Immediate Loading of Dental Implants in the Edentulous Maxilla: Case Study of a Unique Protocol

Thomas J. Balshi, DDS, FACP

Glenn J. Wolfinger, DMD, FACP

Although immediate loading of dental implants is increasingly gaining recognition as an important option for certain categories of implant patients, the maxillary arch has historically posed difficulties that have limited the number of immediate loading applications. To address the needs of patients who cannot tolerate maxillary removable complete dentures, an immediate loading protocol we call TEETH IN A DAY™ utilizes a conversion prosthesis has been expanded to include full-arch maxillary reconstruction. Use of a large number of implants to prevent micromotion at the bone-to-implant interface is a critical element in this protocol. A patient treatment is reported.
(Int J Periodontics Restorative Dent 2003; 23:37-45.)

*Private Practice; and Director, Institute for Facial Esthetics, Fort Washington, Pennsylvania.
** Private Practice, Fort Washington, Pennsylvania; Clinical Fellow, Department of Prosthodontics, Harvard University School of Dental Medicine, Boston; and Prosthodontist, Department of Veterans Affairs Medical Center, Philadelphia.

Reprint requests: Dr Thomas Balshi, 467 Pennsylvania Avenue #210, Fort Washington, Pennsylvania 19034. email: PITEAM@aol.com

A growing body of clinical evidence has begun to document the feasibility of functionally loading dental implants immediately after placement. Ledermann, who began in the late 1970s to splint and immediately load titanium-plasma-sprayed implants, in 1984 reported a 91.2 percent survival rate for 476 implants placed and loaded in this manner in 138 patients . Other researchers, following Ledermann's protocol, subsequently reported success rates of up to 98.1 percent . Since then, clinicians using a variety of approaches have documented the successful use of immediate loading in at least a dozen studies. The authors began developing their own protocol for immediately loaded implant-supported restorations eight years ago. Because of the highly demanding requirements of staff and laboratory support, this protocol is best accomplished by a prosthodontist who surgically places dental implants or by a surgical and prosthodontic team working in the same facility.

The protocol requires fabrication of a preliminary removable

prosthesis prior to surgery. Intimate implant receptor sites are then created, during which the bone quality and quantity are assessed. If the bony architecture appears sufficient to enable achievement of good initial stability, implants are placed, as are abutments, which are tightened with a torque wrench. A fixed restoration is then created immediately by converting the provisional prosthesis to an implant-supported nonremovable prosthesis. While this is taking place in the laboratory, prosthetic cylinders are connected to the abutments and secured with either gold prosthetic screws or long guide pins, depending upon the occlusal clearance. Auto polymerizing acrylic resin is used to affix the prosthetic cylinders to the preliminary prosthesis intraorally. Impressions for the final restoration can be taken before the surgical flap closure but more ideally are accomplished with the flap in a closed position. Alternatively, they may be taken at a later date, generally four to six months after the initial surgery.

During the normal four- to six-month osseointegration healing period, the prosthodontist evaluates the esthetics, phonetics, and functional loading of the restoration. Typically, the prosthesis creates a splinting effect, locking the implants into position as the bone heals around them.

A number of the studies that have been done of immediate loading have concentrated on the mandibular arch, where it has been assumed that the typically denser bone would result in greater initial implant stability. In the posterior maxilla, in contrast, decreased bone quantity and diminished quality along with higher masticatory forces complicate the task of successfully creating all implant-supported prostheses, let alone immediately loaded ones.

Nevertheless, clinical circumstances and patients' needs have urged the investigation of alternatives for patients who are unable to tolerate use of maxillary complete dentures. To address this demand, the authors have expanded their original immediate loading protocol to include cases involving full-arch maxillary reconstruction. The following patient history illustrates this approach.

Report of Patient Treatment

The patient was a 54-year-old woman with a 30-year history of crowns and fixed partial dentures supported by numerous endodontically treated teeth. Many of these teeth were also periodontally compromised and others suffered from advanced intracoronal deterioration. The anatomic and physiological relationship of the compromised dentition had caused continued deterioration. Furthermore, the patient had a tendency to clench and brux. As a result, the parafunctional forces on teeth with minimal root support led to multiple root fractures and additional tooth loss.

A review of the patient's medical history showed her to be in good general health. Medications used at the time of treatment included Zyrtec for allergies, Vioxx for pain, Evista to supplement hormone replacement therapy, and Periostat to control periodontal inflammation. She did report having sensitivity to penicillin.

