ImplantNews
V. 11, Nº 6a | PBA | Novembro/Dezembro 2014 ISSN 1678-6661

Latino-americana

PBA

Pesquisa Básica Aplicada

Edição 2014

Anuário especial
com trabalhos
inéditos de autores
nacionais e internacionais

Órgão Oficial

Prosthodontic revision treatment: total oral rehabilitation of a patient with intense parafunction and advanced bone loss in the posterior maxilla

***Stephen F. Balshi*[1]**
***Glenn J. Wolfinger*[2]**
***Thomas J. Balshi*[3]**

[1]President – CM Prosthetics, Inc., Fort Washington, PA, USA; Director of Research and Biomedical Engineering – Pi Dental Center, Institute for Facial Esthetics, Fort Washington, PA, USA.
[2]Board Certified Prosthodontist – Pi Dental Center, Institute for Facial Esthetics, Fort Washington, PA, USA.
[3]Founder and Board Certified Prosthodontist – Pi Dental Center, Institute for Facial Esthetics, Fort Washington, PA, USA.

ABSTRACT
Rehabilitation of a compromised dentition in individuals with parafunction and excessive masticatory forces is difficult to manage long term. This patient example illustrates an expedited treatment approach to replace and restore the missing and deteriorated dentition. A plan was developed to cope with this clinical status and future requirements. The maxilla was treated with 10 endosseous implants, which included 2 in the pterygomaxillary region and 2 in the zygoma. The mandibular arch was treated with 7 endosseus implants. The definitive screw-retained prostheses consisted of maxillary porcelain-fused-to-metal and mandibular acrylic resin veneer of a cast metal framework. The patient has been followed for seven years. Prosthodontic complications have been limited to acrylic resin veneer fractures on the mandibular implant-supported prosthesis.

Key words – Dental implants; Osseointegration; Zygoma; Pterygoid; Teeth in a day; Bone loss; Biomechanics.

Introduction

Oral rehabilitation of the totally collapsed dentition in individuals with pronounced parafunction and excessive masticatory forces is challenging for the prosthodontic treatment team. The goal for the rehabilitation is to provide the patient with a predictable and durable solution which factors in the excessive function but also addresses improved esthetics.

Some of these patients have gone through various treatment plans in their past to address problems such as missing or deteriorated dentition. However, often times these patients are treated in a localized manner to address a specific problem raised by the patient rather than providing that patient with a comprehensive treatment plan. Oral biomechanics are often neglected in localized treatment plans and therefore the restorations ultimately break down due to fatigue or excessive force.

Masticatory forces are higher in the posterior region than they are in the anterior[1]. When posterior dentition is lost, the bone resorbs[2] leaving reduced volume of bone for implant-supported prostheses in an area where the greatest forces are exerted. This creates a biomechanical concern[3-5]. Many clinicians treatment plan bone augmentation procedures for the resorbed posterior maxilla. These techniques include iliac block grafting procedures[6], maxillary sinus augmentation[7], and Le Fort I osteotomies with interpositional bone grafting[8]. Other clinicians treatment plan with tilted implants[9-10], with the most popular of these plans utilizing the All-on-4 treatment concept[11-14]. The All-on-4 treatment concept is a predictable solution for many edentulous patients, but those patients that require second molar occlusion or have advanced pneumatization of the maxillary sinuses may not be candidates. Patients with diagnosed parafunctional habits who have the ability to overload an implant prosthesis may not be good candidates for the All-on-4 treatment concept either.

