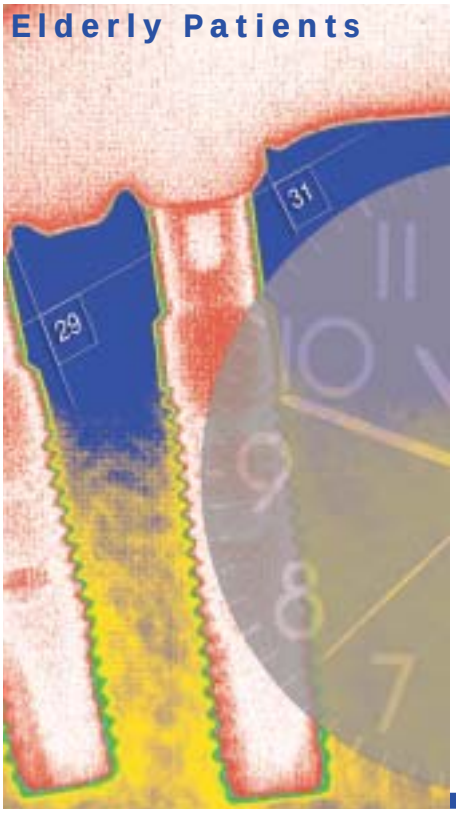


Immediate-Loading Dental Endosteal Implants and the Elderly Patient

Frank M.A. Vidjak, DDS, MSEd, and Margarita Zeichner-David, PhD

Abstract

The concept of immediately loading dental implants has the potential of being a viable addition to treatment modalities. The major decision-making challenge in managing depleted dentitions and complete edentulism in an aging society lies in differentiating the treatment outcomes, especially patient-mediated assessments (including economic analyses) of the various prosthodontic options available for older adults. The ability to chew properly is of great importance to maintain a healthy nutrition and improve oral comfort and quality of life, particularly in the elderly years.

The scope of treatments offered to patients has significantly broadened in the past few decades. Treatment plans, which once were focused solely on the presence or absence of natural dentition, were limited to traditional fixed and/or removable prosthodontics. Few developments in the clinical practice of dentistry have had such a great impact as the development of the endosteal dental implants, and Brånemark deservedly receives most of the credit for providing this type of treatment protocol.

The group of individuals with the highest propensity for compromised function, comfort, and self-esteem are edentulous patients.[1,2] Given the nature of the mandibular arch anatomy, this area is often the source of many post-treatment complications. It is well-known that jaw bones tend to resorb when teeth are lost. Many factors have been proposed as being responsible for the individual variations in post-extraction bone remodeling. Some of them are systemic (smoking, diseases, osteoporosis, etc.); however, since severe residual ridge resorption may occur even when the bone is in good condition, there must be local functional factors that determine which individuals experience more or less pronounced bone loss.[3] Bone resorption represents a particularly serious problem for elderly patients since many of them have to wear complete dentures, which results in a compromised chewing function.

The number and percentage of older adults has increased dramatically during the past century, and about 9 million of the older adults in the United States are edentulous.[4] Tooth loss can be severely disabling, and it has a profound impact on the quality of life of elderly people.[5] In addition to the esthetic and self-esteem issues associated with edentulism that can lead to isolation and depression, there is an association between masticatory efficiency and limited food choices that has long been established. An al-

Authors / Frank M.A. Vidjak, DDS, MSEd, is a prosthodontist in full-time practice in Beverly Hills, Calif. He teaches part time at the University of Southern California School of Dentistry.

Margarita Zeichner-David, PhD, is a research professor in the Division of Surgical, Therapeutical, and Bioengineering Sciences at USC School of Dentistry. She is a faculty member in the Graduate Program in Craniofacial Biology, and a member of the Center for Craniofacial Molecular Biology and the Advanced Training for Dental Health Care Professionals Program.

tered food choice as a consequence of reduced masticatory efficiency could result in malnutrition and might be a risk factor for systemic disease thereby placing individuals at increased risk of life-threatening conditions, such as atherosclerosis and cancer.[6-7]

