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Case Report

# Preservation of Peri-Implant Mucosa by the Use of Polypropylene Membrane After Dental Extraction: A Case Report

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## Abstract

After dental extraction, bone resorption of the alveolar walls and invagination of the gingival tissue are expected. Bone resorption is usually greater in thickness than in height. In addition, the loss of gingival tissue can favour peri-implant mucosal defects, causing a risk to the integrity of this natural mechanical barrier, which is the peri-implant gingival tissue. Guided Tissue Regeneration and Guided Bone Regeneration techniques and procedures can be applied, although the success rate is variable and sometimes difficult to achieve. The use of polypropylene membrane has been widely used after dental extraction to maintain blood clot. This in turn is a natural endogenous precursor, consisting of pluripotent cells necessary for bone neoformation. The purpose of this article is to present the case of maintaining the peri implant keratinised gingiva strip - as a mechanical barrier to protect the implant neck - after tooth extraction and osseointegrated implant installation.

***Keywords:** Tissue Regeneration; Bone Regeneration; Oral Surgery; Bioengineering; Implantology.*

## Introduction

After dental extraction, retraction of the blood clot, invagination of the gingival epithelial tissue and resorption of the alveolar bone walls are expected. Bone resorption is usually greater in thickness than in height. Subsequently, loss of gingival tissue may occur, causing peri-implant mucosal defects. Peri-implant gingival tissue, in addition to the aesthetics adjacent to implantoprosthetic rehabilitation, is also considered a natural mechanical barrier, especially to the invasion of periodontopathogenic microorganisms. These defects may therefore pose risks to the peri-implant integrity of the installed screws and to the maintenance of the implantoprosthetic rehabilitation[1-11].

In order to avoid or prevent naturally predictable bone resorption, Guided Tissue Regeneration and Guided Bone Regeneration techniques can be employed. These procedures should, whenever possible, be associated with more conservative and less aggressive dental extraction techniques to favour regenerative results[1-11].

There are several types of membranes, absorbable or non-absorbable, depending on their composition. However, the vast majority of membranes must remain submerged and not exposed to the oral environment. In order to solve this problem, the polypropylene membrane was developed and has been widely used. Its main characteristic is the maintenance and immobility of the clot after dental extraction, and it can still be exposed to the oral environment[1-11].

The purpose of this article is to present the case of maintaining the keratinised gingiva strip adjacent to the implant by using a polypropylene membrane after dental extraction and subsequent osseointegrated implant installation.

## Case Report

A Caucasian male patient, 64-years-old, attended the dental clinic complaining of dental rehabilitation.

Clinically, carious root remnant of tooth 46 was observed. No periodontal disease was observed, presenting healthy gingival tissue (Figure 1). Radiographically, no periodontal bone loss was observed (Figure 2).

The patient was advised of the impossibility of restoration on the dental remnant, and dental extraction was indicated, with future installation of an osseointegrated implant and implantoprosthetic rehabilitation. To maintain the bone remnant, the use of a polypropylene membrane was recommended after dental extraction, with the purpose of preserving the alveolar walls and maintaining the clot inside. The patient agreed with the recommendation and, after consent, the procedures were established.

After local anaesthesia, an intrasulcular incision was made between teeth 45, 46 and 47, without relaxants and with detachment of the periosteum. Dental extraction (Figure 3) was performed delicately to ensure the greatest preservation of the alveolar walls. After careful curettage and washing with saline solution, bleeding and blood clot formation were promoted (Figure 4).

