

Restoration of the Edentulous Maxilla: The Case for the Zygomatic Implants

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Restoration of the atrophied edentulous maxilla poses a great dilemma to the oral and maxillofacial surgeon and restorative dentist. Conventional removable denture prostheses are adequate for some individuals; but improved technology in dental implantology has led many to request alternative approaches with implants. Patients with adequate maxillary bone are ideal candidates for implants, but are the exception. Patients with moderate to severe atrophy challenge the surgeon to discover alternative ways to use existing bone or resort to augmenting the patient with autogenous or alloplastic bone materials. Many procedures have been suggested for these atrophied maxillae before implant placement, which include Le Fort I maxillary downfracture,¹ onlay bone grafts,^{2,3} and maxillary sinus graft procedures,⁴⁻⁸ including local and distal harvesting. Some of these treatment options entail multiple surgical interventions, varying success rates, restriction of denture wear throughout a long transitional period, increased surgical fees, and perhaps costly hospitalization.

Brånemark first used the zygoma implant as a major breakthrough in the treatment of maxillary atrophy.^{9,10} The implant, a titanium endosseal threaded implant ranging in length from 30 to 52.5 mm, is placed in stable cortical maxillary buttress bone. The implant has a built-in 45° angled platform lending to ideal ridge positioning. The placement of 2 zygoma implants and 4 anterior maxillary implants provides

superb retention and support for a fixed prosthesis with 1 in-office surgical procedure, no bone grafting, no hospitalization, and with predictable success.

In the 1980s to 1990s the sinus lift was the most commonly selected choice for maxillary bone augmentation before placing dental implants. In 1996, the Academy of Osseointegration Sinus Graft Consensus Conference (Wellesley, MA) focused on various parameters for grafting maxillary sinuses in association with dental implants. The Consensus Conference issues included indications, contraindications, materials, failure analysis, immediate versus late approach of implant placement, and prosthetic considerations. To answer these questions, 39 surgeons grafted 1,007 sinuses and placed 2,997 implants over a 10-year period. At least 3 years of postrestoration care was necessary for study inclusion. The failure analysis showed a 61% implant loss when there was 5 mm or less of host bone present. Sixty-one percent of implants were lost when they were placed simultaneously with sinus lift bone grafts. The failure difference between simultaneous and delayed implant placement was not statistically significant. The Consensus Conference recommended sinus lift grafting before implant placement when less than 8 mm of host bone was available.¹¹

Krekmanov et al^{12,13} used "tilted" implants to support a fixed prosthesis in the posterior maxilla and mandible. Aparicio et al¹⁴ and Widmark et al¹⁵ reported successful prosthetic rehabilitation with tilted implants that were placed at significant angles to the alveolar crest, incorporated with conventionally placed dental implants. Both tilted and conventional (nontilted) implants were placed in each case, similar to zygoma implant "tilting." The 5-year success rate for tilted implants was 95.2%. The success rate for axial implants was 91.3%. Despite these minor failures, the prostheses survival rate was 100% with this technique. The average marginal bone loss for these tilted implants was 1.21 mm and 0.92 mm for axially placed implants.

Approximately 15 years ago, Brånemark reported a 97% 10-year success rate with 164 zygoma implants. The indication for placement of zygoma dental implants was for the severely resorbed edentulous max-

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illa.¹⁶ The current Brånemark protocol primarily uses a sinus window technique for placement of these zygoma dental implants. Stella and Warner's¹⁷ published "sinus slot technique" significantly simplified the original Brånemark protocol as well as outlined anesthesia techniques allowing zygoma implant placement in the office setting with intravenous sedation. Moreover, the sinus slot technique places the zygoma platform directly over the alveolar ridge making a zygoma implant platform indistinguishable from traditionally placed implants. The "sinus slot" is a guide window made directly through the buttress wall of the maxilla, whereby the zygoma implant is guided through the maxilla to the apex insertion at the junction of the lateral orbital rim and the zygomatic arch. This lateral sinus slot allows greater potential for bone-to-implant interface because of this lateral position, and eliminated the sinus window and sinus lining elevation for placement of the implant. By circumventing the need for sinus lift grafting as well as the lengthy healing period for graft consolidation, the placement of zygomatic dental implants has greatly improved clinical predictability and has reduced the time required for posterior maxillary reconstruction in patients with less than 8 mm of host bone. If we assume a zygoma implant is no different than a tilted implant with a built in 45° angled abutment, we can anticipate similar success rates of 95% for the zygoma implants.

