Mini-Implants to Reconstruct Missing Teeth in Severe Ridge Deficiency and Small Interdental Space: A 5-Year Case Series

Ziv Mazor, DMD,* Marius Steigmann, DMD,† Roy Leshem, DDS,‡ and Micahel Peleg, DMD§

Two of the major obstacles for dental implant placement to replace missing teeth are the lack of adequate bone width and interdental space. Overcoming these limitations requires bone augmentation procedures that transform the deficient ridge into a ridge that is capable of receiving conventional tooth-form implants. In the case of inadequate interdental space, orthodontic tooth movement is advocated before implantation. Using narrow-diameter mini-implants allows the clinician to overcome both of these obstacles without the need for additional grafting procedures or orthodontic tooth movement. The mini-implants are immediately loaded and restored so as to enable the patient to have satisfactory mastication and aesthetic appearance. A 5-year follow up of 32 implants demonstrates the benefit of this treatment modality. (Implant Dent 2004;13:336–341)

Key Words: dental implants, augmentation procedures, orthodontic tooth movement, narrow ridge

Dental implants are a valid treatment modality for the completely[1,2] or partially[3,4] edentulous patient. A single-tooth implant can be an elegant solution, although not an easy one. Implant treatment for a single missing tooth can potentially lead to a well-functioning and aesthetically pleasing single crown on an implant.[5–9] However, to achieve optimal treatment results, resorption defects should be repaired to gain sufficient ridge width in which to place the implant. This requires experience and a high degree of surgical and prosthetic skills. The natural situation can only be approached if all treatment stages are adequately planned and conducted, and if no major complications occur. To prevent disappointments, both dentist and patient should be well aware of all conditions required for an optimal result. Lack of bone width and/or interdental space prevents the placement of implants. Therefore, in these situations, augmentation procedures, as well as orthodontic tooth movement, are prerequisites to implantation.

Numerous augmentation techniques have been reported in the dental literature[10–13] to facilitate implant placement in the deficient ridge using blocks or particulated grafts, which require several stages before tooth reconstruction. Orthodontic tooth movement is needed before implantation for inadequate mesiodistal space in between teeth. Lack of interdental space is a common finding in cases of congenitally missing anterior teeth, closure of space after extractions, and after extraction of narrow-diameter teeth such as the lower and upper lateral incisors. Placing an implant in a narrow interdental space without orthodontic tooth movement has the potential risk of bone loss to the adjacent teeth, especially to the root aspect facing the implant. However, these augmentation procedures have some drawbacks such as prolonged time until tooth reconstruction, patient morbidity, and expense.[14,15] Side effects of bone augmentation include profound edema, pain, and discomfort, and possible risks of nerve and blood vessel injury leading to nerve disturbance and hematoma. The use of mini-implants is a new treatment modality and an alternative to the conventional implantation regimen.

When reconstructing teeth lost resulting from periodontal disease, there is a great amount of bone loss both vertically and horizontally. Placing an implant/abutment deeper than the bone level of the adjacent teeth is likely to cause further bone loss as a result of the proximity of the implant and the tooth. A 2.4-mm diameter one-piece implant with no implant abutment connection allows greater clearance between the implant and the adjacent teeth so as to decrease the potential for bone loss.

The purpose of this article is to describe the use of mini-implants for fixed restorations (with a follow up of up to 5 years) to enable the practitioner to overcome the anatomic obstacles of ridge width and narrow interdental space by immediate loading and reconstruction. As well, 2 case reports are presented that illustrate the use of mini-implants.

Subjects and Materials

The study consisted of 32 patients who required single implants for

*Private practice, Ra'anana, Israel.
†Private practice, Heidelberg, Germany.
‡Private practice, Herzlia, Israel.
§Private practice, Tel-Aviv, Israel.

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single-tooth replacements. Patients were treated in the private offices of the authors. Criteria for inclusion in the study group were alveolar ridge width of up to 4 mm or interdental space of less than 4 mm.

