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Case Report

Placement of Dental Implant after Use of Guided Bone Regeneration with Polypropylene Membrane

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Abstract

One of the principles of modern Implantology is the maintenance of soft and hard tissues or the reduction of bone resorption, particularly after the exodontia. The teeth extraction beginning of resorption of the alveolar bone. The resorption is more in width than the height. In this perspective, the maintenance of the blood clot inside the alveolus is essential to avoid invagination of the epithelial tissue. The guided bone regeneration technique proposes the regeneration of the bone defect using occlusive membranes. Angiogenesis and chemotaxis of cells competent for bone formation is only possible with the maintenance of immobility of the clot. Blood cells, particularly platelets, are most responsible for encoding and producing new bone tissue through bone morphogenetic proteins (BMPs), which will repair the post-surgical alveolus. The purpose of this article is present a case of placement of dental implant after use of guided bone regeneration with polypropylene membrane.

Keywords: Bone Regeneration; Oral Surgery; Bioengineering

Introduction

Exodontia is frequent in daily dental practice, with several causes, particularly due to caries and periodontal diseases [1].

One of the principles of modern Implantology is the maintenance of soft and hard tissues or the reduction of bone resorption, particularly after the exodontia. From the teeth extraction initiates of resorption of the alveolar bone. The resorption is more in width than the height. In this perspective, the maintenance of the blood clot inside the alveolus is essential to avoid invagination of the epithelial tissue.

After the exodontia, the rupture of the blood vessels of the periodontal ligament and vascular-nervous bundle occurs, forming the clot inside the alveolus. There is the attraction of several cell types and proteins responsible for genetic information for bone production. Bone morphogenetic proteins (BMPs), synthesized by blood platelets, indicate and signal the sites for the deposition of extracellular matrix and the subsequent production and mineralization of the trabecular structure of bone tissue [2,3].

Intense vascular proliferation (angiogenesis) and chemotaxis of cells (epithelial and connective tissue cells) competent for bone formation is only possible with the maintenance of immobility of the clot. Blood cells, particularly platelets, are most responsible for encoding and producing new bone tissue through bone morphogenetic proteins (BMPs), as well as the totipotent or pluripotent cells differentiate and the new osteoblasts, as well as the existing ones, secrete a matrix that can mineralize, which will repair the post-surgical alveolus [4,5].

The guided bone regeneration technique, through a physical barrier, aims at containment of cell types undesirable to the alveolar bone repair, particularly the invagination of epitelial tissue, wich would avoid the maintenance of the blood clot and favoring the immobility of the osteoblasts in the proliferative alveolar site. The osteoblasts - precursor cells of bone tissue - initiate the process of secretion of the extracellular matrix that will later form bone. In a few months, from the formation of concentric lamellae, with Havers and Volkmann channels and adequate nutrition, it will culminate the osteoid tissue to maturation, which makes the tissue susceptible to the maintenance of the functional activities resulting from masticatory loads [6].

There are several types of barrier, the absorbable ones (collagen, polylactic acid, polyglycan acid, polyurethane and acellular dermal matrix) or non absorbable (cellulose, expanded polytetrafluoroethylene, teflon, latex, titanium and aluminum oxide) [7]. However, many materials had limitations in their use and indications [8,9].

Purpose of the Study

The purpose of this article is present a case of placement of dental implant after use of guided bone regeneration with polypropylene membrane.

Case Report

A black male patient, 54 years-old, attended the private clinic with to need for periodontal treatment and exodontias.

The presence of generalized chronic periodontitis, with pathological migration and marked mobility in teeth 31 and 41, were observed (Figure 1).

Figure 1: *Initial clinical features: generalized chronic periodontitis and pathologic migration on teeth 31 and 41.*

Radiographs showed dental losses (teeth 16, 18, 21, 25, 28, 35, 36, 45 and 48), dental implant (tooth 21), generalized horizontal bone loss in alveolar ridges and marked vertical bone loss in teeth 31 and 41 (Figures 2 and 3).