Evaluation of her dental condition and history revealed the maxilla to be in a state of complete deterioration (Figures 1-4). Despite the successful osseointegration of three Brånemark implants in the right maxillary bicuspid and first molar areas, a severe loss of occlusal vertical dimension had occurred, along with posterior collapse and diminished dimensions in the lower third of her face. The remaining natural maxillary dentition (numbers 6 through 15) had completely deteriorated. The patient freely admitted to being embarrassed by and ashamed of her degraded appearance, which included severe discoloration and fracture of the long-standing provisional restorations. With the exception of the anterior mandible, the mandibular dentition also suffered. Traditional fixed prosthodontics had failed and the molars on the right side had recently been lost.

Figure 1 Pre-treatment smile line.

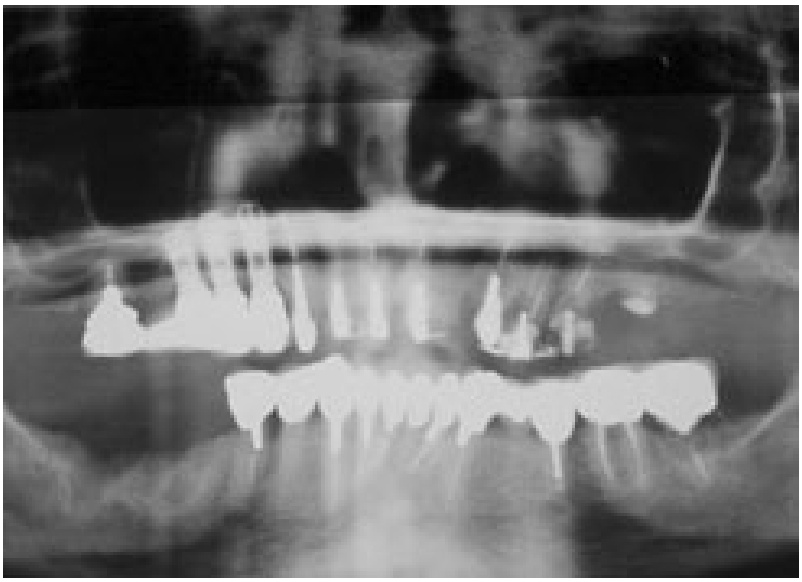


Figure 2 Pre-treatment panoramic radiograph.

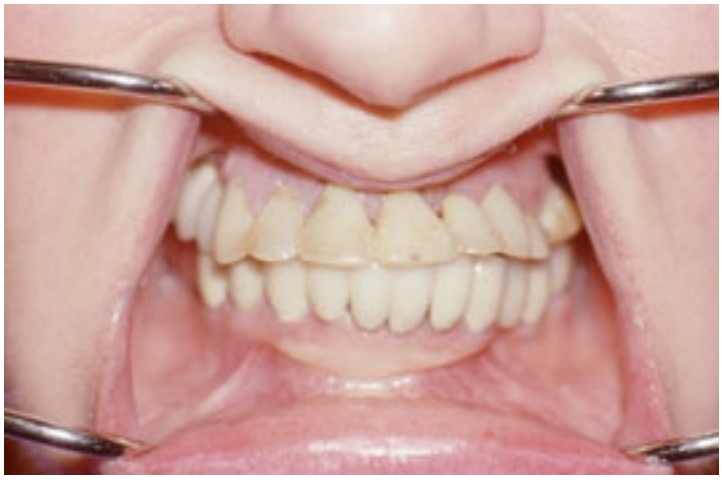


Figure 3 Pre-treatment flared maxillary dentition and loss of occlusal vertical dimension.

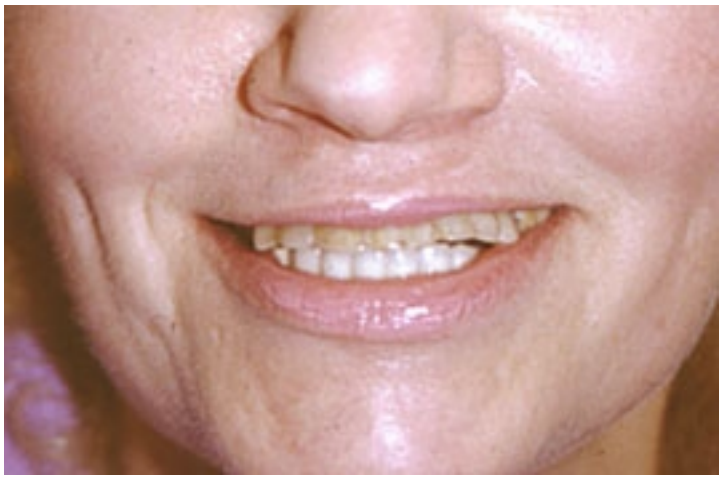


Figure 4 Pretreatment Incisal relation.