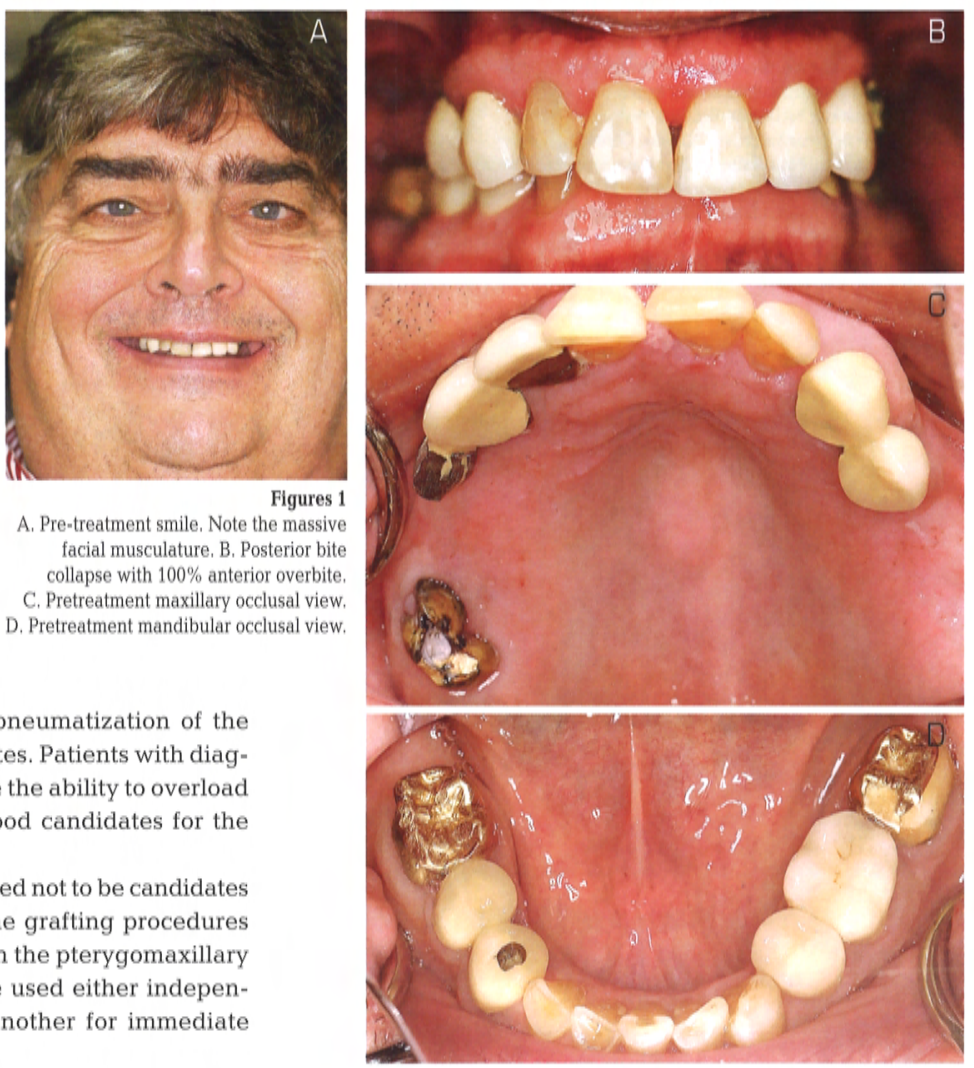
For the patients who are determined not to be candidates for All-on-4, the aforementioned bone grafting procedures can be used. Alternatively, implants in the pterygomaxillary region[15-17] and the zygoma[18-21] can be used either independently or in conjunction with one another for immediate functional loading[21].

The following report illustrates the comprehensive treatment of a patient with intense parafunction, who has worn down multiple dental restorations from various localized treatment plans. He will not experience retreatment, but rather revision treatment – an entirely different approach than what was previously attempted that addresses his current clinical conditions and his esthetic and functional demands.

Patient Report

History

A 60-year old Caucasian male with a totally collapsed dentition presented to a private prosthodontic practice. The patient reports being diabetic that is controlled with medication (amaryl 4mg/day). The patient also reports having Lyme disease for which he takes amoxicillin for indefinitely. The patient is currently a non-smoker, however did admit to smoking approximately 20 years ago. The patient had



Figures 1
A. Pre-treatment smile. Note the massive facial musculature. B. Posterior bite collapse with 100% anterior overbite. C. Pretreatment maxillary occlusal view. D. Pretreatment mandibular occlusal view.

existing implants and crowns placed in the maxilla approximately 5 years prior. Full coverage crowns and bridges were completed in the mandible 10 years prior.