Bedrossian et al¹⁸ recently published an article with the largest patient pool of zygoma implants to date. They discuss their treatment protocol and results. A total of 44 zygoma implants and 80 premaxilla implants were placed in 22 patients. All patients were followed for a minimum of 34 months. They reported a 91.25% survival rate for the premaxilla implants, while none of the zygoma implants failed.

Various authors¹⁹⁻²² have recently described similar results using zygoma implants for the treatment of cleft deformities, maxillectomy defects, and complex bony and soft tissue contour deficits. At our institution, we critically examined and presented a surgical technique of zygoma implants for reconstruction of the atrophic maxilla as an alternative to sinus lift grafting procedures. Zygoma implants were placed in 16 patients (12 women, 4 men) between the ages of 40 and 65. All patients met our clinical indications for unilateral or bilateral posterior maxillary rehabilitation with zygoma implants. Using the sinus slot technique, the authors have placed 80 dental implants, including 25 zygoma implants, in 16 patients for unilateral and bilateral posterior maxillary reconstruction (Figs 1,2). All implants were placed in the outpatient office setting using Stella and Warner's sinus slot technique and local anesthesia technique combined with

intravenous conscious sedation. Criteria for reconstruction of the posterior maxilla was as follows:

1. Moderately to severely resorbed edentulous maxilla; or
2. Posterior maxilla missing bicuspids and molars (missing second bicuspid and molars in select cases).
3. Sufficient interincisal opening and surgical access to place zygomatic implants using the sinus slot technique.
4. No acute or productive sinusitis.
5. Two or more traditional implants 10 mm or larger could be placed in addition to the zygoma implant.

The dentists who restored the zygoma implants as well as the laboratory technicians who fabricated the prostheses were sent a questionnaire to determine outcome analysis of the zygoma implants placed. Of the 16 cases in this study, all have been successfully restored to completion. One zygoma implant in 1 patient failed to integrate and was removed under local anesthesia. This patient had chronic sinusitis noted on radiographic evaluation. Three months after resolving the sinus infection the zygoma implant was replaced and this patient was restored to completion. No traditional endosseous dental implants failed. A 96% success rate for the zygoma implants and a 100% success rate for the dental implants has been achieved.

A majority of the dentists as well as the laboratory technicians agreed that the relative position of the zygoma implant platform was placed on the crest of the maxillary ridge; the screw access hole of the zygoma implant emerged in the central groove of the first molar; and the final restoration did not require any angled or custom fabricated abutments. There was no additional time required when compared with traditional implant techniques. The laboratory and overall prosthetic fees for the zygoma implant reconstruction were found to be equal to or less expensive than traditional implants in all but 1 case.

Placement of zygoma implants using the sinus slot technique virtually eliminates the need for sinus bone grafting for reconstruction of the severely atrophic maxilla. In our study, we achieved a 96% success rate for zygoma implants in the atrophic maxilla, and a 100% success rate for dental implants. These results compare similarly with Brånemark and Bedrossian's studies, although we placed zygoma implants without cross-arch stabilization. The original Brånemark protocol recommended cross-arch stabilization in all cases.

The built-in 45° angled platform of the zygoma implant is a significant biomechanical feature that

