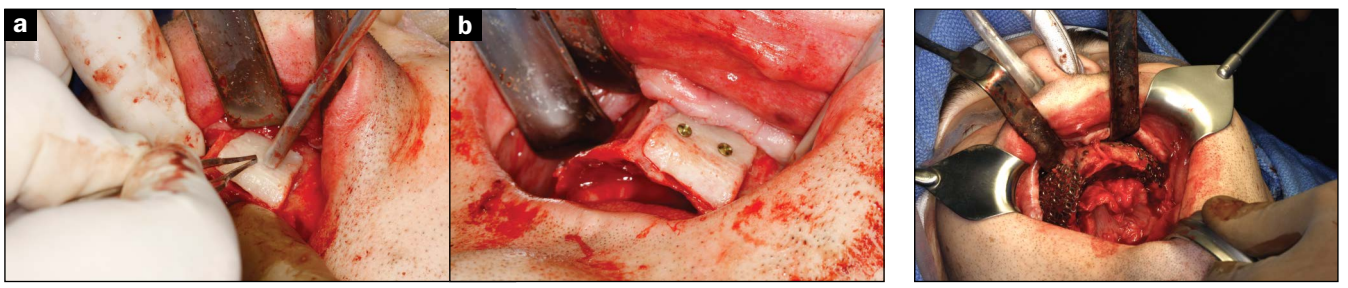

Figure 8a. Bone block shaped for recipient site. **Figure 8b.** Autogenous block fixated.

Figure 9. Titanium cage in place for posterior bone augmentation, blocks in place for anterior maxilla.

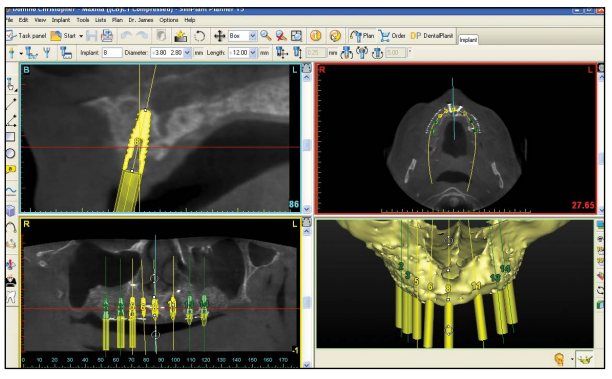

Figure 10. CBCT post sinus and block graft for implant planning.

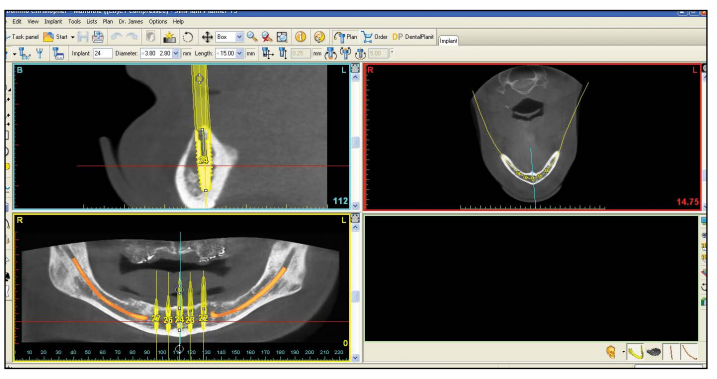

Figure 11. CBCT reformatted for mandibular implant rehabilitation.

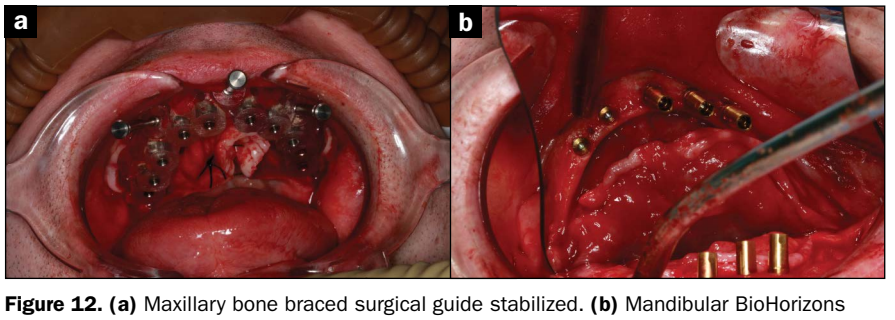

Figure 12. (a) Maxillary bone braced surgical guide stabilized. **(b)** Mandibular BioHorizons implant placement.

