

Optimization of guided bone regeneration in post-extraction socket by means of the Fugazzoto technique

Abstract / Introduction: During the surgical planning for prosthetic rehabilitation performed by means of osseointegrated implants, we often face some limitations such as pneumatized maxillary sinus, in which case we can make use of alveolar regeneration and bone grafting procedures.

Objective: This article discusses and reports a case of alveolar regeneration. **Results:** Treatment resulted in bone gain that allows implant placement without further grafting procedures. **Conclusion:** Guided bone regeneration (GBR) provided predictability and optimization of surgical treatment.

Keywords: Maxillary sinus elevation. Bone regeneration. Oral surgery. Maxillary sinus.

Lucas de Freitas KÜHLKAMP

Resident in Implantodontics, CEPID-UFSC.

Bernardo Born PASSONI

PhD resident in Implantodontics, CEPID/UFSC.

Artur Breno Wanderley ALÉCIO

PhD resident in Implantodontics, CEPID/UFSC.

César Augusto Magalhães BENFATTI

Associate professor, Department of Dentistry, Federal University of Santa Catarina (UFSC).

Ricardo de Souza MAGINI

Adjunct professor, Department of Dentistry, UFSC.

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Contact address: Ricardo de Souza Magini. Rua Vitória Régia, 42 - Córrego Grande Florianópolis/SC - Brazil — CEP: 88037130 - E-mail: magini@ccs.ufsc.br

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» The patient displayed in this article previously approved the use of her facial and intraoral photographs.

INTRODUCTION

Rehabilitation of the posterior maxilla performed by means of implant-supported prostheses can be quite challenging. Horizontal and vertical bone resorption after tooth extraction, low bone quality and pneumatization of the maxillary sinus require careful diagnosis and clinical approach if the patient intends to rehabilitate this area with osseointegrated implants.¹ With the advent of sinus floor elevation, bone regeneration and bone grafting techniques, the possibilities of rehabilitating the posterior maxilla by means of implants have expanded.²⁻¹¹

Several techniques for sinus floor elevation are described in the literature. The first one was the lateral window approach described by Tatum¹² in 1986; followed by Summers,¹³ in 1994, with a more conservative crestal approach performed by means of osteotomes. In 1999, Fugazzotto¹ described a modification of Summers technique, which consists in using the inter-root septum to elevate the maxillary sinus membrane. This procedure is performed with the aid of a trephine bur and osteotomes.

Bone resorption and remodeling require the use of grafting and alveolar filling material to preserve bone architecture. Although autogenous bone graft remains as the standard reference for this type of procedure, some synthetic material of remarkable quality fulfill this role satisfactorily, with the advantage of presenting lower post-operative morbidity.¹⁴

With a view to preventing the risk of bacterial infection, grafted areas must be covered and stabilized by a mechanical barrier, thus providing healing of soft tissues by first intention.^{15,16} The literature presents several methods employed to accomplish such closure, namely: modified flaps, pedicle grafts, free gingival tissue graft and synthetic material.

This article discusses, through a case report, the possibility of increasing bone height by means of non-traumatic sinus floor elevation performed through Fugazzotto's technique, followed by alveolar filling with particulate composite bovine bone and surgical site closure with free gingival tissue graft.

CASE REPORT

A 52-year-old female patient, with good systemic health, sought the clinics of the Center for Study and Research in Dental Implants of the Federal University of Santa Catarina (CEPID/UFSC) with chief complaint of coronal destruction of tooth #26.

Clinical examination (Fig 1) confirmed the presence of a healthy periodontium and a small amount of remaining tooth which had already undergone an unsuccessful attempt of endodontic treatment. Due to root fragility and low predictability of prosthetic rehabilitation, it was decided on the extraction of the remaining tooth and placement of an implant in the region of tooth #26.

Cone Beam CT analysis (Fig 2) revealed maxillary sinus pneumatization in the region of tooth #26, which hindered immediate implant placement. For this reason, it was decided on non-traumatic sinus floor elevation performed during extraction.