The Treatment Plan

Because of her longstanding and severe gag reflex, the patient expressed a fervent desire to avoid wearing a complete maxillary denture. At the same time, she yearned to achieve relief from her chronic dental pain and headaches, replace her discolored temporary teeth with an attractive smile, and improve the collapsed appearance of her face and the associated wrinkles. In light of her history of fracturing a variety of past dental restorations, a decision was made to place multiple implants. The hope was that this would provide enough support to successfully stabilize an immediately loaded implant-supported maxillary prosthesis.

The treatment plan included the use of a Zygoma implant (Nobel Biocare, Yorba Linda, California) on the left side, where bone volume in the maxillary posterior was minimal. Pterygomaxillary implants also would be utilized to provide support for both the right and left maxillary posterior areas.

In the mandible, restoration of the posterior areas was to be achieved with implant-supported prostheses. Since a decision was made to retain the mandibular anterior crowns and fixed bridge, there was no need to immediately load the mandibular posterior implants; a traditional implant-supported prosthesis was planned instead.

It must be pointed out that the authors previously have considered severe bruxing and clenching to be a contraindication for this protocol. However, given this patient's clinical situation, it was felt that the severity of the her gag reflex and the powerful psychosocial benefits that successful implant therapy promised to provide to her warranted an attempt at immediate loading of the maxillary arch. The patient was thoroughly informed of the rehabilitation plan, including the higher risk of failure posed by her bruxism. She provided written consent for all aspects of her treatment.

An occlusal registration was made by taking the patient's existing occlusal position and adding 8mm to it to compensate for the amount of facial collapse that had occurred (Figure 5). This information enabled articulation of master casts. These in turn were utilized to fabricate a complete maxillary full-arch acrylic prosthesis that would provide the appropriate lip support and make the lower third of the patient's face appear younger.

The patient was also advised that in case all the bone was found to be Type IV, use of the immediately loading protocol would not be feasible, and a temporary lightweight complete removable prosthesis instead would have to be employed, using the three previously placed Brånemark implants as retentive elements. To prepare for this contingency, the laboratory technicians created a second complete denture.

Surgical Prosthodontics

Nasal intubation for general anesthesia was successfully accomplished, and local anesthetic also was administered in order to provide hemostasis and enhance the patient's postoperative comfort.

The remaining maxillary teeth were removed and the sockets thoroughly cleansed of all soft tissue. In the posterior mandible, multiple teeth were also removed, and the surgical sites were debrided of all visible pathology and irrigated with an antibiotic solution. The patient was then re-draped in the sterile protocol.

Placement of the Zygoma implant was addressed first, in accordance with the protocol established by Professor Brånemark. After carefully opening the sinus wall, the Schneiderian membrane was gently levated from the sinus floor and posterior walls and moved anteriorly. The sinus was then packed with an epinephrine-soaked gauze packing material to reduce bleeding and aid in obtaining visibility.

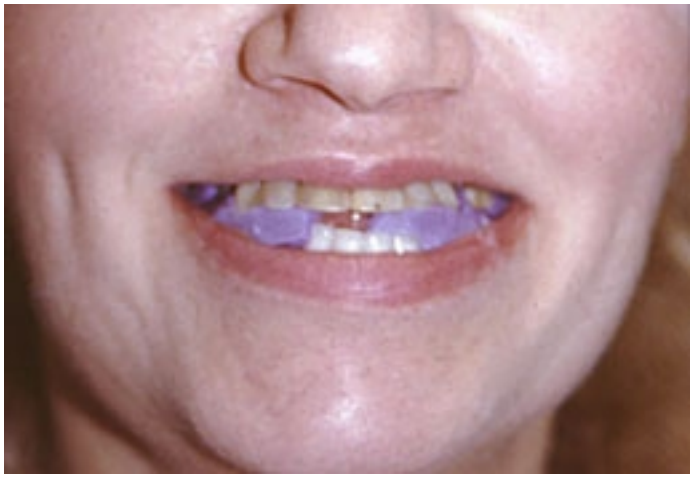


Figure 5 Establishing the appropriate occlusal vertical dimension.