A significant amount of information focusing on creating treatment modalities to improve the quality of life of the edentulous patient has been published. Since more people are living longer, the edentulous aging patient represents a challenge for dentists trying to restore esthetics and function to increase quality of life. When placing endosteal implants, it is important to understand the process of bone remodeling and the factors that can affect the integration of osseous dental implants. Approximately 0.7 percent of a human skeleton is resorbed daily and replaced by new healthy bone. With aging and metabolic disease states, the normal turnover process may be reduced and could affect the placement and integration of implants.[8] Osseointegration involves an osseous healing response that may be compromised by aging given that the patient's healing process itself could be compromised. However, several recent studies have documented the comparison of implants in older (65-91 years) and younger (41-60 years) adults, finding no difference in the success rate of osseointegration.[9-13] These studies indicate that age should not be a determinant in excluding edentulous patients from being treated with diverse prosthodontic procedures, including implants.

The original protocol described by Brånemark and colleagues[14-15] requires two stages — first, surgical placement of the implant fixture; second, surgical uncovering of implant fixture — with a healing period of approximately three months between surgeries. The healing period provides a time of nonfunction to ensure that osseointegration of the implants occurs. Many authors have published studies that validated the use of this protocol, which, in turn, has led to its wide acceptance by the dental profession.[16-22]

Though clinically successful, certain aspects of the protocol have come under scrutiny due to lack of

Figures 1a and b. Pretreatment, January 2000.

Figures 2a and b. Pretreatment radiographs, January 2000.

Figure 3. Maxillary complete denture and mandibular immediate complete denture at time of placement.

Figure 4. Mandibular anterior ridge six weeks post-extraction.

Figure 5. Surgical guide in place during implant surgery.

Figure 6. All implant sites prepared.

Figure 7. All implants have been placed and 20 degree Astra Uniabutments connected.

Figure 8. Entaglio surface of mandibular complete denture prior to placement of silicone pressure-indicating material.

Figure 9. Mandibular complete denture with silicone pressure-indicating material placed over implant abutments.

Figure 10. Openings made in mandibular complete denture where implant abutment location evident.

scientific evidence to support them. One of the issues being reviewed in recent years has been the need for a healing period following implant placement. Many studies describe a one-stage surgical protocol followed by the immediate utilization of the implants, particularly when treating the anterior mandible.[23-29] The reported success shows a trend that could be comparable to the two-stage protocol. The advantages of immediately loading implants are that it allows for immediate improvement in the patient's functional ability and self-confidence while dramatically reducing treatment time. Proper clinical assessment of bone density and implant stability becomes even more important when implants are immediately loaded since the usual period of healing (nonfunction) has been eliminated. In the present study, the authors report the case of an edentulous elderly patient who received an immediately loaded mandibular fixed implant-supported complete denture, formerly referred to as a hybrid prosthesis, thus eliminating all previous taboos concerning immediate loading of implants and the elderly patient.

Contrary to most of the studies involving immediate implant loading, the intent of this treatment plan was to place the minimum number of implants with maximum anterior-posterior distribution. Minimizing the number of implants reduces the surgical and prosthetic complexity, as well as the overall cost. Maximizing the anterior-posterior distribution allows for minimal impact on the final prosthesis should a failure of osseointegration occur.

Case Presentation

A 79-year-old Caucasian female came to the office with a complaint of mandibular pain. Clinical and radiographic examination revealed unstable maxillary and mandibular removable partial dentures and unrestorable infection-prone mandibular dentition (**Figures 1a and b and 2a and b**). Following a thorough conversation with the patient about her treatment options, a decision was made to remove

Figure 11a. Openings enlarged to avoid binding of Astra metal provisional copings on the denture base.

Figure 11b. Undercut areas blocked-out with reversible hydrocolloid (VanR Corp., Oxnard, Calif.)

Figure 11c. Long lab screws retaining metal provisional cylinders while autopolymerizing polymethylmethacrylate powder and liquid is placed by brush.

all the remaining dentition and follow with placement of new maxillary and mandibular dentures (**Figure 3**). The patient returned a few months later with a somewhat compromised masticatory function due to mobility of the mandibular denture. A dental CT scan was performed. Since the patient was in good health, was a nonsmoker, and had good bone density, it was decided to replace the mandibular removable prosthesis with a fixed implant-supported prosthesis (**Figure 4**). Due to lack of clinical and radiographic signs of combination syndrome and the patient's satisfaction with a conventional complete denture, no implants were scheduled to be placed in the maxilla.