Surgical planning was based on the atraumatic extraction of the compromised tooth without flap elevation, but by means of periosteal and forceps, so as to preserve the integrity of the alveolar septum (Fig 3) and avoid absorption of the buccal wall.

After extraction, socket curettage was performed to eliminate potential infections caused by apical root remnants. Maxillary sinus elevation carried out by means of Fugazzotto's technique was initiated with osteotomy of 5mm in depth performed with a

trephine bur of 5 mm in diameter (Neodent®, Curitiba - Brazil) (Fig 4). The procedure included the septum and nearly 50% of the socket (Fig 5A), leaving a bone base of 2 mm below the septum. Subsequently, maxillary sinus elevation was performed with the use of an osteotome similar in size to the trephine bur, pushing the septum and its floor into the sinus (Fig 5B). For socket filling, particulate composite bovine bone (Genmix/Baumer®, Mogi Mirim - Brasil) was used (Fig 6).

With a view to achieving first intention healing, free gingival tissue graft was performed (Fig 7A) and sutured to the remaining edges of the socket (Fig 7B). After 7 days, the suture was removed and a cone

beam CT was taken to assess the bone volume obtained. After 30 days, complete healing of soft tissue was observed (Fig 8). Further tomographic examinations (Fig 9) revealed that the maxillary sinus membrane was lifted in approximately 3 mm by means of the inter-root septum and the filling material, which, after bone formation/maturation, enabled implant placement with an appropriate length.

DISCUSSION

Extraction of compromised teeth for subsequent implant rehabilitation requires maximum alveolar bone preservation, thus increasing surgical predictability and keeping the gingival architecture.

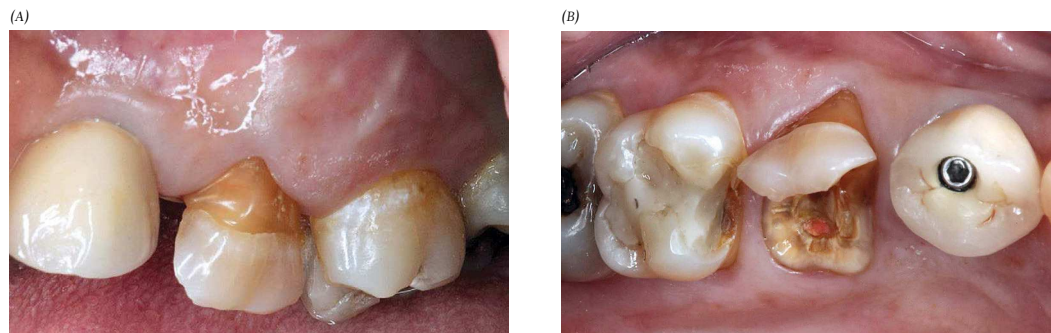


Figure 1. Initial clinical aspects: **A)** Buccal surface of tooth #26. **B)** Occlusal surface of tooth #26.

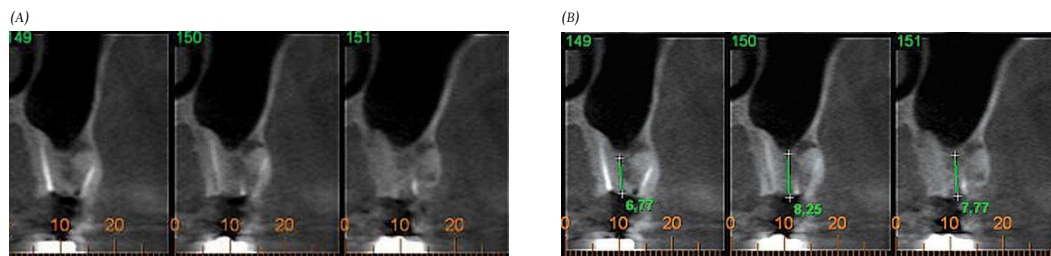


Figure 2. **A)** Pre-operative cone beam computed tomography. **B)** Pre-operative cone beam computed tomography with measures that evince remaining bone height.