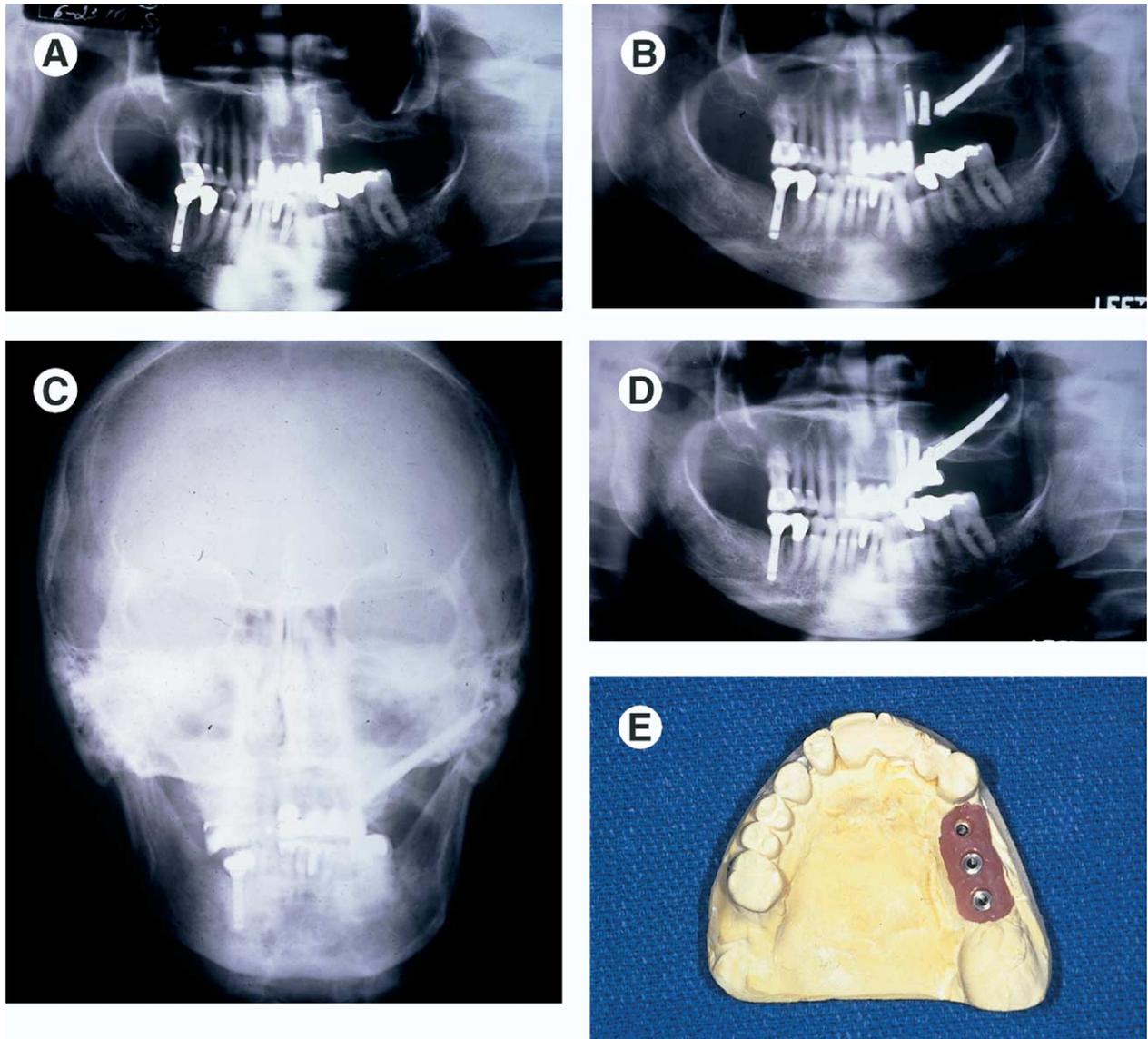


FIGURE 1. Unilateral implant placement. A, Panorex of patient's initial presentation. B, Postsurgical panorex. C, Postsurgical PA Skull. D, Postrestoration panorex. E, Working laboratory model.

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lends itself to ideal positioning on the crest of the maxillary ridge for prosthetic rehabilitation. Therefore, the surgeon can rotate the implant platform to conform to individual variations in anatomy and reduce the need for angled prosthetic abutments. The rotational mechanism of the platform on the zygoma implants allows the implants to emerge in the central groove of the first molar in the majority of the cases. In most of the cases in our study the restoring dentist and laboratory technician were able to restore the prostheses without the use of any abutments, thereby decreasing prosthetic cost and increasing the diameter of the prosthetic screw. This larger diameter screw may be tightened to a higher torque value as it is attached directly to the prosthesis.

Surgical time is dramatically reduced when using zygoma implants as compared with the sinus lift grafting technique. The zygoma implant technique involves 1 surgery, whereas the previous alternative involves a graft placement and a subsequent healing/consolidation period as well as a second surgery for implant placement. Restoration of zygoma implants is accomplished approximately 6 months after placement of the implant.

We advocate the use of zygoma implants in the severely resorbed edentulous maxilla. By using a 1-stage procedure instead of 2 procedures, as is necessary with many sinus lift grafting techniques, surgical time and out-of-pocket fees are significantly reduced. The increased predictability of final success