Titanium screw implants, 2.4 mm, 13 mm in length were used (Hi-Tec Implants, Herzlia, Israel). All implants were immediately loaded with temporary crowns for 3 to 4 weeks followed by conventional crown reconstruction made of porcelain fused to metal (PFM).

Clinical and periapical radiographs were taken pretreatment, postoperatively, during rehabilitation, and at follow ups.

Results

Of the 32 implants, 31 were integrated successfully and reconstructed with PFM crowns. One implant was lost 3 months postrehabilitation as a result of mechanical overload. Patients reported complete satisfaction regarding function, aesthetics, and phonetics.

Examples of Procedures

Patient No. 1

A 65-year-old woman presented with a missing mandibular left first molar (Fig. 1). The ideal treatment plan was augmentation of the deficient ridge in a buccolingual dimension followed by an implant. Because the patient refused to undergo the augmentation procedure, it was decided to place 2 narrow-diameter (2.4 mm) temporary implants to avoid the need for augmentation.

After reflection of a full-thickness mucoperiosteal flap, the alveolar ridge was exposed revealing 3.5 mm of width (Fig. 2). Two osteotomies for 2.4-mm fixtures were performed with a 2.0-mm drill (Fig. 3). Two Hi-Tec fixtures were inserted and the flap was sutured and closed with primary intention (Fig. 4). An immediate self-curing acrylic temporary crown was fabricated to allow access for cleansing. Impressions were taken 6 weeks later and the final PFM restoration was cemented (Fig. 5). A periapical radiograph, 5 years postoperatively, shows no signs of bone resorption (Fig. 6).

