

# Reconstruction of Severely Resorbed Atrophic Maxillae and Management With Transitional Implants

Paul S. Petrunaro, DDS, MS\*

The evolution of implant-supported rehabilitation of the edentulous patient is well documented in the dental literature.<sup>1-6</sup> Numerous modifications of the initial implant devices were observed with the two-stage screw-type implants initiated by the Brånemark System so as to replace previous technology.<sup>5,6</sup>

Following the protocol, surgically and restoratively, the submerged implants are placed in a two-stage surgical sequence. At the initial procedure the implants are placed, and the cover screws are seated. The implants and surrounding tissues are allowed to mature and integrate over a 4- to 6-month healing phase. At the second-stage surgery, the implant fixture is exposed, and a variety of healing or permanent abutments are seated. This allows the prosthodontist or restorative clinician to engage the head of the implant fixture, in addition to allowing the gingival tissues to heal. The restorative clinician then initiates techniques that result in the fabrication of the definitive prosthesis.

In the early development of implant technology, the lack of quality and volume of bone in the maxillary and mandibular arches often preceded implant therapy. As technologies evolved, so did surgical techniques aimed at augmenting bone and soft tissue contours to a level that would receive dental implants in an adequate environment.<sup>7-9</sup>

*The reconstruction of the severely resorbed maxilla requires complex surgical treatment sequencing. Often, multiple grafting procedures are required either before or in conjunction with implant placement. Regardless of the surgical modality, the grafting procedures and the placement of implants in poor quality bone require undisturbed healing during which no pressure is placed on the grafted implant ridge. The use of transitional implants allows the surgeon to provide stable temporary prostheses throughout the*

*healing phase, while preventing pressure from being placed on the grafted or implant reconstructed ridge throughout the maturation. These transitional implant-supported temporaries allow the implant team to maintain vertical dimension, and they provide the patient with the benefits of implant-supported restorations during the time leading up to final prosthetic reconstruction. (Implant Dent 2000;9:271-277)*

**Key Words:** *functional temporary prostheses, symphyseal grafts, healing phase management, multidisciplinary approach*

Initially, and with the development of the new technologies to replace bone, patients were often instructed to refrain from the use of their full or partial dentures for 7 to 14 days after the initial surgical visit. This usually impeded potential patients from initiating implant-related bone grafting procedures. In addition, in the past, extended healing phases were used to avoid premature pressure being placed on the newly implanted or bone grafted ridge. Exfoliation of the graft particles or barrier membranes, or implant fixtures themselves, caused failure of the surgical procedures and delayed case completion, not to mention patient dissatisfaction.

A major focus in implantology has become the patient's comfort and aesthetics throughout their healing phases and with their final restorations.<sup>10-13</sup> Over the past 5 to 6 years, clinicians have been able to address

the need for an undisturbed healing of the surgical site during the integration phase. In addition, patients can immediately enjoy the benefits of implant dentistry by having stable and functional temporaries. Patients can now function immediately while allowing the surgical site to heal without pressure from a prosthesis.<sup>10-13</sup>

A stable and functional temporary prosthesis can be made using the Modular Transitional Implant System (MTI-MP, Dentatus USA). The system consists of small-diameter titanium implants that support an overdenture or custom-processed acrylic resin temporary prosthesis. Three prefabricated components comprise this system: gingival protective sleeves, connective bars, and modular/singular copings. The system is designed for chairside fabrication, and its purpose is to provide support for an interim prosthesis

\*Private Practice.

10. Gottehrer NR, Singer C. Full team approach for provisional stabilization of the edentulous implant patients. *Dent Today*. 1996;15:56-59.

11. Petrungraro PS, Smilanich MD, Adams T. Altering the concepts of implantology for the 21st century. *Contemp Esthetics Restorative Pract*. 1999;3:30-37.

12. Petrungraro P. Fixed temporization and bone-augmented ridge stabilization with transitional implants. *Pract Periodontics Aesthet Dent*. 1997;9:1071-1078.

13. Froum S, Emtiaz S, Bloom M. The use of transitional implants for immediate fixed temporary prosthesis, in cases of implant restorations. *Pract Periodontics Aesthet Dent*. 1998;10:737-746.

14. Tatum H, Jr. Maxillary and sinus implant reconstruction. *Dent Clin North Am*. 1986;30:207-229.

15. Smiler DG, Holmes R. Sinus lift procedure using sinus porous hydroxyapatite: A preliminary clinical report. *J Oral Implantol*. 1987;13:239-253.

