

Management of d-PTFE Membrane Exposure for Having Final Clinical Success

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INTRODUCTION

Reconstruction of alveolar bone atrophy by means of nonresorbable membrane is a well-known technique. Expanded polytetrafluoroethylene membrane (e-PTFE) classically required perfect soft tissue closure to prevent wound dehiscence. The consequence of membrane exposure ranges from a minor problem necessitating membrane removal to a major problem including treatment failure and implant loss.¹⁻⁴ In the last few years, e-PTFE membrane has been discontinued from the dental market. An alternative to this barrier is the high-density polytetrafluoroethylene (d-PTFE) membrane. It is a nonresorbable device made of a high-density PTFE with submicron (<0.3 μm) porosity size that has been originally tested in postextraction sockets without primary soft tissue closure.⁵⁻⁷ Thanks to its structure, the d-PTFE barrier seems to have more resistance to bacterial penetration, protecting the regenerating bone or implant. Some authors^{5,6} have claimed the possibility that this membrane may remain exposed to the oral cavity with reduced risk of possible complications, such as bacterial contamination, infection, and loss of the graft.

This article describes the case of a d-PTFE membrane exposure and its management.

DESCRIPTION OF THE CASE

A 63-year-old female patient presented for treatment of a left maxillary premolar. After clinical and radiographic examination, a longitudinal fracture of tooth 2.4 was detected. The initial treatment option consisted in tooth removal and delayed implant insertion with a ridge augmentation procedure.

After the tooth extraction and an uneventful healing of 2 months, the site was re-evaluated. Radiographic analysis showed a 3-dimensional alveolar bone atrophy that required

a nonresorbable membrane application for bone regeneration. Thus, a dense polytetrafluoroethylene (d-PTFE) device was selected to handle this bone defect.

Amoxicillin and clavulanic acid (1000 mg bid), ibuprofen (600 mg bid) and chlorhexidine digluconate (0.2 % mouth rinse) were prescribed.⁸⁻¹⁰

After injection of local anesthesia, a mid-crestal incision in the keratinized mucosa was extended to the gingival sulcus of 2 adjacent teeth both mesially and distally. A full thickness flap was elevated to reach the bone defect. The implant site was prepared with calibrated surgical burs and a 3.4 mm diameter x 11 mm length implant (Xive S, Dentsply, Mannheim, Germany) was positioned with a recorded stability over 30Ncm. The bone augmentation procedure was performed by combining a titanium-reinforced d-PTFE (Cytoplast, Osteogenics Biomedical, Lubbock, Texas) with deproteinized bovine bone graft (Bio-Oss, Geistlich, Wolhusen, Switzerland). Then, four pins were placed to fix the membrane over the graft. Periosteal releasing incisions were done at the level of the buccal flap to ensure proper passivation prior to suture. The suturing technique consisted of horizontal internal mattress and single suture.

Postoperative instructions were given: cold pack, soft food diet, no hot drinks or food, no demanding physical work or exercise, and no prosthesis on treated area. Sutures were removed 14 days after surgery (Figures 1 through 8).

At the time of suture removal, wound dehiscence was noticed. A membrane exposure larger than 3 mm without any sign of infection was recorded. The membrane was left in place for additional 2 weeks to ensure bone regeneration.

Four weeks after the regenerative procedure, a full thickness flap was elevated to remove the d-PTFE membrane and the fixation pins. The underlying bone graft was clinically healthy without any sign of infection and thus was left in place so as not to alter the regeneration process. A connective tissue graft was harvested from the palate and placed on the top of bone graft area to obtain wound closure.

Abutment connection was carried out 7 months after the first surgery.

After 3 weeks, a polyether impression was made to manufacture a screw-retained provisional restoration. After an additional 2 months, a definitive full ceramic restoration (IPS e.max CAD LT, Ivoclar, Schaan, Principality of Liechtenstein) was cemented on a cad/cam zirconia abutment (Atlantis, Dentsply).