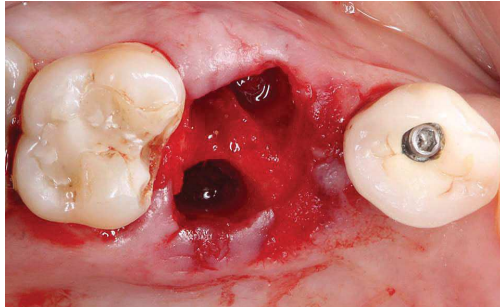


Figure 3. Tooth socket after atraumatic extraction. Note the maintenance of the inter-root septum.



Figure 4. Trephine bur with diameter proportional to the alveolar septum and 50% of the extraction socket.

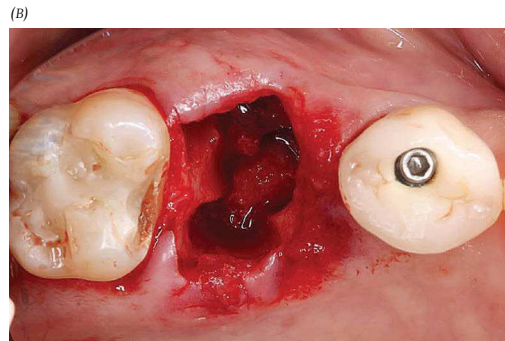
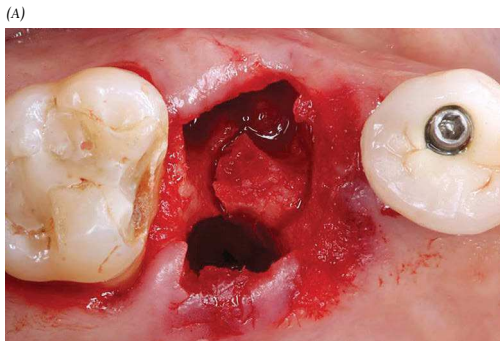


Figure 5. Occlusal view of the socket. **A)** After trephine bur is used. **B)** After osteotome is used.

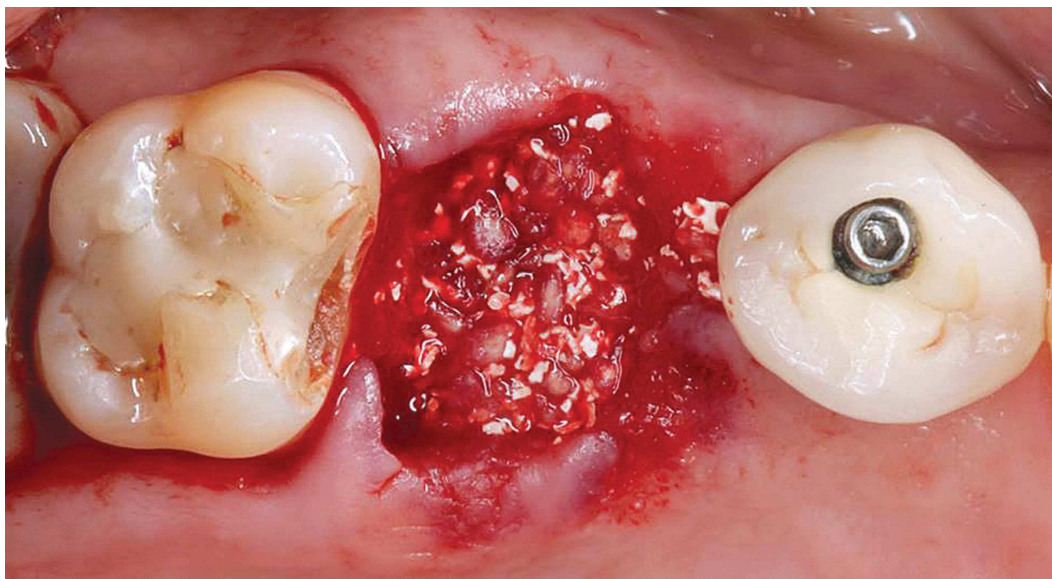


Figure 6. Socket filling with particulate composite bovine bone.