16. Smiler D, Johnson PW, Lozada

JL, et al. Sinus lift grafts and endosseous implants. Treatment of the atrophic posterior maxilla. *Dent Clin North Am*. 1992;36:151-186.

Reprint requests and correspondence to:

Paul S. Petrungraro, DDS, MS  
1745 Northwestern Avenue S.  
Stillwater, MN 55082  
Phone: (651) 351-2994  
Fax: (651) 351-3161  
Email: DrPaul@Petrungraro.com



## Abstract Translations [German, Spanish, Portuguese, Japanese]

**AUTOR:** Paul S. Petrungraro, DDS, MS\* \**Privatpraxis. Schriftverkehr: Paul S. Petrungraro, DDS, MS, 1745 Northwestern Avenue S., Stillwater, MN 55082, USA. Telefon: 001-651-351-2994, Fax: 001-651-351-3161, E-mail: DrPaul@Petrungraro.com*

**ABSTRACT:** Die Wiederherstellung stark resorbierter Oberkiefer erfordert eine komplexe Abfolge der chirurgischen Behandlungsschritte. In vielen Fällen muß entweder vor oder zeitgleich mit der Einbringung des Implantats eine mehrfache Pfropfung vorgenommen werden. Unabhängig von der chirurgischen Methodik erfordern sowohl die Pfropfung als auch die Einpflanzung der Implantate in Knochengewebe geringer Qualität einen ungestörten Heilungsprozeß, der keinerlei Druckbelastung auf der aufgepfropften Knochenschicht duldet. Der Einsatz von Übergangsimplantaten bietet dem behandelnden Arzt einerseits die Möglichkeit, vorübergehend Prothesen zu benutzen, die über den gesamten Heilungszeitraum hinweg stabil bleiben. Andererseits sorgen diese Implantate dafür, daß die aufgepfropfte oder implantierte Wachstumsstelle während der Aufbauphase von jeder Druckbelastung freigehalten wird. Damit erlaubt die implantatgestützte Übergangslösung den Transplantationschirurgen die Einhaltung der vertikalen Abmessungen, und gleichzeitig profitiert der Patient in der Zeit bis zu abschließenden prothetischen Versorgung von den Vorteilen implantatgestützter Maßnahmen.

**SCHLÜSSELWÖRTER:** Übergangsprothese, Symphysen-Transplantat, Wundheilungsbehandlung, interdisziplinärer Ansatz

**AUTOR:** Paul S. Petrungraro, DDS, MS\* \**Práctica privada, Stillwater, MN. Correspondencia a: Paul S. Petrungraro, DDS, MS, 1745 Northwestern Avenue, S., Stillwater, MN 55082, USA. Teléfono: (651) 351-2994, Fax: (651) 351-3161, Correo electrónico: DrPaul@Petrungraro.com*

**ABSTRACTO:** La reconstrucción de una maxila severamente reabsorbida requiere una secuencia de tratamientos quirúrgicos complejos. A menudo, se requieren procedimientos de varios injertos antes o junto con la colocación del implante. Independiente de la modalidad quirúrgica, los procedimientos de injertos y la colocación de implantes en hueso de pobre calidad requiere una curación sin molestias durante la cual no se coloca ninguna presión sobre el borde del implante injertado. El uso de implantes transitorios permite al cirujano proporcionar una prótesis temporaria estable durante la fase de la curación, mientras que previene que se coloque presión en el borde del implante reconstruido y/o injertado durante la maduración. Estos implantes temporarios apoyados transitorios permiten que el equipo de implante mantenga la dimensión vertical; y proporcionan al paciente con los beneficios de la restauraciones apoyadas por implantes durante el tiempo que lleva al a reconstrucción protética final.

