The increased use of small-diameter implants

Gordon J. Christensen, DDS, MSD, PhD

Many people in the United States are edentulous. Estimates of the percentage of edentulous people vary, but clinicians agree that every practice has a significant number of people wearing complete dentures. Some of these patients are elderly and physically debilitated. Often, because of their health challenges, they cannot undergo the surgery necessary for simple conventional implant placement. Many do not have adequate funds to pay for comprehensive oral care. Additionally, I have observed when treating many of these patients that most of them do not have adequate bone for placement of conventional-diameter (3 millimeters or larger) root-form dental implants. When I have offered these patients relatively extensive bone-grafting procedures that could provide the necessary bone for placement of conventional-diameter root-form implants, most of them have rejected my proposals. The reasons for their refusal are that they do not want to go through the bone-grafting procedure, they cannot afford grafting or both. Consequently, in my opinion, they are a forsaken and forgotten group, destined to go through the remainder of their lives with inadequate oral function, often poor esthetics and, almost inevitably, low self-esteem.

Dentists know well that the major challenge for these patients is lack of retention and support for their mandibular dentures. Often maxillary dentures serve relatively well, probably because of the support afforded by the hard palate. Most general dentists and prosthodontists do not hesitate to offer these patients comprehensive, expensive treatment plans, only to have the patients refuse therapy owing to the cost. I consider the patient with inadequate mandibular dentures to have the most commonly occurring major oral disability. What can be done for these people?

In this column, I will describe reasons for the use of conservative, minimally invasive small-diameter implants (SDIs). Additionally, I will discuss three relatively simple technique concepts for restoration of SDIs placed in edentulous mandibles.

IS THERE A NEED FOR SMALL-DIAMETER ROOT-FORM IMPLANTS?

Standard-diameter implants, 3 mm or larger in diameter, received clearance from the U.S. Food and Drug Administration (FDA) for long-term use in the late 1970s. Their success is well-known. These implants are

placed surgically by some general dentists and prosthodontists, most periodontists and oral surgeons and a few other specialists. When patients are healthy and they have adequate bone, root-form implants larger than 3 mm in diameter provide simple, relatively nontraumatic and highly appreciated treatment. However, many times adequate bone is not present, especially in the areas of severe need for retention and support of fixed or removable oral prostheses.

In my opinion, the major physiological and functional needs for root-form dental implants are demonstrated by the edentulous mandible, the badly resorbed edentulous maxilla and the maxilla or mandible without any anterior teeth (Kennedy classification IV). I have observed that patients with these conditions have significant debilitation in oral function. In addition to these severe needs for implants, there are numerous other uses for dental root-form implants that are well-known to dentists (such as in patients with Kennedy classifications I, II and IV).

Patients in severe need often do not have sufficient bone to allow placement of standard-diameter implants. Many patients who have severe oral dysfunction will not or cannot undergo placement of conventional implants because of inadequate bone. For many of them, SDIs are a more acceptable alternative to bone grafting or to forgoing treatment altogether.

SDIs, or "mini-implants" as they commonly are called, generally are considered to be less than 3 mm in diameter. They initially were used as provisional or transitional implants for supporting both fixed and removable prostheses while conventional implants, 3 mm in diameter or larger, integrated into the bone. In addition, they have been used widely in orthodontic therapy as anchors toward which natural teeth are moved for orthodontic reasons.

SDIs were first cleared by the FDA for long-term use in 1997 (T.A. Ulatowski, Division of Dental, Infection Control and General Hospital Devices, Office of Device Evaluation, Center for Devices and Radiological Health, FDA, written communication to V.I. Sendax, Sendax MDIC Management, November 1997). The research regarding use of SDIs for long-term support of removable and fixed partial dentures has been accumulating for several years.[1-21]

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Numerous companies produce SDIs. Among them are Dentatus (New York City); Dental Implant Technologies (Scottsdale, Ariz.); Implant Direct (Calabasas Hills, Calif.); Imtec, a 3M Company (Ardmore, Okla.); Intra-Lock (Boca Raton, Fla.); and Sterngold Dental (Attleboro, Mass.).

I have placed and restored SDIs for more than eight years with success. I have found them to be a simple, predictable, minimally invasive, relatively inexpensive solution for some neglected clinical situations, especially treatment of patients with the severe challenges previously described.