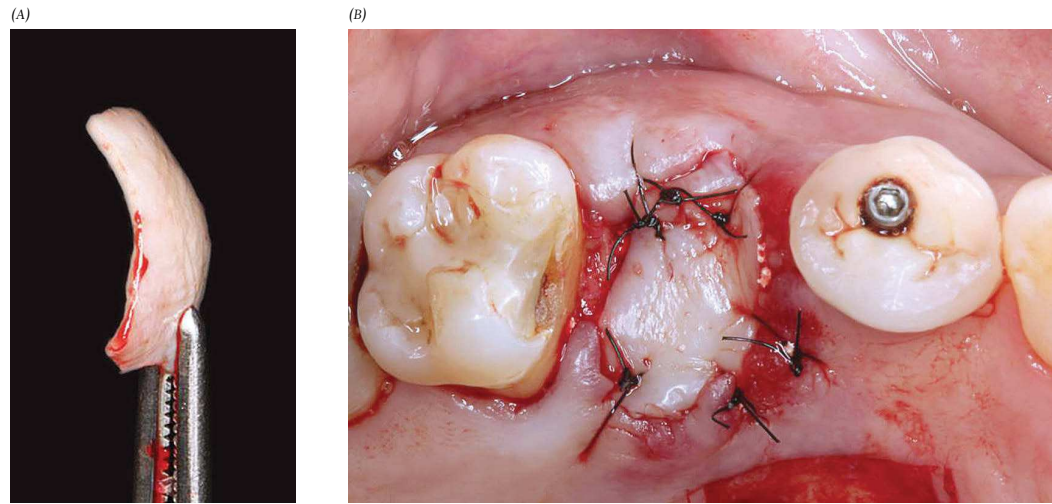


Figure 7. A) Harvested free gingival tissue graft. B) Free gingival tissue graft sutured to the surgical socket.

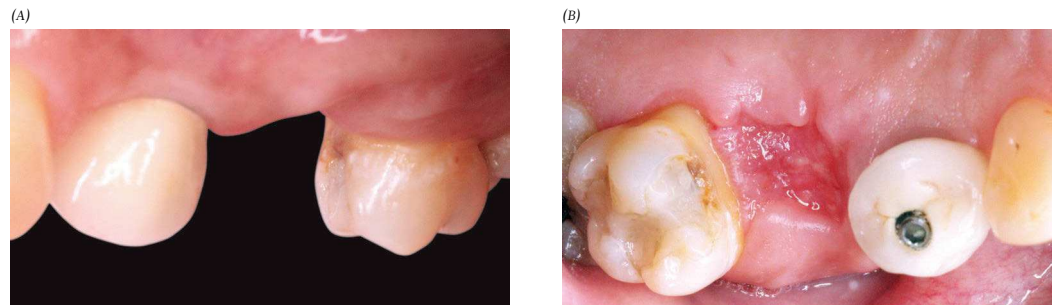


Figure 8. Post-operative phase after 30 days: A) Buccal clinical view. B) Occlusal clinical view.

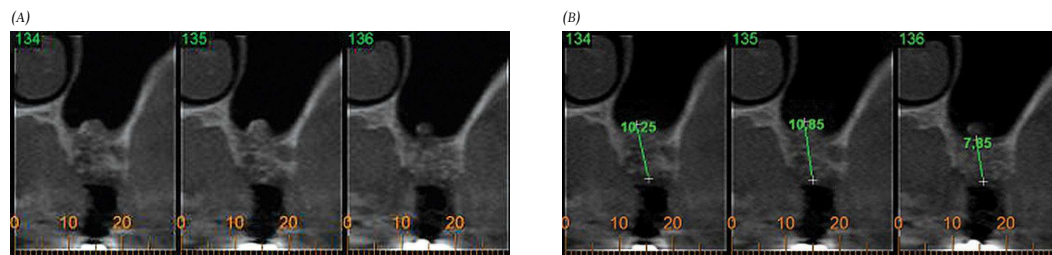


Figure 9. A) Post-operative cone beam computed tomography. B) Post-operative cone beam computed tomography with measures that evince bone height gain near 3 mm.

