Immediate Loading of Implants with Fixed Restorations in the Completely Edentulous Mandible: Report of 27 Patients from a Private Practice

Jeffrey Ganeles, DMD[1]/Marvin M. Rosenberg, DDS[2]/Robert L. Holt, DMD, PhD[3]/Linda H. Reichman, BEd[4]

Numerous authors have documented clinical success in loading threaded implants at the time of implant placement when carefully controlled surgical and restorative protocols are followed. This clinical series documents the application of immediate loading techniques to fixed mandibular restorations in 27 patients who were edentulous or had non-restorable mandibular dentitions. Eighteen patients had complete conventional maxillary dentures, while 9 had natural or fixed prosthetic maxillary dentitions. Twelve different restorative dentists provided prosthetic support for these patients and used 4 different restoration types: laboratory- or office-processed, with cement or screw retention. Five to 8 threaded implants were placed in each patient. One hundred sixty-one of the 186 implants that were placed by the authors were loaded immediately using fixed provisional restorations of the various designs. More than 99% (160/161) of the immediately loaded implants and 99.5% (185/186) of all implants were clinically integrated and radiographically successful at the time of final evaluation for restoration fabrication. After final implant evaluation, no additional implant losses occurred, indicating an implant survival rate of nearly 100% over a mean of 25.0 months (range 13 to 41 months) following implant placement. While a strong preference for cement-retained restorations was apparent, all prostheses showed similar success. The data and the experience described in this report indicate that immediate loading with fixed restorations using appropriate surgical and restorative techniques can be a predictable technique for rehabilitation of the completely edentulous mandible. (INT J ORAL MAXILLOFAC IMPLANTS 2001;16:418–426)

Key words: *dental implants, immediately loaded implants, provisional fixed prosthesis*

Based on the original work of Adell and coworkers[1] and Brånemark and colleagues,[2] clinicians long believed that a period of stress-free healing after implant placement was an essential requirement for osseointegration. This recommendation arose from initial preclinical studies of Brånemark and colleagues,[2] Cameron and associates,[3] and Schatzker and coworkers.[4] These authors concluded that motion between an endosseous screw and bone resulted in connective tissue proliferation and fibrous encapsulation of the screw, with reduced anchorage predictability. Cameron and associates[3] observed that bone did not grow into the pores of a porous implant in the presence of macromotion, but ingrowth occurred in the presence of micromotion at the level of about 50 µm.

Most of the endosseous cylindric dental implant systems developed followed the guidelines of Adell and coworkers[1] and Brånemark[5] in recommending a 3- to 6-month unloaded healing period for successful osseointegration. An exception to this protocol was the titanium plasma-sprayed (TPS) screw developed by Straumann AG (Waldenburg, Switzerland), which was designed to be loaded using a cast bar

[1]Assistant Professor, Nova Southeastern University College of Dental Medicine, Fort Lauderdale, Florida.
[2]Associate Professor and Co-Director, Advanced Education in Periodontics, Nova Southeastern University College of Dental Medicine, Fort Lauderdale, Florida.
[3]Visiting Lecturer, Nova Southeastern University College of Dental Medicine, Fort Lauderdale, Florida.
[4]Executive Director, Professional Services, Rosenberg, Holt, Zinser, & Ganeles PA, Boca Raton, Florida.

Reprint requests: Dr Jeffrey Ganeles, 3020 N. Military Trail, Suite 200, Boca Raton, FL 33431. Fax: (561) 912-9883. E-mail: jganeles@perio-implant.com

and overdenture immediately following surgical placement in the mandible.[6,7] Using this technique, Babbush and coworkers[7] and Chiapasco and associates[8] documented implant success rates of 88% to 97% over 5 to 13 years. Ledermann and colleagues[9] histologically confirmed osseointegration with 70% to 80% bone-to-implant contact in a mandibular symphysis necropsy specimen after 12 years of implant and prosthesis function in a 95-year-old patient. Much of the experimental data regarding osseointegration, implant mobility, and motion were recently summarized by Szmukler-Moncler and coworkers.[10]

