Immediate Implant Placement in Fresh Mandibular Molar Extraction Socket: 8-Year Results. A Case Report

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Recently, successful implant placement in fresh extraction sockets has been reported. In this case report, we present the results of an immediate implant placement in a fresh extraction socket of a mandibular molar with simultaneous bone regeneration using a nonresorbable membrane and no other graft materials. Clinical and radiographic findings acquired 8 years after implant placement demonstrated a stable peri-implant situation and confirmed a satisfactory treatment result.

Key Words: dental implants, immediate placement, ridge preservation, socket preservation, hemisection, root resection, chronic periodontitis

INTRODUCTION

Recent reports have demonstrated the successful placement of dental implants into fresh extraction sockets in the anterior as well as in the molar region.\(^1\)\(^-\)\(^4\)

The implant diameter is often smaller than the diameter of the root of the extracted tooth, which may lead to a gap between the implant and the extraction socket wall. In cases where the distance between the implant and the extraction socket is less than 2 mm, spontaneous bone healing can be expected without the necessity for additional grafting procedures.\(^5\)\(^-\)\(^7\)

However, if the distance is larger than 2 mm, then grafting procedures are necessary. Although limited data are available on the different protocols used for grafting in these cases, the grafting of extraction sockets is a well-established treatment modality.\(^6\)

In previous studies, nonresorbable expanded polytetrafluoroethylene (ePTFE) membranes were shown to promote bone regeneration in extraction sockets.\(^8\)\(^,9\) One drawback of ePTFE membranes is their high surface roughness, which facilitates bacterial adhesion. Furthermore, these membranes require primary closure to avoid premature degradation, which often is not easily achievable when extraction sites are covered. High-density polytetrafluoroethylene (dPTFE) membranes are another type of membrane that has been suggested for use in these cases. The key advantage of these membranes is that their surfaces are impenetrable to bacteria, which means that they can be left exposed during the healing period.

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In the anterior region, an implant can be placed immediately within the confines of the residual extraction socket. In the molar region, however, implant placement in the root socket can lead to a nonideal restorative position. This may result in mechanical overload of the implant. Furthermore, the resulting shape of the restoration may render oral hygiene more difficult, which enhances the risk for peri-implantitis. To avoid these potential problems, studies have suggested placing the implant into the interradicular bone and augmenting the remaining socket with graft material and a membrane.

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Herein, a case is described in which a single implant is placed in the interradicular bone of a mandibular molar extraction socket. The remaining socket was grafted using a nonresorbable dPTFE membrane without additional graft material. The patient was observed for a period of 8 years.

**CASE REPORT**

The patient (40-year-old, male, nonsmoker) visited the private periodontal office of one of the authors (G.G.Z, Duesseldorf, Germany) in January 2001. Chronic periodontitis was diagnosed, and the patient was treated with scaling and root planing (SRP). Tooth #30 had a vertical fracture and therefore was scheduled for extraction (Figure 1A). No pain or fistula formation was noted.

The following treatment modalities were discussed with the patient. The first option involved the hemisection of tooth #30 with extraction of the distal root and tooth segment, followed by augmentation of the

**FIGURE 1.** First examination. (A) Fracture of the distal root of tooth #30. (B) Socket area prepared for implant placement. (C, D) Implant placement. (E) The membrane was pierced at the implant shoulder, and the closure screw was used to fixate the membrane.
distal socket. Following these procedures, a metal-ceramic bridge would be fabricated using tooth #29 and the mesial segment of tooth #30 as abutments. The possible risks and limitations of this treatment modality were published recently. The second option involved extraction of tooth #30 and augmentation of the socket, followed by a delayed implant placement, performed as described previously. The third option involved extraction of tooth #30 and fabrication of a metal-ceramic bridge using tooth #29 and the mesial segment of tooth #30 as abutments. The fourth option was immediate implant placement. The patient agreed to the option of having an immediate implant placement; however, he refused the use of any alloplasts, xenographs, and/or allografts. The patient was informed about the treatment procedures; at least 1 week elapsed after the information was provided and before the informed consent form was signed.

The patient fulfilled the following required criteria before undergoing treatment: (1) the patient had no contraindications to treatment, such as systemic diseases (eg, diabetes), and he was not consuming any prescription medications or recreational drugs; (2) the buccal and lingual plate of the extraction socket was present; (3) the teeth adjacent to the extraction socket were free of overhanging or insufficient restoration margins; (4) the patient did not use nicotine; and (5) the interradicular septum was wide and intact following the tooth extraction.