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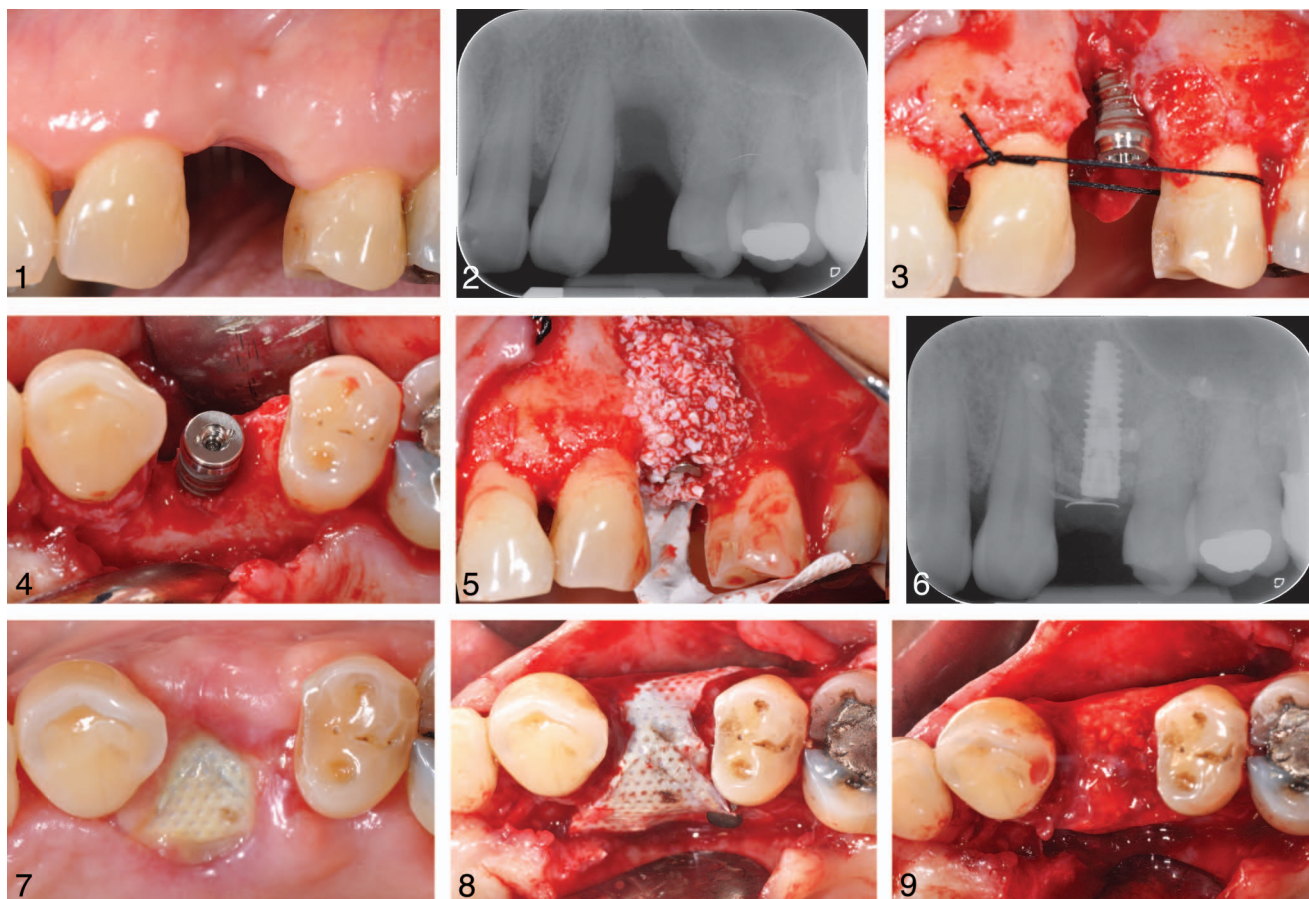
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FIGURES 1–9. **FIGURE 1.** Clinical lateral view of the bone defect 2 months after tooth extraction. **FIGURE 2.** X ray of the bone defect. **FIGURE 3.** Buccal view of the implant position. **FIGURE 4.** Occlusal view of the implant position. **FIGURE 5.** A deproteinized bovine bone graft combined with a titanium reinforced high-density polytetrafluoroethylene was used to handle the bone defect. **FIGURE 6.** X ray after the regenerative procedure. **FIGURE 7.** Membrane exposure at 3 weeks follow-up postop. **FIGURE 8.** Preoperative picture before membrane removal. **FIGURE 9.** The bone graft under the membrane appeared clinically healthy; occlusal view.

A clinical and radiographic follow up was made 12 months after the placement of the definitive crown (Figures 9 through 15).