Many case reports describe high success rates with the use of immediately loaded implants in the mandible to support fixed provisional restorations. Schnitman and associates[11] used 2 to 3 two-stage threaded implants to immediately support fixed provisional restorations, while the remaining implants were submerged for conventional healing. In this initial 3-year study, 3 of the 22 immediately loaded implants failed early in healing, while the remaining implants successfully integrated. After up to 10 years, they noted that 24 of 28 immediately loaded implants remained clinically successful.[12] It was further noted that the implants lost were mainly short, posteriorly positioned implants in poor-quality bone. Tarnow and coworkers[13] documented 10 case reports (6 mandibles and 4 maxillae) with high rates of implant survival and restoration success over 5 years. Other shorter-term reports for immediately loaded mandibular implants have been published by Salama and coworkers,[14] Balshi and Wolfinger,[15] and Jaffin and associates.[16] Randow and colleagues[17] published favorable implant survival rates with a 3-week loading protocol in the mandible. Levine and associates[18] showed 100% clinical integration and survival in maxillary implants. All of the clinical reports documented positive results for the individual implants and 100% success rates for the fixed prostheses.

Brånemark and coworkers[19] reported similar results with a clinical system developed specifically for an immediately loaded definitive fixed prosthesis using 3 mandibular implants. Fifty patients with 150 implants were followed for up to 3 years. This study documented success rates of 98% for both the prostheses and individual implants.

Numerous animal studies confirm osseointegration with immediately loaded mandibular implants. Sagara and coworkers[20] concluded that osseointegration occurred with unilaterally splinted screw implants but noted that increased marginal bone loss may occur. In monkeys, Piattelli and colleagues[21] found significantly greater bone-to-implant contact in 24 immediately loaded mandibular implants compared to 24 unloaded ones. All implants integrated and no fibrous tissue was present at the bone-to-implant interface. In a study of 2 immediately loaded posterior mandibular implants retrieved from humans, Piattelli and associates[22] showed histologic confirmation of osseointegration, with 60% to 70% bone-to-implant contact on 2 immediately loaded TPS-coated screw-shaped implants.

It has been suggested by Levine and coworkers,[18] Tarnow and coworkers,[13] and Salama and coworkers[14] that several requirements should be met for clinical success with immediately loaded implants. These criteria include: an adequate number and distribution of implants, good implant stabilization, rigid provisional splinting, and a physiologic occlusal scheme.

The purpose of this report was to review the methods used for the present patient sample, which were thought to be consistent with the reported biologic and clinical requirements for a successful immediate loading technique. The procedures and results from the treatment of 27 consecutively treated patients are reported. Observations and suggestions for performing this treatment modality in a private practice environment will be discussed.

METHODS AND MATERIALS

Patient Selection and Preoperative Planning

Twenty-seven patients (15 men and 12 women, with an age range of 45 to 89 years and a mean age of 65.0 years) were referred to a private periodontal practice for treatment of their mandibular arches. All patients were either completely edentulous or were soon to be edentulous because of advanced caries or periodontal disease and desired fixed restorations. Their health was good or non-contributory. Six patients smoked 1 pack of cigarettes per day, 2 had controlled Type 2 diabetes, and 7 had controlled hypertension. Twelve different restorative dentists provided the prosthetic care for these patients; 5 dentists were specialists in prosthodontics and 7 were general dentists.

In the opposing maxillary arches, 18 patients wore removable prostheses and 9 had natural dentitions or fixed restorations. Assessment of the occlusal plane and vertical dimension was determined by the restorative dentist to ensure that a physiologic occlusion could be established with the proposed new mandibular prosthesis. If it was determined that the maxillary plane was not conducive to establishing the occlusal goals, then this was altered by occlusal adjustment, provisionalization, or new denture fabrication prior to treatment of the mandibular arch.

Preoperative surgical evaluation included a clinical examination and periapical and/or panoramic radiographs. Diagnostic casts were obtained, which also assisted in surgical template fabrication. The radiographs were evaluated to ensure that there was adequate bone height available for placement of four to six 10-mm implants between the mental foramina and additional implants distal to the mental foramina. Clinical examination was performed to ensure there were no significant anatomic limitations, such as undercuts or resorption. No attempt was made to classify radiographic bone quality.

