Therapy for Missing Lower Medial Incisor by Means of Reduced Diameter Implants

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INTRODUCTION

Since Brånemark first described the principle of osseointegration in the field of dentistry,© dental implantology has become a rapidly evolving and innovative field. In 2004, the American Dental Association Council on Scientific Affairs cited dental implants as the “first generation of tissue engineering devices that will affect the dental profession.” Accordingly, a wide variety of implant materials, shapes, sizes, and surface treatments have been devised. Patients have become aware of the potential of dental implants; prostheses that function immediately are often desired. To meet this demand, implants of increasingly smaller diameter have been devised, and single-stage procedures©,©,© with immediate functional loading©,©,© have become available. Small-diameter implants (SDIs) are the preferred treatment modality in cases of limited anatomic geography. These implants range from 2.75–3.3 mm in width and from 8.0–15.0 mm in length.© Specifically, SDIs are indicated for replacement of teeth with small cervical diameters and in cases of reduced interradicular bone.© They also have been shown to be a viable alternative to bone augmentation when poor alveolar ridge width is encountered© and in cases of restricted mesiodistal anatomy.© Based on this in vivo and in vitro success, the mini dental implant (MDI) seems a logical successor. Smaller than their SDI counterparts, MDIs have diameters ranging from 1.8–2.4 mm. MDIs were initially designed for temporary prosthetic stabilization during the healing phase of standard implants.© Reproducible success in this indication©,© has led to expanded use in orthodontic anchorage,©,© for the temporary fixation of transplanted teeth,© in periodontal therapy,©,© and, more recently, for long-term fixed and removable prosthetics.©,©,©,©

Although the Sendax MDI (3M ESPE, OsseoSOURCE, St Paul, Minn) was the first MDI to gain approval from the U.S. Food and Drug Administration for long-term applications, several other MDI systems are available, including Hi Tec Implants (Hi Tec Implants, Herzelia, Israel) and Monorail MTI.
Transitional Implants (Dentatus AB, Hagersten, Sweden). The titanium-aluminum-vanadium alloy of the Sendax MDI gives it the increased strength required for long-term applications. A recent study by Kanie and colleagues\(^{26}\) compared the biomechanical properties of the mini transitional implant (MTI) with those of the Sendax MDI. Based on a flexural test (a fixed horizontal load was applied to the implant head), the authors determined that the MDI was 2.3 times stronger than the MTI. They concluded that the MTI is suitable for transitional use in accordance with its design, but the MDI should be used if “intensity is a priority.”\(^{26}\)

### MATERIALS AND METHODS

The patient was a 25-year-old male non-smoker with a missing lower right medial tooth (#25); an intercoronal space of 3.5 mm was present (Figure 1). Both neighbor incisors had a mesiodistal diameter of 6.0 mm. The patient rejected therapy by orthodontists. Adjacent teeth were reduced with a diamond bur to a mesiodistal diameter of 5.0 mm; thus a space of 5.0 mm was created. After clinical and radiologic examination and evaluation of the retrieved information, it was decided to insert a 1.8 mm IMTEC MDI implant (15.0 mm in length; IMTEC Europe GmbH, Oberursel, Germany) (Figure 2). No connective tissue grafts were placed before implant therapy was begun, and the implant was inserted according to the usual surgical protocol (flap surgery). Flap surgery was chosen, although the standard insertion of an MDI is flapless. This was decided as the result of a critically low bone supply; clinicians wanted to be able to visually control insertion and to achieve the ideal implant position (Figures 3 and 4). The patient had a high lip line; thus no provisional prosthesis was necessary. Wound healing occurred without complications. After 3 months, the implant was loaded with a single metaloceramic crown (Figure 5).

### RESULTS

During the observation period of 1 year, no implant loss was noted. The patient was very satisfied with the result. After 1 year, no bone resorption was present (Figure 6).

### DISCUSSION

The history of dental implantology is one of paradigm shifts.\(^{2}\) Recent years have seen a movement away from submerged, 2-stage placement without functional loading to single-stage, nonsubmerged procedures with immediate functional loading.\(^{27,28,29}\) Accordingly, to reduce patient morbidity and convalescence, minimally invasive surgery has become routine.\(^{7,30,31}\) MDIs meet these new standards of implant dentistry.\(^{32}\) Minimally invasive oral surgery preserves the periosteal and endosteal blood supply, augmenting the osseointegration process. In addition, the flapless approach reduces bleeding, decreases postoperative discomfort, and virtually eliminates the convalescent period.\(^{33,34}\) In our case, the flap method was chosen despite the mentioned advantages of the flapless approach. This was decided as a result of the described critically low bone supply, so that we were able to visually control insertion and to achieve the ideal implant position. In their 5-year retrospective study, Vigolo and Givani\(^{34}\) present results from 52 MDIs for single-tooth restorations placed in 44 patients. Results achieved by mini implant rehabilitation were similar to those reported for standard single-tooth implant restoration. The total implant survival rate was 94.2%. Two implants were lost at second-stage surgery, and another was lost after temporary loading.\(^{34}\) In our case, we decided to pursue therapy without a temporary crown because of the high enough lip line of the patient; thus no provisional prosthesis was necessary in this case. The greatest disadvantage of the MDI is its poor efficacy in immediate extraction sites; the
large socket diameter precludes adequate implant-bone interface. Also, a greater number of implants are recommended for MDI restorations. For single-tooth replacements, 1 MDI is used for an anterior and a bicuspid tooth, and 2 MDIs are used for a molar. With appropriate MDI training and respect for traditional implant theory, every general
dentist can successfully introduce MDIs into his or her daily practice.34

CONCLUSIONS

Implant therapies in patients with small availability of space and bone are a great challenge today. In lacking bone supply buccolingually and with reduced intercoronal space of 5.0 mm, definitive therapy with diameter-reduced MDIs is possible in individual cases. The nonablative thread architecture particularly enables gentle bone spreading and bone condensing of the implant bed and considerably improves primary stability.

ABBREVIATIONS

MDI: mini dental implant
MTI: mini transitional implant
SDI: small diameter implant

REFERENCES