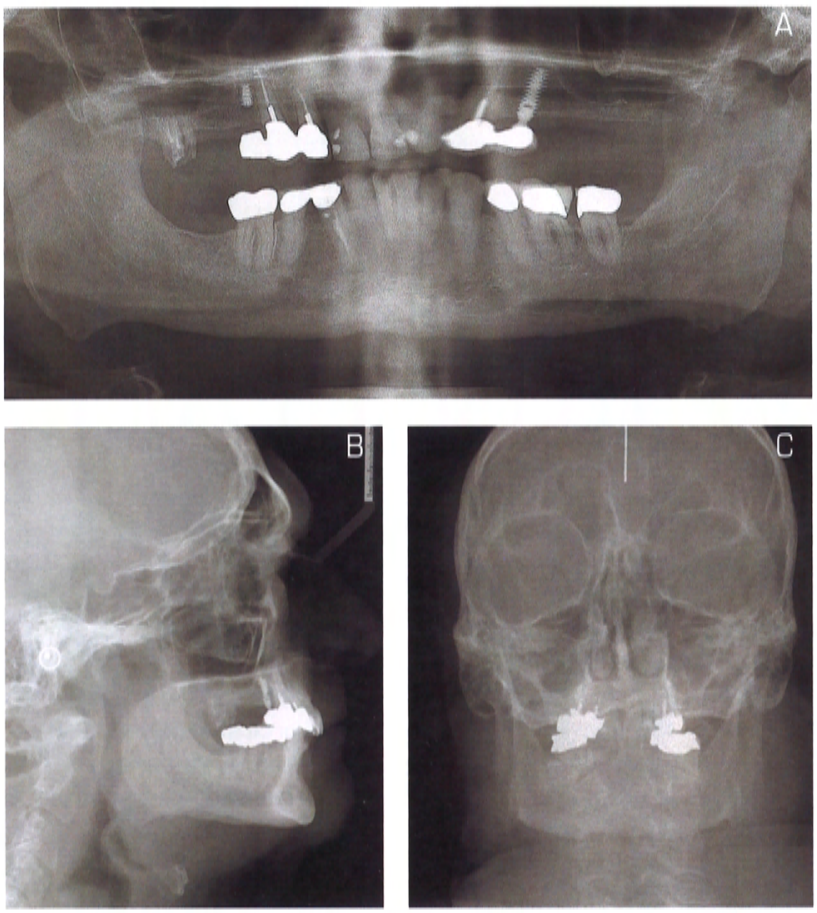
Comprehensive revision treatment plan

The patient was examined both clinically (Figures 1) and radiographically (Figures 2) and the following diagnosis was made: 1) apical lesion in the area of tooth #7, 2) fractured implant in the area of #12, 3) dental malocclusion, 4) posterior bite collapse, 5) 100% anterior overbite, 6) atrophic posterior maxilla, and 7) hopeless remaining natural dentition. A comprehensive revision treatment plan was developed for a total oral rehabilitation. The plan included extraction of all remaining teeth, removal of the two existing implants, and placement of 10 maxillary and 7 mandibular endosseous implants all of which were to be immediately loaded following the Teeth in a Day protocol[22-23]. In the maxilla, bilateral zygomatic and pterygomaxillary implants were planned to provide predictable posterior support in a patient who has intense parafunction. Definitive screw-retained prostheses were planned as porcelain-fused-to-metal in the maxilla and metal framework veneered with acrylic in the mandible.

Revision treatment – surgical

After agreeing to the outlined revision treatment plan, an interocclusal registration was made (Regisil 2x; Denstrply Caulk, Milford, DE) at a reestablished vertical dimension of occlusion. Alginate (Jeltrate Chroma, Dentsply Caulk) impressions of both maxillary and mandibular arches were made and the resulting models were articulated using the interocclusal registration. Using digital photographs and notes recorded from the prosthodontist about the desired tooth position, the laboratory fabricated maxillary and mandibular immediate dentures.

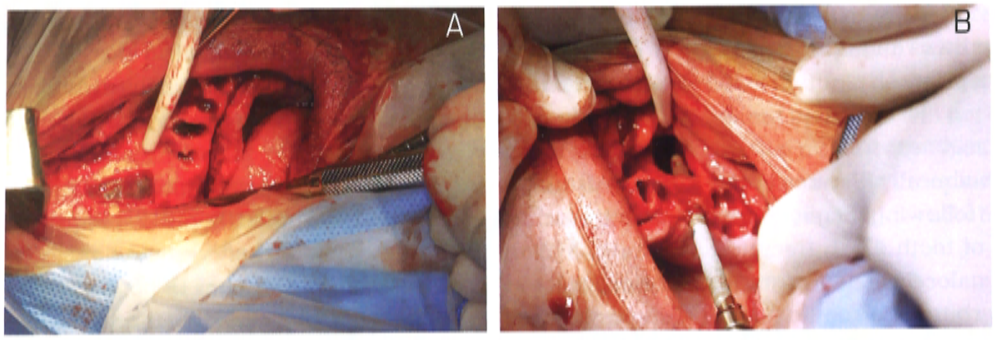
The patient then appointed for surgery. It is the author's preference to administer general anesthesia with nasal intubation to patients undergoing zygomatic implant placement. All remaining dentition was extracted and the sites were debrided with an antibiotic solution (tetracycline 250 mg; AA Pharma, Inc., Toronto, Canada). The two existing maxillary implants were also extracted.

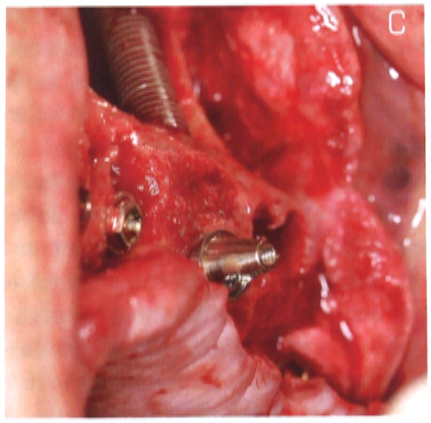


Figures 2
A. Pre-treatment panoramic radiograph reveals a fractured implant. B. Pretreatment lateral cephalometric radiograph shows patient's deep overbite. C. Pre-treatment A-P cephalometric radiograph.