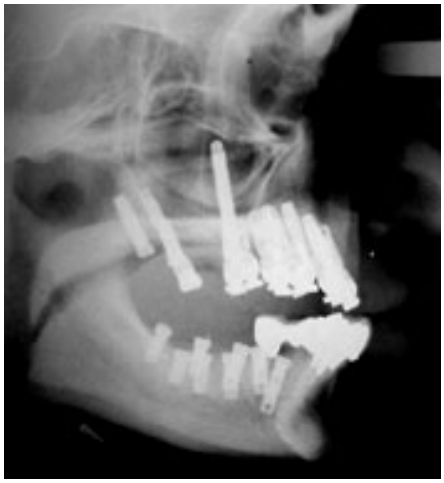


Figure 6 Lateral cephalometric radiograph taken on the day of Stage I surgery, revealing placement of a Zygoma implant and two pterygomaxillary implants along with the standard Brånemark implants.

Careful dissection of the facial soft tissues was accomplished to expose the zygomatic process, identifying the anterior/superior notch. A 45-mm-long Zygoma implant was then inserted.

Eight additional Brånemark implants were then placed in the maxilla, including five in the anterior, two in the right posterior, and one in the left posterior. The most distal implant on each side was a pterygomaxillary implant.

A combination of angled and EsthetiCone abutments were placed on all the implants, except for the left pterygomaxillary one. It received a short (4.0mm) standard abutment. In addition, the abutments on the three implants that had been inserted in 1992 were replaced with 1mm EsthetiCone abutments to improve the esthetic design of the new prosthesis. Because extremely soft bone was encountered in the maxillary right posterior, a decision was made to put cover screws on the two most posterior implants and submerge them submucosally in the traditional 2-stage protocol. This was done in order to optimize the chances of osseointegration.

The acrylic prosthesis was then securely attached to all of the maxillary implants except the last two on the right side, using the conversion prosthesis technique . The laboratory-fabricated prosthetic arch was set to the predetermined occlusal vertical dimension using a palatal "stop" connected to the lingual aspect of the teeth. A rubber dam was placed over the abutments to protect the soft tissues and the sutures. Then autopolymerizing methylmethacrylate was utilized to affix the prosthesis to the prosthetic cylinders (which in turn were fastened tightly to the abutments). The prosthesis was then removed from the mouth and given to laboratory technicians for refinement. The laboratory also added additional reinforcing acrylic throughout the lingual and cervical areas. This became the immediately loaded non-removable prosthesis.

While the maxillary prosthesis was being refined in the laboratory, the eight mandibular implants were placed -- four each on both the left and right superior to the inferior alveolar neurovascular canal. Cover screws were used on all the mandibular implants, which were then submerged in the traditional manner.

Figure 6 shows a lateral cephalometric radiograph taken on the day of surgery. Note the placement of a Zygoma implant and two pterygomaxillary implants, along with the standard Brånemark implants. Table 1 displays the implants and abutments utilized in both the maxilla and mandible.

Extubation occurred a little more than four hours after initiation of the surgery. The patient awoke to an entirely restored occlusal vertical dimension and an esthetically pleasing smile.

On the following day, the patient experienced normal facial swelling. Ice packs and appropriate medications were used to help control this. The patient was also directed to take 10mg of diazepam nightly, in an effort to increase her relaxation level and reduce the likelihood of parafunctional forces being applied to the healing implants.