The socket augmentation was performed as described previously. Briefly, an intrasulcular incision extending to the adjacent teeth was made, and a full-thickness flap was elevated. No vertical releasing incisions were made. Tooth #30 was hemisected, and the 2 roots were removed carefully to preserve all remaining interradicular bone. The socket was curetted carefully and irrigated with sterile saline solution (Figure 1B). The dimensions of the sockets were measured with a periodontal probe (UNC 15, Hu-Friedy, Leimen, Germany) during surgery after tooth extraction, elevation of the flap, and removal of the remaining soft tissue. The mesiodistal distance was 14 mm, the buccolingual distance was 9 mm, and the depth in the mesial area was 8 mm. The coronal width of the interradicular bone was 3 mm, and the width was 3.5 mm at the base of the socket. A dental implant (wide neck [WN], 4.8 mm, length 12 mm, with a 2.8-mm polished neck, sand-blasted, large grit, acid-etched [SLA], Straumann, Waldenburg, Switzerland) was placed into the interradicular bone (Figure 1C and D). To prepare the implant bed, a punch-mark was made approximately 1.5 mm mesial of the interradicular bone median using an externally irrigated 2.3-mm-round bur. This was followed by deep drilling along the implant axial line to allow the implant to have adequate bone contact at the distal site. The implant was placed 3 mm into the solid mandibular bone apical to the extraction site. After placement of the implant, a primary stability was achieved. The socket was covered with a nonresorbable dPTFE membrane (Cytoplast, Regentex GBR-200, Oraltronics, Bremen, Germany). The membrane was trimmed, and it vertically covered at least 50% of the buccal and lingual bone plate of the extraction socket (Figure 2). The dPTFE membrane was applied alone without the use of any soft or hard tissue grafts, and no additional steps were taken to secure the membrane in place. The membrane covering the implant site was pierced with a scalpel at the implant shoulder, and a closure screw (Straumann) was used to fixate the membrane. The flap was repositioned and was sutured into place with interrupted sutures (Ethibond, Excel 3-0, Johnson & Johnson, St-Stevens-Woluwe, Belgium), and the membrane was left partially exposed (Figure 1E).
The patient was administered an analgesic (100 mg diclofenac, once daily for 4 days) and a systemic antibiotic (600 mg clindamycin, once daily for 6 days, Ratiopharm, Ulm/Donautal, Germany); furthermore, he was advised to rinse with a 0.1% chlorhexidine digluconate solution (Chlorhexamed Fluid, GlaxoSmithKline, Buehl, Germany) twice daily for 5 weeks. The patient was instructed to begin taking the medication 1 day before surgery.

After surgery had been performed, the sutures were left for 1 week. The membrane was left partially exposed (Figure 3A) and was removed 4 weeks after surgery. At that time, a healing cap (Straumann) was placed over the implant (Figure 2B and C). Eight months after surgery, the implant was loaded with a single, metal-fused ceramic crown (Figure 3D and F).

Postoperative follow-up visits were made every week during the first 5 weeks after surgery. Then the patient was enrolled in a maintenance program consisting of semi-annual follow-up appointments. During the follow-up visits, oral hygiene instructions were given and the teeth were cleaned and polished. The follow-up visit that occurred 3 months after placement of the fixed partial denture (FPD) was considered the baseline examination (BSL).

At the BSL, and at the 1-, 2-, 3-, 5-, and 8-year examinations after loading, the implant and all natural teeth present were examined at 4 sites per tooth. These examinations measured bleeding on probing (BOP), plaque index (PI), probing attachment level (PAL) for implant #30, and clinical attachment level (CAL). The PAL was estimated using a periodontal probe (UNC 15, Hu-Friedy) and was defined as the distance in millimeters between the deepest point of the peri-implant pocket and the smooth neck section of the implant. CAL measurements were defined as the distance between the deepest point of the periodontal pocket and the cementoenamel junction (CEJ). On teeth with restorations, the restoration margin was used as the reference. All measure-
ments were rounded up to the nearest millimeter.

**RESULTS**

In the present study, a dental implant was placed immediately following extraction of a mandibular molar, and the implant was observed over a time span of 8 years. During this period, the implant remained in function.

The patient reported any unusual pain or discomfort, abscess, swelling, or allergic reactions during the course of treatment. Although the membrane was left partially exposed after surgery, no signs of acute inflammation or exudates and/or pain were detected (Figure 1E). Plaque accumulation was observed on exposed surfaces of the membrane (Figure 3A). After membrane retrieval, nonepithelialized soft tissue was found in the area previously covered by the membrane. This tissue completely reepithelialized clinically within 4 weeks after membrane removal (Figure 3B and C). Radiologically, bone regeneration could be visualized 8 months after surgery (Figure 2D). Clinically, the entire keratinized gingiva was preserved (Figure 3E and F). Eight years after surgery, a shallow bone defect was observable on the X ray (Figure 4).