DISCUSSION

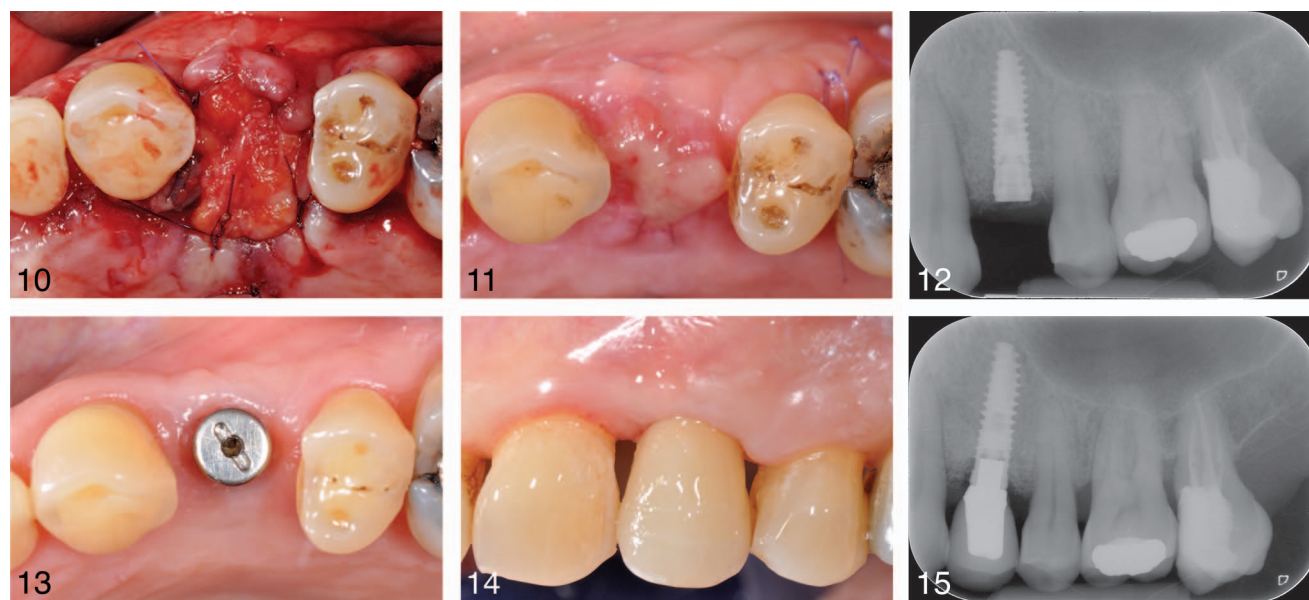
Today, guided bone regeneration by using of nonresorbable PTFE membrane is a predictable procedure for the reconstruction of the atrophic jaw ridges. However, it is not lacking difficulties. Complications may vary from dehiscence with limited consequence to an abscess with the consequent treatment failure. Membrane exposure is considered the most common drawback. In the early 1990s, Buser² experienced 41% of wound dehiscence in horizontal-guided bone regeneration. From this pioneering study, a better knowledge of soft tissue and membrane handling has drastically reduced the possibility of exposure.^{8,11}

Incomplete wound closure and consequent barrier exposure is usually the consequence of a clinical mistake at one step of the surgical procedure, as reported in previous study.¹² In this case report, the leading factor may be related to insufficient flap release with consequent tension and damage

on the suture or to the flap during periosteal incision with subsequent soft tissue necrosis.

The management of a membrane exposure is still a controversial issue because most of the reported information is not evidence-based but rather derived from the clinical experience of the surgeon. Fontana et al¹² recently proposed a clinical classification of complications with e-PTFE membrane for an easier identification of the treatment procedure. In case of large membrane exposures (>3 mm) without purulent exudate, the authors suggest immediate membrane removal so as not to jeopardize the underlying bone graft. This clinical approach was appropriate with e-PTFE membrane since this barrier had a "labyrinth-like" structure with medium-high porosity. Once exposed to the oral environment, microorganisms could quickly invade the surface and pass through the membrane in 3 to 4 weeks, as reported by Simion.¹³

On the contrary, the d-PTFE barrier is made of two layers of high-density polytetrafluoroethylene with less than 0.2–0.3 μm porosity size. For this reason, d-PTFE has been tested in postextraction socket without primary soft tissue closure since the 1990s.^{5–7} Barber et al⁵ described the possibility to achieve bone regeneration around implants with d-PTFE membrane without primary soft tissue closure. At the time of tooth



FIGURES 10–15. **FIGURE 10.** A connective tissue graft was placed to cover the regenerating bone graft. **FIGURE 11.** Soft tissue healing after 2 weeks. **FIGURE 12.** X ray of the submerged healing. **FIGURE 13.** Healing abutment connection. **FIGURE 14.** Buccal view of the final restoration after 1 year. **FIGURE 15.** X ray after 1 year.

extraction, the implant was placed in association to a bone graft. A membrane was used to cover the bone graft and the surgical defect with minimal flap reflection. The barrier was removed 4 to 6 weeks after, and a well-regenerating bone was observed. The area was left to heal for additional 3 months before abutment connection.

It may be hypothesized that this device may offer more resistance to bacterial contamination and penetration. For this reason, in this clinical report, the device was left in place for 4 weeks to ensure proper space-making effect. Barber⁵ suggested removing the membrane within 6 weeks to avoid major risk of complications; however, in this case, the soft tissues around the exposed device were stable without any sign of infection and, thus, device removal was postponed to enhance bone quality. As of now, we do not have sufficient experience to define which is the “point of no return” in d-PTFE membrane removal.

The use of d-PTFE membrane has been recently claimed by several authors^{9,11} as a valid alternative to e-PTFE to rebuild large bony defect and atrophic maxillary and mandibular arches. Nevertheless, long-term clinical studies are needed to confirm this hypothesis.

ABBREVIATIONS

d-PTFE: high-density polytetrafluoroethylene
e-PTFE: expanded polytetrafluoroethylene

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