Table 1: Implants and Abutments Used in Both Jaws		
Tooth Position	*Implant*	*Abutment*
Maxilla		
Right third molar	4 mm x 15 mm RP	4-mm Standard (Nobel Biocare)
Right first molar	4 mm x 10 mm RP	3-mm Standard
Right lateral incisor	4 mm x 13 mm RP Mark IV (Nobel Biocare	Angulated 17 degree 2mm
Right central incisor	4 mm x 15 mm RP Mark IV	Angulated 4 mm EsthetiCone
Left lateral incisor	4 mm x 13 mm RP Mark IV	3-mm EsthetiCone
Left canine	4 mm x 15 mm RP Mark IV	Angulated 17 degree 2mm
Left first premolar	4 mm x 15 mm RP Mark IV	Angulated 17 degree 2mm
Left first molar	45-mm Zygoma	Angulated 4 mm
Left third molar	3.75 mm x 20 mm RP	3-mm Standard
Mandible		
Left third molar	3.75 mm x 8.5 mm RP	3-mm Standard
Left second molar	3.75 mm x 8.5 mm RP	3-mm Standard
Left first molar	3.75 mm x 10 mm RP	1-mm EsthetiCone
Left second premolar	3.75 mm x 13 mm RP	1-mm EsthetiCone
Right second premolar	3.75 mm x 10 mm RP	1-mm EsthetiCone
Right first molar	3.75 mm x 8.5 mm RP	1-mm EsthetiCone
Right second molar	3.75 mm x 8.5 mm RP	1-mm EsthetiCone
Right third molar	3.75 mm x 7 mm RP	3-mm Standard

Figure 7 Facial appearance two weeks after Stage I surgery and placement of temporary acrylic prosthesis on immediately loaded implants.

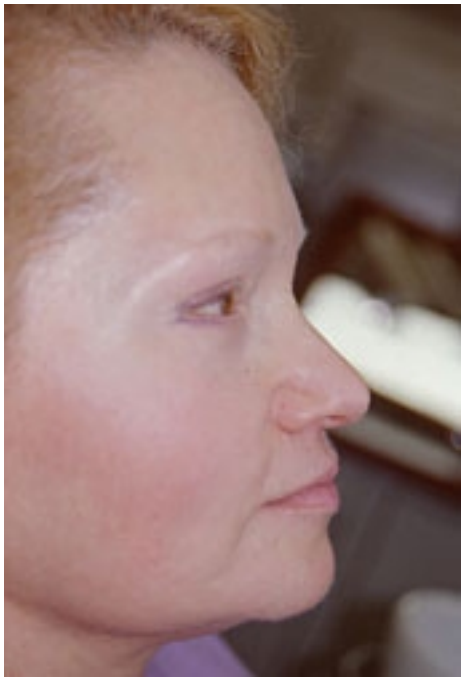


Figure 8 Two weeks after surgery, improved lip support and vertical position have enhanced the lower third of the face.

Twelve days later, the patient returned for suture removal and occlusal evaluation. The swelling had completely subsided at that time and the patient reported being pleased with her dental esthetics and restored facial appearance despite the asymmetric midline of the temporary prosthesis (Figures 7 and 8). This midline would be realigned in the final porcelain prosthesis. The occlusion was adjusted slightly in an effort to establish an even contact and distribution of forces in the anterior region.

Although the mandibular implants were deemed ready for second-stage surgery after three months, the patient's personal schedule delayed exposure of these implants until five months after the initial Stage I surgery (Figure 9). Three months later (eight months after the initial surgery), she underwent another second-stage surgery to uncover the two maxillary right implants . A final impression was also taken that same day for the final porcelain-fused-to-gold, custom-designed, tissue-integrated prosthesis (Figure 10).

When this prosthesis was constructed and delivered, it provided ideal lip support and maintained the reestablished occlusal vertical dimension (Figure 11). Dental esthetics and function were fully restored (Figures 12-16).