***Figure 1:*** *Carious root remnant of tooth 46, with healthy gingival tissue.*

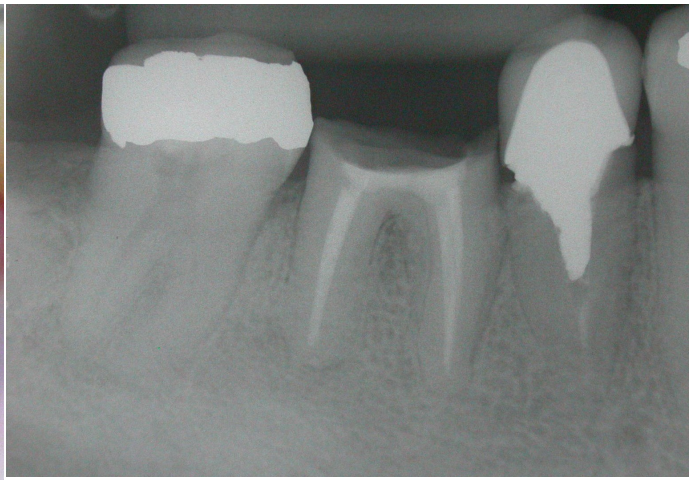

***Figure 2:*** *Absence of periodontal bone loss.*

***Figure 3:*** *Dental extraction of the roots of tooth 46.*

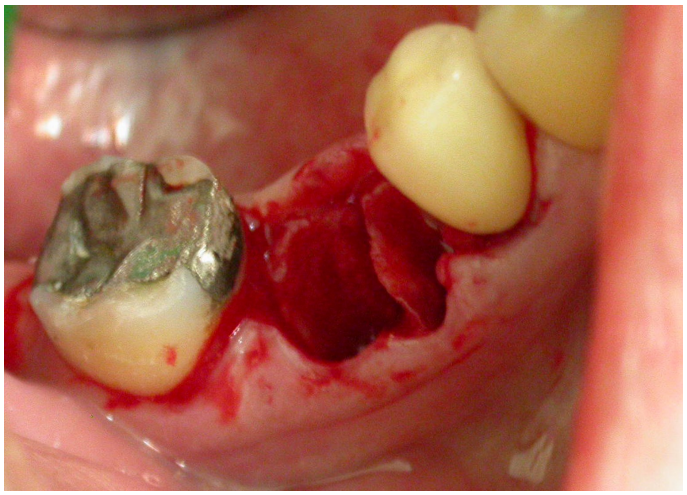

***Figure 4:*** *Surgical site after dental extraction.*

The polypropylene membrane (BoneHeal™, BoneHeal, São Paulo, Brazil) was adapted and installed over the alveolus in the buccal-lingual direction. The region was sutured and the membrane was intentionally exposed to the oral environment (Figure 5). Analgesic, anti-inflammatory and antibiotic drugs were prescribed to the patient.

At the subsequent visit (7 days), the remaining sutures (Figure 6) and the polypropylene membrane (Figure 7) were removed. Clinically, the presence of the fibrin membrane-covered clot (inherent to the healing process) and the thickness of the alveolar ridge were observed (Figure 8). No complaints or complications were reported.

Four months after dental extraction, a 4.5 X 10 mm Cone Morse osseointegrated implant (SIN, São Paulo, Brazil) was installed, followed by implantoprosthetic rehabilitation (Figure 9). Clinically, the preservation of an extensive band of keratinised gingiva of the periimplant mucosa adjacent to the screw was observed, favouring protection of the region (Figure 10).

