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ENXERTO MINERAL ÓSSEO BOVINO DESPROTEINIZADO EM SEIO MAXILAR PELA TECNICA DA JANELA LATERAL: RELATO DE UM CASO CLINICO

MINERALIZED BOVINE BONE GRAFTING IN THE MAXILLARY SINUS USING THE LATERAL WINDOW TECHNIQUE: A CLINICAL CASE REPORT

INJERTO ÓSEO MINERAL BOVINO DESPROTEINIZADO EN SENO MAXILAR MEDIANTE LA TÉCNICA DE VENTANA LATERAL: REPORTE DE UN CASO CLÍNICO

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Resumo

Este estudo teve como objetivo relatar um caso clinico onde foi realizado o levantamento do seio maxilar e preenchimento com enxerto de matriz inorgânica óssea bovina através da técnica da janela lateral. Um paciente do sexo masculino compareceu a clínica de reabilitação oral da pós graduação em Implantodontia do Instituto de Ciência e Tecnologia - Câmpus de São José dos Campos (UNESP) com queixa da ausência de alguns elementos dentários. No exame clínico e radiográfico na região posterior da maxila posterior foi observada a pneumatização do seio maxilar e espessura do remanescente ósseo deficiente para a instalação dos implantes. O tratamento proposto foi a realização do levantamento do seio maxilar e preenchimento com biomaterial e após 1 ano foi realizada a instalação de dois implantes na região do 25 e 26 com travamento dos implantes acima de 35 Ncm.

Palavras-chave: Enxerto ósseo; Regeneração óssea; Seio maxilar.

Abstract

This study aimed to report a clinical case where maxillary sinus elevation and filling with bovine inorganic bone matrix graft were performed using the lateral window technique. A male patient attended the oral rehabilitation clinic of the Implantology postgraduate program at the Institute of Science and Technology - São José dos Campos Campus (UNESP) with a complaint of missing teeth. Clinical and radiographic examination revealed maxillary sinus pneumatization and insufficient bone thickness in the posterior maxilla for implant installation. The proposed treatment involved maxillary sinus elevation and filling with biomaterial, and after 1 year, two implants were placed in the 25 and 26 regions with implant stability achieved above 35 Ncm.

Keywords: Bone graft; Bone regeneration; Maxillary sinus.

Resumen

Este estudio tuvo como objetivo reportar un caso clínico en el que se realizó la elevación del seno maxilar y su relleno con injerto de matriz ósea bovina inorgánica mediante la técnica de ventana lateral. Un paciente de sexo masculino acudió a la clínica de rehabilitación oral del posgrado en

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Implantología del Instituto de Ciencia y Tecnología – Campus de São José dos Campos (UNESP), con queja por la ausencia de algunos elementos dentarios. En el examen clínico y radiográfico de la región posterior del maxilar se observó la neumatización del seno maxilar y un espesor óseo remanente insuficiente para la instalación de implantes. El tratamiento propuesto consistió en la realización de la elevación del seno maxilar con relleno mediante biomaterial y, después de 1 año, se llevó a cabo la instalación de dos implantes en la región de los dientes 25 y 26, con un torque de inserción superior a 35 Ncm.

Palabras clave: Injerto óseo; Regeneración ósea; Seno maxilar.

1. Introduction

Maxillary atrophy, particularly in the posterior region, represents a significant challenge for dental implant placement due to low bone density and maxillary sinus pneumatization. In such cases, prior to implant placement, additional bone augmentation procedures are required, such as maxillary sinus elevation or residual bone augmentation (Zaniol; Zaniol, 2017; Pistilli, et al., 2022).

The maxillary sinus elevation procedure aims to increase bone volume in the posterior maxilla by superior repositioning of the sinus floor, thereby creating sufficient vertical bone height to accommodate dental implants. This surgical approach generally involves the use of bone graft material to fill the space created between the sinus floor and the Schneiderian membrane (Meneghetti et al., 2023).

The sinus lift technique was first reported in 1980 (Boyne; James, 1980). The literature describes three main approaches for this procedure: the lateral window technique, the lateral window technique with simultaneous implant placement, and the Summers technique (Zaniol; Zaniol, 2017; Pistilli, et al., 2022; García, et al., 2021).

The Summers technique was introduced by Robert Summers in 1993 and is indicated for cases presenting residual bone height greater than 5 mm, allowing a vertical bone gain of approximately 3 to 5 mm (Tasoulis, et al., 2011). This approach offers reduced treatment time, as it is based on a single-stage surgical procedure for implant placement and may be performed with or without grafting material (García, et al., 2021; Yamada, et al., 2013). However, disadvantages

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include the potential risk of sinus membrane perforation during the procedure and patient discomfort associated with osteotome insertion (Parra, et al., 2017).