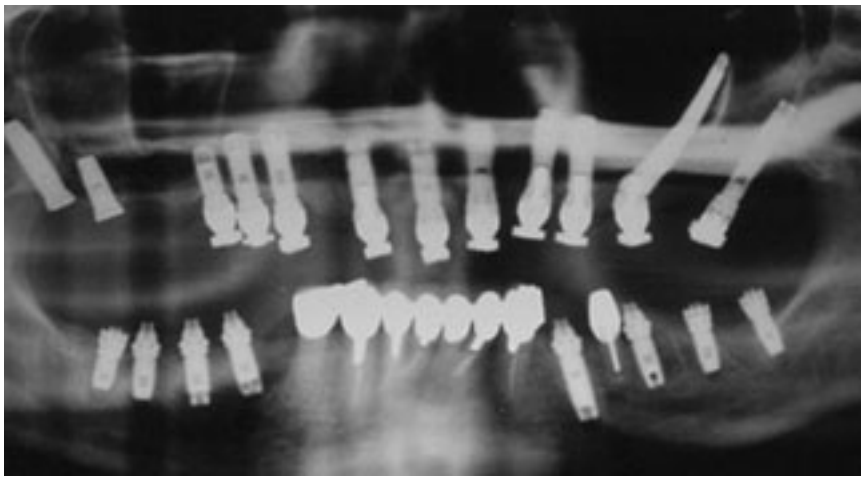
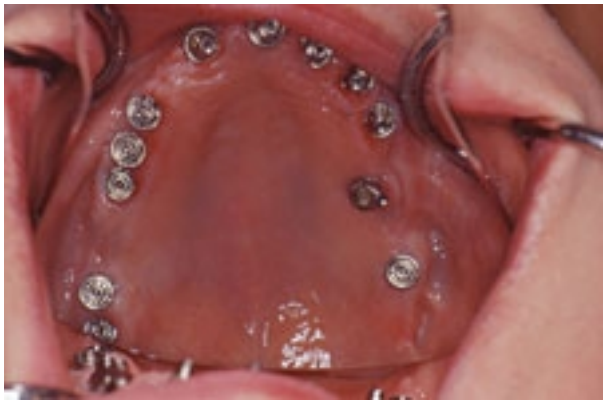


Figure 9 Panoramic radiograph of immediately loaded implants in the maxilla and Stage II (abutment connection) for mandibular posterior, six months after Stage I surgery.

Figure 10 The healed maxillary arch after removal of the immediately loaded acrylic prosthesis eight months after surgery.



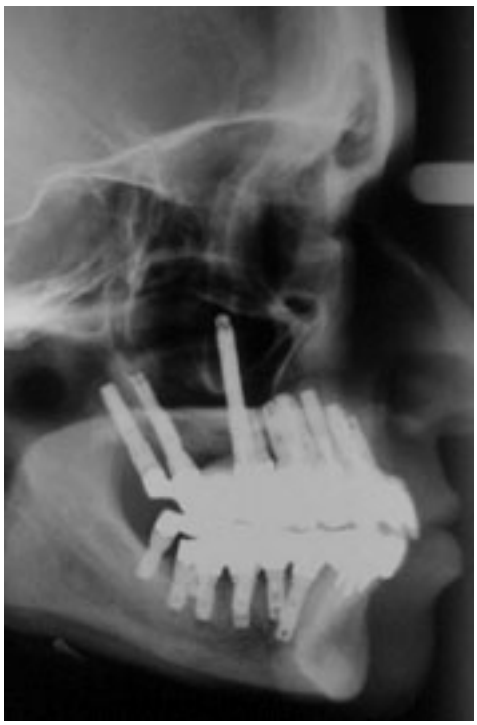


Figure 11 Post-treatment lateral cephalometric radiograph.

Discussion

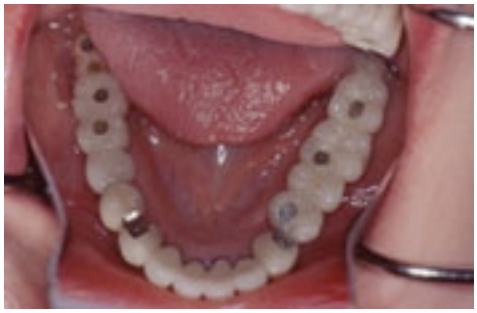
When evaluating any patient as a possible candidate for the immediate loading protocol, the patient's dental history, medical conditions, and current clinical and radiographic status of their teeth, and the availability of bone all must be assessed. In addition, the prosthodontic team should have a clear understanding of the patient's perceived needs, desires, inhibitions, and phobias.

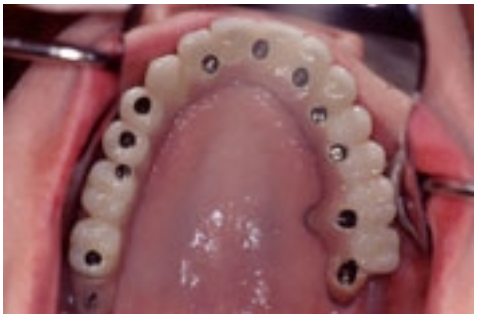
With appropriate patient selection, the authors' experience suggests that a high rate of clinical success can be anticipated, even when this protocol is employed in the edentulous maxilla. In the course of the past year and a half, the authors have treated six patients with edentulous maxillas, placing a total of 64 implants (an average of 10.6 per patient) to support a fixed set of teeth the day of implant placement. To date only one implant has failed (a 1.6 percent failure rate). The survival rate of implants over this short period of time has been excellent (98.4 percent). All six patients have had fixed teeth from the day of implant surgery. The authors attribute these high survival rates to the achievement of an ample foundation for osseointegration in combination with a strong and highly rigid prosthesis designed to splint and immobilize the individual implants. The result is prevention of micromotion at the bone-to-implant interface. The use of many implants to achieve success for immediate loading in the maxilla is supported by a previously published study16.

