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Exodontia with Polypropylene Membrane Followed by Future Implant Installation: Case Report with 10-Years Follow-up

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Abstract

After exodontia, some biological tissue repair phenomena occur. Invagination of the gingival epithelial tissue and subsequent resorption of the alveolar bone walls is expected. Clinically, bone resorption can compromise the future installation of osseointegrated implants, hindering the rehabilitation of edentulous areas. Guided Tissue Regeneration and Guided Bone Regeneration techniques can be used to prevent post-exodontia bone resorption. These techniques should also be associated with more cautious and preservative exodontias to safeguard regenerative results. The polypropylene membrane has been used after exodontia with the main aim of maintaining and immobilising the blood clot inside the alveolus and, due to the possibility of exposure to the oral environment, without suffering contamination or adsorption of dental biofilm and subsequent infection. The purpose of this article is to present the case of the use of a polypropylene membrane after the exodontia of a molar, in order to preserve and maintain bone tissue for the future installation of an osseointegrated implant and the respective implantoprosthetic rehabilitation. The case has been followed up for 10 years.

Keywords: Tissue Regeneration; Bone Regeneration; Bioengineering; Oral Surgery; Implantology; Rehabilitation

Introduction

After exodontia, some biological tissue repair phenomena usually occur. Contact with salivary enzymes and bacterial products from the oral cavity causes the blood clot to retract. Gradually, tissue repair results in invagination of the gingival epithelial tissue and resorption of the alveolar bone walls. Clinically, bone resorption is observed to be greater in thickness than in height. Considering subsequent dental rehabilitation in edentulous areas, bone thickness becomes an important bone framework for the installation of dental implants [1-14]. In addition, the preservation of peri-implant and mucosal tissues is also necessary, as it is a natural mechanical barrier, especially against the invasion of periodontopathogenic microorganisms [13].

Guided Tissue Regeneration and Guided Bone Regeneration techniques can be used to prevent the bone resorption that is predictable with exodontia. When possible, these techniques should be associated with more cautious and preservative exodontias to safeguard regenerative results [1-14].

Several types of materials and regenerative techniques can be used to preserve bone after exodontia. However, most of these biomaterials must remain submerged and not exposed to the oral cavity, thus avoiding contamination. In order to resolve this clinical situation, the polypropylene membrane was designed to be intentionally exposed to the oral environment and to maintain and immobilise the blood clot after exodontia [1-14].

The purpose of this article is to present a case of bone tissue preservation after exodontia prior to the installation of an osseointegrated implant using a polypropylene membrane.

Case Report

An African-descendent male patient, 29-years-old, attended the dental clinic complaining of a fractured tooth.

Radiographically, the patient presented the separated roots of the lower right first molar caused by caries (Figure 1). Cone beam computed tomography showed the amount of adjacent bone tissue and the relationship with the mandibular canal, considering exodontia and future installation of an osseointegrated implant (Figure 2). Figure 3 illustrates the remaining condition of the buccal cortical bone of the lower right first molar (white lines).

Figure 1: Roots of the lower right first molar affected by caries (A: panoramic radiograph; B: approximate view).

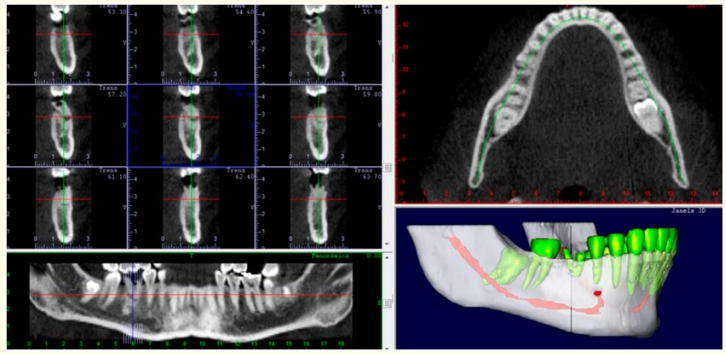

Figure 2: Computed tomography in virtual planning prior to exodontia.

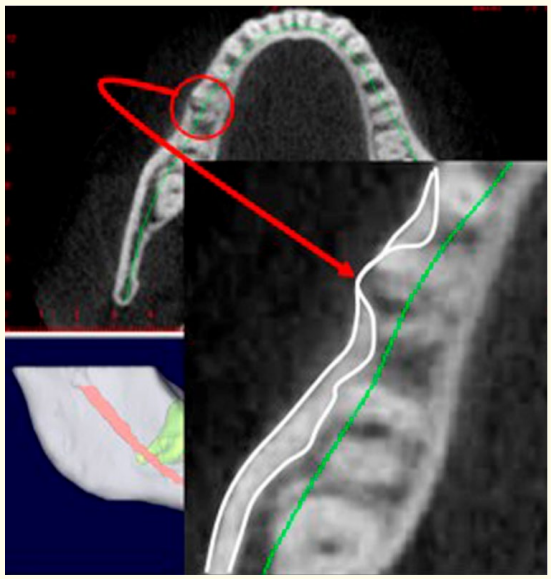

Figure 3: Reduced buccal cortical bone of the lower right first molar (white lines).