The lateral window technique, initially described by Tatum in 1986, is considered a simple and predictable approach (Tatum, 1986). It provides broad visualization of the grafting site and is indicated for patients with residual bone height less than 6 mm (Pistilli, et al., 2022; Bhalla; Dym, 2021). This technique involves performing an osteotomy to create a bony window in the lateral wall of the maxilla, elevating the sinus membrane, and filling the created space with autogenous graft and/or biomaterial. The procedure is finalized with placement of a resorbable collagen membrane and/or repositioning of the removed bony window (Pistilli, et al., 2022; Zaniol, et al., 2018). In contrast, the lateral approach with simultaneous implant placement requires achieving primary implant stability in the residual bone, followed by graft coverage of the implants (Zaniol; Zaniol, 2017).

The size of the lateral window is of fundamental importance to prevent sinus membrane perforation and to facilitate surgical access. The recommended width, height relative to the sinus floor, and distance from the anterior sinus wall vary among authors and do not appear to significantly affect clinical outcomes or postoperative patient discomfort (Baldini, et al., 2017). Furthermore, the use of piezoelectric devices has been shown to reduce the risk of sinus membrane perforation compared with conventional rotary instruments (Jordi, et al., 2018).

Regarding graft materials used to fill the volume obtained after sinus membrane elevation, the gold standard remains autogenous bone graft, either alone or in combination with a bone substitute. However, xenogeneic and synthetic grafts have also demonstrated effectiveness when used alone and may be considered when autogenous bone is not available (Starch-Jensen, et al., 2018; Starch-Jensen et al., 2020; Starch-Jensen, et al., 2021).

Therefore, the present study aims to report a case of sinus lift in an atrophic maxilla using a xenogeneic bone graft through the lateral window technique, followed by dental implant placement.

2. Case report

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Male patient, ACS, 63 years old, presented to the Specialization Clinic in Implant Dentistry at the Institute of Science and Technology Applied to Oral Health (ICT–UNESP), São José dos Campos campus, with complaints of an ill-fitting removable partial denture, unsatisfactory dental esthetics, absence of several teeth in the dental arches, and the desire to undergo implant placement in the edentulous areas (Figure 1).

Figure 1 – Initial frontal view of the patient's smile



Caption: Frontal view of the patient.

During anamnesis, the patient was found to be systemically healthy and reported social alcohol consumption and no smoking history. He also reported a history of hypertension controlled with hydrochlorothiazide. According to the American Society of Anesthesiologists (ASA) classification, the patient was classified as ASA II.

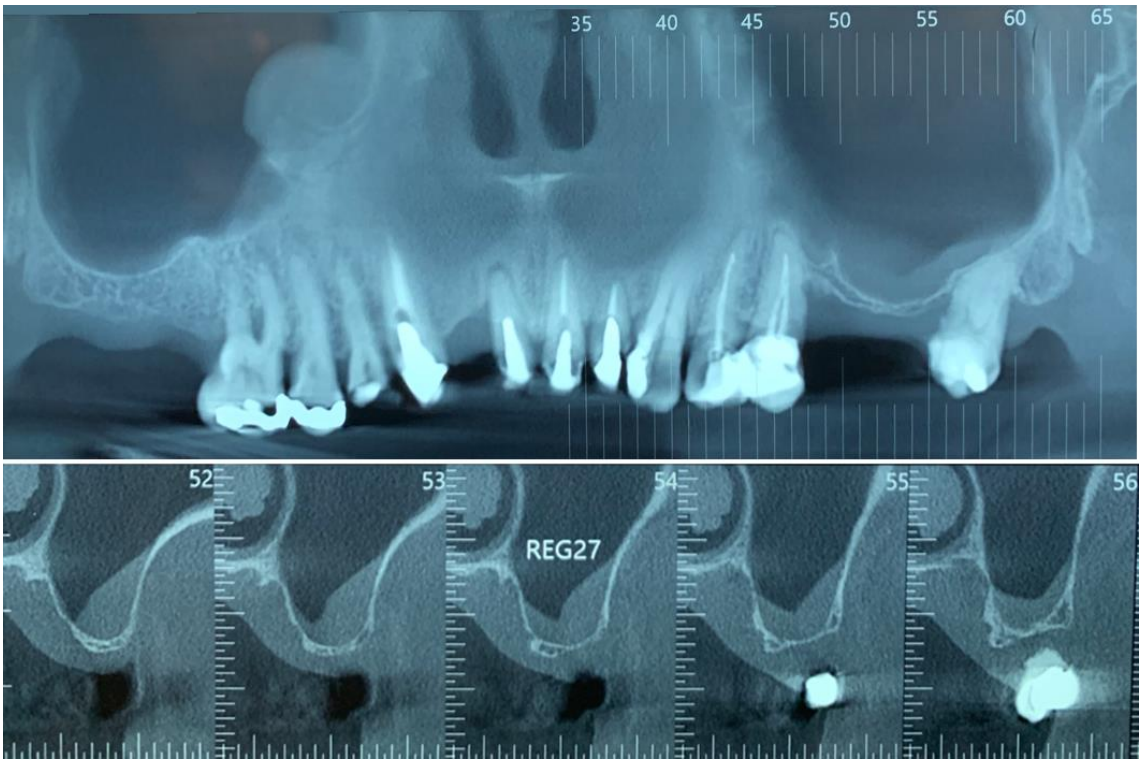
Intraoral examination revealed inadequate plaque control, abfraction lesions

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in some teeth caused by occlusal disharmony, ill-fitting crowns, an ill-adapted removable partial denture, and absence of teeth #17, #12, #26, #27, #35, #36, #45, #46, and #47. Cone-beam computed tomography (CBCT) demonstrated atrophy of the edentulous maxillary alveolar ridge with insufficient bone volume for implant placement (Figure 2).