Therefore, atraumatic extraction should be performed whenever possible.¹⁷ Regeneration procedures have been increasingly used, since the literature demonstrates significant changes in alveolar bone crest after extraction when these procedures are not performed, which may hinder subsequent implant placement.¹⁸

Some cases present limiting factors that hinder the surgical procedure, namely: atrophic maxillary ridge or pneumatized maxillary sinus. In these cases, elevation of the maxillary sinus membrane proves a feasible option, as it aims to achieve sufficient bone height for implant placement in the posterior maxilla. The high success rates and predictable results yielded by this procedure are widely described in the literature.^{19,20,21}

The traumatic approach performed by means of the lateral window technique, followed by the elevation of the membrane and cavity filling, as reported by Tatum,⁵ is indicated when bone crest thickness is between 2 and 4 mm. The atraumatic or crestal approach of Summers⁶ requires a minimum height of 5 to 6 mm, and the elevation of the membrane is carried out through osteotomes. In the case reported herein, the remaining bone septum was 6 mm thick, which would allow atraumatic elevation of the maxillary sinus; however, the procedure could only be carried out after healing of the post-extraction socket. Nevertheless, it is not possible to predict the rate of maxillary sinus pneumatization and/or alveolar reabsorption, for this reason, a more complex surgery, such as the opening of a lateral window, could be required. In this case, Fugazzoto's technique allowed greater predictability and security in maintaining bone architecture, indispensable for implant placement.

It is worth noting that, whenever a patient is submitted to any surgical procedure, one must consider the advantages and disadvantages of the options available. The traumatic technique provides greater bone gain, however, it is a more invasive procedure that increases postoperative morbidity. The crestal approach, on the other hand, is minimally invasive, but with limited bone gain.²² Due to the aforementioned limitations, Fugazzoto's technique¹ was chosen to increase the maxillary sinus floor immediately after extraction of the upper molar. Fugazzoto¹ highlighted that the association of his technique with alveolar regeneration is key to maintain the three-dimensional architecture of the socket, avoiding major structural changes and enabling the maintenance of buccal-lingual and apico-coronal architecture.

The use of bone grafting and regeneration material has been widely discussed in the literature. Even though the best results are still obtained with autogenous bone, biomaterial have proved extremely effective, in addition to providing high predictability.^{23,24} Xenogeneic biomaterial, hydroxyapatite enriched with calcium sulphate and hydroxyapatite enriched with magnesium are among bone substitutes. They were tested by Crespi, et al²⁵ who demonstrated that implant placement over these substrates did not influence the clinical results, even though further histological studies are required. Other comparative studies reveal that associating swine, bovine and synthetic bone substitutes is a valid procedure when compared with autogenous bone used alone. Schlegel et al²⁶ compared bovine bone substitute (Bio-Oss) with autogenous bone, assessing their effectiveness as material used for maxillary sinus filling. Their study revealed that excellent results can be achieved with the biomaterial.

Therefore, the present study used bovine biomaterial composed of organic and inorganic particles to fill the cavity, which not only decreased the amount of operated sites, but also post-operative morbidity. Furthermore, the choice for this type of biomaterial was based on its structural properties that merge the advantages of good speed bone formation / resorption and, at the same time, enable maintenance of the socket as a result of the particles with low resorption rate.^{27,28}

Primary flap closure is key to bone regeneration. Several authors recommend the use of pedicled connective tissue graft, since it provides better esthetics, graft

nutrition and, as a consequence, greater predictability.^{29,30} In spite of that, since the present case did not require esthetic outcomes, free gingival tissue graft was performed to seal the surgical socket, which allowed healing by second intention.

CONCLUSION

Fugazzotto's technique enables sinus floor elevation to be performed at the same time of tooth extraction, providing great predictability to GBR, decreasing treatment time and the number of surgical procedures, and optimizing treatment with osseointegrated implants.

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