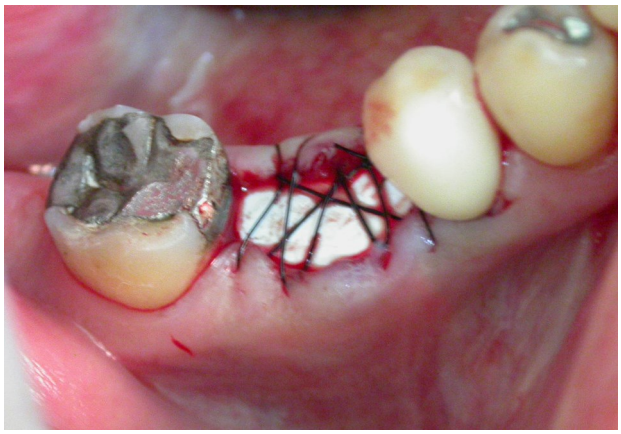

***Figure 5:*** *Installation of BoneHeal™ membrane and sutures.*

***Figure 6:*** *Remaining sutures after 7 days.*

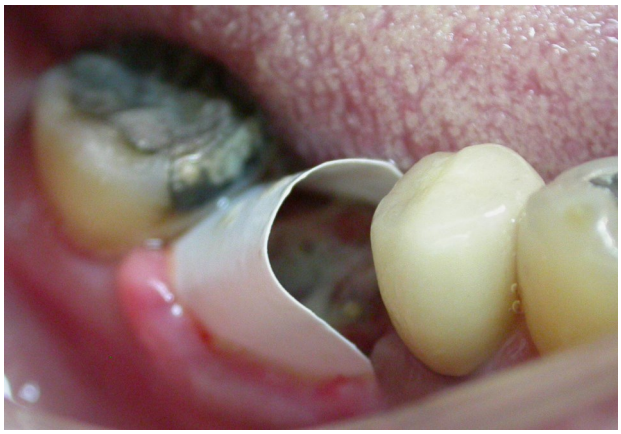

***Figure 7:*** *Removal of the BoneHeal™ membrane.*

***Figure 8:*** *Clot covered with fibrin membrane. Note the thickness of the alveolar ridge.*

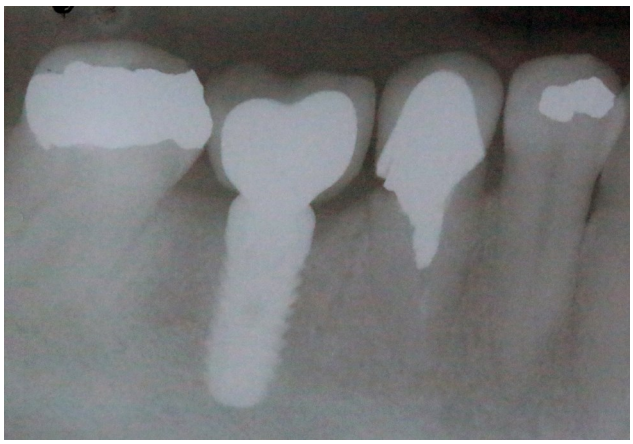

***Figure 9:*** *Installation of osseointegrated implant and implantoprosthetic rehabilitation.*

***Figure 10:*** *Preservation of the keratinised gingival strip of the peri-implant mucosa adjacent to the screw.*

## Discussion

Considering dental extraction as a traumatic and aggressive event, all those biological phenomena are expected, from haemostasis, chemotaxis, angiogenesis, extracellular matrix deposition and the subsequent production and mineralisation of the trabecular structure of bone tissue, based on the inflammatory process. The genetic information for bone production and maturation involves the synthesis of bone morphogenetic proteins (BMPs) by platelets, as well as the differentiation of pluripotent cells into osteoblasts[12,13].

Following dental extraction and subsequent rupture of blood vessels, the presence of a clot is observed within the alveolus. Vascular proliferation is initiated by vigorous angiogenesis. The blood clot is formed by the connection between the fibrin network and the alveolar walls. At this stage, by contact with salivary enzymes and oral microorganisms, physiological retraction of the clot occurs, also caused by the invasion of epithelial cells. At this stage, resorption of the alveolar bone walls begins. Neutrophils and salivary immunoglobulins prevent the invasion of oral microorganisms, being the first line of host defence[1-11].