**PALABRAS CLAVES:** prótesis temporaria funcional, injertos simfiseales, tratamiento de la fase de curación, método multidisciplinario

**AUTOR:** Paul S. Petrungraro, DDS, MS\* \**Clinica Particular, Stillwater, MN 55082. Correspondências devem ser enviadas a: Paul S. Petrungraro, DDS, MS, 1745 Northwestern Avenue S., Stillwater, MN 55082, USA. Telefone: (651) 351-2994, Fax: (651) 351-3161, E-mail: DrPaul@Petrungraro.com*

**SINOPSE:** a reconstrução do maxilar severamente reabsorvido requer uma coordenação complexa com tratamento cirúrgico. Muitas vezes, procedimentos de enxertos múltiplos são necessários antes da colocação do implante, ou em conjunto com a mesma. Independentemente da modalidade cirúrgica, os procedimentos de enxerto e a colocação de implantes em osso de baixa qualidade requer cicatrização sem distúrbio, durante a qual não é colocada pressão na borda do implante enxertado. O uso de implantes transicionais permite ao cirurgião fornecer uma prótese temporária estável durante a fase de cicatrização, ao mesmo tempo que evita a colocação de pressão na borda reconstruída do enxerto e/ou do implante durante a maturação. Estes implantes temporários transicionais apoiados permitem à equipe de implante manter a dimensão vertical, além disso, eles fornecem ao paciente os benefícios de restaurações apoiadas por implante durante o tempo que antecede a reconstrução protética final.

**PALAVRAS-CHAVES:** prótese temporária funcional, enxertos de sínfise, tratamento da fase de cicatrização, método multidisciplinar



**Fig. 25.** Postoperative panorex, permanent implants placed along with the placement of transitional implants.

**Fig. 26.** Completed implant-supported restoration.

**Fig. 27.** Panorex, completed restoration.

**Fig. 28.** Facial view, case completion.

the anterior maxillary regions before the seating of the transitional implants (Fig. 20). The existing denture was then hollowed out, the components were secured to the implant fixtures, and acrylic resin was inserted into the hollowed out denture. The denture was then seated over the MTI component system to complete the assembly.

The patient was dismissed with a stable, transitional implant-supported temporary prosthesis. A postoperative panoramic radiograph shows the placement of the transitional implants in the anterior region, and the titanium grooved bar that along with the modular components of the MTI system, supports the transitional prosthesis (Fig. 21).

A 6-month postoperative clinical view after removal of the transitional implants is seen in Figure 22. (Note the increase in bone and tissue thickness of the anterior maxillary region as a result of the onlay grafting. In addition, note the lack of any tissue damage after removal of the transitional implants.) After administration of local anesthesia, crestal incisions were made in the maxillary arch from the tuberosity region to the incisive canal area bilaterally, and full-thickness flaps were elevated. Eight SteriOss Replace implants (Nobel-Biocare, Yorba Linda, CA) were placed. All implants were 4.3 mm in diameter and 13 mm in length and coated with hydroxylapatite to aid in initial bone-implant stabilization (Fig. 23). Before closure, eight MTI transitional implants were seated in the maxilla, anterior to the sinus grafted regions. Closure was obtained by a combination of horizontal and vertical mattress continuous

sling suturing techniques with 5.0 Monocryl suture (Fig. 24). A postoperative panoramic radiograph after the patient's second surgery is seen in Figure 25.

After allowing the area to heal for 6 months, the third surgical stage in the maxillary arch was then completed. The transitional implants were removed in a counterclockwise rotation with slight apical pressure. After crestal incisions with full thickness flap elevations were made, healing abutments were placed over the eight permanent implants. The interim denture was hollowed out, and relined with CoeComfort (GC America) reline material over the healing abutments. In 1 month, impression techniques were initiated. A dissection of the hyperplastic tissue in the incisive canal region was performed at the same time. The final implant-supported removable denture can be seen in Figure 26. A postoperative radiograph shows the addition of implants in the mandibular arch and restoration to the remaining natural teeth (Fig. 27). The patient's reestablished vertical dimension and smile can be seen in Figure 28.