The patient was advised of the need for exodontia and future installation of an osseointegrated implant and implantoprosthetic rehabilitation. A polypropylene membrane was recommended after exodontia in order to preserve the alveolar walls and keep the blood clot inside. The patient agreed to the recommendation and signed a Consent Form.

After local anaesthesia, an intrasulcular incision was made the lower right second premolar to the lower right second molar, with detachment of the periosteum and without relaxants. Exodontia was carried out subtly to ensure the greatest preservation of the alveolar walls (Figure 4). The alveolus was duly curetted and washed, ensuring bleeding for subsequent blood clot formation. The polypropylene membrane (BoneHeal™, São Paulo, Brazil) was cut and adapted to cover the alveolus (Figure 5). The gingiva was sutured over the membrane, remaining exposed to the oral environment (Figure 6). The patient was prescribed analgesics, anti-inflammatories and antibiotics.

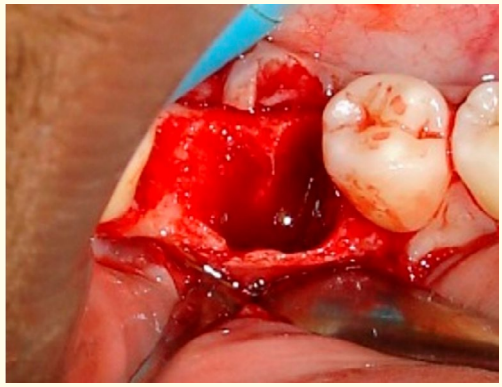

Figure 4: Exodontia performed.

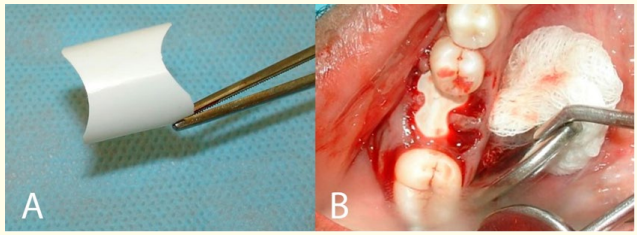

Figure 5: Use of the polypropylene membrane (A: cut and adaptation; B: membrane installed).

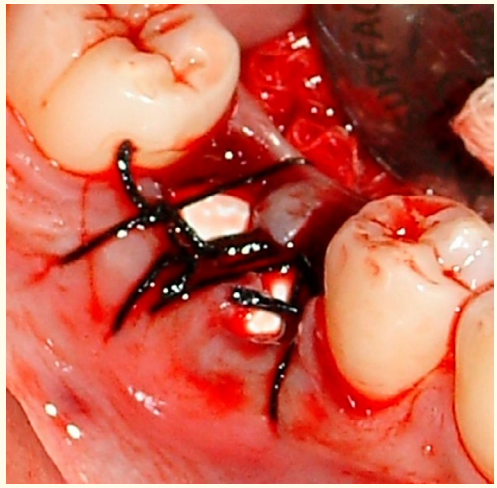

Figure 6: Gingiva sutured over the membrane.

At the next appointment (7 days), the remaining sutures and the polypropylene membrane were removed (Figure 7). No complaints or complications were reported.

Figure 7: Post-surgical evaluation (7 days - A); Suture removal (B); Surgical site after membrane removal (C).

After 4 years and 6 months, the patient returned for the installation of the osseointegrated implant. Clinically, the thickness of the alveolar ridge was maintained (Figure 8). Computed tomography and virtual planning for implant installation determined a 4 X 12mm screw with internal hexagon (Figure 9).

Figure 8: Clinical evaluation after 4 years and 6 months.