Within 3 days, granulation tissue fills the alveolus, whose central and peripheral parts are activated by angiogenesis. The differentiated and undifferentiated cells that make up the granulation tissue are supplied by the periodontal ligament and endosteum. Osteoblasts migrate to the region, starting to fill the socket from day four. One week later, secretion and deposition of osteoid matrix by osteoblasts is initiated, with subsequent formation of bone tissue. Bone formation is centripetal (from the periphery to the centre of the socket), permeated by granulation tissue. At 45 days after the surgical procedure, mature bone tissue is permeated by irregular trabeculae. Thereafter, osteocytes are incorporated and attached to the mature bone tissue. The formation of concentric lamellae with Havers and Volkmann canals occurs within a few months. With adequate nutrition and maturation of the osteoid tissue, the newly formed bone is viable for functional activities resulting from masticatory loads[1-11]. For implantoprosthetic rehabilitation, 4 to 6 months should be waited (mandible and maxilla, respectively)[14]. In contrast, epithelial tissue covers the socket more quickly after 21 days, promoting isolation between the surgical site and the oral cavity[15].

Based on these physiological steps, atraumatic dental extraction and the maintenance and immobility of the blood clot within the dental alveolus should be considered. Carelessness or traumatic procedures may cause delays in bone repair or increase bone loss[18]. It is also important to emphasise that even based on reverse planning, dental implant surgeries require advanced bone maturation[16,17].

Autogenous bone grafts are the gold standard as biomaterials for filling bone defects, covered by submucosal membranes. However, two surgical procedures must be considered - donor and recipient sites, the main disadvantage being the morbidity caused. In these cases, the polypropylene membrane is recommended due to the possibility of exposure to the oral environment[1-11,18-20].

The polypropylene membrane has several benefits such as malleability; ease of use and adaptation to the surgical site; possibility of exposure to the oral environment without contamination; can be used without relaxing incisions and fixing screws; low cost. Polypropylene does not undergo hydration or soaking and subsequently does not undergo dimensional changes, being impermeable and stable. It has been widely used in Guided Bone Regeneration after dental extractions, enucleation of cystic lesions and bone defects[1-11]. Local physiology (chemotaxis and angiogenesis) is enhanced by the use of the polypropylene membrane, favouring the own physiology of the organism in the synthesis and maturation of the newly formed bone[18,19].

Removal of the polypropylene membrane is recommended in 7 to 14 days. There is no accumulation of food debris, dental biofilm or adherence to scar tissue. However, in contact with the blood clot through its inner surface, osteoblasts and osteogenesis precursor cells adsorb[1-11,18,19].

After dental extraction, resorption of the buccal and lingual walls of the dental alveolus is expected, thus being greater in thickness than in height. Additionally, loss of mucogingival tissues is also expected. Figure 10 shows the maintenance of bone thickness thanks to the use of the polypropylene membrane and the permanence of the blood clot inside the alveolus, favouring the preservation of the keratinised gingiva strip, conforming the mucogingival tissue adjacent to the implantoprosthetic rehabilitation and to the osseointegrated implant.

## Conclusion

In order to maintain peri-implant bone and mucosal tissues, the use of polypropylene membrane after dental extraction favours the maintenance of blood clot inside the dental alveolus. Thereafter, endogenous biological phenomena, initiated by chemotaxis and angiogenesis, until the maturation of the newly formed bone, can culminate in the preservation of peri-implant tissues.

## Conflict of Interest

The authors declare no conflict of interest.