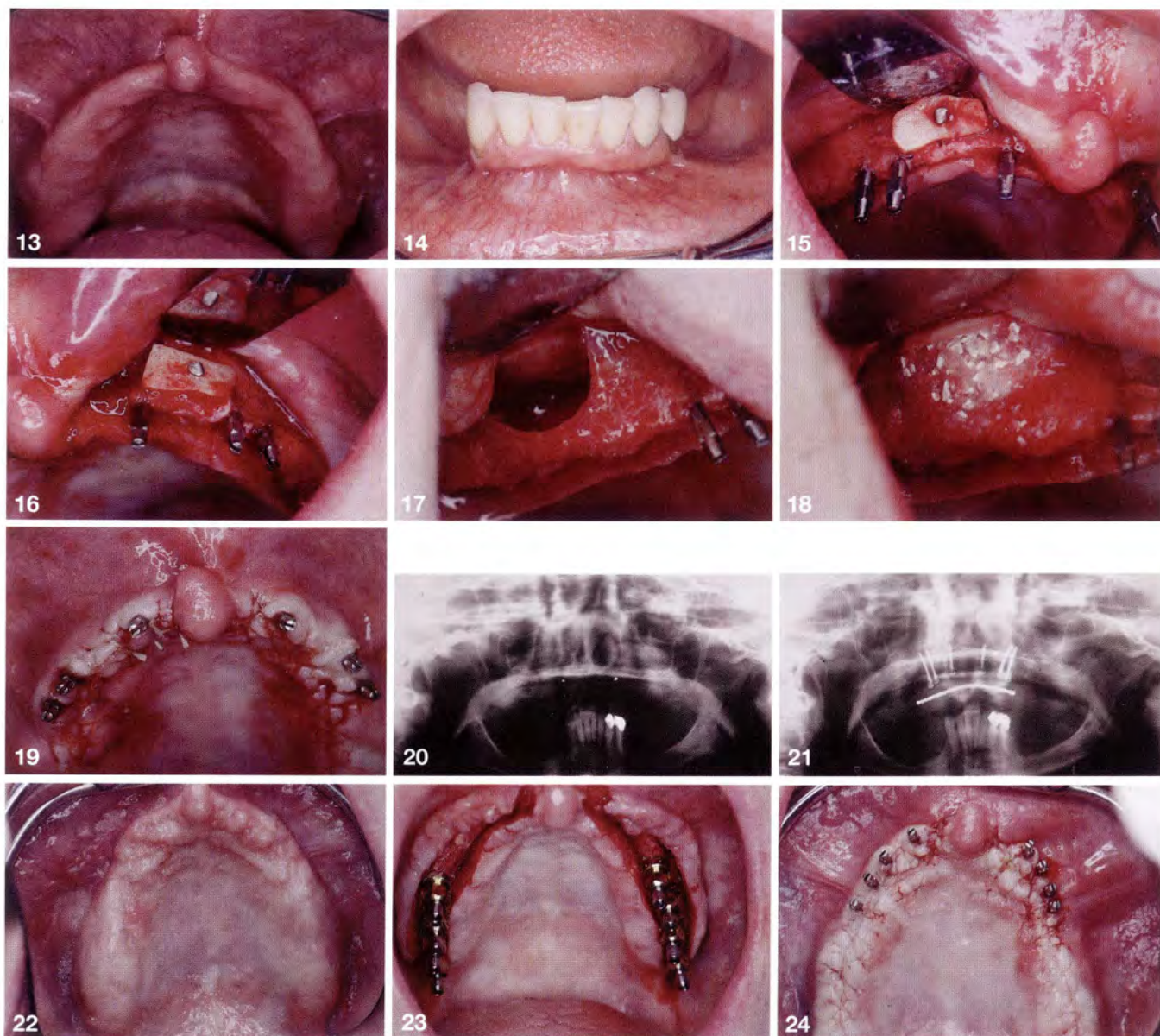
## CONCLUSION

Reconstruction of severely resorbed maxillae usually requires multiple grafting procedures in addition to implant reconstruction. The healing and transitional phases for patients before the use of transitional implants was often difficult to manage. Transitional implants allow the implant team to calculate the patient's vertical dimension, phonetics, and aesthetics and provide patients with stable dentitions throughout the

healing phases. This allows the underlying grafted or implant sites to heal uneventfully. The use of transitional implants also allows the patient to experience the benefits of dental implantology immediately throughout the healing phases and completes cases more rapidly and with a higher degree of success.

## REFERENCES

1. Linkow LI. *Implant Dentistry Today: A Multidisciplinary Approach*. Padua, Italy: Piccin Nuova Libreria; 1990:439-442.
2. Linkow LI. A surgical perspective: Immediate placement of blade-/plate-form and self-tapping vent-placed screw implants into fresh extraction sites. *J Oral Implantol*. 1995;21:131-137.
3. Judy KW, Misch CE. Evolution of the mandibular subperiosteal implant. *NY J Dent*. 1983;53:9-11.
4. Niznik GA. The Core-Vent implant system: The evolution of an osseointegrated implant. *Implantology*. 1983;84:3:34-46.
5. Brånemark P-I, Zarb GA, Albrektsson T, eds. *Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry*. Carol Stream, IL: Quintessence Publishing; 1985:11-81.
6. Adell R, Lekholm U, Rockler B, Brånemark P-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg*. 1981;10:387-416.
7. Jovanovic SA, Spiekermann H, Rizhter EJ. Bone regeneration on implants with dehiscence defect sites: A clinical study. *Int J Oral Maxillofac Implants*. 1992;7:233-245.
8. Nevins M, Mellonig JT. The advantages of localized ridge augmentation prior to implant placement: A staged event. *Int J Periodontics Restorative Dent*. 1994;14:96-111.
9. Lazzara RJ. Immediate implant placement into extraction sites: Surgical and restorative advantages. *Int J Periodontics Restorative Dent*. 1989;9:332-343.

