

Two Bilateral Zygomatic Implants Placed and Immediately Loaded: A Retrospective Chart Review with Up-to-54-Month Follow-up

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Purpose: To report on the outcome of placement of two bilateral zygomatic implants with an immediately loaded prosthesis. **Materials and Methods:** A retrospective chart review was conducted of all patients treated with zygomatic implants between August 1, 2011 and June 6, 2016. All patients had at least two zygomatic implants placed bilaterally and immediately loaded with a provisional prosthesis the same day of implant placement. The implants were Nobel Biocare TiUnite or machined surface with lengths of 30 to 52.5 mm. All patients were treated by a team consisting of one surgeon, a restorative dentist or prosthodontist, an anesthesiologist, and a laboratory technician. Implant success was defined as successful integration of the implant; prosthetic success was defined as retention of the prosthesis under normal function. **Results:** One hundred five zygomatic implants were placed and immediately loaded in 28 patients over a period of 1 to 60 months. Ages ranged from 46 to 81 years, with 26 female and 2 male patients. All the implants were placed by one surgeon. The immediate load on the day of implant placement was completed by either one of 2 prosthodontists or 11 restorative dentists. Implant success was 96% (101/105). All four failed implants were in one patient and were TiUnite surface coated. **Conclusion:** This study demonstrated that two zygomatic implants bilaterally placed and immediately loaded with a full-arch splinted prosthesis will provide a predictable outcome. *INT J ORAL MAXILLOFAC IMPLANTS* 2017;32:1399–1403. doi: 10.11607/jomi.5786

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Edentulism is a chronic disease that is associated with significant rates of morbidity and health issues. It is estimated that 12 million Americans are completely edentulous, and 36 million are edentulous in one arch.¹ Treatment of the edentulous arch can be accomplished with either fixed or removable dental prostheses. In patients who desire a fixed dental prosthesis (FDP) and have adequate bone, conventional endosseous root form implants have been used with great success.² The results provide predictable function, esthetics, and improved quality of life.³ When coupled with an immediately loaded prosthesis, patients can return to a more normal lifestyle in an expedited time frame.⁴

When the clinical presentation is compromised, conventional implant placement may not be possible. Fixed prosthetic treatment for the severely atrophic maxilla presents a challenge for the surgical and restorative team. Among the issues to consider are a lack of osseous tissue; enlarged pneumatized sinus; and resorption of the maxilla in a posterior, medial, and superior direction. The result is a substantially smaller base for dento-alveolar substitutes. When considering treatment options for one or more of these clinical presentations, the dental team has two options: a “grafted approach” or “graftless approach.”

In the grafted approach, the atrophic area(s) of desired implant placement is grafted. In the severely atrophic maxilla, this often requires an onlay and an inlay technique for reconstruction. The need to avoid pressure on the graft is a challenge during the consolidation period. This is partially mediated by using provisional implants or not allowing the patient to wear a prosthesis during this time frame. The advantages of this approach include predictable and documented clinical success⁵ and predictable implant placement. Disadvantages are morbidity of the donor site, increased treatment time and surgical procedures, questionable opportunity to immediately load, and an increased cost.

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The graftless approach utilizing zygomatic implants was first reported by Brånemark et al in 1988 and later made available to the profession in 1998 after proven clinical success.⁶ The surgical success rates have been reported at 94%, with a prosthetic success rate of 96% after 5 years.⁷ The advantages to this procedure include fewer procedures and shortened treatment time since there is no bone grafting, the ability to load a fixed provisional restoration immediately, no donor site morbidity if autograft is utilized, fewer implants, and decreased cost. A critical disadvantage is that the potential loss of a zygomatic implant may jeopardize the entire prosthesis.

The initial Brånemark protocol called for the placement of two zygomatic implants in the posterior maxilla and four conventional root form implants in the anterior maxilla. A full-arch splinted FDP was immediately placed loading both the zygomatic and conventional implants. In this approach, the zygomatic implants emerged medial (palatal) to the alveolar ridge. This yielded a restoration that was less than ideal with regard to speech, hygiene, and comfort.

