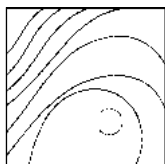


## Immediate Implant Placement and Restoration in Infected Sites



Alan M. Meltzer, DMD, MScD\*

*The long-standing assumption that active infection is a contraindication for immediate implant placement has been challenged recently. High implant survival rates have been reported even when implants were placed immediately in infected extraction sockets and provisionalized within 36 hours. To further evaluate the impact of nonocclusal loading on implants placed in cleaned periodontally or endodontically infected extraction sites, this retrospective study examined the results of 77 implants placed in 63 patients and followed for between 3 and 24 months. Initial primary stability was achieved for all implants, and reverse torque testing at 3 and 4 months postoperatively showed 76 of 77 implants (98.7%) to be successfully osseointegrated. (Int J Periodontics Restorative Dent 2012;32:e169–e173.)*

\*Clinical Professor, Department of Periodontics and Perio-Prosthesis, School of Dental Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.

Correspondence to: Dr Alan M. Meltzer, Staffordshire Professional Center, 1307 White Horse Road, Bldg. B, Suite 100, Voorhees, NJ 08043; fax: (856) 772-2325; email: ameltzerdmd@comcast.net.

Micromotion of the implant along the bone-implant interface has been shown to have tolerance limits. Micromotion in the range of 50 to 150  $\mu\text{m}$  or less does not interfere with osseointegration, but micromotion greater than 200  $\mu\text{m}$  appears to disrupt the osseointegration process.<sup>1</sup> It is essential to achieve adequate primary (mechanical) stability until sufficient biologic stability (secondary stability) has been established.<sup>2,3</sup>

When implants have been placed in fresh extraction sockets and sufficient primary stability has been achieved, the results are comparable to those obtained with a delayed approach.<sup>4,5</sup> Placement of implants in fresh extraction sites where periodontal or endodontic infection has been present is controversial and reported as a contraindication for immediate implant placement.<sup>6–9</sup> Implant infection and failure have been linked to periodontal or periradicular infections in some clinical reports.<sup>10</sup>

Preclinical experiments induced in animals followed by extraction of the affected teeth and

placement of dental implants have resulted in successful osseointegration.<sup>11,12</sup> A recent randomized prospective study in which implants were placed immediately in infected extraction sockets and allowed to heal unloaded reported a survival rate of 92% after 6 months.<sup>13</sup> Other studies demonstrated similar results.<sup>14-16</sup>

The present retrospective study was undertaken to further evaluate the outcome of placing dental implants in periodontally or endodontically infected extraction sites followed by immediate provisionalization using a nonocclusal loading protocol.

## Method and materials

This study included patients who presented with active periodontal or endodontic lesions. Hopeless teeth were treated, followed by placement and immediate provisionalization of one or two implants. No implants were placed in infected immediate extraction sites and immediately provisionalized if such placement would have excessively disrupted the buccal and palatal plates and potentially led to a compromised esthetic outcome; the host bone was inadequate either apically or laterally to allow for the establishment of primary stability; or the patient had uncontrolled diabetes, a bleeding disorder, compromised immunity, or was receiving chemotherapy, radiation to the head or neck, or intravenous bisphosphonates. Smokers were not excluded.

All patients were treated with the same protocol. Once the teeth were deemed hopeless, preoperative impressions were taken to construct a provisional shell crown or crowns. The patient was provided prescriptions for postoperative pain management and 500 mg amoxicillin to be taken starting at least 48 hours before surgery and continued for a total of 8 days.

All surgeries were conducted with lidocaine (1:100,000) using either a flapless technique or a mini-flap. The teeth were extracted, and each site was curetted meticulously using hand instruments and flushed with 3 mL of 0.12% chlorhexidine gluconate followed by saline. Preparation of the osteotomy site(s) was performed following the manufacturer's protocol for NanoTite Prevail Tapered Implants (Biomet 3i). Twenty-one implants were placed in the maxillary incisor region, 14 in the mandibular incisor region, 9 in the maxillary canine position, 31 in the posterior maxilla, and 2 in the posterior mandible. Implant stability was measured using an Osstell ISQ instrument (Osstell), and the final insertion torque was measured using a custom hand ratchet.

Residual peri-implant gaps were filled with mineralized xenograft. If the gap exceeded 2 mm or it was deemed to be esthetically necessary, a cross-linked collagen membrane was used as a guided bone regeneration barrier.

A cement- or screw-retained provisional restoration was immediately attached to the implant(s) and adjusted to eliminate any oc-

clusal loading. A postoperative radiograph was taken. The patient was instructed to eat a soft diet for 6 weeks or to masticate on the opposite side and to rinse twice daily with 0.12% chlorhexidine gluconate.

Initial postoperative follow-up occurred at 7 to 14 days. Patients then returned every 2 weeks, on average, for the first 8 weeks. Radiographs were taken on the day of implant placement, 8 to 12 weeks later, and at the time of definitive restoration delivery.