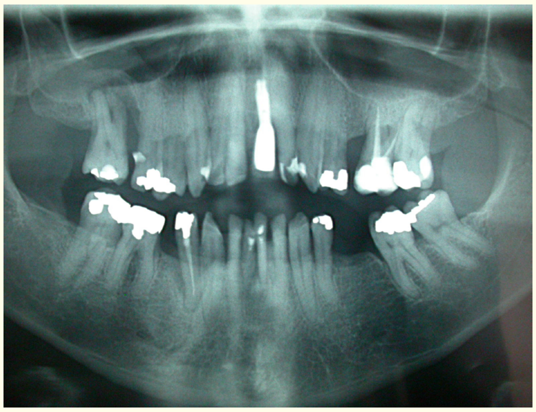

Figure 2: *Panoramic radiograph showed dental losses and generalized bone loss in alveolar ridges.*

Figure 3: *Periapical radiograph showed bone loss on teeth 31 and 41.*

Periodontal treatment was performed (Figure 4). The teeth 31 and 41 were indicated to extractions. The use of the polypropylene membrane as regenerative techniques (Guided Bone Regeneration) was suggested and accepted by the patient, in view of the future placement of implants in the region. Cone beam computed tomography was performed and the bone measurements were defined (Figure 5). The 3D reconstruction was presented by the association of cross sections (Figure 6).

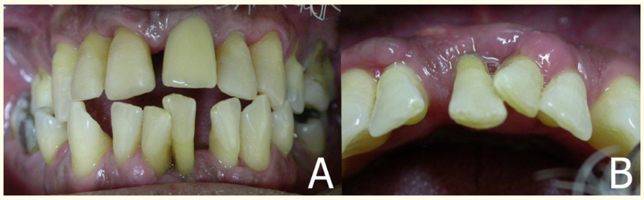

Figure 4: *Periodontal treatment performed.*

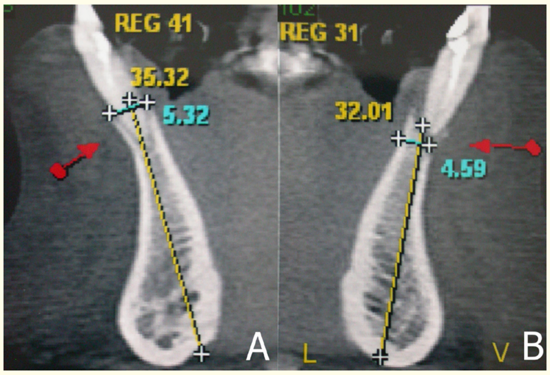

Figure 5: *Remaining bone on teeth 31 and 41 (computed tomography - cross sections).*

Figure 6: *3D Reconstruction from computed tomography.*

After dental extractions and subsequent curettage of the alveoli, abundant irrigation with saline solution was performed. After the stimulation of bleeding to form blood clot, the polypropylene membrane (Bone Heal^{TM}, INP, São Paulo, Brazil) covered the clot and the alveolus and was sutured, being intentionally exposed to the buccal medium (Figure 7). The natural teeth were cutted, adapted and bonded at the surgical site as temporary prosthesis (Figure 8). Regimen of administration of analgesic, anti-inflammatory and antibiotic drugs were followed by the patient.

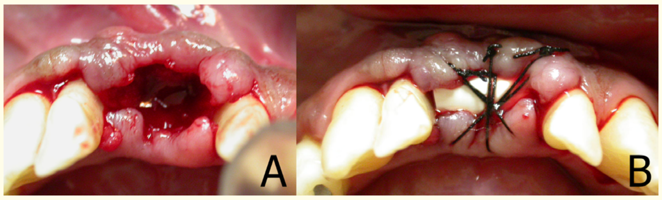

Figure 7: *Immediate post-exodontic surgical bed (A). Occlusal view: polypropylene membrane exposed to the buccal medium and sutured on the postoperative surgical bed (B).*