After consulting with the patients and obtaining informed consent, the authors devised treatment plans for immediately loaded fixed restorations. Four methods of fabricating acrylic resin provisional restorations were planned after consultation with the restorative dentists. The options were as follows: *(1)* laboratory-processed, screw-retained (LPS) (4 patients); *(2)* laboratory-processed cemented (LPC) (12 patients); *(3)* office-processed, screw-retained (OPS) (3 patients); and *(4)* office-processed cemented (OPC) (8 patients).

The LPS and LPC restorations were fabricated in a dental laboratory using impressions and an occlusal registration made during or shortly after implant placement surgery. The restorations were usually metal-reinforced acrylic resin. Two early LPS restorations were placed 7 days after implant surgery. All other provisional restorations, including the remaining LPS cases, were placed within 2 days of implant placement surgery. The OPS and OPC restorations were fabricated chairside by the restorative dentist using a prefabricated shell of acrylic resin or other dental restorative material and were placed the same day as the implants.

Implant selection was generally influenced by the restorative dentist's preference for a specific system. Twenty-five patients were treated with Straumann ITI implants (Straumann USA, Waltham, MA), 1 patient was treated with Astra implants (Astra Tech, Lexington, MA), and 1 patient was treated with threaded Frialit-2 implants (Friadent, Irvine, CA).

Surgical Procedures

Patients were premedicated with oral antibiotics appropriate for the individual patient. Local anesthesia was obtained via bilateral inferior alveolar nerve blocks and local infiltration. Full-thickness crestal incisions were made. Any remaining teeth were extracted and sockets thoroughly degranulated and curetted. Five to 8 implants were placed in each patient in positions determined during treatment planning with the restorative dentist. All implants that were used were of a threaded design. Bone tapping was not performed when placing ITI implants to increase the "tightness" (initial stability) of the implants in the surgical sites.

The strategy in implant positioning was to restore posterior teeth without cantilevers if possible. Six patients did not have adequate bone height superior to the mandibular nerve, necessitating a unilateral or bilateral cantilever prosthesis design with 5 to 6 implants in the symphysis. In patients with adequate bone superior to the mandibular nerve, at least 1 posterior implant was placed to enable restoration of the first or second molar sites. Five to 6 implants were planned for patients with removable prostheses in the maxillary arch or with a maxillary arch that was restored to the first molar. Patients who had opposing natural dentition or a fixed restoration extending to the second molar were treatment-planned for 8 implants distributed around the mandibular arch.

Implants were categorized by the surgeon during surgery as stable and suitable for loading, or as unstable and inappropriate for loading. This determination was made subjectively based on bone density, resistance to drill penetration, and torque effort during implant placement. When prosthetically desirable, implants were placed in fresh extraction sockets. If sockets were not completely filled by the implants, then any residual defects were grafted with fresh autogenous bone coagulum collected in a bone trap (Ace Surgical, Brockton, MA). If these implants were categorized as stable, then they were included with other stable implants for immediate loading. Implants placed with large remaining alveolar defects, or those that demonstrated insufficient stability, were designated as inappropriate for immediate loading and were either grafted with autogenous bone coagulum and covered with expanded polytetrafluoroethylene (e-PTFE) membranes (Implant Innovations, West Palm Beach, FL) and submerged or partially covered with resorbable collagen membranes (Biogide, Osteohealth, Shirley, NY).

At least 4 and up to 8 widely distributed stable implants were needed to proceed with the immediate loading protocol. Appropriate prosthetic abutments—solid abutments or Octabutments for ITI implants, 20-degree 3-mm abutments for Astra implants, or MH-6 abutments for Frialit-2 implants—were tightened to the stable implants. Twenty-five "unstable" implants received healing abutments or were submerged and were excluded from further restorative procedures related to the provisional restoration.

Interrupted 5-0 Vicryl (Johnson & Johnson, Sommerville, NJ) sutures were placed interproximally

Fig 1 An occlusal registration base is fabricated when an existing denture is not available or cannot be used.