USING SMALL-DIAMETER IMPLANTS IN EDENTULOUS MANDIBLES

I will outline three prosthodontic methods for restoring only one of the most debilitating clinical situations, edentulous mandibles. I consider this oral condition to be the most severe, and also the most neglected, commonly occurring malady in dentistry.

Rubber O-ring denture retention using SDIs. In this treatment, the dentist places four to six SDIs, usually ranging from 1.8 to 2.9 mm in diameter, as parallel to each other as possible and anterior to the mental foramen. Small spheres on the coronal portions of the implants are projections of the implant body extending a few millimeters from the gingival tissues into the oral cavity. A standard mandibular denture impression, made in a custom-fitted tray or in the patient's existing denture, includes the implants, the residual mandibular ridges and the border-molded oral mucous membranes. The laboratory technician places analogues into the wells made by the implants in the impression and pours the impression in the usual manner. When the impression is separated from the stone cast, the analogues representing the implant abutment heads protrude from the cast. The dentist places metal housings con-

taining rubber O-rings on the analogue heads and processes the denture to retain the housings and O-rings. He or she adjusts the denture in the usual manner, evaluating fit, pressure spots, occlusion and esthetics and then making any necessary corrections. The dentist or dental hygienist will need to replace the rubber O-rings periodically, as they lose their ability to retain the denture in place during service. This concept is the one used most commonly for SDIs in patients with edentulous mandibles (Imtec manufactures a well-known brand).[1,2]

Denture retention by means of SDIs and soft relining material. Dentatus has designed and researched use of SDIs using soft denture-relining material around the implants to support and retain mandibular complete dentures. The Atlas system uses four or more implants of appropriate length and of 2.2 mm or 2.4 mm in diameter, which the dentist places in the mandible at equal intervals anterior to the mental foramen. The dentist makes a complete mandibular denture and removes from it the interior portion in the location of the implants. He or she then lines this undercut space in the denture base with soft silicone denture-relining material, which surrounds the SDIs and retains and supports the denture. The dentist constructs the soft denture liner so that the patient can remove it for cleaning. This concept affords flexibility and movement of the denture in relation to the stress of masticating food. The soft liner can be replaced as it wears and becomes inadequate to retain the denture.

ERA denture attachment retention using SDIs. The Sterngold Dental ERA Mini Implant System uses the well-known ERA attachment system, in which one part of the ERA attachment is incorporated into the denture base and the corresponding ERA component is placed on top of each of the four implants. The technique generally requires two smaller 2.2-mm–diameter implants in the anterior portion of the mandible and one 3.25-mm–diameter implant on each side of the arch in the area just anterior to the mental foramen. These four implants provide positive, stable retention and support for the denture and offer several levels of retention according to patient needs and the level of retentiveness of the ERA attachment placed into the denture.

Although there are many possibilities for use of SDIs in retaining mandibular dentures, the three techniques I have described appear to be the most commonly encountered. Undoubtedly, other attachment methods will be developed as use of the SDI concept continues to mature and further research is available.

SUMMARY

Conventional-diameter root-form implants (3 mm and larger in diameter) are one of the major advancements in dentistry's history. However, they often cannot be used in patients who have minimal bone and who will not or cannot undergo bone grafting, patients who are unhealthy or patients who want minimally invasive procedures.

Research continues to demonstrate the surgical and prosthodontic success of SDIs (less than 3 mm in diameter) used as support and retention for removable prostheses. These implants offer dentists and their patients an alternative to the more invasive placement of conventional-diameter implants. SDIs can provide minimally invasive, simple, fast and effective treatment. Additional research is needed to identify the best and most reliable prosthodontic methods for use of SDIs. ■

Dr. Christensen is the director, Practical Clinical Courses, and a cofounder and senior consultant, CR Foundation, Provo, Utah. He also is the senior academic advisor, Scottsdale Center for Dentistry, Scottsdale, Ariz.; an adjunct professor, Brigham Young University, Provo, Utah; and an adjunct professor, University of Utah, Salt Lake City. Address reprint requests to Dr. Christensen at CR Foundation, 3707 N. Canyon Road, Suite 3D, Provo, Utah 84604.

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