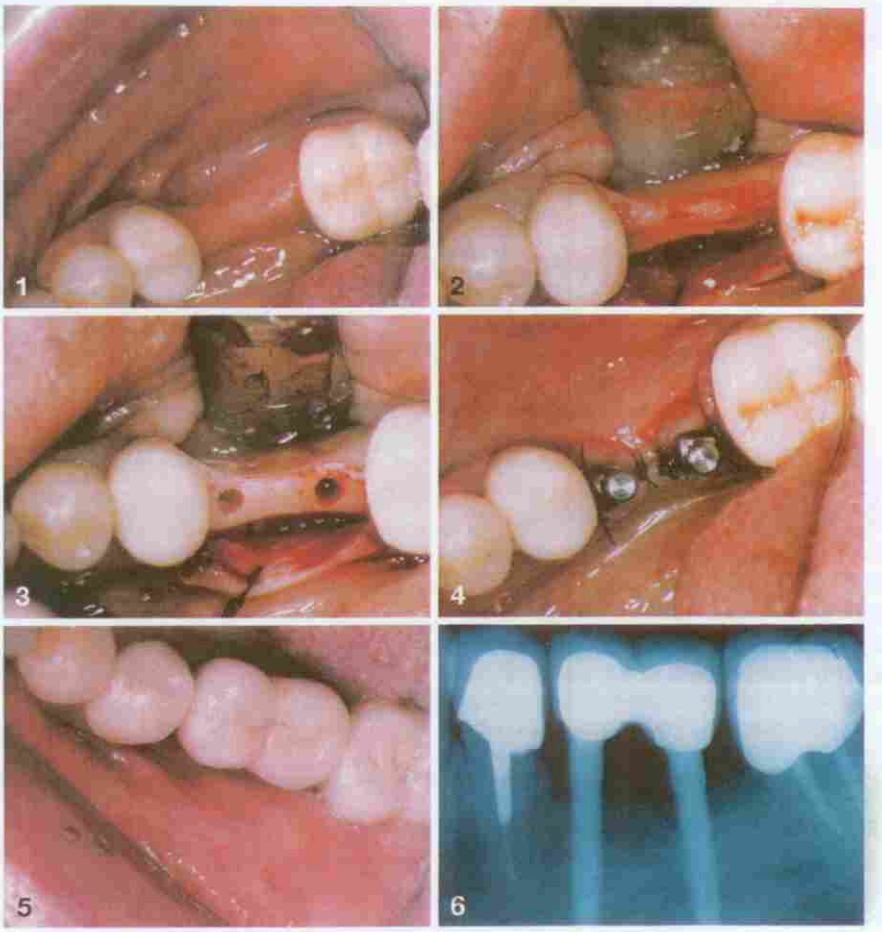

Fig. 1. A 65-year-old woman presented with missing mandibular left first molar.
Fig. 2. Ridge exposure revealing 3.5 mm of width.
Fig. 3. Two osteotomies for 2.4-mm fixtures.
Fig. 4. After suturing.
Fig. 5. Final porcelain-fused-to-metal restoration (occlusal view).
Fig. 6. Periapical radiograph 5 years postoperatively.

Patient No. 2

A 22-year-old woman presented with a congenitally missing maxillary left lateral incisor with an interdental space of 4 mm (Fig. 7). Because the patient refused orthodontic tooth movement to open an adequate interdental space for a conventional fixture, it was decided to use a narrow-diameter implant.

After local anesthesia, a full-thickness mucoperiosteal flap was elevated reflecting the alveolar ridge. The osteotomy was prepared with a 2.0-mm drill (Fig. 8). A Hi-Tec 2.4-mm mini-implant, 13 mm in length, was inserted (Fig. 9). The flap was sutured with primary intention. Healing was uneventful and a periapical radiograph showed perfect alignment of the mini-implant with regard to the adjacent teeth. The implant was immediately loaded with a temporary acrylic crown followed by a PFM crown at 6 weeks. Clinical and radiographic follow up 3 years postoperatively showed success in achieving aesthetics, function (Fig. 10), and maintaining bony levels (Figs. 11 and 12).

Discussion

Reduction of the alveolar ridge, caused by bone resorption in the edentulous and partially edentulous maxilla, is a frequent problem[16–18] in oral implantology, especially in the maxilla. Augmentation of the resorbed parts of the residual ridges, particularly when autologous bone is used, can be successful.[19–21] However, clin-

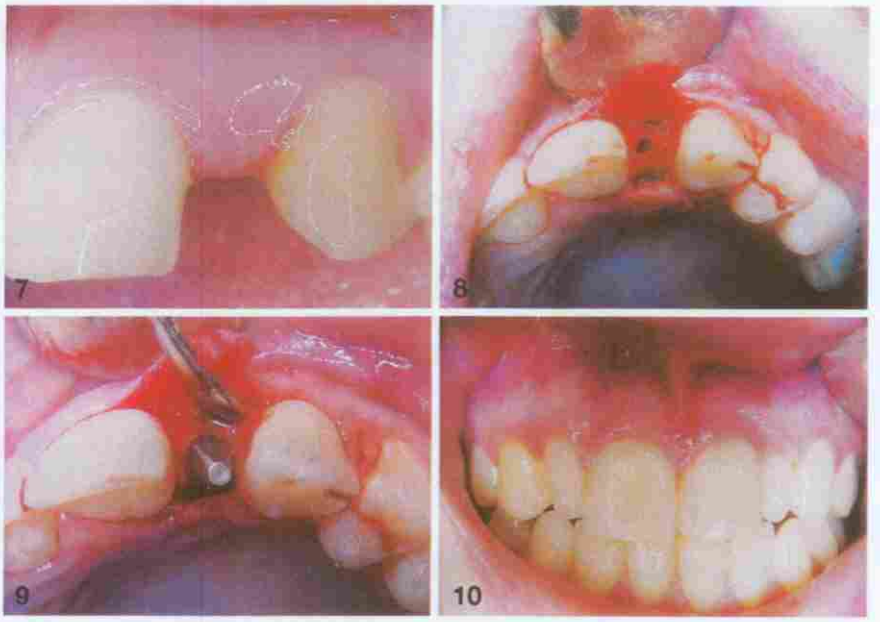

Fig. 7. A 22-year-old woman presented with congenitally missing maxillary left lateral incisor with interdental space of 4 mm.
Fig. 8. Flap reflection and osteotomy preparation.
Fig. 9. Implant insertion (palatal and buccal sides).
Fig. 10. Clinical view 3 years postoperatively.