Figure 12 Dental esthetics and function have been fully restored.

Figure 13 Post-treatment mandibular arch.

Figure 14 Post-treatment palatal view.





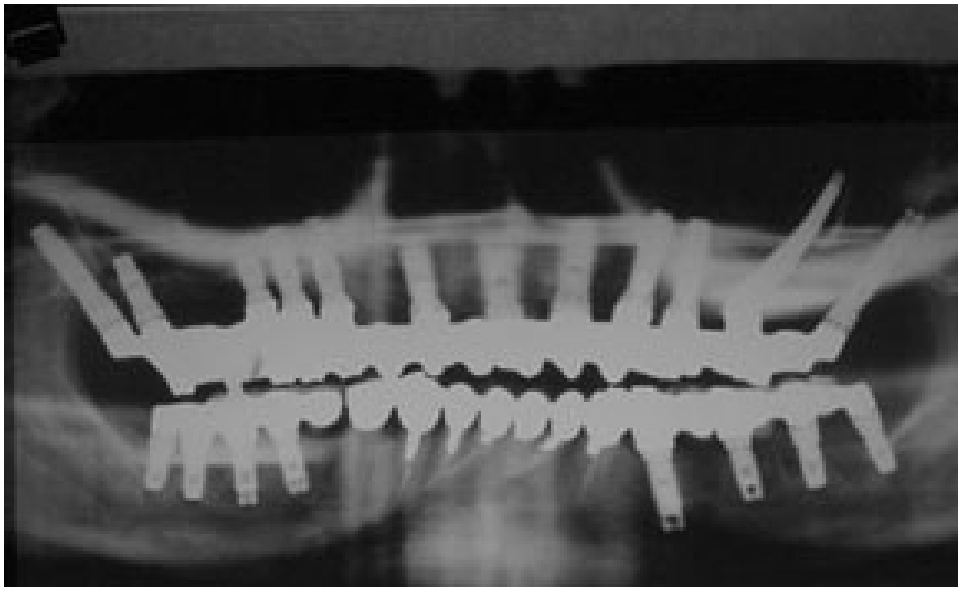


Figure 15 Post-treatment panoramic radiograph

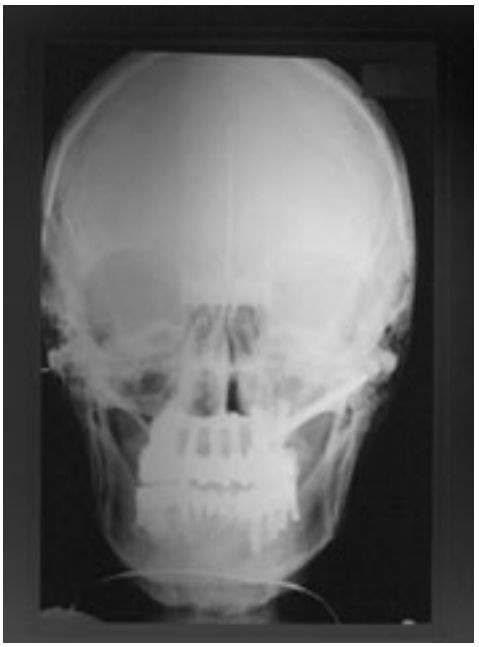


Figure 16 Post-treatment anterior / posterior cephalometric radiograph.

When a patient has a nasotracheal tube placed during general anesthesia and the patient's eyes are draped, it makes it difficult to assess the facial midline during the surgical procedure. In this case, the midline was several millimeters off center and needed to be corrected in the final restoration.

Conclusion

The Teeth in a Day(tm) immediate loading protocol can provide an optimal form of implant prosthodontic therapy for patients who are extremely averse to the use of a removable prosthesis or physiologically unable to do so. The protocol requires the ultimate cooperation and coordination of professional and laboratory staff all working attentively and swiftly to minimize the overall surgical treatment time.