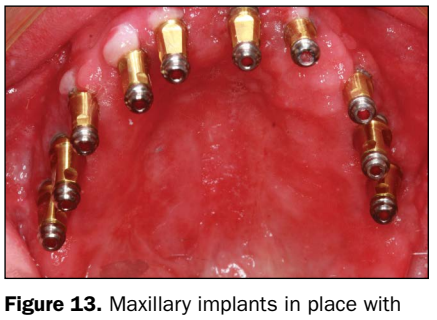

Figure 13. Maxillary implants in place with BioHorizons 3-in-1 abutments.

Prosthetic Phase

Upon getting clearance from the surgeons to begin prosthetic rehabilitation, the following clinical steps were done:

Initial impressions were made with Aquasil Ultra Extra (Dentsply Sirona) using ball-top screws affixed to BioHorizons 3-in-1 titanium abutments (Figures 13 and 14). Then the baseplates and rims (Glidewell Laboratories) were made, which were screw-retained for a

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Figure 14. Aquasil Ultra Extra (Dentsply Sirona) mandibular impression.

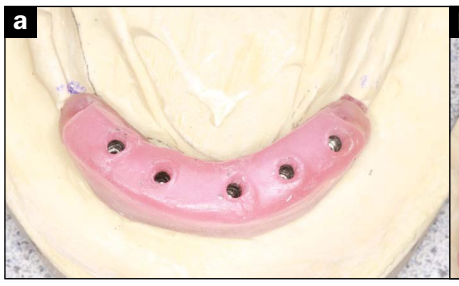

Figure 15a. Mandibular screw-retained baseplate.

Figure 15b. Maxillary screw-retained baseplate.

Figure 15c. Initial tooth setup displaying inadequate lip support.

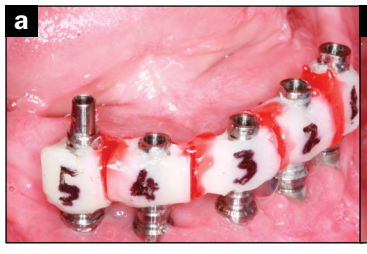

Figure 16a. Verification jig with Sheffield one-screw test initiated.

Figure 16b. Maxillary verification jig prior to luting.

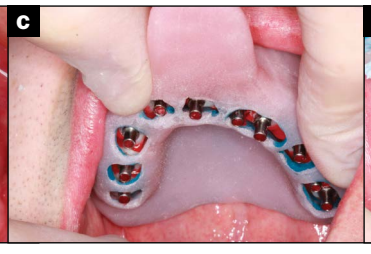

Figure 16c. Custom tray for pickup of luted verification jig.

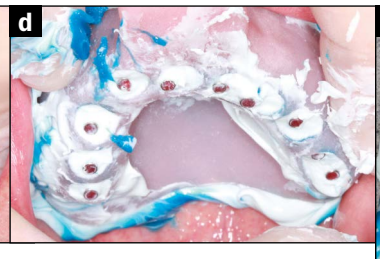

Figure 16d. Aquasil Ultra Extra open tray pickup of maxillary jig.

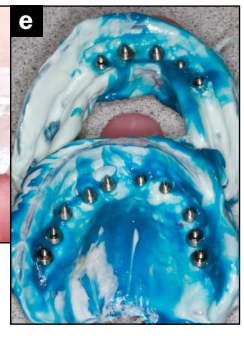

Figure 16e. Master impressions maxillary and mandibular implants (Aquasil Ultra Extra).

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maxillo-mandibular bite registration at the proper vertical dimension of occlusion (VDO) (Figure 15). The author has these baseplates made with all implants being screw-retained, and *open labial windows* on the baseplate so that the implant abutment interface could be visualized directly. This is a secondary verification to also make sure there is no rocking of the baseplate. When only 2 screws are used to affix the baseplate, an additional verification opportunity is lost.