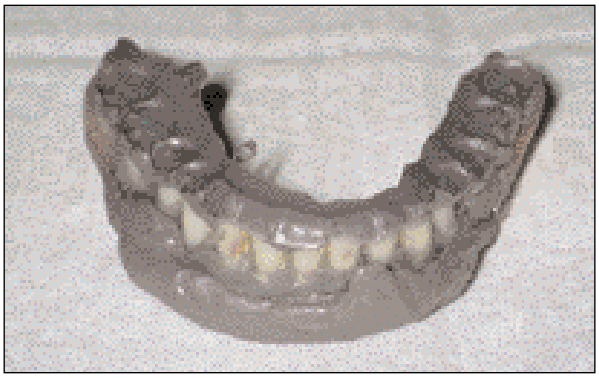

Fig 2 Mandibular denture used as occlusal registration appliance, with an additional ribbon of impression material over the occlusal surface to capture an impression of opposing maxillary teeth.

to loosely adapt the flaps to the implants. Prosthetic procedures appropriate for each provisional restorative technique were then performed. Where medically appropriate, patients were given 30 mg ketorolac tromethamine intramuscularly (Wyeth Laboratories, Philadelphia, PA) for analgesia and were kept on appropriate antibiotics for 4 to 7 days. A 0.12% chlorhexidine rinse was prescribed for 2 to 3 weeks. Either the restorative dentist or one of the authors placed provisional restorations following surgery, according to the provisional restorative technique. Cemented restorations were seated with permanent cement. Meticulous occlusal adjustment was performed to minimize posterior lateral forces and to develop an anterior guidance with minimal vertical rise in lateral excursive movements.

Patients were advised to moderate their diets by selecting softer foods requiring less masticatory force for several weeks following implant placement. They were seen for routine postoperative care at 1-week intervals for 2 to 3 weeks, then monthly thereafter. Sutures were usually removed at 2 weeks or allowed to dissolve. Panoramic radiographs were taken at 3 to 6 months. Patients who did not have bone regenerative procedures were referred to their restorative dentist for completion of restorative treatment within 3 to 6 months. Patients who had guided bone regeneration procedures around selected unloaded implants were scheduled for e-PTFE removal and second-stage surgery at 6 months. They were subsequently referred for definitive restoration after complete healing. Posttreatment periapical and panoramic radiographs were obtained for all patients. Beginning 1 year after surgery, patients were followed up annually with clinical and radiographic evaluations.

Provisional Technique

For LPS and LPC restorations, the surgeon made impressions and occlusal registrations after abutment placement at the time of surgery. Appropriate transfer copings for the specific implant and abutment designs were picked up in a disposable stock tray with polyether impression material (Impregum, Espe, Norristown, PA).

An occlusal registration was then made using an existing mandibular denture or a custom occlusal registration tray/surgical template (Fig 1). If available, an existing complete mandibular denture was relieved on the tissue side to allow seating over the abutments. The template or denture was modified to allow occlusion against the opposing dentition or denture while keeping the implant abutments covered. The registration vehicle was then filled with polyether impression material and seated directly over the mandible (Fig 2). At the same time, impression material or occlusal registration paste was placed on the occlusal surface of the denture or registration device, and the patient was instructed to occlude. This captured the 3-dimensional vertical and maxillomandibular horizontal occlusal relationship with the opposing dentition.

Following cast preparation, the implant analog cast was seated into the occlusal registration and mounted in an articulator against the opposing cast. A processed acrylic resin restoration with metal reinforcement was fabricated (Fig 3a). Prosthesis placement with permanent cement and occlusal adjustment occurred 1 to 3 days following implant placement surgery (Fig 3b).

The OPS restorations involved a reline and pickup technique with prefabricated screw-retained provisional cylinders that were seated on the implant abutments intraorally. Figures 4a to 4c

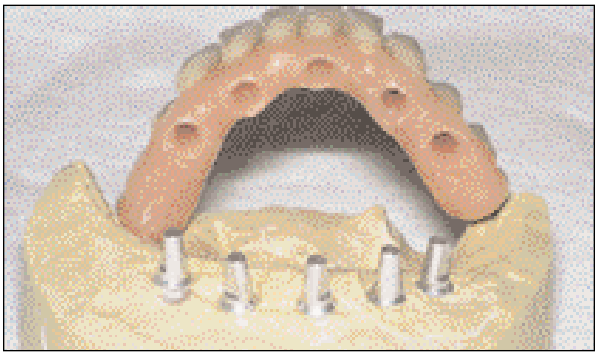

Fig 3a New metal-reinforced, fixed provisional (LPC) restoration and analog cast.