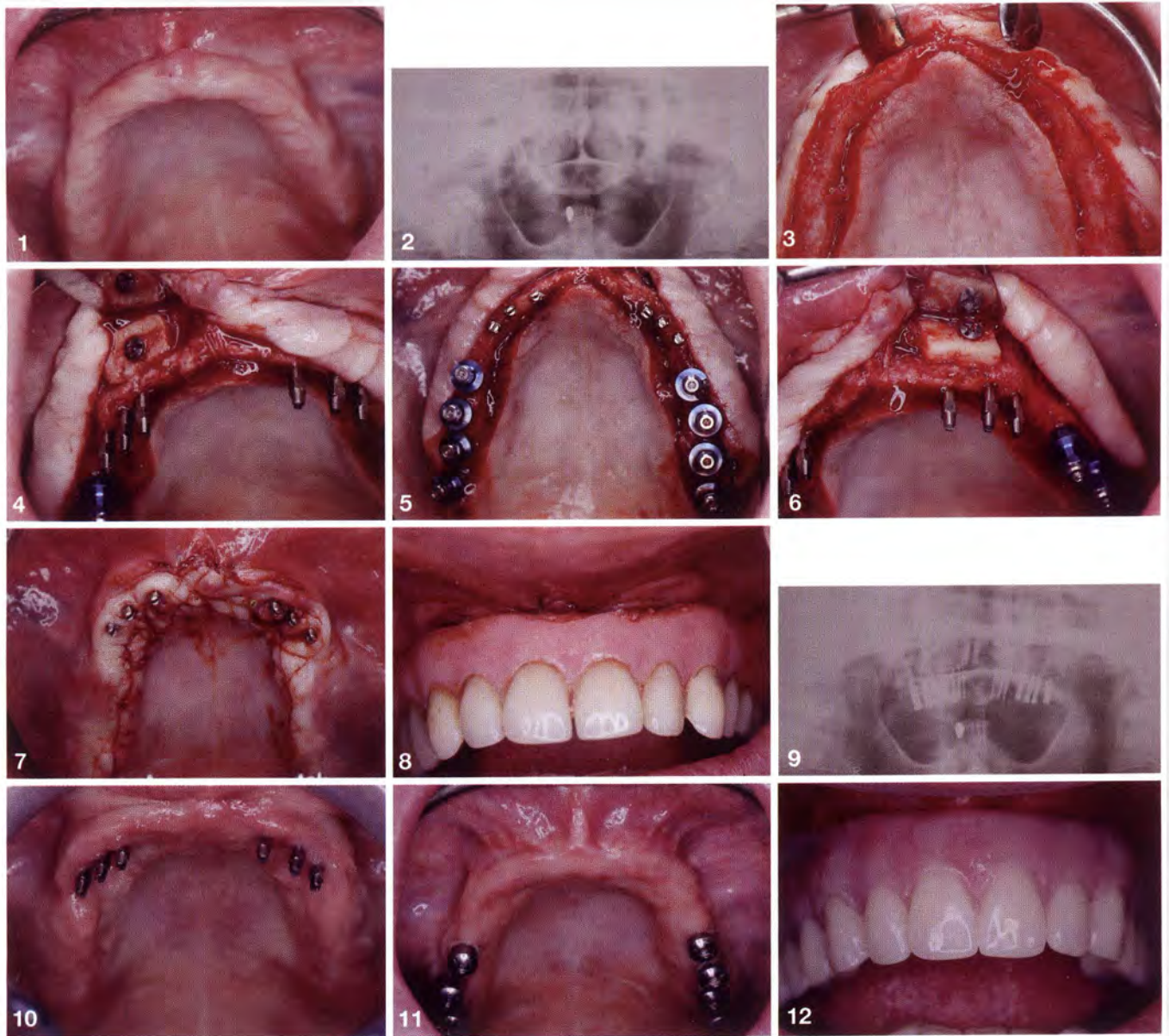


**Fig. 13.** Preoperative clinical view maxillary arch, case 2.  
**Fig. 14.** Preoperative clinical view mandibular arch, case 2.  
**Fig. 15.** Clinical view transitional implants and secured onlay graft, right side.  
**Fig. 16.** Clinical view transitional implants and secured onlay graft, left side.  
**Fig. 17.** Clinical view after the buccal plate has been rotated mesially and superiorly, and the sinus membrane has been elevated.  
**Fig. 18.** Combination graft complex inserted into the elevated sinus cavity.  
**Fig. 19.** Closure of the maxillary arch.  
**Fig. 20.** Panorex before placement of the transitional implants.  
**Fig. 21.** Final postoperative panorex with sinus elevations, onlay grafting, and the transitional implant/bar assembly.  
**Fig. 22.** Six-month post initial surgery, clinical view of the maxillary arch.  
**Fig. 23.** Placement of the eight permanent implants.  
**Fig. 24.** Closure in the maxillae after the eight temporary implants were seated.

the sections were secured inferior to the ridge undercuts in the anterior maxilla by two Dentatus Transitional implant fixtures (Dentatus USA). Once the grafts were secured, six transitional implants (Dentatus USA), four 21 mm in length and 1.8 mm

diameter and two 17 mm in length and 1.8 mm in diameter were seated in the region of the maxilla just anterior to the sinuses bilaterally, approaching the midline (Figs. 15 and 16). At that point, sinus elevation procedures were performed (Figs. 17

and 18). Closure was obtained by continuous sling, horizontal and vertical mattress suturing techniques with 5.0 Monocryl sutures (Ethicon, Inc, Somerville, NJ) (Fig. 19). A panoramic radiograph shows the grafted sinuses and block sections in



**Fig. 1.** Preoperative clinical appearance before implant placement and bone grafting procedures, case 1.  
**Fig. 2.** Preoperative panorex, case 1.  
**Fig. 3.** Full thickness flap elevations, please note severe bone loss in the maxillary anterior region.  
**Fig. 4.** Onlay graft secured, transitional implants seated, and the permanent implants seated posteriorly, right maxillary view.  