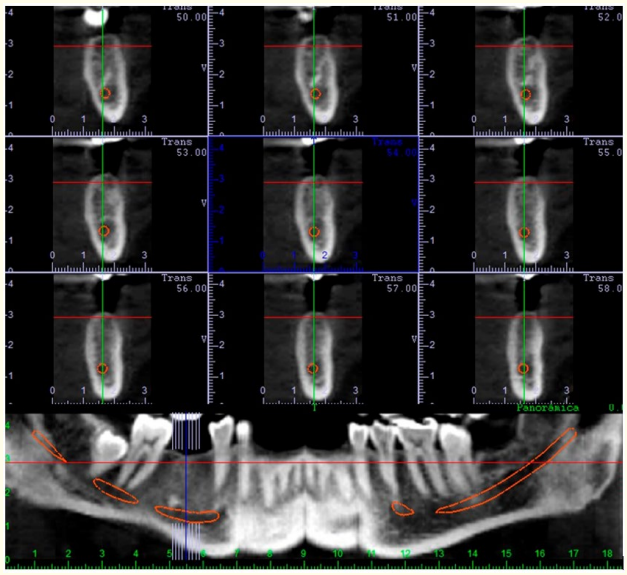

Figure 9: Computed tomography and virtual planning for implant installation.

A surgical guide was made to install the implant (Figure 10). After local anaesthesia, a stop was used on the needle itself to measure the transmucosal measurement (2mm), when the needle meets the bone (Figure 11). This measurement was added to the 12mm of bone perforation (Figure 12). The implant was installed using flapless surgery (Figure 13). A healing agent was installed for gingival conditioning (Figure 14). A post-immediate periapical radiograph was taken to assess implant positioning (Figure 15). The patient was given analgesic and anti-inflammatory drugs.

Figure 10: Surgical guide made.

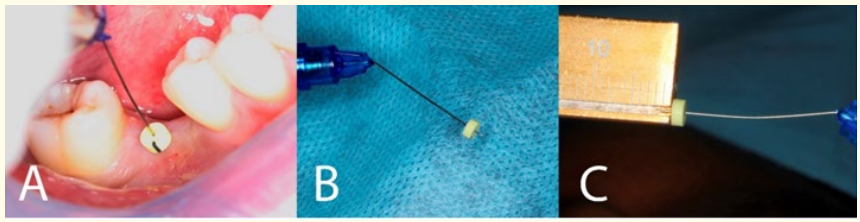

Figure 11: Measurement of transmucosal height (A, B and C).

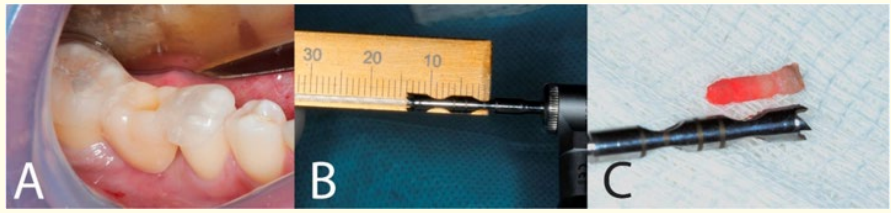

Figure 12: Use of the surgical guide (A); Measurement of the measurement for milling (B); Drill used and removal of the bone fragment (C).

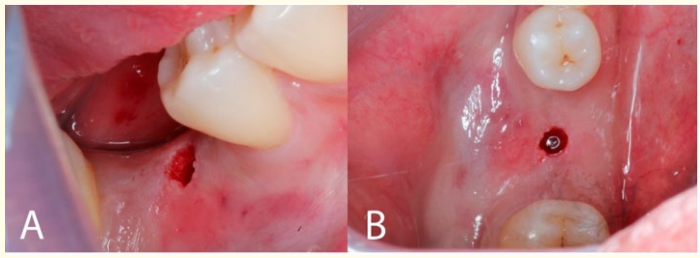

Figure 13: Implant installation using flapless surgery (A: right lateral view; B: occlusal view).

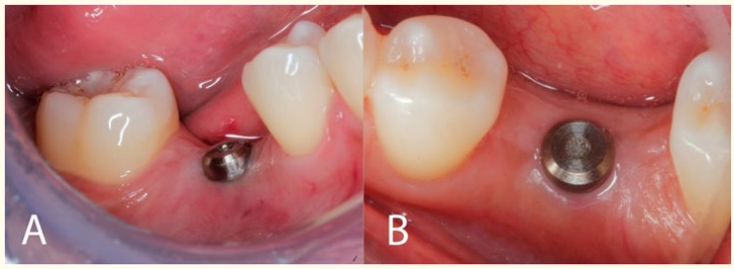

Figure 14: Healer installed.

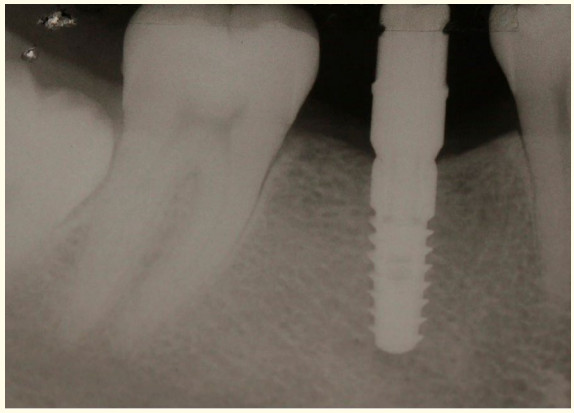

Figure 15: Periapical radiograph after immediate implant installation.