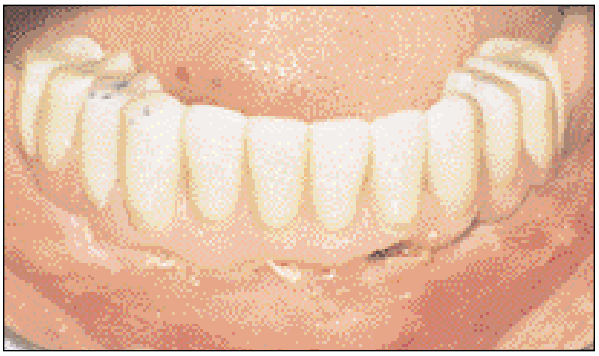

Fig 3b Fixed provisional (LPC) on implants during occlusal adjustment.

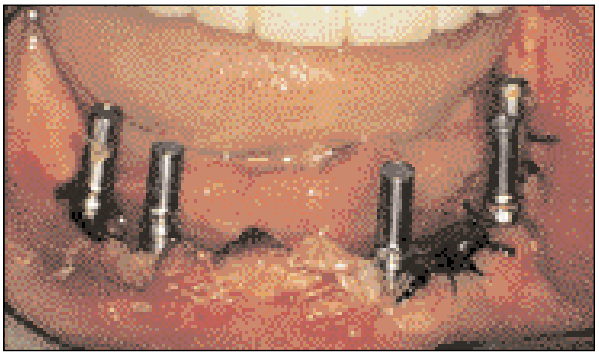

Fig 4a Astra titanium provisional cylinders attached to 5 implants prior to provisional fabrication.

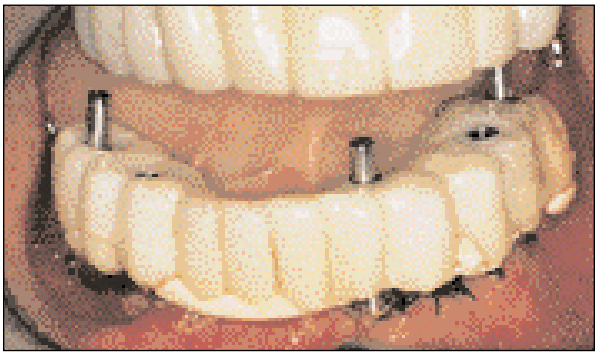

Fig 4b Addition of acrylic resin to prefabricated matrix during provisional fabrication.

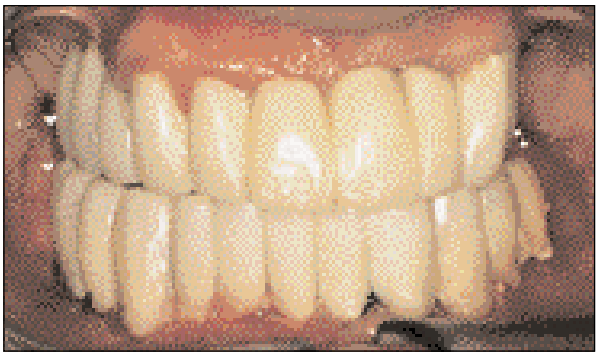

Fig 4c Completed OPS restoration in occlusion.

show Astra titanium provisional cylinders incorporated into a prefabricated acrylic resin shell for the fixed provisional restoration. Figures 5a and 5b show OPC restorations fabricated using a similar technique to the prefabricated acrylic resin coping pickup on the implant abutments. A complete denture was sometimes retrofitted to the abutments for either OPS or OPC restorations (Fig 5c). The OPC and OPS restorations were usually seated and placed in function in the restorative dentist's office the same day as implant surgery.