Because of the small number of measurements taken, a statistical analysis could not be performed. However, no changes were observed in BOP and PI measurements taken between the BSL and subsequent examinations. The range in measurements made at the natural teeth and at the placed implant was 4%-6% for both parameters (n = 20). One site at implant #30 had a positive BOP measurement. At the BSL, the mean PAL was 0.3 mm. During the observation period, the PAL of implant #30 showed a deterioration of 1.5 mm (Figure 4). The PAL had deteriorated by 1 mm at the 1-year examination and had deteriorated an additional 0.5 mm at the 3-year examination. No additional changes in PAL were noted between the 3-year and 8-year examinations. CAL was measured at 4 sites per tooth using the periodontal probe described above. The natural teeth (n = 19) treated by SRP were clinically stable during the entire observation period. The mean CAL at BSL was 6.5 mm, and the range was 5.8–6 mm between the 1-year and 8-year examinations.

**DISCUSSION**

Implant placements in fresh extraction sockets with or without the use of covering membranes and/or graft materials have been reported in a several recent publications. Although this protocol can be implemented successfully for single-rooted teeth, as long as certain preliminary requirements are fulfilled, little is known about the use of this approach for multirooted teeth. It has been suggested that the implant should be placed into a minimum of 3 mm of solid bone apical to the extraction site.14–16

A main factor determining the success of immediate placement is the initial stability of the implant. The extraction site must be evaluated to see whether it is suitable for immediate implant placement. Furthermore, during surgery, any doubts will dictate secondary implant placement after the extraction site has healed. Micromovements...
between the implant and the surrounding bone should be avoided to allow successful healing to occur. In the present case report, the interradicular septum of the mandibular molar extraction socket and part of the mesial socket were used to anchor the implant. Furthermore, the implant was inserted 3 mm apical to the socket. The positive outcome of the treatment may have been due to the insertion of the implant 3 mm into the mandibular bone and to the adequate implant-bone contact that occurred in the interradicular septum area. Therefore, sufficient height and width of the interradicular septum should be considered serious selection criteria for this treatment modality. Further selection criteria include the following: (1) absence of clinical signs of acute periodontal or endodontic abscess formation, (2) establishment of healthy periodontal conditions before surgery and instructing the patient in oral hygiene, (3) management of postoperative maintenance, and (4) patient compliance.

The observation of a crestal gap between the implant shoulder and the socket wall is a common finding, and in such cases augmentation procedures are indicated. Certainly, the use of grafts is an established procedure; however, direct ongrowth of the autologous bone to the implant surface is the goal of regenerative surgery. Adequate bone formation in the remaining socket was achieved by using a membrane without additional graft material. Although the feasibility of bone regeneration in extraction sockets achieved by solely using dPTFE membranes was demonstrated previously, this is the first report, to the authors’ knowledge, that successfully used this approach in conjunction with immediate implant placement.

The long-term stability of immediate implant placement in the molar region has been demonstrated previously; however, the existing data are not sufficient for determination of treatment guidelines. Existing studies on immediate placement in single-rooted extraction sockets indicate that it is crucial to have a sufficient amount of bone for immediate stability. These findings suggest that in cases of immediate implant placement in the molar regions, a sufficient interradicular bone width should be present. The necessity of grafting seems to depend on the distance between the implant surface and the extraction socket wall. The relationships and differences between grafting and loading protocols must be determined in future studies.

Existing data suggest that atraumatic tooth extraction is necessary to preserve the maximum existing bone. A previous study showed that covering an extraction socket in the mandibular molar area with a dPTFE membrane led to predictable bone regeneration; regeneration also was reported in cases of vertical defects of the buccal wall. However, no studies have described the feasibility of immediate implant placement and extraction socket augmentation using only a covering membrane without grafting material in the absence of an intact buccal wall.

In the presented case report, the long-term success of an implant immediately placed in the extraction socket of a molar is demonstrated. Additional studies with a larger sample size are necessary to confirm these findings.
ABBREVIATIONS

BOP: bleeding on probing
BSL: baseline examination
CAL: clinical attachment level
CEJ: cementoenamel junction
dPTFE: high-density polytetrafluoroethylene
ePTFE: expanded polytetrafluoroethylene
FPD: fixed partial denture
PAL: probing attachment level
PI: plaque index
SLA: sandblasted, large grit, acid-etched
SRP: scaling and root planning
WN: wide neck

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