## References


1. Pedron IG, Salomão M, Bispo LB. Regeneração óssea guiada com membrana de polipropileno na preservação alveolar pós-exodontia prévia a futura instalação de implante osteointegrado. Revista Maxillaris Portugal 2017;83(10):36-45.
2. Pedron IG, Bispo LB, Salomão M. Selective polypropylene membrane: alveolar behavior in post-extraction repair with a view to the future installation of osseointegrated implants. Italian Journal of Dental Medicine 2018;3(2):33-8.
3. Pedron IG, Magno Filho LC, Salomão M, Varoli FP, Al-Juboori MJ. Guided bone regeneration with polypropylene membrane associated with dental implant placement. J Health Sci Inst 2018;36(4):275-80.
4. Pedron IG, Salomão M. Polypropylene membrane in post-extraction alveolar repair with a future perspective on osseointegrated implants. Implants - International Magazine of Oral Implantology 2019;20(1):10-15.
5. Pedron IG, Salomão M. 聚丙烯膜在拔牙术后牙槽骨修复 中的应用 -- 展望骨内种植修复发展前景 (The application of polypropylene membrane in alveolar bone repair after tooth extraction - looking at the prospect of developing intraosseous repair with implants). Cosmetic & Implants China 2019(1):17-20.
6. Pedron IG, Salomão M, Medeiros JMF, Shitsuka C, Magno Filho LC. Placement of dental implant after use of guided bone regeneration with polypropylene membrane. Scientific Archives of Dental Sciences 2019;2(8):25-30.
7. Bispo LB, Salomão M, Roque Neto A, Shitsuka C, Pedron IG. Uso de membrana como fator preditivo do comportamento ósseo alveolar pós-exodontia. Revista Odonto 2020;28(55):21-29.
8. Santos LN, Najar ET, Cerqueira JS, Salomão M, Kuramochi MM, Medeiros JMF, Shitsuka C, Pedron IG. Use of polypropylene membrane to accelerate bone maturation after cystic exeresis. Scientific Archives of Dental Sciences 2020;3(12):46-53.
9. Bacaro KD, Salomão M, Lourenço D, Magno Filho LC, do Lago Pimentel Maia M, Pedron IG. Bone regeneration using polypropylene membrane in peri-implant bone loss: Case Report with 4 years of follow-up. SVOA Dentistry 2022;3(3):162-167.
10. Barros NMV, Salomão M, Shitsuka C, Pedron IG. Use of polypropylene membrane after exodontia for maintaining bone thickness: Case report. SVOA Dentistry 2021;2(4):161-167.
11. Pedron IG, Seroli W, Salomão M, Kubo H, Shitsuka C. Reparação óssea por meio de membrana de polipropileno após exérese cística. Revista Maxillaris Portugal 2020;15(112):36-43.
12. Araújo MG, Wennström JL, Lindhe J. Modeling of the buccal and lingual bone walls of fresh extraction sites following implant installation. Clin Oral Implants Res. 2006;17(6):606-14.
13. Araújo MG, Sukekava F, Wennström JL, Lindhe J. Tissue modeling following implant placement in fresh extraction sockets. Clin Oral Implants Res. 2006;17(6):615-24.
14. Ley J. Minimally invasive extraction and immediate implant placement: the preservative. J Oral Impl 2006;32(4):204-5.
15. 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(4):313-23.
16. Botticelli D, Berglundh T, Lindhe J. The influence of a biomaterial on the closure of a marginal hard tissue defect adjacent to implants: an experimental study in the dog. Clin Oral Implants Res 2004;15(3):285-92.

17. Nemcovsky CE, Moses O. Rotated palatal flap. A surgical approach to increase keratinized tissue width in maxillary implant uncovering: technique and clinical evaluation. Int J Periodontics Restorative Dent 2002;22(6):607-12.

18. Caplanis N, Lozada JL, Kan JYK. Extraction defect: assessment, classification and management. J Calif Dent Assoc 2005;33(11):853-63.

19. Nevins M, Camelo M, De Paoli S, Friedland B, Schenk RK, Parma-Benfenati S, Simion M, Tinti C, Wagenberg B. A study of the fate of the buccal wall of extraction sockets of teeth with prominent roots. Int J Periodontics Restorative Dent 2006;6(1):19-29.

20. Fickl S, Zuhr O, Wachtel H, Stappert CFJ, Stein JM, Hüerzeler MB. Dimensional changes of the alveolar ridge contour after different socket preservation techniques. J Clin Periodontol 2008;35(10):906-13.

21. Salama M, Ishikawa T, Salama H, Funato A, Garber D. Advantages of the root submergence technique for pontic site development in esthetic implant therapy. Int J Periodontics Restorative Dent 2007;27(6):521-7.

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