Definitive Restoration

When patients returned for the definitive restoration, all abutments were retorqued to manufacturer's specifications; ITI abutments were tightened to 35 Ncm, Astra abutments were retightened by firm hand pressure, and Frialit-2 MH-6 abutments were torqued to 25 Ncm. All patients underwent routine prosthodontic procedures for the fabrication of ceramometal fixed prostheses. Cantilevered restorations were fabricated in one piece. Restorations that were supported by posterior implants were fabricated in 2 or 3 unsplinted sections.

Implants that tolerated final torque application without rotation or pain were judged to be clinically

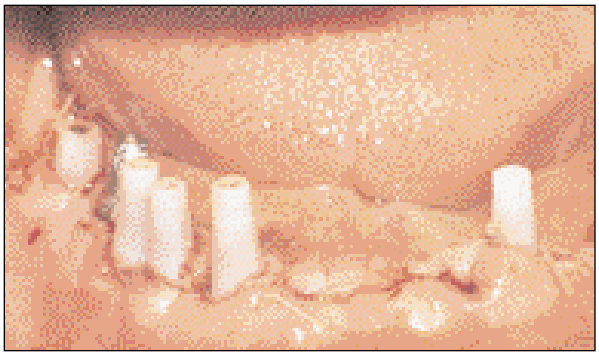

Fig 5a Acrylic resin sleeves in place over ITI solid abutments for OPC prosthesis.

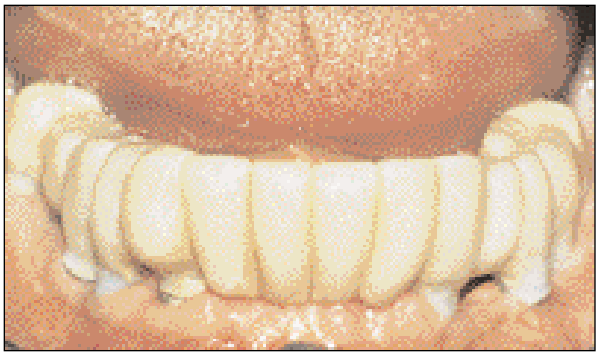

Fig 5b Completed OPC prosthesis after 8 weeks healing.

integrated. Bone levels were assessed by panoramic and periapical radiographs at the time of final restoration. Radiographs were evaluated for periimplant radiolucency and bone loss below the transmucosal collars of the ITI implants, the tapered coronal portions of the Astra implants, or the polished collar of the Frialit implants.

RESULTS

Patient data are shown in Table 1.

Twenty-seven patients were treated with the immediate loading protocol in completely edentulous mandibles. Nine patients were dentate or had fixed restorations in the maxillary arches, while 18 wore removable prostheses. Five of the 18 patients with removable maxillary restorations wore implant-retained maxillary overdentures during the treatment period for the mandibular arches.

A total of 186 implants were placed in the 27 patients. One hundred sixty-one were deemed stable at the time of implant surgery and immediately loaded. Twenty-five were not adequately stable and were not immediately loaded. They were either submerged for regenerative treatment or allowed to heal in a conventional unloaded manner. These unloaded implants were distributed among 12 patients. Fifteen patients had all of their implants immediately loaded. The mean number of immediately loaded implants for the provisional restorations was 6.0, with a range of 4 to 8. The mean number of implants for final restorations was 6.9, with a range of 5 to 8.

One implant was lost 3 weeks after placement, with pain and mobility (patient MP). This implant was an immediately loaded terminal abutment in the posterior mandible in relatively poor-quality bone. Further analysis of this 63-year-old male patient revealed bruxism and generally heavy occlusal function with his maxillary complete denture. The failed implant was successfully replaced 2 months later and allowed to heal in an unloaded protocol; final restoration was then performed. All other implants were deemed clinically integrated at definitive restoration and withstood final torquing and routine restorative procedures. No significant crestal bone loss was noted at the time of definitive restoration for any implant.