The Teeth in a Day(tm) immediate loading protocol can provide an optimal form of implant prosthodontic therapy for patients who are extremely averse to the use of a removable prosthesis or physiologically unable to do so. The protocol requires the ultimate cooperation and coordination of professional and laboratory staff all working attentively and swiftly to minimize the overall surgical treatment time.

Acknowledgements

Robert Winkelman, MDT and the staff of Fort Washington Dental Lab; the administrative and clinical staff of Prosthodontics Intermedica; lab technicians, James Williams, CDT and Antoinette Robinson; Anesticare Inc.

References

1. Ledermann, PD. Das TPS-Schraubeimplantat nach siebenjahriger Anwendung. Quintessenz 1984;30:1-11.

2. Babbush CA, Kent J, Miseik D. Titanium plasma-sprayed (TPS) screw implants for the reconstruction of the edentulous mandible. J Oral Maxillofacial Surg 1986;44:274-282.

3. Schroeder A, Maeglin B, Sutter F. Das ITI-Hohlzlinderimplantat Typ F zur Prosthesenretention beim zahnlosen Kiefer. Schweizerische Monatschrift fur Zahnheilkunde 1983;93:720-733.

4. Szmukler S, Piattelli A, Favero GA, Dubruille J-H. Consideration preliminary to the application of early and immediate loading protocols in dental Implantology. Clin Oral Impl Res 2000;11:12-25.

5. Ericsson I, Randow K, Nilner K, Petersson A. Some clinical and radiographic features of submerged and non-submerged titanium implants. A 5-year follow-up study. Clin Oral Impl Res 1997;8:422-426.

6. Becker W, Becker BE, Israelson H, et al. One-step surgical placement of Brånemark implants: a prospective clinical multicenter study. Int J Oral Maxillofac Implants 1997;12:454-462.

7. Collaert B, deBruyn H. Comparison of Brånemark fixture integration and short-term survival using one-stage or two-stage surgery in completely and partially edentulous mandibles. Clin Oral Impl Res 1998;9:131-135.

8. Schnitman PA, Wohrle PS, Rubenstein JE et al. Ten-year results for Brånemark implants immediately loaded with fixed prostheses at implant placement. Int J Oral Maxillofac Impl 1997;2(4)495-503.

9. Schulte W, Heimke G. The Tubingen immediate implant. Quintessence 1976;27(6)17-23.

10. Wohrle PS. Single tooth replacement in the aesthetic zone with immediate provisionalization: fourteen consecutive case reports. Pract Periodontics Aesthet Dent 1998;9:1107-1114.

11. Tarnow DP, Emtiaz SE. Classi A. Immediate loading of threaded implants at Stage 1 surgery in edentulous arches: ten consecutive case reports with 1-to-5-year data. Int J Oral Maxillofac Impl 1997;12(3):319-324.

12. Ericsson I, Nilson H, Lindh T, Nilner K, Randow K. Immediate functional loading of Brånemark single tooth implants. Clin Oral Impl Res 2000;11:26-33.

13. Malo, Rangert, Dvarsater. Immediate function of Brånemark implants in the esthetic zone: a retrospective clinical study with 6 months to 4 years of follow-up. Clin Oral Impl Rel Res 2000;2:137-145.

14. Gatti, Haefliger, Chiapasco. Implant-retained mandibular overdentures with immediate loading: a prospective study of ITI implants. Int J Oral Maxillofac Implants 2000;2:70-77.

15. Chiapasco, Gatti, Rossi, Haefliger, Markwalder. Implant-retained mandibular overdentures with immediate loading: a retrospective study of 226 cases. Clin Oral Impl Res 1997;8:48-57.

16. Levine RA, Rose L, Salama H. mmediate loading of root form implants: two case reports 3 years after loading. Int J Perio Rest Dent 1998,18(4):333-343.

17. Bedrossian E, Stumpell L III, Beckely M. Indersano T. The zygomatic implant: Preliminary data on the treatment of severely resorbed maxillae. A clinical report. Int J Oral Maxillofac Implants 2002;17:861-865.

18. Balshi TJ. The Biotes conversion prosthesis: a provisional fixed prosthesis supported by osseointegrated titanium fixtures for restoration of the edentulous jaw. Quintessence 1985;16:667-677.