**Fig. 5.** Occlusal view of the permanent and transitional implants.  
**Fig. 6.** Onlay graft secured, transitional implants seated, and permanent implants seated posteriorly, left maxillary view.  
**Fig. 7.** Closure of the maxillae around the transitional implants.  
**Fig. 8.** The patient's existing removable denture retrofitted to and supported by the transitional implants.  
**Fig. 9.** Postoperative panorex showing transitional implants, permanent implants, sinus elevations, and onlay symphysis grafting.  
**Fig. 10.** Two-month postoperative clinical view.  
**Fig. 11.** Three weeks after removal of the transitional implants.  
**Fig. 12.** Implant-supported removable full prosthesis.

pneumatized, and she presented with hyperplastic tissue in the area of the incisive canal region (Figs. 13 and 14).

After the completion of the diagnostic phase, which consisted of an intraoral examination, diagnostic

waxing of the hard and soft tissues that needed to be replaced, and radiographic evaluation, it was determined to initially elevate both sinuses and add onlay symphyseal grafts to eliminate the osseous defects present in the anterior maxilla.

Transitional implants were to be used to support the existing full arch removable prosthesis.

After harvesting of the two block grafts from the symphyseal region, their dimensions having been obtained from the diagnostic waxing,

and allow for an uninterrupted healing site.

In the complex surgical plan dealing with severely resorbed atrophic ridges, the necessity for advanced grafting procedures is routinely required. Combination sinus elevation procedures, onlay symphyseal grafting procedures, and tissue augmentation procedures are often needed to create a site appropriate to receive dental implants.<sup>14-16</sup> In many cases, the healing phase may span 18 to 20 months.

The following case reports review treatment planning, the management of the healing phase and various surgical procedures; extensive sinus grafting, onlay symphyseal grafting, and implant procedures in patients with severely resorbed maxillae.