ically this can be a complicated way of solving the problem. Bone augmentation procedures such as bone-splitting and bone-widening techniques,[22,23] combined with guided tissue regeneration, onlay bone blocks, or particulate bone grafts, have been used to restore the deficient ridge. In nearly all of these surgical reconstructive procedures, implant placement usually follows at a later stage.

The problem of ridge deficiency and interdental space can be solved with the use of narrow-diameter implants. Placement of mini-implants (1.8–2.4 mm in diameter) that are retrieved is a well-established procedure used to support fixed or removable prostheses.[24–30] Mini-implants provide immediate fixed provisional prosthesis, avoid premature implant loading, and protect augmented sites. In most patients, the transitional implants were retrieved at the time of implant uncovering, unlike the present clinical study in which implants were loaded immediately, maintaining function up to 5 years.

This clinical study used mini-implants to reconstruct single missing teeth in narrow anterior and posterior ridges and narrow interdental spaces, are loaded immediately, then followed for 5 years.

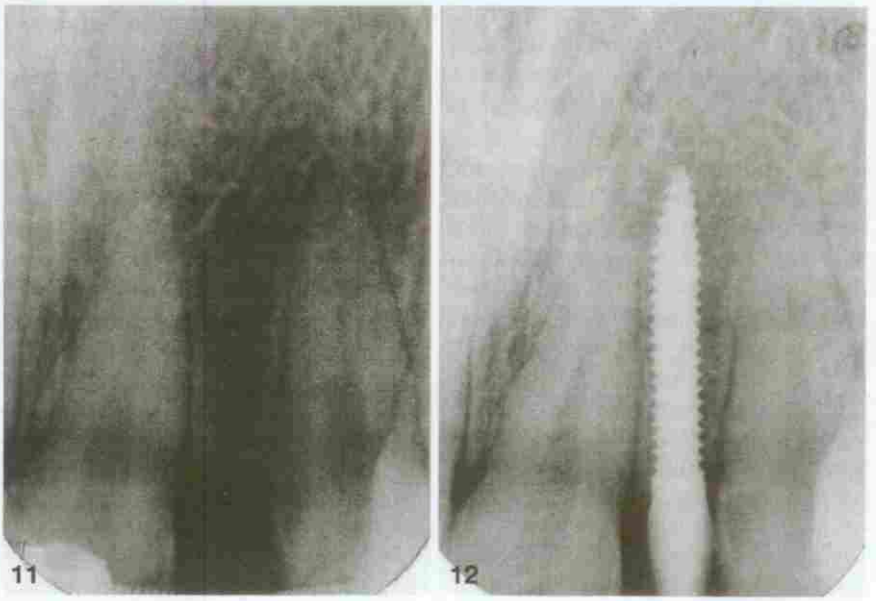

Fig. 11. Preoperative apical radiograph.
Fig. 12. Postoperative periapical radiograph.

Conclusion

Within the limits of this pilot study, the proposed treatment modality of mini-implants may serve as a useful option to rehabilitate a single tooth in both deficient ridges and in narrow interdental spaces. Future studies should be conducted to evaluate the long-term survival of these implants.

Disclosure

Dr. Roy Leshem claims to have a financial interest in HiTec Implants, whose product, titanium screw implant 2.4 mm, is mentioned in this article. All other authors claim to have no financial interest in any company or any of the products mentioned in this article.

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Reprint requests and correspondence to:
Ziv Mazor, DMD
#5 Atarot Street
Ra'anana, 42567 Israel
Phone: +972-9-771 9862
Fax: +972-9-+774 9863
E-mail: zmazor@netvision.net.il