

## The 'mini'-implant has arrived

**H**istorically, the initial users of most types of dental implants mainly were general dental practitioners, who often were severely criticized by their peers for their involvement with implants. During the evolution of and the initial successful use of implants, practitioners still did not accept implant dentistry. With the introduction and refinement of the osseointegrated root form implant over the last 40 years, implant dentistry has been accepted slowly by both general and specialty practitioners. Root-form dental implants have allowed many types of difficult oral treatment to be accomplished that were nearly impossible before the introduction of implants.<sup>1-4</sup> When root-form implants were popularized, oral surgeons, peri-

odontists, some prosthodontists and a few general dentists became involved in placing them. However, the high cost of implants for patients and the assumed difficulty in placing them has impeded implant use

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to the degree that they are achieving only a small part of the service potential of which they are capable.

As a prosthodontist who has placed root-form implants for more than 20 years, I have encouraged interested, surgically oriented general dentists and prosthodontists to place

root-form dental implants in healthy patients who have adequate bone. My motivation of general dentists often has been met with criticism by surgical specialists, but I stand behind my recommendations that the more dentists who take the time to become educated adequately in the surgical aspects of implant placement, the more patients will be served by this superior treatment. It is well-known that implants are used widely in many countries that lack the legal obstacles found in the United States.

As interested dentists become involved in implant dentistry, they may want to consider joining the implant organizations and attending their meetings. These groups include the American Academy of Implant Dentistry, the Academy of Osseointegration and the International Congress of Oral Implantology. The oral surgery, periodontal and orthodontic spe-

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cialty organizations also provide many continuing education courses on implant dentistry.

In my opinion, the increasingly popular “mini”-implant concept will assist the movement of general dentists into implant placement, and it will serve many dental patients who would not have been able to have typical standard-sized, root-form implants.

This article includes a discussion of mini-implants and their potential uses in dentistry.

### WHAT ARE MINI-IMPLANTS?

When the original root-form implants were introduced, they had a diameter of about 3.75 millimeters. Although I have heard various reasons for selection of this diameter, the logic or research supporting these reasons has been unclear. An implant of nearly 4 mm in diameter requires at least 6 mm of bone in a facial-lingual dimension for placement without grafting additional bone to augment the site. After years of placing implants in all locations of the mouth, it is my observation that seldom do I see 6 mm of bone in a facial-lingual dimension. Often, an osteotomy must be used to widen the osteotomy and the minimal bone, thereby allowing placement of the 3.75-mm implant in the less-than-adequately sized bony site.

Some implant companies have recognized the challenge of minimal bone presence and made implants of a smaller diameter (ranging from 3 to 3.5 mm). Although this change is only a slight reduction in diameter, it has allowed easier placement of root-form implants in the maxillary lateral incisor

area, mandibular anterior sites or in any area in which bone has shrunken. These slightly smaller-diameter implants have been used widely and have been successful, in spite of allegations that they would be too weak.

In the last few years, root-form implants ranging from 1.8 mm to slightly more than 2 mm in diameter have been promoted for long-term service. These so-called “mini”-diameter implants have been used successfully as interim implants to support pro-

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visional prostheses, while larger-diameter implants were integrating into bone. When minis were used as interim implants, the intent was to remove the mini-implants when the larger-diameter implants were put into service. As might have been anticipated, when attempting to remove these interim mini-implants, practitioners found that they could not be removed, because they had integrated into the bone during the interim service period. As a result, some of the companies producing mini-implants have applied for approval of the small-diameter implants for long-term use. The first company approved for long-term use was IMTEC (Ardmore, Okla.), makers of Sendax MDI and MDI Plus, in August 2003.

The diameter of root-form implants ranges from approximately 1.8 mm to approximately 6 mm. Three general categories

of implant diameters are available: the mini-implant ( $\approx$  1.8 mm), the standard-sized implant ( $\approx$  3.75 mm) and the wide-body implant ( $\approx$  6.0 mm), with all sizes in between. Use of mini-diameter implants is increasing, and more research publications and clinical technique articles about them are becoming available.<sup>5-14</sup> Use of large-diameter implants ( $\approx$  6 mm) also is increasing for situations in which inadequate bone is available in a crestal-apical dimension, but adequate bone is available in a facial-lingual dimension.