The next step was placing acrylic blocks on each implant, luting them together and performing the Sheffield one-screw test (Figures 16a and 16b). This test allows the clinician to screw in the terminal abutments, then the central abutments, then alternating implants to ensure that the verification jig seats passively. An open-tray impression was made using Aquasil Ultra Extra (Dentsply Sirona Restorative) due to its extended working time and excellent tear strength and accuracy (Figures 16c to 16e), and was then sent to Glidewell Laboratories to set all the denture teeth for final verification of the proper aesthetics and phonetics. Once this was done, it was learned that the A-P spread of 1.5x the distance between a line through the anterior-most mandibular implant and a line connecting the 2 terminal implants would only allow for a first bicuspid to first bicuspid occlusion. Zirconia implant bridges that are built with greater than 1.5x A-P distance lose their warranty as they may fracture (Figures 17a and 17b). A bar overdenture would be used for mandibular rehabilitation (Figure 17c). The maxillary arch was still treatment planned for a zirconia bridge (BruxZir [Glidewell Laboratories]), as with 10 implants, the A-P spread is ideal. Unfortunately, the polymethyl methacrylate (PMMA) prototype temporary bridge had an anterior cantilever and insufficient lip support for proper aesthetics and speech (Figure 18).

Figure 17a. Tooth try-in, bite registration with labial windows in baseplates.

Figure 17b. The anterior-posterior spread indicates inability to extend mandibular occlusal set up beyond first bicuspid occlusion.

Figure 17c. Mandibular bar overdenture with LOCATOR attachments (ZEST Anchors).

Figure 18a. Maxillary polymethyl methacrylate (PMMA) provisional displaying potential anterior cantilever.

Figure 18b. Maxillary PMMA over lower bar overdenture setup.

Figure 18c. Facial view of try-in shows deep naso-labial fold and inadequate lip support.

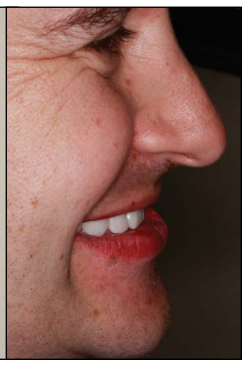

Figure 18d. Profile view of inadequate lip support, Class III tendency, and concave facial profile.

The inability to fabricate a PMMA restoration and subsequent bridge necessitated a change of treatment plan...

The inability to fabricate a PMMA restoration and subsequent bridge necessitated a change of treatment plan and prosthetic design. The cantilever of the prosthesis as well as the ridge-lap design would lead to food impaction and subsequent inability to maintain adequate hygiene for the BruxZir bridge. Working closely with the Glidewell Laboratories team helped in identifying these issues prior to final bridge fabrication and delivery. The need to access the implants with brushes, oral irrigation, and floss would not have been possible with a ridge-lap design (Figure 19).

The patient understood and accepted a bar overdenture design for both arches, as this option had been discussed in presurgical discussions with both the surgeons and restorative dentist present (Figure 20). The bars were fabricated, tried in, and delivered with the denture in wax with LOCATOR attachments (ZEST Anchors) cold-cured to the baseplates to verify lip support and phonetics prior to processing. The restoration prescribed by the dentist requested a metal-reinforced denture, so the dentist worked closely with the digital design team at Glidewell Laboratories to ensure there was no more than 2.0 mm of unsupported acrylic for strength. The digital files were

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sent for approval, modifications were made, and the final denture design was optimized for strength (Figure 21). An acrylic denture over a titanium bar is thin in areas, and the forces of mastication on a young male with high force factors could lead to denture fracture in a short time. Metal reinforcement of the overdenture increases longevity of the prosthesis.

Duplicate Overdentures

Duplicate overdentures were offered to the patient, as wear of denture teeth is a problem with overdentures. The lab team had the bars, VDO, and shade mold of approved dentures and could easily make cores for tooth placement and the digital files to recreate the partial denture frameworks. The patient accepted a second set of overdentures at a reduced fee. There is a tremendous value psychologically, financially, and emotionally to offering 2 sets of overdentures at the final delivery. (Note: The author offers "embarrassment dentures" routinely for the same reasons. These Lang acrylic duplicate dentures with acrylic teeth are fabricated at a lower cost and offered at a reduced fee. They are intended for a patient to wear in an emergency to avoid the embarrassment, in professional or social settings, of being without teeth.)

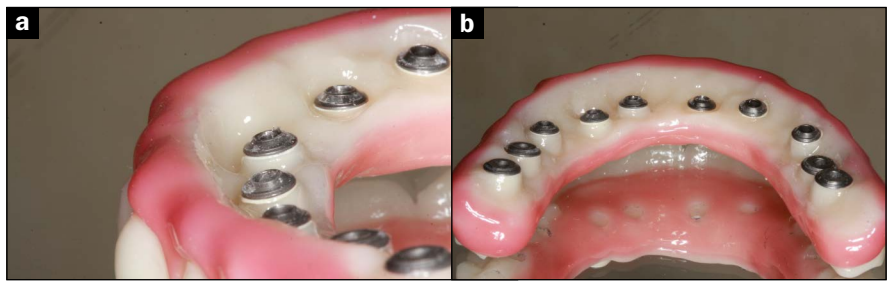

Figure 19a. Facial ridge-lap of teeth in PMMA temporary would lead to food impaction and inability for hygienic access.