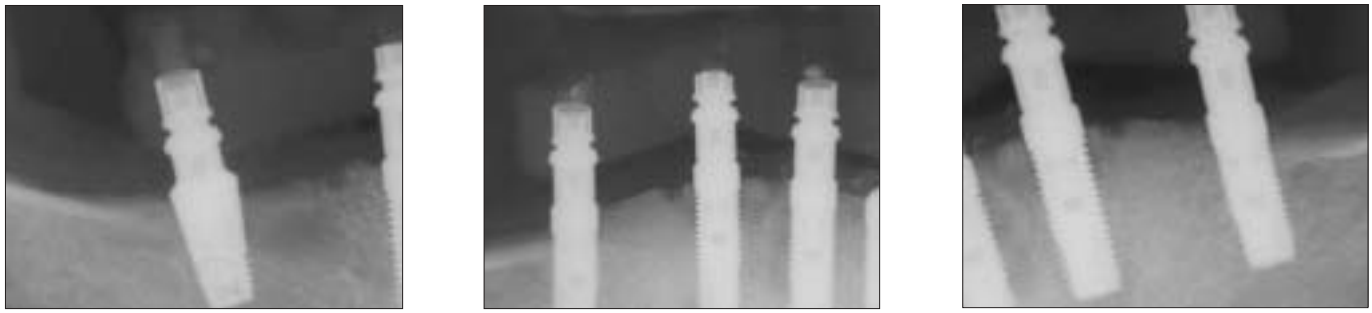
Seven Astra implants (Astra Tech, Inc., Lexington, Mass.) were placed (one 4.5 mm x 8 mm ST, five 4 mm x 13 mm, one 4 mm x 10 mm). Due to the proximity of the inferior alveolar nerve in the No. 29 position, a 4.5 mm x 8 mm implant was placed (**Figures 5 and 6**). The 20 degree Uniabutments were attached to all the implants except for the implant placed in the mid-symphysis area (**Figure 7**). There was no apparent strategic value in utilizing the implant at this time. During the surgery, the surgeon felt that the bone density and implant stability were favorable to immediately load the implants.

Figure 12a. All metal provisional copings have been attached with PMMA resin. The mandibular complete denture was recontoured to facilitate access for cleaning.

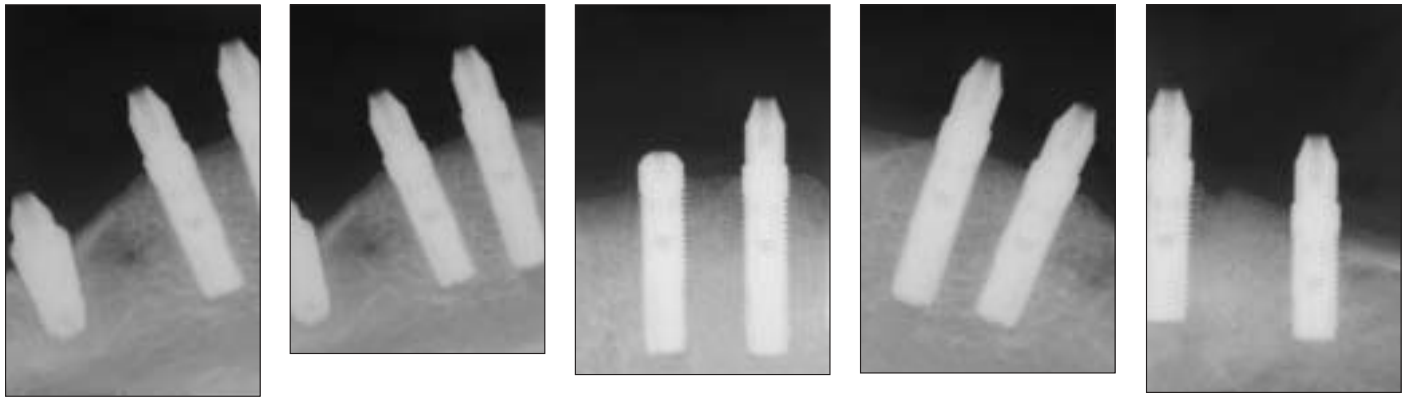
Figure 12b. Final placement of provisional fixed implant-supported complete denture.