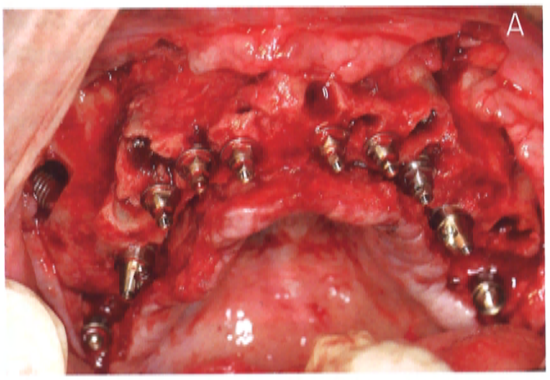
Beginning in the mandible, the alveolar ridge was reduced to allow for sufficient prosthetic space for the planned screw-retained prosthesis. Seven endosseous implants (NobelSpeedy Groovy RP; Nobel Biocare, Yorba Linda, CA) were placed in the mandible into Type III bone according the criteria established by Lekholm and Zarb[24]. Transmucosal abutments (Esthetic-one and Brånemark Standard; Nobel Biocare) were connected to the implants. The conversion prosthesis technique originally described by Balshi in 1985[25] and then further refined[26] was used to convert the mandibular immediate denture to an all-acrylic resin screw-retained prosthesis. The maxillary complete denture was positioned intraorally to set the occlusion for the mandibular conversion prosthesis. The mandibular conversion prosthesis was then trimmed, finished and polished and made ready for delivery to the patient, but was not installed at this time. This process will be further explained with illustrations in the maxillary arch.

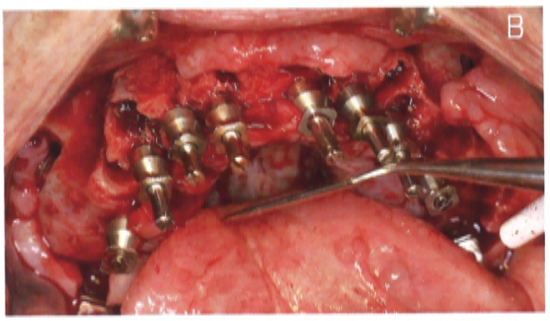
In the maxilla, the alveolar ridge was reduced in certain areas to provide a flat platform of bone for prosthetic purposes. The preparation for the zygomatic implants was completed first to ensure the maximum amount of bone-implant-contact is achieved with the zygoma implants[27-28].





Figures 3
A. Lateral sinus window for visibility during zygoma implant placement. B. Installation of zygoma implant. C. Angulated abutment (17 degree) installed on zygoma implant.

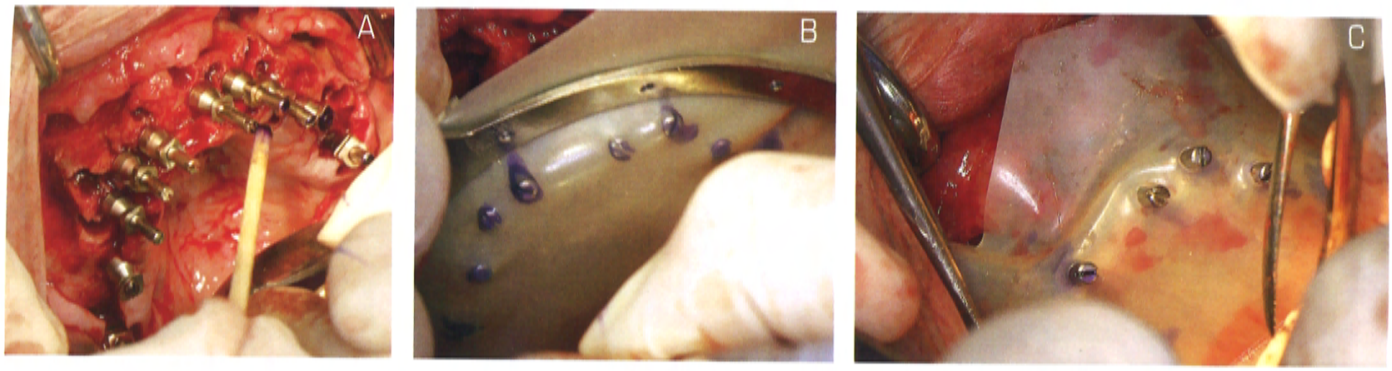




Figures 4
A. Installation of abutments on 10 maxillary implants placed immediately following extraction of remaining teeth and fractured implant. B. Prosthetic cylinders placed using 10 mm guide pins

A window was opened in the lateral wall of the maxillary sinus to be able to completely visualize the drilling to the zygoma (Figure 3A). The dual diameter zygomatic implants (3.9 mm at the apical end; 4.6 at the coronal end) were then installed (Figure 3B). The bilateral pterygomaxillary implants were installed next, followed by the six implants anterior to the maxillary sinuses. All implants were determined to be placed in Type III bone[24]. Angulated transmucosal abutments (Estheticone) were connected to the zygomatic implants to bring the prosthetic access closer to the occlusal table (Figure 3C). Straight transmucosal abutments were connected on the remaining 8 implants (Figure 4A) and then appropriate prosthetic cylinders were installed on the abutments with guide pins (Figure 4B). Following the conversion prosthesis technique[25-26], the tops of the guide pins were marked with ink (Dr. Thompson Color Transfer Applicators; Great Plains Dental Products, Kingman, KS), Figure 5A. A rubber dam (X-Heavy; Coltene/Whaledent, Cuyahoga Falls, OH) was then impressed against the ink laden guide pins to clearly mark the abutment position (Figure 5B). After holes were punched in the rubber dam, it was installed over the prosthetic cylinders to block out any undercuts and to protect the soft tissues from the forthcoming exothermic reaction that takes place with the acrylic resin (Figure 5C).