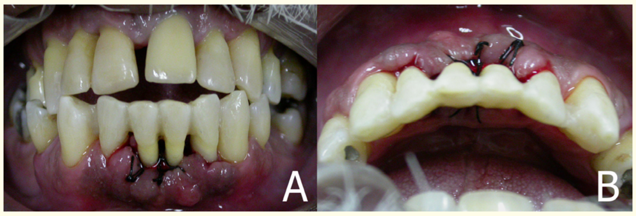

Figure 8: *The natural teeth were cutted, adapted and bonded at the surgical site as temporary prosthesis.*

After 10 days of surgery, the sutures and membrane were removed (Figures 9-11) and the patient did not present complaints or complications. The maintenance and immobilization of the clot was observed, as well as the maintaining the thickness of the alveolar ridge.

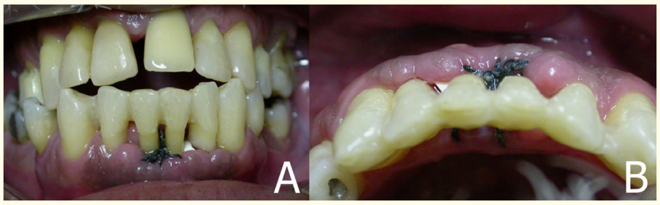

Figure 9: *Post-surgical (10 days) after exodontia.*

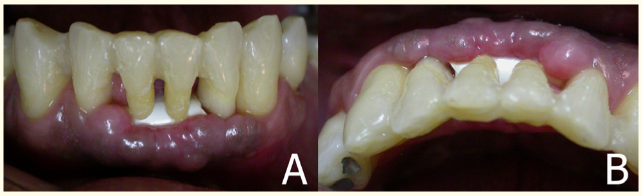

Figure 10: *Removal of the remaining sutures.*

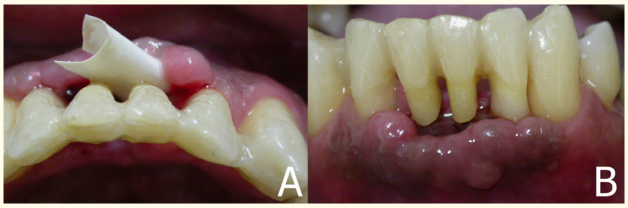

Figure 11: *Removal of the polypropylene membrane. Observe the maintenance of bone thickness.*

After 6 months, cone beam computed tomography was repeated and presented the bone maintenance (Figure 12), previous to the placement of implant and prosthetic rehabilitation (Figure 13). The patient has been accompanied in periodontal and implant programme of maintenance (Figure 14).

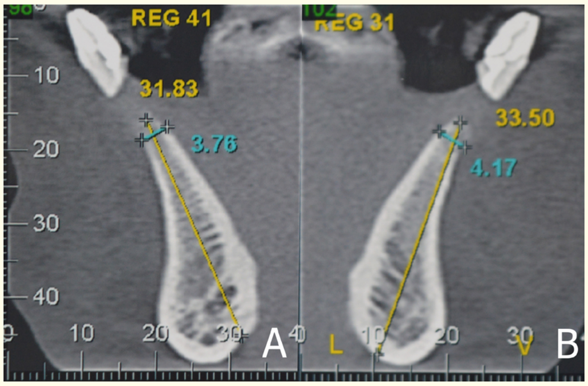

Figure 12: *Bone maintenance presented by cone beam computed tomography after 6 months.*

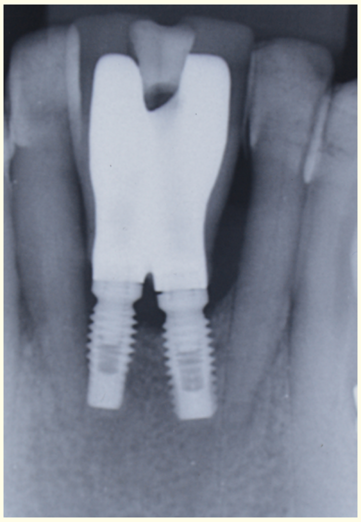

Figure 13: *Installation of osseointegrated implants and prosthetic rehabilitation on teeth 31 and 41.*

Figure 14: *Clinical evaluation in periodontal and implant programme of maintenance.*

Discussion

After the exodontia, usually occurs the physiological retraction of the clot, caused by microorganisms and salivary enzymes. Cellular and tissue phenomena inherent in physiological repair initiate local hemostasis [10]. The fibrin network connects to the walls of the alveolus, generating a clot with gelatinous and yellowish appearance. Neutrophils work to prevent invasion of microorganisms from the oral cavity as well as salivary immunoglobulins [2].