The process of creating a provisional mandibular fixed implant-supported complete denture began with the use of a silicone pressure-indicating material (Fit-Checker, GC America) in the entaglio surface of the mandibular complete denture (**Figures 8 and 9**). Openings were made so that the six Astra metal provisional cylinders could be placed without binding on the denture (**Figure 10**). The provisional cylinders were connected to the denture with autopolymerizing resin (Laboratory Repair Resin, Dentsply Corp.) (**Figures 11a, b, and c**). The denture was removed and recontoured to allow access for cleaning. The provisional restoration was screwed into place and the screw access openings sealed (**Figures 12a and b**). Baseline radiographs were made (**Figures 13a, b, and c**).

One week after the surgery, the patient unexpectedly announced that she had to leave the country. Following her return three months later, clinical and radiographic exams were completed. At this time, it was determined that the implant in the No. 29 position had failed (**Figures 14 and 15**). This implant was removed. The provisional restoration was modified accordingly (**Figure 16**). The loss of this implant had no impact on the progression of treatment



Figures 13a, b, and c. Radiographs, March 2000, the day of implant and prosthesis placement.



Figures 14a through e. Radiographs, June 2000, with provisional fixed implant-supported complete denture removed.

due the favorable anterior-posterior distribution of the remaining implants. A soft-tissue impression with light-bodied polyvinylsiloxane impression material (Extrude, Sybron/Kerr Corp.) was made using the provisional restoration. This allowed for the registration of the soft tissues, centric relation position, and the vertical dimension of occlusion in one step (**Figures 17 a, b, and c**). An impression of the maxillary denture was made for the working cast. The casts were mounted, and the process of fabrication of the final restoration began.

To eliminate the presence of a majority of occlusal access openings, two gold substructure bars each with one

Figure 15. June 2000, the provisional prosthesis removed and the condition of implants evaluated. The implant in the No. 29 position was found to be mobile.

Figure 16. Provisional prosthesis with failed implant provisional cylinder removed and area recontoured.

Figure 17a. Tissue impression in place.

Figure 17b. Entaglio surface of tissue impression using the provisional restoration as a tray.

Figure 17c. Provisional restoration and tissue impression on working cast. Soft tissue contours and the vertical dimension of occlusion registered at the same time.

Figure 18. Implant-supported tissue bars in place. Each has a threaded site for a lateral set-screw.

Figure 19. Silicone putty matrix in place to verify presence of adequate space for metal superstructure, PMMA resin, and denture teeth.

Figure 20. A wax and acrylic resin replica of the provisional prosthesis was utilized to verify the vertical dimension of occlusion.

Figure 21. The superstructure was cast, indexed, and soldered.

Figure 22. Labial view of final restoration. Space for cleaning access that was determined during the provisional phase of treatment was duplicated in the final restoration.

Figure 23. Occlusal of view of final restoration. Note single direct implant connection lingual to No. 22. All other access openings have been eliminated by underlying tissue bars.