The mandibular conversion prosthesis was installed at this time to maintain the plane of occlusion during the pick-up of the maxillary immediate denture. Autopolymerizing acrylic resin (Jet; Lang Dental, Wheeling, IL) was mixed to a thick fluid consistency, loaded into a 50 ml syringe (Utility Syringe Curved; Benco Dental, Pittston, PA), and injected over the rubber dam connecting all prosthetic cylinders. The maxillary immediate denture was positioned over the cylinders with the guide pins protruding through the palatal side of the prosthesis (Figures 6A-B). After the resin was completely

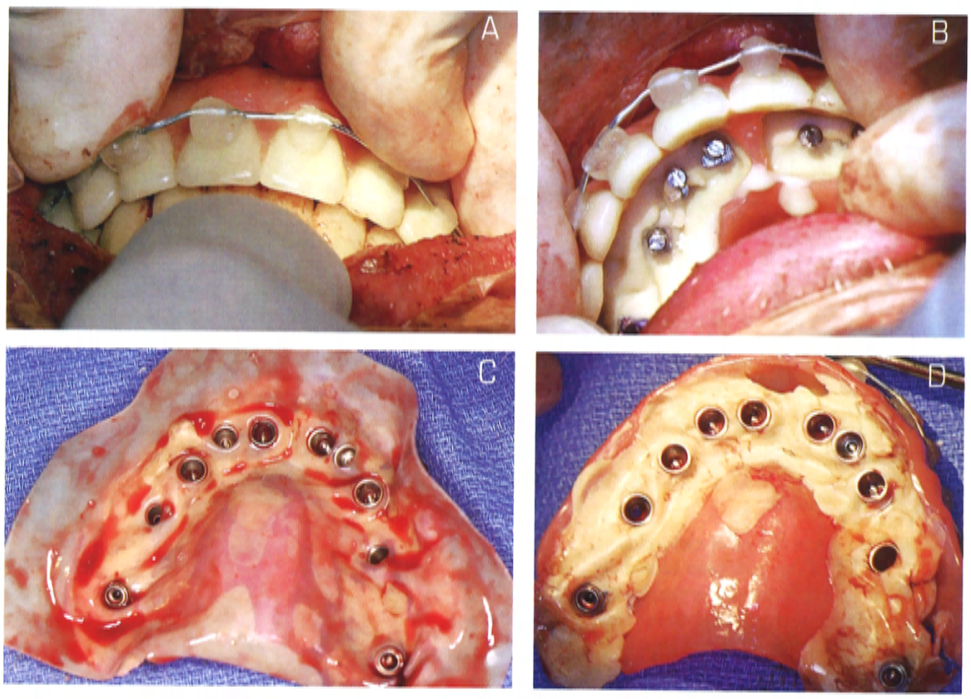


Figures 5

A. Ink stick used to color the top of the guide pins. B. Rubber dam records position of the implants. C. Rubber dam installed over prosthetic cylinders.

set, the guide pins were removed and the immediate denture was removed from the patient (Figure 6C). As long as there was a rigid connection between the immediate denture and all of the prosthetic cylinders, the pick-up procedure can be considered successful (Figure 6D). Any voids that exist can be filled in with additional acrylic extraorally (Figures 7A-B). The immediate denture was then trimmed, finished and polished and prepared for delivery (Figures 7C-D).

The mucosal tissues were then approximated and closed with interrupted sutures (4-0 Vicryl FS-2; Johnson & Johnson; Skillman, NJ), Figure 8A. Just prior to inserting the conversion prosthesis, all surfaces of the all-acrylic resin interim prosthesis were painted with a denture sealant (Palaseal; Heraeus Kulzer, South Bend, IN) and polymerized in a rotating curing unit for 2 minutes. The prosthesis was then delivered (Figures 8B-C) and the occlusion was adjusted. Each screw access channel was densely packed and sealed with a light cured flexible resin material (Telio CS; Ivoclar Vivadent; Amherst, NY). Postoperative panoramic (Figure 9A) and cephalometric (Figures 9B-C) radiographs were taken to confirm seating of both the maxillary and mandibular conversion prostheses. Table 1 details the implant dimensions for all 17 implants used in the revision treatment of this patient.