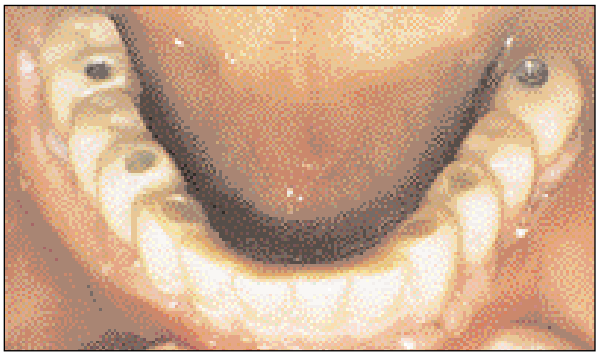

Fig 5c Finished OPS provisional restoration using existing denture (occlusal view).

The clinical success rate of the immediately loaded implants at the time of final abutment placement and torquing was 99.4% (160 of 161 implants). For all implants in the series, the success rate at the time of final abutment torquing was 99.5% (185 of 186 implants). Postoperative follow-up for all patients ranged from 13 to 41 months, with a mean of 25.0 months. No additional implants were lost during that time, indicating an interval implant survival rate of 100%.

Table 1 Summary of Implants Placed, Restoration Types, and Patient Data

Patient	Implant type/ surface	No. of implants		Restoration type	Opposing occlusion	No. of implants failed	Age (y) at placement	Months loaded
		Placed	Loaded					
SG	ITI,TPS	6	6	LPS	Removable	0	57	41
AO	ITI,TPS	8	4	OPS	Fixed	0	45	37
PM	ITI,TPS	6	6	LPS	Fixed	0	57	37
MF	ITI,TPS	6	6	OPC	Removable	0	66	35
NG	ITI,TPS	6	5	OPC	Removable	0	56	33
NB	ITI,TPS	5	5	OPC	Removable	0	77	31
DK	ITI,TPS	8	8	LPC	Fixed	0	69	30
RK	ITI,TPS	6	6	OPC	Removable	0	55	29
DJ	ITI,TPS	6	6	OPS	Removable	0	45	28
WD	ITI,SLA	8	5	LPC	Removable	0	56	26
SS	ITI,SLA	7	5	OPC	Removable	0	61	25
TC	ITI,SLA	6	6	LPC	Removable	0	55	24
MC	Frialit, Acid-etched	7	5	LPC	Removable	0	74	24
MK	ITI,SLA	8	6	OPC	Removable	0	68	24
MB	ITI,SLA	8	5	OPC	Removable	0	89	24
AT	ITI,TPS	7	6	LPS	Fixed	0	88	23
IC	ITI,SLA	6	6	OPC	Removable	0	67	21
RW	ITI,SLA	8	8	LPC	Fixed	0	75	20
JD	ITI,SLA	5	5	LPC	Fixed	0	85	20
CR	ITI,SLA	6	6	LPC	Removable	0	77	19
JK	ITI,SLA	8	7	LPC	Removable	0	63	19
LP	ITI,SLA	8	6	LPC	Fixed	0	48	18
RR	ITI,SLA	8	8	LPC	Removable	0	64	18
RS	ITI,SLA	5	5	LPC	Removable	0	72	16
AC	Astra Tech,TiOblast	8	5	OPS	Fixed	0	50	16
MP	ITI,SLA	8	8	LPC	Removable	1	63	15
JK	ITI,SLA	8	7	LPS	Fixed	0	72	13
Totals		186	161			1		
Means							65.0	25

TPS = titanium plasma-sprayed; SLA = sandblasted and acid-etched; LPS = laboratory-processed screw-retained; OPS = office-processed screw-retained; OPC = office-processed cemented; LPC = laboratory-processed cemented.

DISCUSSION

The results obtained in this short-term clinical series are very similar to the reports of previous authors using fixed mandibular restorations on immediately loaded implants.[13–15,17] The previous papers cited optimal clinical integration of implants placed at the time of definitive restoration, with few failures.

Levine and associates,[18] Tarnow and coworkers,[13] and Salama and colleagues[14] previously stated that controlling certain force factors with newly placed implants can lead to predictable clinical implant integration despite loading. In an investigation of early failures, Tarnow and coworkers[13] stated that rigid splinting and minimal lateral force application were critical factors for success. They suspected that their early failures were the result of the removal of early provisionals for Periotest (Siemens Dental, Bensheim, Germany) mobility measurement for each individual implant. After 2 early implant failures, possibly resulting from the trauma of provisional removal, this aspect of their protocol was abandoned, and no further implant failures occurred.