### IN WHAT SITUATIONS ARE MINI-IMPLANTS INDICATED?

In my opinion, I find more indications for narrow-diameter implants ( $\approx$  1.8 mm) than for standard-diameter implants ( $\approx$  3.75 mm). When inadequate bone is present for placement of standard-diameter implants, most practitioners have been taught to suggest bone grafting, either using autogenous bone (from various sites in the patient’s body) or one of the many available bone substitutes. However, few patients desire to have, or can afford, bone grafting. The expense of dental implants already is prohibitive for most patients, without the added cost, trauma, pain and uncertainty of bone grafting. In my opinion, if dental implants are ever to achieve their optimum service potential for typical, average-income dental patients, methods need to be found to allow placement of implants in areas of remaining natural bone, using minimally invasive procedures without grafting. The mini-diameter implants have the potential to

assist in this challenge. Any practitioner placing dental implants is well-acquainted with the routinely observed clinical situations in which narrow-diameter implants are indicated. Mini-implants are especially indicated—and I have used them with success—in the following areas.

**Edentulous arches with minimal remaining bone in a facial-lingual dimension.**

Many patients who have been edentulous for several years do not have enough remaining facial-lingual bone to place standard-diameter implants without grafting. It is possible to place some mini-diameter implants ( $\approx 1.8$  mm) in bone that is as narrow as 3 mm in a facial-lingual dimension. It is necessary to have adequate crestal-apical bone for a 10-mm-length implant, and I would prefer 12 mm or more. Some of the companies providing narrow-diameter implants recommend placing the implants without making an incision or raising a flap. From my experience, I suggest that when placing narrow implants in the minimally acceptable bone situation just described, the clinician should raise a flap to see the location and amount of the bone and to allow exact placement of the implants at the correct angulation in the bone. Judging the amount of bone present in a crestal-apical dimension is easily done using a panoramic radiograph, which magnifies the image by at least 30 percent. The amount of facial-lingual bone can be identified by tomographic radiographs, ridge mapping using commercially available calipers to penetrate the facial and lingual soft tissue and measure the

bone, or by visual observation when the soft-tissue flap is raised. Many patients with the clinical conditions described have minimal financial resources, and low-cost identification of bone presence is suggested. If one of the narrow-diameter implants fails in service, the clinician may simply screw it out. The use of small-diameter implants prevents the formation of the large hole in the bone that remains when a

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standard-sized implant fails, and the smaller hole left by a failed small-diameter implant soon fills with new bone. Another small-diameter implant can be placed in an adjacent location, followed by retrofitting of the prosthesis.

**Removable partial dentures (RPDs), Kennedy Class I, II and IV.** When bilateral distal extension (Class I), unilateral distal extension (Class II) or anterior extension (Class IV) removable partial dentures are planned, it is common knowledge that the dentures will rock toward the respective edentulous areas when chewing. If at least 3 mm of facial-lingual bone and 10 mm or more of crestal-apical bone are present in any of the edentulous sites, and mini-implants are placed, patient satisfaction is increased significantly. The partial denture rests

on the small implants, retained and supported in various ways: denture soft liner, rubber “O” rings in housings or other special abutments. Rocking toward the edentulous areas is eliminated and denture retention is improved.

**Extra support and retention under fixed partial dentures (FPDs).** Occasionally, situations arise in which an FPD is planned that has questionable potential retention from natural teeth, and the patient has refused RPD treatment or grafting and standard implants. Mini-implants can be placed in the edentulous areas and used to support the pontic areas of the FPD. When an FPD becomes loose on one end, and the prosthesis can be removed from the other abutment without destroying it, the prosthesis often can be salvaged. A small-diameter implant is placed in the pontic area, a hole is cut in the underside of the pontic, the abutment retainers of the FPD are cleaned and roughened internally, and the FPD is recemented using the mini-implant as additional support and retention under the pontic. Research is under way to study the long-term use of small-diameter implants as the full support and retention for fixed partial dentures. To date, clinical success has been promising.

**SUMMARY**

There is no question that dental implants have been the most influential change in dentistry during the last half-century. In general, they are well-proven and highly useful. However, the diameter of standard implants ( $\approx 3.75$  mm), along with the frequent need to graft bone to allow for their placement, have lim-

ited their use for those who most need implants. The introduction, approval and continuing observation of success of smaller-diameter mini-implants have stimulated use of implants in situations in which standardized implants could not have been used without grafting. The result has been more patients who have been served successfully at reduced cost with mini-implants—patients who could not have been treated with implants otherwise. Continuing research is needed for further verification of the acceptability of mini-implants. ■

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