As surgical procedures evolved, however, conventional anterior implants were no longer required. The zygomatic implants were placed with a more lateral approach, yielding better prosthetic emergence profiles within the conventional alveolar/tooth envelope. Placing four zygomatic implants allowed for the creation of a more favorable anterior-posterior distribution and a provisional FDP that can be loaded immediately.^{8,9}

This paper will report on the outcome of zygomatic implants placed by one surgeon and immediately restored by either a prosthodontist or restorative dentist with a follow-up of 1 to 54 months.

MATERIALS AND METHODS

All patient charts in one oral surgery office were reviewed from August 1, 2011 to June 6, 2016. To be included in this retrospective review, all patients had to have at least two zygomatic implants placed bilaterally and immediately loaded with a provisional prosthesis the same day of implant placement. The exclusion criteria were surgeries in the office that did not include zygomatic implants, surgeries where less than four zygomatic implants were placed, and zygomatic implants that were not immediately loaded.

After a comprehensive oral exam, patients fitting the clinical presentation consistent with a diagnosis of an atrophic maxilla were presented with both grafted and graftless options for a fixed restoration. The advantages and disadvantages were discussed. This paper reports on the patients who were treated with the graftless approach.

Presurgical diagnostic evaluation included cone beam computed tomography (CBCT), diagnostic casts, vertical dimension of occlusion (VDO), centric relation (CR), and skeletal relationships. The CBCT was used to visualize the alveolar arch and maxillary sinuses as well as the osteomeatal complex. The alveolar arch was analyzed for thickness, height, and form. The maxillary sinuses were evaluated for any signs of inflammation or pathology.

Preprosthetic diagnostic evaluation included a tooth/alveolar try-in to evaluate esthetics, phonetics, lip, and orofacial contours. Upon approval of esthetics by the patient, a surgical guide was fabricated from this same prosthesis to aid in implant placement. The diagnostic complete denture was processed into a conventional complete denture and duplicated in clear acrylic for the guide.

Prior to treatment, the surgical, anesthetic, and restorative teams reviewed the case.

Surgical

Surgery was performed under general anesthesia. The patients were intubated nasally and paralyzed for the surgical component. After the patient was appropriately anesthetized, local infiltration and V2 blocks were given; 8 cc of 2% lidocaine with 1:100,000 was administered. A crest of ridge incision was made with bilateral vertical releases at the posterior buttress. The buccal/lingual position of the crest of ridge incision was based on leaving an adequate (> 2 mm) zone of keratinized mucosa to the buccal. Full-thickness mucoperiosteal flaps were elevated with clear visualization of the maxillary buttress, nasal aperture, and the zygomatic base with extensions toward the temporal process and superiorly toward the cru. With exposure of the zygoma region, the surgical stent was placed. Visual inspection at this time was important to the prosthetic and surgical direction.

The relationship between the alveolar ridge, zygomatic base, and the occlusal table of the premolar/molar determined the implant position as it extended toward the zygomatic region. The implant relationship to the sinus was intrasinus, extrasinus, or partial sinus in its emergence from the base of the zygoma. No one technique has been found to be superior; however, if lateral loading is used, the intrasinus approach is the most favorable for the rehabilitation of severely atrophic maxillae.¹⁰

Initially, the left posterior implant was placed as far back on the zygomatic bone as possible. This allowed the implant base to emerge in the first molar region. The surgical stent was placed to idealize the depth and implant prosthetic emergence. The implant was rotated to ensure positioning of the prosthetic screw in the desired envelope of the prosthesis. The prosthetic driver was placed in the implant mount, allowing for improved visualization of this emergence. The

Fig 1 (Left) Prosthesis demonstrating esthetic smile and arch form filling the buccal corridors.



Fig 2 (Right) Occlusal view demonstrating the soft tissue health around the zygomatic implants emerging from the residual alveolar ridge in an ideal position (buccal fat pad was mobilized).



Fig 3 (Left) Postoperative CBCT scan demonstrating appropriate positioning of the zygomatic implants in the zygomatic bone.