A fragment of bone tissue removed during milling was submitted for histopathological examination, which revealed mature bone tissue (Figure 16).

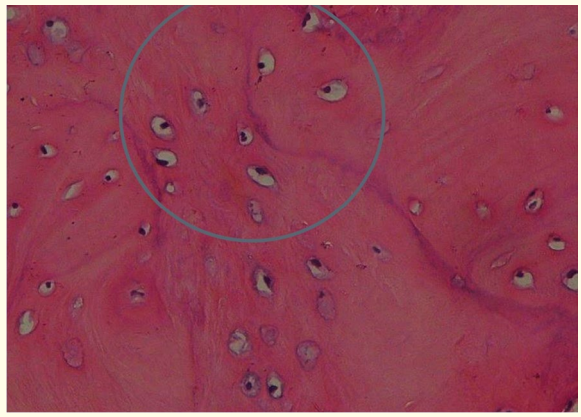

Figure 16: Histopathological aspects. Mature bone tissue (400X).

After 90 days, the metal-ceramic crown was made over the installed implant (Figure 17).

Figure 17: Metal-ceramic crown installed (A: occlusal view; B: right lateral view).

Discussion

Bone resorption is expected after exodontia. Assuming the subsequent implantoprosthetic rehabilitation of the edentulous area after exodontia, more subtle and less traumatic procedures should be considered in order to preserve the remaining bone tissue. The presence of a blood clot inside the alveolus is of paramount importance, as it is a predisposing and essential factor for bone neoformation and maturation. In addition, more conservative procedures, as used in this case with flapless surgery, can favour the processes of bone repair and osseointegration of implants [1-14].

In recent decades, various biomaterials and regenerative techniques have been used to preserve bone after exodontia. Autogenous bone grafts are the gold standard for filling bone defects. They must be covered by membranes or submucosal barriers. However, considering the need for two surgical procedures (donor and recipient sites), the main disadvantage is the morbidity caused. In addition, this bone tissue needs to be covered by membranes or barriers covered by a full flap in order for healing to occur by first intention [1-14].

In view of the surgical difficulty and occasional comorbidities, the polypropylene membrane was designed to be intentionally exposed to the oral cavity. Its outer surface is smooth, making it difficult for dental biofilm to accumulate in contact with the oral cavity. The polypropylene does not undergo hydration, soaking or dimensional changes, making it waterproof and stable. The inner face is slightly textured, favouring adsorption and immobilisation of the blood clot inside the dental alveolus. It does not require the use of grafts to fill the alveolus or bone defect, but only maintains the blood clot as a precursor to future bone tissue. In addition, the polypropylene membrane is easily adapted and installed due to its malleability, as can be seen in Figure 5. It requires no relaxing incisions, no fixing screws and is inexpensive. It is recommended that the polypropylene membrane be removed in 7 to 14 days [1-11, 13, 14].

The polypropylene membrane already acts to maintain the blood clot inside the bone cavity. The clot is rich in platelet supply and growth factors involved in bone healing and neoformation. The own local physiology of the patient is activated by the polypropylene membrane through chemotaxis and angiogenesis, favouring the synthesis and maturation of the newly formed bone [1-14].

The polypropylene membrane was developed for use after exodontia and prior to the installation of osseointegrated implants [1-8]. However, it has been widely used in bone regeneration in bone cavities in general. The use of the polypropylene membrane has been reported after the exeresis of cystic lesions [9, 10] and in bone regeneration in implants affected by periimplantitis and severe bone loss [11]. Satisfactory results were demonstrated in the simultaneous elevation of the maxillary sinus membrane and placement of dental implants using a polypropylene barrier and without bone grafting [12]. The polypropylene membrane has also been shown to be effective in preserving the peri-implant mucosa, favouring protection for the installed implant and gingival aesthetics [13]. Recently, guided bone regeneration with a polypropylene membrane was presented after the explantation of a fractured implant and the subse-

quent reinstallation of another implant [14].

Conclusion

Maintaining the blood clot inside the dental alveolus after exodontia is essential for preserving, maintaining and regenerating bone, with a view to the future installation of osseointegrated implants and implantoprosthetic rehabilitation. The use of polypropylene membranes has been widely used in Guided Bone Regeneration techniques, basically favouring the maintenance of blood clots. Its use is practical, as are other more conservative proposals, and it also reduces the morbidity of surgical procedures for patients.

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