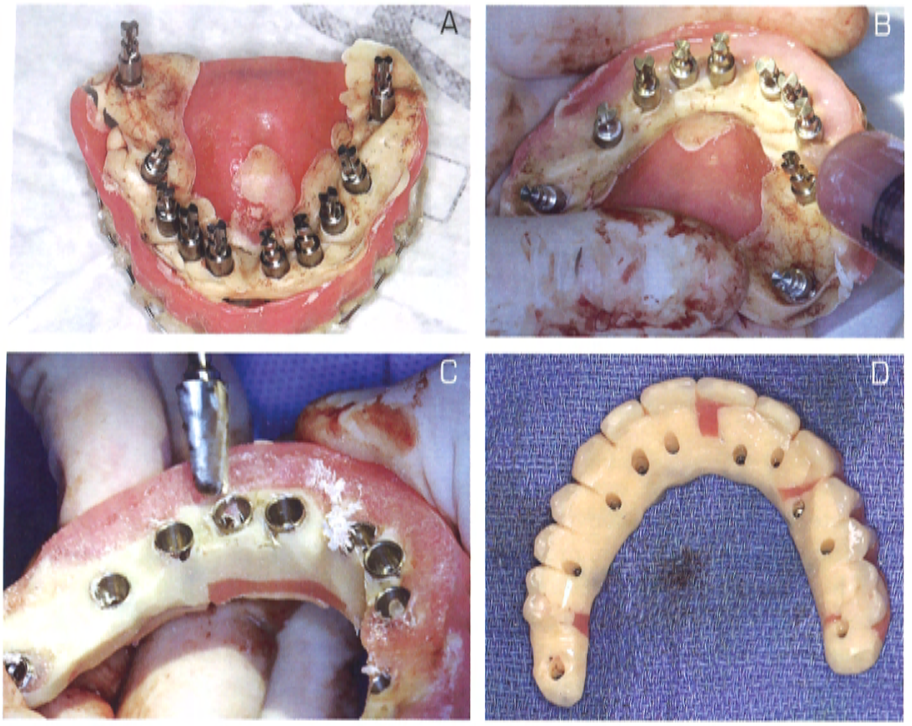
Figures 6

A. Maxillary complete immediate denture is positioned at the restored occlusal vertical dimension. B. Autopolymerizing acrylic is injected around prosthetic cylinders to connect to the dentition. C. Removal of the guide pins releases the maxillary prosthesis. D. Prosthetic cylinders attached to the immediate denture.

Revision treatment – prosthetic

Twelve weeks following implant placement, the patient returned for evaluation of osseointegration and definitive impressions. The maxillary and mandibular conversion prostheses were removed. All abutment screws were checked and tightened. It was determined at this time that all implants were clinically stable and the final impression could be made to begin construction of the definitive restorations.

The conversion prostheses were reinstalled using long guide pins. Wash pick-up impressions of both conversion prostheses were made to record the accurate relationship of all implants in each dental arch. Abutment replicas (Estheticone and Brånemark Standard; Nobel Biocare) were installed in the

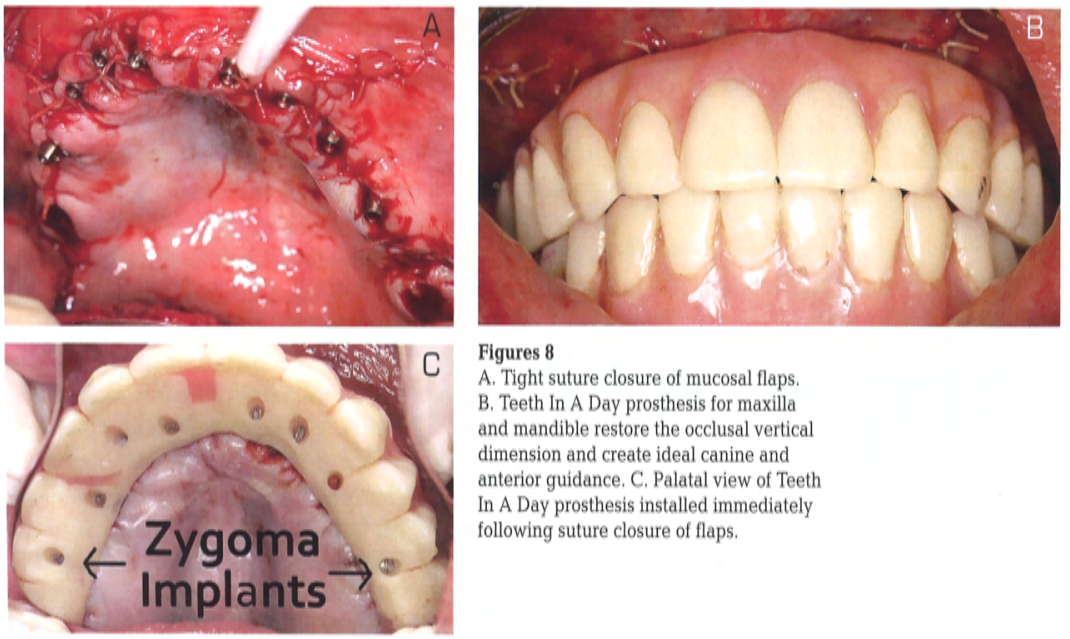


Figures 7
A. Abutment replicas are installed to protect the internal surface. B. Additional acrylic is injected in all voids to strengthen the Teeth In A Day prosthesis. C. Excess acrylic flanges and palate are removed. D. Teeth In A Day prosthesis is contoured and polished.