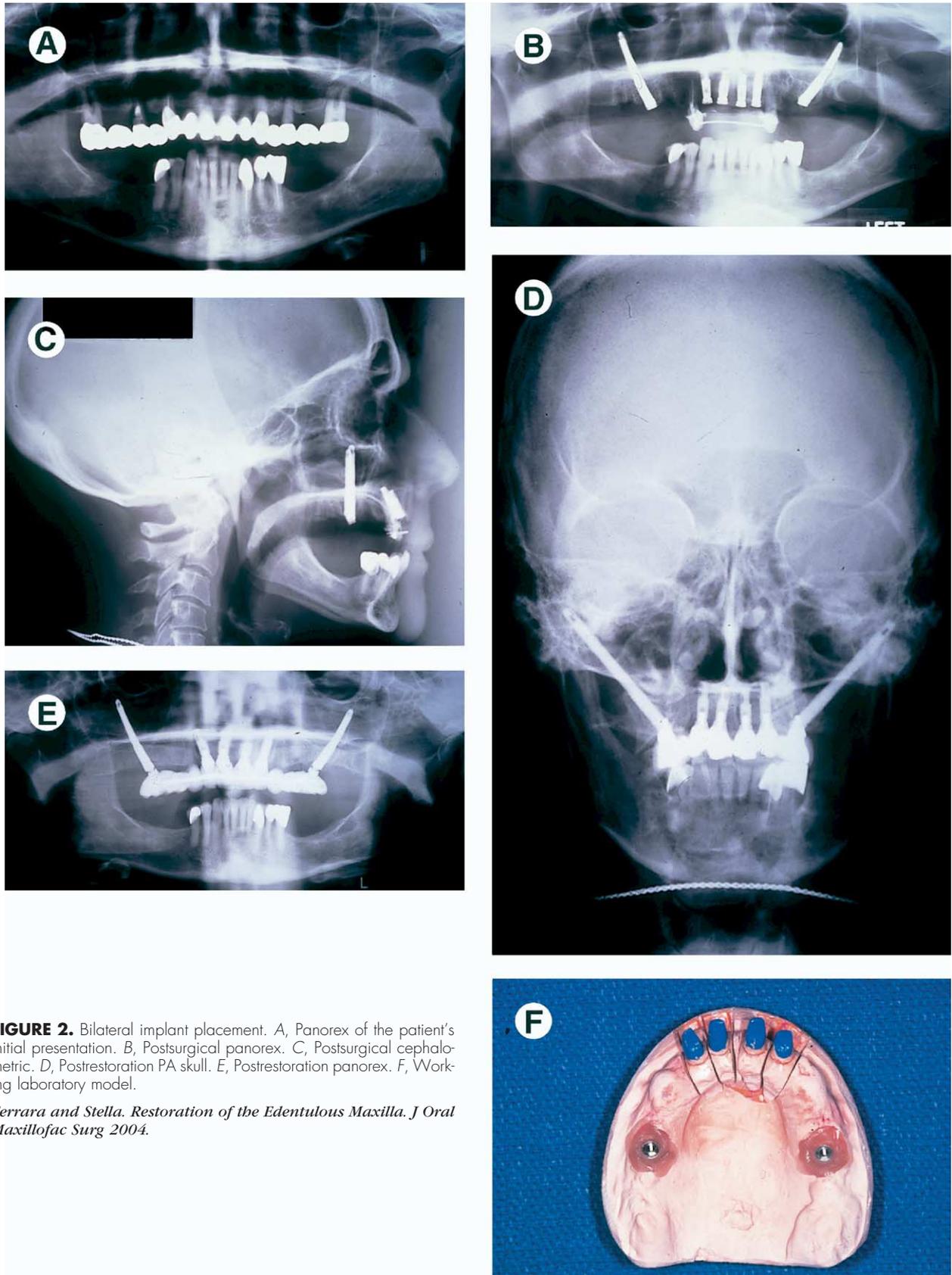


FIGURE 2. Bilateral implant placement. A, Panorex of the patient's initial presentation. B, Postsurgical panorax. C, Postsurgical cephalometric. D, Postrestoration PA skull. E, Postrestoration panorax. F, Working laboratory model.

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rates for zygoma implants versus sinus lift grafting is paramount to the clinician in determining surgical options for the patient with a severely resorbed maxilla.

In summary, we advocate the use of zygoma implants in the atrophied edentulous maxilla because:

1. Success rate of osseointegration for the zygoma implant is greater than 96%.
2. Surgical interventions for the patient are decreased.
3. No bone harvesting or bone grafting procedure is necessary.
4. Overall operating and office time for the surgeon is decreased.
5. The zygoma implant surgery can be accomplished in an office setting.
6. Precise positioning of the zygoma implant platform on the crest of the maxillary ridge allows the access screw hole of the zygoma implant to emerge in the central groove of the first molar.
7. The final restoration does not require any angled or custom fabricated abutments.
8. There is no additional laboratory or restorative dental time required when compared with traditional implant techniques.
9. The overall laboratory and prosthetic fees for the zygoma implant reconstruction are relatively equal to or less than traditional implants.
10. The comparative cost of zygoma implant placement versus grafting procedures is a savings for the patient.

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