The observation of predictable osseointegration in this patient series and the previous literature clearly contradicts some of the original "requirements" for osseointegration as stated by Brånemark and associates[2] and summarized by Szmukler-Moncler and coworkers.[10] The forces exerted on the implants through fixed provisional restorations can apparently be minimized or reduced below the range of "deleterious micromovement."[3,10] A number of clinical factors can influence an implant's resistance to movement. These include: the number, distribution, length, diameter, and macroscopic stabilizing characteristics of the implant; patient bone

quality or density; precision of surgical technique; stiffness of the restoration; and occlusal force application through function and parafunction. It appears that if these factors can be adequately balanced, then predictable integration can be anticipated despite immediate functional loading.

The number of implants used in each patient appears to have been adequate to allow for clinical osseointegration and definitive prosthesis fabrication. From this series and others, there does not appear to be a clear indication of the minimum implant support required. Tarnow and coworkers[13] used up to 13 implants for the mandibular arch, although in some patients only half of the implants were immediately loaded. Alternatively, the Novum system (Nobel Biocare, Göteborg, Sweden) developed by Brånemark and associates[19] uses 3 implants in the symphysis. In the present patient series, the number of implants varied according to certain patient parameters, including the nature of the opposing dentition and history of parafunctional habits. Empirically, this formula appears to have been adequate to prevent generation of excessive forces on the implants and excessive micromovement, which could have hindered osseointegration.

There was a clear preference for cemented restorations (n = 20), with 12 patients having laboratory fabrication of the entire provisional restoration and 8 having the provisional restoration fabricated in an office. Screw-retained restorations were used less frequently (n = 7), with office-fabricated (n = 3) and laboratory-fabricated (n = 4) prostheses nearly equally divided.

From this review, no data can be generated yet regarding the implant longevity or long-term success rates. However, other long-term data from Schnitman and coworkers[12] and Tarnow and colleagues[13] indicate that once immediately loaded implants have clinically osseointegrated, they appear to take on the long-term predictability characteristics of conventionally healed and loaded implants.

All implants used in this report were screw-type design with rough surfaces. The ITI TPS, ITI SLA (sandblasted and acid-etched), Frialit-2 acid-etched, and Astra TiOblast all showed similar clinical osseointegration results in this immediately loaded case series. In humans, initial reports for early loading for some implant systems suggest that abutment connection and function 6 to 8 weeks after placement in types I, II, and III bone is possible and predictable. This reduced time for clinical osseointegration, or "early loading," should be distinguished from immediate loading as described here. Early loading protocols as reported by Buser and associates,[23] Cochran and colleagues,[24] and Lazzara and coworkers[25] may be more clinically important in the treatment of partially edentulous situations, poor bone quality, or where immediate loading is not practical.

Patients appeared to benefit from immediately loaded implant restorations in several tangible ways. First, they resumed function quickly following surgery and provisional restoration placement. Masticatory function was uniformly judged to be superior to pretreatment comparisons by all patients within 1 week, particularly when contrasted to conventional removable complete dentures. Early application of uncontrolled, excessive forces to not-yet-osseointegrated implants may be a significant cause of early failure. Removable dentures can often inadvertently apply these excessive forces, whether or not the implants are submerged below the flaps. The high predictability of implants shown in this series and others seems to indicate that the use of a fixed provisional restoration can help control the occlusal forces that are applied to the healing bone-to-implant interface within a physiologic range.

Further study is needed to determine the long-term success of immediately loaded implants. Additional data are also needed to determine the minimal bone density and maximal occlusal loading permissible for predictable immediate loading. Once these criteria are described, it may be possible to predictably apply the principles of immediate loading to smaller edentulous sections, areas of poor bone density, and the maxilla.

CONCLUSIONS

With appropriate stabilization and occlusal loading, mandibular implants can be immediately loaded in a complete-arch configuration with no apparent detrimental effect on the rates of osseointegration. Specific loading circumstances and surgical-prosthetic protocols have been suggested. Patient satisfaction and acceptance of this approach have been gratifying.

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