Differential and undifferentiated cells are supplied by the endosteum and the periodontal ligament, about three days after the exodontia, colonizing the granulation tissue within the alveolus [1,3].

Osteoid matrix fills the defect after four days of the surgical procedure, with the sole filling function of the socket [11,12].

Angiogenesis is activated within one week after surgery, in the center and peripheries of the alveolus, in which bone tissue interposes into the granulation tissue [2,3].

At three weeks, the epithelial tissue completely covers the surgical site and there is complete isolation between the alveolus and the oral cavity. In up to 35 days, secondary bone formation occurs from the periphery to the center of the alveolus, where new osteoblasts are formed and recruited from osteoprogenitor cells for the secretion of osteoid tissue. At 45 days, mature bone tissue permeated by irregular trabeculae is formed. Osteocytes become embedded and trapped in the mature bone tissue that formed [13].

Only after 4 and 6 months (for mandible and maxilla, respectively), the bone tissue becomes compatible with the installation of osseointegrated implants under prosthetic rehabilitation [14]. Based on the reverse planning perspective, even performing pre-prosthetic surgeries requires more advanced bone maturation [15,16].

The blood clot should be kept immobile within the alveolus after surgery. In this perspective, care must be taken against deleterious factors that may delay or negate the repair process of the alveolus [17].

In places where bone loss was unavoidable, autogenous bone grafts are considered gold standard for the purpose of replacing or filling bone defects. One of the main advantages of its use is the reduction of surgical time, thus avoiding the need for a second surgical stage with greater morbidity for the patient [24-27]. They are indicated in correction of bone defects, surgeries of maxillary sinus and through the use of grafts in blocks, helping in the consolidation of the bone repair. To assist in the closure of the mucoperiosteal flap in extensive bone defects, membranes and screens are indicated [28,29].

Several types of materials have been used as a membrane in the technique of guided bone regeneration. A set of features ideal for the use of these barriers: easy adaptability; mechanical resistance compatible with applied loads; being able to be cut and shaped; malleability; possible exposure to the oral environment without promoting infection; unnecessary additional resources such as bolts or tacks; unnecessary relaxing incisions; possible removal without the use of drill bits or punch instruments; and low cost [18]. As observed in the present report, the polypropylene membrane attended most of the prerequisites for the purpose of osteopromotion.

Additionally, the polypropylene membrane potentially has numerous advantages, such as: intentional exposure of the membrane to the buccal environment; the flaps may be kept apart from each other pending healing by second intention; there is no supremacy of use of granular biomaterials within the alveolus, only blood clot; without greater financial expenditures with complementary instruments; without previous hydration, being dimensionally stable during the period of stay in the surgical niche; being waterproof; it can be removed between 7 and 14 days; without adherence to scar tissue; the inner surface promotes adsorption of osteoblasts and precursor cells; it can be used in cases of immediate implants by the Schroeder Technique with also immediate load, allowing the simultaneous regeneration of bone and inserted gingiva tissue; hindering the accumulation of dental biofilm and food debris [19-23].

In contemporary Dentistry, membrane guided bone regeneration techniques seek maximum preservation and more conservative procedures, achieving osteopromotion and osteogenesis. The use of the polypropylene membrane after the exodontia protects the clot, potentiates the local physiology and favors the very nature of the organism in the synthesis and endogenous maturation of the bone [27,28].

Conclusions

The polypropylene membrane, previously indicated to install the osseointegrated implant, was advantageous in several factors. More studies are needed for the validation of this membrane in comparison to other biomaterials.

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