Postoperative implant maintenance was performed between 3 and 4 months. This included removal of the provisional restoration and cleaning of the sulcus with 0.12% chlorhexidine gluconate using a cotton-tipped applicator. The crown and abutment were also cleaned using the chlorhexidine solution and a mildly abrasive brush to remove plaque, debris, and biofilm. The implant was reverse torque-tested using a hand ratchet to determine if osseointegration had occurred. If so, the provisional restoration was reinserted. An implant-level impression was taken, and construction of either a definitive restoration or long-term provisional restoration in occlusion was started.

## Results

A total of 77 implants were placed in 63 patients (24 males, 39 females). Forty-nine patients received 1 implant and 14 patients received 2 implants. All 2-implant placements were splinted constructions.



**Fig 1a** Endodontic failure with a recurrent periapical abscess and associated root fracture was diagnosed at the maxillary right second premolar site.



**Fig 1b** Definitive restoration in place 4.5 months after implant placement.

The mean implant stability quotient at the time of placement was 80.71 (range, 72 to 85). Final insertion torque readings ranged from 90 to 110 (mean, 98.71). At the time of the maintenance appointment, the reverse torque testing showed 76 of 77 implants to be osseointegrated (98.7%). After a follow-up period ranging from 3 to 24 months, all 76 osseointegrated implants had survived.

## Discussion

The advantages of immediate placement include reduced treatment time, fewer treatment visits, simplification of the restorative process, and improvement of the patient's psychologic outlook regarding treatment.<sup>17</sup> However, because of the potential for implant contamina-

tion during the initial healing period, immediate placement and loading of implants placed in infected sites has frequently been considered to be contraindicated.

The placement of implants into extraction sockets is routine. This is influenced by contemporary knowledge of morphologic site changes after extraction.<sup>4,18,19</sup> These dimensional changes impact both the hard and soft tissues. There is evidence of horizontal loss of up to 50% in mandibular molar regions, with 60% of that occurring in the first 3 months.<sup>20</sup> Other investigators have demonstrated significant loss taking place between 4 and 12 months after extraction.<sup>21,22</sup>

The results of this retrospective analysis corroborate previous findings regarding immediate placement and provisionalization of implants placed in sites with pre-

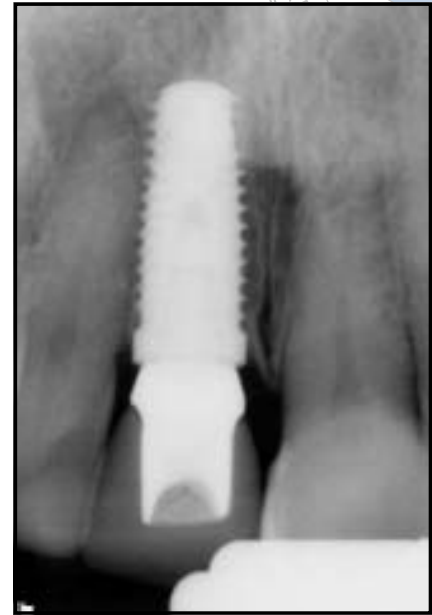
treatment infections.<sup>16</sup> The protocol for both studies required achievement of primary stability in conjunction with thorough and meticulous debridement of the infection site. It should be noted that full-arch restorations were intentionally excluded from this retrospective study because the extensive splinting associated with full-arch restorations provides a great mechanical advantage over the mechanical stability process in a one- or two-implant restoration.

Figures 1 and 2 demonstrate the treatment of two patients using the protocol employed in this study. The first patient presented complaining of soreness while eating. After diagnosing endodontic failure with recurrent periapical abscess and associated root fracture of the maxillary right second premolar (Fig 1a), the tooth was extracted



**Fig 2a** (left) *External root resorption with caries and recurrent periapical pathology was diagnosed at the maxillary right central incisor site.*

**Fig 2b** (right) *Definitive restoration in place 9.5 months after implant placement.*



and a 5/4 NANO Prevail Tapered Implant was immediately placed and nonocclusally loaded with a PreFormance Temporary Cylinder (Biomet 3i) and screw-retained provisional restoration. Four and a half months later, a custom abutment and definitive porcelain crown were delivered (Fig 1b). The second patient presented with soreness and pain around the maxillary right central incisor site upon mastication. External root resorption with caries and recurrent periapical pathology was diagnosed (Fig 2a). The tooth was extracted, and a 4/15 × 13-mm NANO Prevail Implant was placed immediately. The void spaces on the

facial aspect of the residual socket were filled with Bio-Oss collagen material (Geistlich). The implant was nonocclusally loaded immediately with a screw-retained PreFormance Temporary Cylinder and provisional prosthesis. Figure 2b is a radiograph of the definitive restoration taken 9.5 months after implant placement.