TABLE 1 – IMPLANT DISTRIBUTION

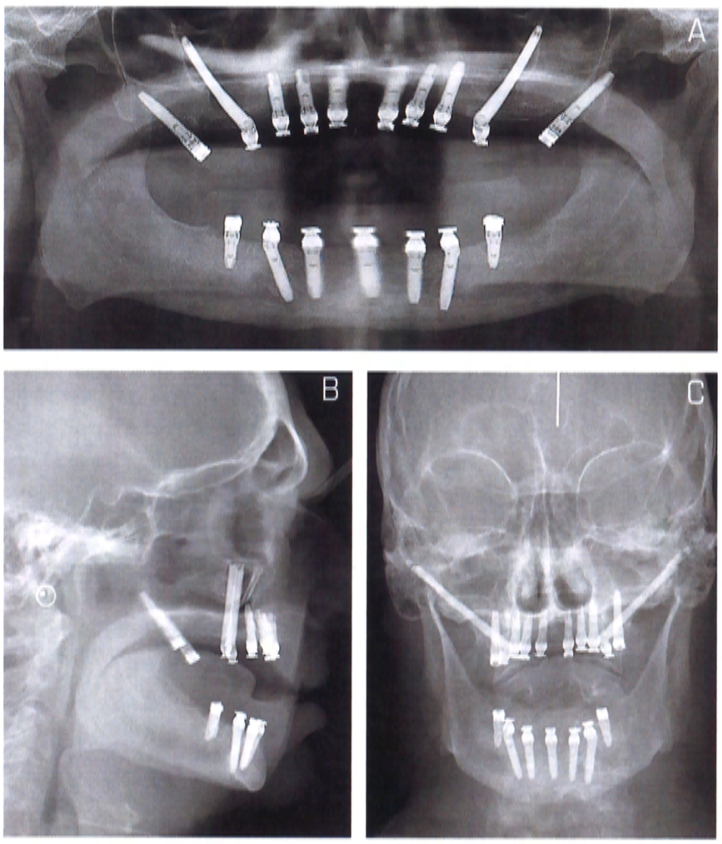
Tooth position	Implant dimensions
Maxilla	
2*	4 x 18
4^	47.5 mm
5	4 x 15
6	4 x 13
8	4 x 13
9	4 x 13
10	4 x 13
11	4 x 13
14^	50 mm
16*	4 x 18
Mandible	
19	4 x 8.5
20	4 x 18
22	4 x 15
24	4 x 15
27	4 x 15
29	4 x 18
30	4 x 8.5

All implants are NobelSpeedy Groovy RP except for the zygomatic implants.
* Indicates pterygomaxillary implant position.
^ Indicates zygomatic implant position.



Figures 8
A. Tight suture closure of mucosal flaps. B. Teeth In A Day prosthesis for maxilla and mandible restore the occlusal vertical dimension and create ideal canine and anterior guidance. C. Palatal view of Teeth In A Day prosthesis installed immediately following suture closure of flaps.

impressions with the long guide pins. The master impressions were poured with a gingival replication silicone material (Gingifast Rigid; Zhermack, River Edge, NJ) and type IV die stone (Velmix Pink; Kerr Lab, Orange, CA).



Figures 9

A. Post surgery panoramic radiograph with Teeth In A Day prostheses installed in maxilla and mandible. B. Post surgery lateral cephalometric radiograph shows Teeth In A Day prosthesis with 45 degree angulated pterygomaxillary implants are used to eliminate posterior cantilevers. C. Post Surgery A-P Cephalometric radiograph illustrates 45 degree angulation of the 50 mm long zygomatic implants.

Figures 10

A. Completed treatment with porcelain-fused-to-metal maxillary prosthesis. B. Maxillary porcelain-fused-to-metal prosthesis with restored occlusal vertical dimension. C. Complete mouth rehabilitation with porcelain-fused-to-metal maxillary prosthesis and acrylic with a metal framework mandibular prosthesis. D. Post treatment panoramic radiograph shows 10 maxillary and 7 mandibular Brånemark implants supporting screw retained fixed prostheses.

After the stone set, the guide pins were removed and the prostheses were removed from the impression. The conversion prostheses were then used to articulate the master casts in a semi-adjustable articulator because they contain the proper jaw relationship that was established at the time of installation 12 weeks prior. The articulated master casts, along with cross mounted stone casts of the maxillary and mandibular conversion prostheses were sent to the dental laboratory for fabrication of the final prostheses.