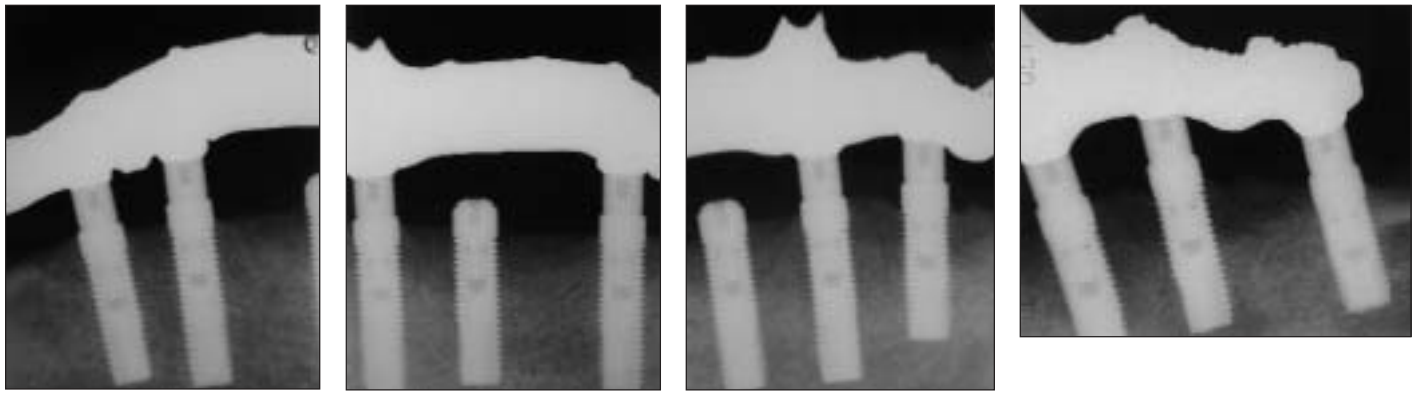
lateral set screw were fabricated. One opening would remain in the No. 22 position (**Figure 18**). A silicone core (Reprosil Putty, Coe, Inc.) made of the entire provisional prosthesis was utilized to evaluate clearances required for the restorative materials and components (**Figure 19**). A wax and acrylic resin replica of the provisional prosthesis was utilized to verify the vertical dimension of occlusion (**Figure 20**). This replica was cut back to the desired form of the superstructure. The superstructure was cast, indexed, and soldered (**Figure 21**). A final clinical and radiographic evaluation for passivity of fit of the framework was completed. At this point, no further clinical evaluations were made. The final restoration was completed and the prosthesis delivered (**Figures 22 through 25**).

Figure 24. Entaglio view showing receptacle sites for tissue bars and direct connection to implant in No. 22 position. Openings for lateral set-screws can be seen lingual to the tissue bar areas.

Figure 25. Labial view of maxillary and mandibular prostheses on day of final placement.

Figure 26. Smile with final prostheses in place.

Figure 27. Frontal view with final prostheses in place.



Figurs 28a-d. Radiographs December 2002 — Note minimal crestal bone height change since time of implant placement.

It has been almost three years after the treatment, and the patient has maintained an excellent level of oral hygiene, had no complications, and had an extremely high satisfaction level (**Figures 26 and 27**). Radiographically, the bone levels appear to be stable (**Figures 28a through d**). The anterior maxilla continues to show no clinical signs of combination syndrome. Although the patient lives out of the country, she has been returning for recall exams once or twice a year.

Closing Remarks

There is no doubt that the way in which dentists utilize dental implants is evolving at an astounding rate. The intimate relationship between living oral tissue and artificial dental implant material is influenced by several factors,

such as biocompatibility and/or biotoxicity of the implant material, differential elasticity of the materials and tissues, implant design, primary implant stability, the manner by which the tissues attach to the material surface, topography of the material surface, presence of micromovement, and implant-abutment joint design.[30] All of these factors, in addition to the age and overall systemic health of the patient, will determine the clinical success of the implants.

The concept of immediately loading dental implants has the potential for being a viable addition to treatment modalities. Scientific evidence derived from animal studies using beagle dogs indicates that the micromotion at the implant-bone interface does not interfere with the osteogenesis and new bone growth at the implant-bone interface.[31] It appears that the increased function causes a load-related bone formation that minimizes the physiologic age-related mandibular bone mass density and that this effect seems to be independent of the attachment system.[25]

The major decision-making challenge in managing depleted dentitions and complete edentulism in an aging society now lies in differentiating the treatment outcomes, especially patient-mediated assessments (including economic analyses) of the various prosthodontic options available for older adults.[32] However, at this time, clinical judgment plays an even more critical role due to subjective nature of the decision-making process when immediately loaded implants are concerned. Who is the anatomically, physiologically, and psychologically appropriate individual to be treated in this manner? Many issues remain unanswered. However, the ability to chew properly is of great importance to maintain a healthy nutrition and improve oral comfort and quality of life. Continued research in this area will be critical to bring this part of the treatment planning process into the evidence-based arena. CDA

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To request a printed copy of this article, please contact / Frank M.A. Vidjak, DDS, MSEd, 465 N. Roxbury Drive, Suite 703, Beverly Hills, CA 90210.