### Conclusion

The results of this retrospective study confirm that primary stability and subsequent osseointegration can be achieved when implants are

placed immediately into periodontally or endodontically infected extraction sites that have been disinfected and thoroughly debrided in conjunction with an oral antibiotic regimen and then nonocclusally loaded. After up to 2 years of follow-up, the overall implant survival rate was 98.7%.

### Acknowledgment

The prosthodontic reconstruction was done by Dr Richard Cavanaugh, Doylestown, Pennsylvania.

## References

1. Szmukler-Moncler S, Salama H, Reingewirtz Y, Dubruille JH. Timing of loading and effect of micromotion on bone-dental implant interface: Review of experimental literature. *J Biomed Mater Res* 1998; 43:192–203.
2. Meltzer AM. Primary stability and initial bone-to-implant contact: The effects on immediate placement and restoration of dental implants. *J Impl Reconstruct Dent* 2009;1:35–41.
3. Salama H, Rose LF, Salama M, Betts NJ. Immediate loading of bilaterally splinted titanium root-form implants in fixed prosthodontics—A technique reexamined: Two case reports. *Int J Periodontics Restorative Dent* 1995;15:344–361.
4. Chen ST, Wilson TG Jr, Hämmerle CH. Immediate or early placement of implants following tooth extraction: Review of biologic basis, clinical procedures, and outcomes. *Int J Oral Maxillofac Implants* 2004;19(suppl):12–25.
5. Lazzara RJ. Immediate implant placement into extraction sites: Surgical and restorative advantages. *Int J Periodontics Restorative Dent* 1989;9:332–343.
6. Schwartz-Arad D, Chaushu G. The ways and whereof of immediate placement of implants into fresh extraction sites: A literature review. *J Periodontol* 1997; 68:915–923.
7. Werbitt MJ, Goldberg PV. The immediate implant: Bone preservation and bone regeneration. *Int J Periodontics Restorative Dent* 1992;12:206–217.
8. De Bruyn H, Collaert B. Early loading of machined-surface Brånemark implants in completely edentulous mandibles: Healed bone versus fresh extraction sites. *Clin Implant Dent Relat Res* 2002;4: 136–142.
9. Lekholm U. Immediate/early loading of oral implants in compromised patients. *Periodontol* 2000 2003;33:194–203.
10. Ayangco L, Sheridan PJ. Development and treatment of retrograde peri-implantitis involving a site with a history of failed endodontic and apicoectomy procedures: A series of reports. *Int J Oral Maxillofac Implants* 2001;16:412–417.
11. Novaes AB Jr, Marcaccini AM, Souza SL, Taba M Jr, Grisi MF. Immediate placement of implants into periodontally infected sites in dogs: A histomorphometric study of bone-implant contact. *Int J Oral Maxillofac Implants* 2003;18:391–398.
12. Chang SW, Shin SY, Hong JR, et al. Immediate implant placement into infected and noninfected extraction sockets: A pilot study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;107:197–203.
13. Lindeboom JAH, Tjook Y, Kroon FHM. Immediate placement of implants in periapical infected sites: A prospective randomized study in 50 patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;101:705–710.
14. Casap N, Zeltser C, Wexler A, Tarazi E, Zeltser R. Immediate placement of dental implants into debrided infected den-toalveolar sockets. *J Oral Maxillofac Surg* 2007;65:384–392.
15. Siegenthaler DW, Jung RE, Holderegger C, Roos M, Hämmerle CH. Replacement of teeth exhibiting periapical pathology by immediate implants: A prospective, controlled clinical trial. *Clin Oral Implants Res* 2007;18:727–737.
16. Villa R, Rangert B. Immediate and early function of implants placed in extraction sockets of maxillary infected teeth: A pilot study. *J Prosthet Dent* 2007;97(suppl):S96–S108.
17. Watzek G, Haider R, Mensdorff-Pouilly N, Haas R. Immediate and delayed implantation for complete restoration of the jaw following extraction of all residual teeth: A retrospective study comparing different types of serial immediate implantation. *Int J Oral Maxillofac Implants* 1995; 10:561–567.
18. Fiorellini JP, Howell TH, Cochran D, et al. Randomized study evaluating recombinant human bone morphogenetic protein-2 for extraction socket augmentation. *J Periodontol* 2005;76:605–613.
19. Nevins M, Camelo M, De Paoli S, et al. A study of the fate of the buccal wall of extraction sockets of teeth with prominent roots. *Int J Periodontics Restorative Dent* 2006;26:19–29.
20. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: A clinical and radiographic 12-month prospective study. *Int J Periodontics Restorative Dent* 2003;23: 313–323.
21. Johnson K. A study of the dimensional changes occurring in the maxilla following tooth extraction. *Aust Dent J* 1969; 14:241–244.
22. Lekovic V, Kenney EB, Weinlaender M, et al. A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. *J Periodontol* 1997;68:563–570.