Six weeks following master impressions, the definitive prostheses were delivered (Figs 10A-C). In the maxilla, a porcelain-fused-to-metal prosthesis was fabricated with both tooth colored and tissue colored porcelain. The tissue colored porcelain was shaded to match the acrylic resin in the mandibular prosthesis that was veneering a cast metal framework. A panoramic radiograph was taken to confirm proper seating of the frameworks (Figure 10D). The occlusion was then refined and all access holes were filled with a light cured flexible resin material. The patient has been followed for 7 years since the time of implant placement.

Discussion

Patients with intense parafunction require a comprehensive treatment plan that addresses all biomechanical aspects of dental implant rehabilitation. It is important to avoid lengthy cantilevers and long spans between implants. If the appropriate treatment plan is not implemented, biologic and prosthetic complications can be expected and may lead to failure of both implants and prosthesis.

The patient example presented in this report has successful prosthodontic revision treatment. All implants remain clinically stable and functioning well to support the screw--retained prostheses. The patient has experienced several prosthetic complications that can be attributed to intense parafunction. There were three episodes of fracture to the conversion prostheses from the time of placement to the delivery of the final prostheses. The first episode, which occurred in the mandible, was to an anterior denture tooth. The second and third episodes occurred in the maxilla and were prosthesis fractures in the left posterior. Once the definitive prostheses were delivered, complications were limited to the mandibular acrylic resin to metal prosthesis. There were two episodes of fracture in the mandibular definitive prosthesis: one was to a piece of acrylic lingual to #19 and the other was the prosthetic screw in the area of #30.

Five years after delivery of the definitive prostheses, the patient presented for routine oral hygiene maintenance. It was noted at this time that there was a collapse in the vertical dimension of occlusion due to significant wear of the acrylic denture teeth in the mandibular prosthesis. A treatment plan was presented to the patient for a mandibular 'retread'. A 'retread' is the process in which worn acrylic resin denture teeth are stripped from a metal framework and are replaced with new acrylic resin denture teeth at the desired vertical dimension of occlusion.

With current day technology, the use of a fully milled monolithic acrylic-resin to metal prosthesis (Avadent; Global Dental Science, Scottsdale, AZ, USA) would be beneficial for a patient with intense parafunction. The fully milled prosthesis provides superior strength and should reduce the number of prosthetic complications in the long term. It may also increase the time period from initial delivery when a 'retread' would be necessary. Further studies on those specific prostheses would be necessary to validate these hypotheses.

It is the author's preference to deliver a porcelain prosthesis in the maxilla and an acrylic prosthesis in the mandible for long term maintenance for complete implant prosthodontic rehabilitation patients. With this configuration, the prosthetic maintenance is generally limited to the mandibular arch. If both dental arches are restored with acrylic resin, both prostheses are subject to wear, therefore doubling the maintenance costs of the oral rehabilitation. The authors prefer not to restore both arches with porcelain to prevent fracture of the ceramic veneering materials.

In the posterior maxilla, where masticatory forces are high, it is important to have maximum bone-implant contact. The combination of zygomatic and pterygomaxillary implants in patients with intense parafunction has shown to provide proper support for a screw-retained fixed prosthesis. In the pterygomaxillary region, the length of the implant plays a critical role in the success of the implant[29]. A longer implant is required to engage the dense cortical bone that exists in the medial and lateral pterygoid plates. In the zygoma, it is important to select the an implant length that will allow for penetration of the lateral cortical plate of the zygoma to maximize the bone-implant contact for the implant[27-28]. These cortical bone areas play an important role in the immediate loading protocols that may be employed with these patients.

The patient in this report was a controlled type II diabetic patient. It has been shown in the literature that patients with controlled glycemic levels can achieve successful osseointegration, but the rate of bone healing is slower[30-31]. Therefore, an increased number of implants is recommended when employing an immediate load protocol to reduce the pressure the patient can apply to an individual implant. Splinting and cross-arch stabilization should also be achieved whenever possible under these clinical conditions. These patients should also be provided with a night-time occlusal guard to protect against bruxing and grinding and reduce the wear rate of the acrylic resin restorative materials.

Conclusion

Implant prosthodontic revision treatment can be successful in the patient with intense parafucntion when biomechanics are well understood and the proper comprehensive treatment plan is executed. An increased number of implants will increase the success of this treatment process. A high level of cumulative implant stability throughout the rehabilitation will make an immediate loading protocol a predictable treatment approach. The use of fully milled prostheses either in part or in whole (with an internal metal substructure) may reduce prosthetic complications.

Conflict of interest
We, the authors, hereby declare that no financial support was provided for this study. Also, we and/or our family members did not receive any consultant fees or were paid as consulting services, do not have any stocks or investments, did not receive lecturing fees from potentially cited organizations, have no employment relationships, patents, *royalties*, or have worked for companies with financial interests in this area.

Corresponding address
Stephen F. Balshi
467 Pennsylvania Avenue, Suite 201
Fort Washington, PA 19034, USA.
stephen.balshi@cmprosthetics.com
Tel.: 215-646-6334

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