Fig 4 (Right) Occlusal view of prosthesis supported by four zygomatic implants; note the emergence in the tooth alveolar envelope.



left second zygoma implant was then placed anterior to the first. This implant will emerge at the canine region, but can range from the lateral incisor to the first premolar tooth. Prosthetic positioning was as noted earlier for the initial implant placement. The right side placement of the two zygoma implants was similar to the left side; however, the most proximal implant was placed first, followed by the more distal alignment.

After placement of the four zygoma implants, the implant mounts were removed. Multiunit abutments were placed in conjunction with the restorative dentist to idealize height and angle of prosthetic emergence. When the partial sinus or extrasinus technique was used for any of the zygomatic implants, the buccal fat pad (BFP) was utilized to cover the exposed threads. This approach is routinely used as a solution to address early partial sinus or extrasinus placement that develops crestal soft tissue issues, retraction, and/or chronic inflammation.¹¹ The BFP is encountered just posterior and lateral to the base of the zygoma by creating a small opening in the periosteum laterally. The BFP was advanced and brought anteriorly in a pedicle fashion to cover the exposed implant threads as needed. The BFP can be brought to the midline when needed to cover the threads on most anterior implants. The mucosa was closed with interrupted sutures using 3.0 chromic gut sutures.

Postoperative medications included augmentin, nasal steroid, decongestant, and chlorhexidine for 1 week.

Prosthetic

Following closure of the soft tissue, the pretreatment processed denture was tried in, utilizing the palatal seat and occlusal record taken prior to surgery. This verified proper seating in the anterior-posterior and medio-lateral positions. An index of the intaglio surface

was secured with a recording medium (Blue Mouse) to highlight the implant positions. Titanium temporary cylinders were screwed to the multiunit abutments, and clearance in a 360-degree envelope was visualized to ensure full seating. The cylinders were then luted to the processed complete denture with a fast-curing polymethylmethacrylate. The prosthesis was removed, and all borders, palate, and extensions consistent with a complete denture cut back.

The prosthesis was returned to the patient's mouth and occlusion verified and adjusted. Final polishing was performed extraorally and returned to the oral cavity, secured with prosthetic screws, and access openings sealed with foam pellets and Fermit. Upon waking, the patient was given follow-up instructions, including diet restrictions. The patient was seen postoperatively every week for the first month after treatment and bi-weekly for 2 months or until it was determined that the patient may be followed monthly.

At the conclusion of the 6-month healing time, construction of the definitive prosthesis was commenced. The options for a definitive prosthesis fall within three broad categories: metal-acrylic, metal-ceramic, or all-ceramic (zirconia with or without porcelain layering).

A final master cast was fabricated from either abutment-level or zygomatic implant-level impressions. The implant positions were verified, VDO and CR were recorded, and orofacial esthetics were evaluated. The accuracy of the master cast must be confirmed to ensure a passive fit of the prosthesis on the implants. With zirconia prostheses, there is no mechanism to solder or laser weld, and any adjustment would result in a costly remake.

The definitive prosthesis was delivered approximately 8 months after zygomatic implants were placed (Figs 1 to 4).

RESULTS

A total of 28 patients had 105 immediately loaded zygomatic implants placed over a period of 1 to 60 months. The ages ranged from 46 to 81 years, with 26 female and 2 male patients. All the implants were placed by one surgeon and restored by two prosthodontists and 11 restorative dentists; 51% of the patients were restored by the two prosthodontists. All 105 implants were immediately loaded the day of implant placement with an overall implant and prosthetic success rate of 96% during the follow-up period of the study. The lengths of the zygomatic implants ranged from 30 to 52.5 mm.

Of the 28 patients, 12 patients had previous implant failure and an inability to support a fixed prosthesis. Two of the 28 patients had previous implants that were not removed and used to support the new immediately loaded prosthesis.

All four implant failures were in one patient. The implants failed between 1 and 5 months after implant placement and immediate loading. This patient had had previous bone grafting and implant reconstruction that failed 10 years prior to zygomatic implant placement.

One patient had pterygoid implants placed at the time of zygomatic implant placement. The pterygoid implants were not used in the immediately loaded provisional but were incorporated in the definitive prosthesis.