Figure 19b. Full maxillary ridge-lap was not acceptable.

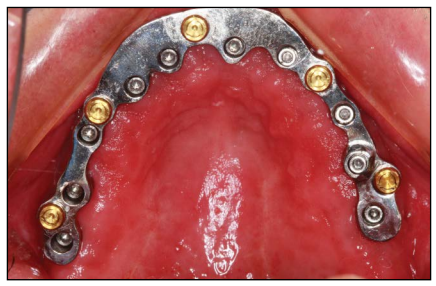

Figure 20. Maxillary LOCATOR bar seated and torqued.

It is imperative to receive the proper training and mentoring to accomplish cases competently and predictably.

The final delivery appointment involved try-in of the milled bars with the Sheffield one-screw test (any rocking at this stage requires sectioning and luting the bar or a new impression of the verification jig); radiographic confirmation of complete seating of the bar; seating of the dentures; and final torqueing of the bar on to the implants, twice at 5-minute intervals. The dentures were tried in and adjusted, and the screw access holes filled in with Teflon tape and composite resin. Both overdenture sets were adjusted. If necessary, quick lab remounts may be performed to detail the lingualized bilateral balanced occlusion. The lingualized occlusion allows sharp 33° cusps to intercuspate with 20° mandibular fossae so sharp, shearing of food may occur. The use of bilateral balancing allows working occlusion to be balanced on the nonworking side during lateral border movement. According to Abichandani et al[3] in the *European Journal of Prosthodontics*, both schema have been proven

Figure 21. Maxillary and mandibular metal-supported bar overdentures with LOCATOR attachments.

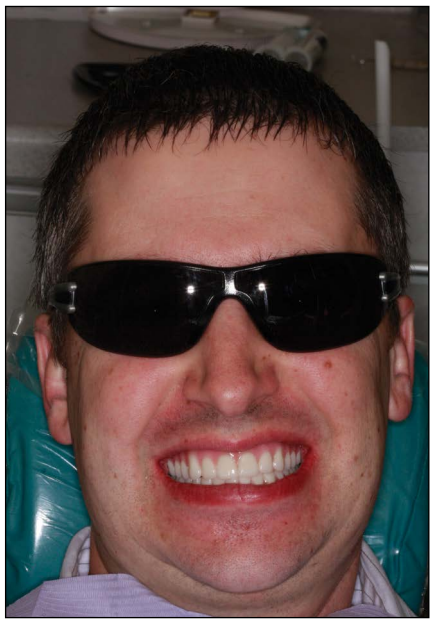

Figure 22. Full-face smile at the one-year follow-up.

advantageous for bar overdentures designs to decrease implant loads.

The patient's postoperative successes were demonstrated by his immediate post-op smile and his smile at the one-year follow-up (Figure 22).

CLOSING COMMENTS

The field of implant dentistry is expanding, as are the cases that benefit from these technological advances. However, the use of technology can only work if we use interdisciplinary thinking to build our rehabilitations for long-term success.

If the general dentist becomes the quarterback in treatment planning—partnering with the implant surgeon(s) after understanding costs, budgets, anatomical limitations and skill sets to complete rehabilitative care—*everyone wins!* Whether the general dentist does just the prosthetics, or both the surgery and prosthetics, it is imperative to receive the proper training and mentoring to accomplish cases competently and predictably.✦

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2. Nyström E, Legrell PE, Forssell A, et al. Combined use of bone grafts and implants in the severely resorbed maxilla. Postoperative evaluation by computed tomography. *Int J Oral Maxillofac Surg*. 1995;24(1 pt 1):20-25.
3. Abichandani S, Bhojaraju N, Guttal S, et al. Implant protected occlusion: a comprehensive review. *European Journal of Prosthodontics*. 2013;1:29-36.

Supplemental Reading

For those wishing to read more on topics related to this article, Dr. Winter will provide a list of selected articles. Contact him via email at the address rick@winterdental.com.

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