## CASE 1

A 62-year-old, nonsmoking, healthy woman with a history of a full maxillary removable prosthesis for >30 years presented for implant reconstruction of that arch. After completion of the diagnostic phase, which consisted of intraoral examination, diagnostic waxing of the hard and soft tissues to be replaced, and radiographic examination, it was determined that implant placement should be in the posterior sinus regions with reconstruction of the anterior bone thickness through onlay symphyseal grafting into the maxillary anterior region (Figs. 1 and 2). In the mandibular arch, the patient would have a new removable prosthesis.

The initial surgical procedure consisted of bilateral sinus elevations, onlay symphyseal block grafting to build the buccal ridge in the area between the maxillary canine eminences. This would accommodate the placement of eight implants: four implants bilaterally in each sinus region, in conjunction with the sinus elevations, and the placement of transitional implants to aid in the management of the healing phase.

A crestal incision from the right tuberosity region to the left tuberosity region was made, followed by full-thickness buccal and palatal flap elevations (Fig. 3). Note the poor

ridge thickness in the maxillary anterior zone and its need to be regenerated to control the thickness of the acrylic resin in the final restoration.

At this point, the mandibular symphyseal region was exposed, and two block sections, whose dimensions were gained from the diagnostic waxings, were removed and secured into the right and left undercuts that were present in the alveolar ridge in the areas of 7, 8, 9, and 10 by the 3i bone fixation system, (3i Implant Innovations, West Palm Beach, FL). Bone particles harvested from procurement of the block grafts were gathered and saved for the sinus regions. Once the grafts had been secured in the buccal undercuts, osteotomies were made in the buccal plate of the right and left sinus regions just inferior to the zygomatic arches. Once the osteotomy was completed, the buccal wall was rotated mesially. A combination graft comprising 3 g of demineralized freeze-dried bone (Musculoskeletal Transplant Foundation, Edison, NJ), 6 g of resorbable hydroxylapatite (Osteograft N-700, CeraMed Dental, Lakewood, CO), and approximately 2 mL of autogenous bone harvested from the symphyseal region was reconstituted with 20 mL of sterile saline and a 1,500-mg capsule of amoxicillin antibiotic solution. At this point the osteotomies were initiated for the placement of the eight implants to their predetermined diameters. Once this had been completed, grafting material was then inserted in the medial aspects. The eight implants were seated (four on the right and four on the left), and the remainder of the treated graft complex was then inserted into the sinus cavity and buccally over the fixtures. Gauze was then seated over the buccal sinus osteotomies. Six MTI implants, (Dentatus USA) 21 mm in length by 1.8 mm in diameter were placed in the palatal aspect of the region between the canine eminences. All slots in the heads of the implants were aligned (Figures 4, 5, and 6 show the permanent implants, transitional implants, and the onlay grafts secured). Once this had been completed, tissue regeneration barriers, BioMend (Sulzer Medica, Carls-

bad, CA) were reconstituted in the same antibiotic/sterile saline solution and placed over the grafted sinus regions. Closure was accomplished by a combination of horizontal and vertical mattress-continuous-sling suturing techniques (Fig. 7).

The original denture was then hollowed out, and the palatal region was removed. Following the restorative protocol of the MTI system, the titanium bar and modular coping assembly was fabricated, and acrylic resin was placed in the hollowed out denture. The denture was seated over the assembly. Once the acrylic resin was set, it was removed, polished, and cemented into place (Fig. 8). A postoperative panoramic radiograph demonstrates the multidisciplinary procedure (Fig. 9). A 2-month postoperative clinical appearance can be seen in Figure 10. (Note the health of the gingival tissues in the areas of the transitional implants.)

Six months after the initial procedures, the temporary implants were removed in a counterclockwise manner, and healing abutments were placed on the permanent implants. The same denture was once again hollowed out and relined with Coe-Soft (GC America, Chicago, IL) over the healing abutments. A clinical view 3 weeks after stage II is seen in Figure 11. (Note the region between the canine eminences and the proper alveolar thickness and vestibular depth that had been established, and the lack of any damage in this region from the use of the transitional implants.)

The final restoration consisted of a bar/implant-supported removable denture that provided the patient with a stable dentate state for the maxillary arch (Fig. 12).

## CASE 2

A 56-year-old, healthy, nonsmoking woman presented for implant reconstruction of the maxillary arch. She had been edentulous in the maxilla for approximately 25 years, and presented with severe bone loss in the anterior maxilla, between the canine eminences, both coronal-apically, and buccal-palatally. In addition, both sinuses were severely