The majority of the restorations (13/28) were metal with acrylic supporting denture teeth. There were eight full-contour zirconia restorations and two metal-ceramic restorations. At the time of this paper, there were four full-arch polymethyl methacrylate acrylic provisional restorations in place and functioning.

DISCUSSION

Treatment of the atrophic maxilla is a challenge to both the surgical and restorative teams. For a fixed prosthesis, a grafted or graftless approach can be utilized. With a grafted option, the patient undergoes an initial surgery of bone placement with either sinus or on-lay grafting of the maxilla. Implants are subsequently placed, and the prosthesis can be loaded immediately or delayed.

In the graftless approach, two implants are placed in each zygoma (total of four zygomatic implants) and immediately loaded with a full-arch splinted prosthesis. The need for additional bone is eliminated because the zygoma is dense cortical bone and well suited for the stresses of mastication. The use of four immediately loaded zygomatic implants has proven to be a predictable tool in restoring these patients to function and esthetics in a shortened treatment time.

A team approach starting at the diagnostic phase through the definitive prosthesis provides a high level of integrated care for these patients. Having this team on site during the surgical procedure allows for better patient management, improved implant visualization for optimal placement, and delivery of the prosthesis in a timely and efficient manner.

The surgical procedure is more extensive than traditional implant surgery and needs to be explained thoroughly to the patient. All the patients underwent general anesthesia to allow for better visualization and soft tissue retraction. Having an immobilized patient ensured that the patient would not move and risk drilling into a nondesirable location or nonideal position. The use of the BFP in the partial sinus or extrasinus approach has been shown to provide an additional soft tissue layer that stabilizes the soft tissue collar around the zygomatic implants.

The definitive restoration can be metal-acrylic, metal-ceramic, full-contour zirconia, or zirconia with layered porcelain. These can be fabricated via conventional casting procedures or through the use of CAD/CAM. The choice of the restoration is primarily dependent on the remaining maxillary anatomy. When the patient presents with good residual alveolar anatomy with adequate facial support, the choice of the definitive restoration can be any of these. For patients with compromised alveolar size and form who require facial support, the choices are fewer. When large volumes of alveolar components and tooth form are needed, a milled full-contour zirconia is indicated. This allows for the replacement of these structures with materials of adequate strength and excellent esthetics without the burden of creating supporting substructures for porcelain and the need for a bulky prosthesis. In select instances, the metal-acrylic prosthesis with the combination of internal metal support, acrylic or composite alveolar substitutes, and denture teeth provides an excellent alternative to the patient who may have financial constraints.

During the healing phase, diet modification and management are critical. The provisional stage can be divided into three phases: early, middle, and late. During the early phase of healing (6 to 12 weeks), the patient should be placed on a liquid or mush food diet. This period is critical for the maturation of the osseous interface. In the middle phase (12 to 18 weeks), the diet may be increased to foods that have some substance, but no hard foods or those that would require significant masticatory force. In the late phase of healing (18 to 24 weeks), patients can progress to foods that require some chewing.

The occlusal scheme for these prostheses is bilateral posterior occlusion with anterior disocclusion in order to distribute occlusal forces over the greatest surface

area. Cusp forms should be relatively shallow, and fossa development should enable a certain amount of freedom in centric contacts. This minimizes occlusal defective contacts.

It is strongly advised that all provisional and definitive restorations be screw retained. Retrievability of the prosthesis has distinct advantages, and with reports of late implant failure and its association with cement extrusion along the implant surface,¹² the elimination of this complication is critical for zygomatic implant success.

Immediately loaded prostheses have a profound and immediate effect on a patient's Oral Health Quality of Life. When given the option, patients prefer this approach over a delayed protocol.¹³ This is seen with regard to increased function, better esthetics, and positive psycho-social changes. Patients with fixed prostheses report improvements in self-esteem and quality of life compared with those with removable prostheses. The protocol described in this paper enables the dental team to deliver this result to the severely atrophic maxillary patient.

CONCLUSIONS

Bilaterally placing two zygomatic implants and immediately loading the prosthesis is a predictable treatment option for the reconstruction of the severely atrophic maxilla. Advantages include fewer surgical procedures, shortened treatment time, predictable immediate load, and no need for adjunct grafting.

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