Figure 2 – Panoramic view of the CBCT



Caption: Tomographic image and cross-sectional views of the maxillary sinus region.

Preoperative medication included dexamethasone phosphate 1 mg + neomycin sulfate 3.5 mg ophthalmic solution (5 mL), prescribed for intranasal use (three drops in each nostril, three times daily), starting three days before surgery. Isotonic saline nasal spray (0.9%) was also prescribed for nasal irrigation twice daily, beginning three days prior to surgery. Additionally, amoxicillin 500 mg combined with potassium clavulanate 125 mg and dexamethasone 4 mg were prescribed, with two tablets of each administered 30 minutes before the surgical

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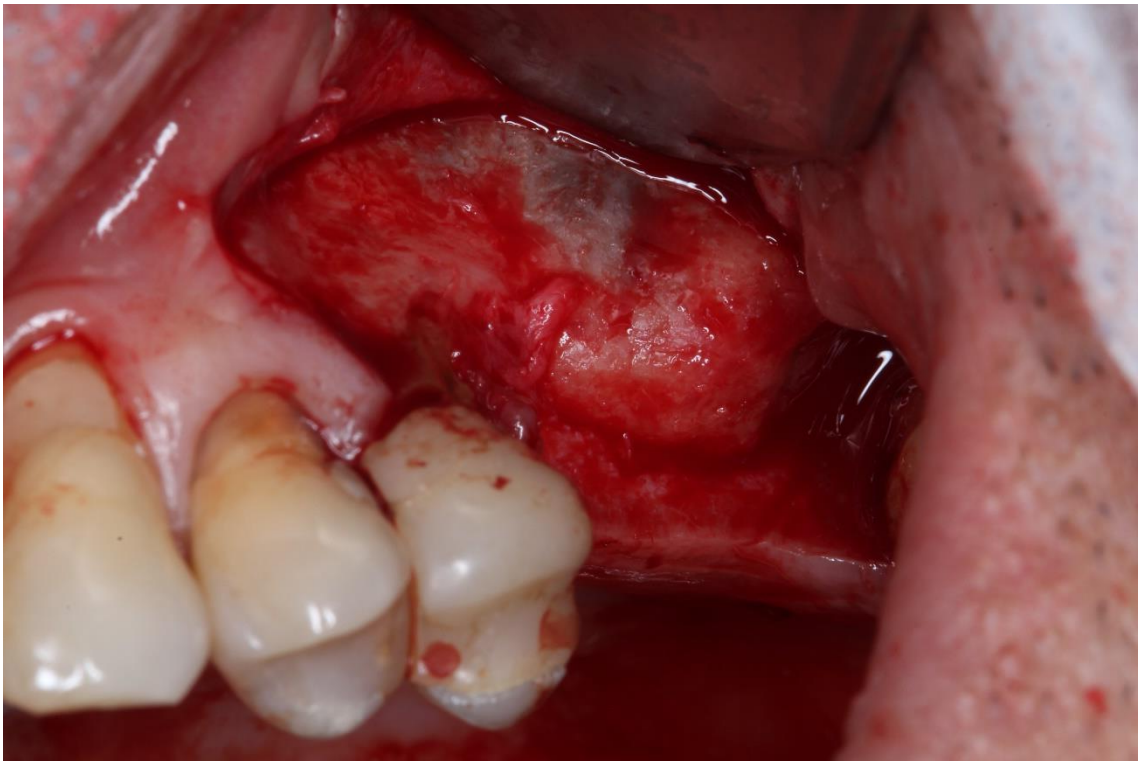
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procedure.

Posterior superior alveolar nerve block anesthesia was performed and complemented with infiltrative anesthesia using three cartridges of 4% articaine hydrochloride with epinephrine 1:100,000 (DFL, São Paulo, Brazil) on the left side.

A crestal incision was performed, complemented by a vertical releasing incision in the region of tooth #25, followed by elevation of a mucoperiosteal flap. The lateral window osteotomy for sinus access was outlined 5 mm from the anterior sinus wall, 4 mm above the sinus floor, and measuring 12 mm in width (Figure 3). Subsequently, osteotomy of the lateral wall was performed using a rotary instrument (No. 7 round diamond bur), respecting the previously marked boundaries.

Figure 3 – Demarcation for initial osteotomy



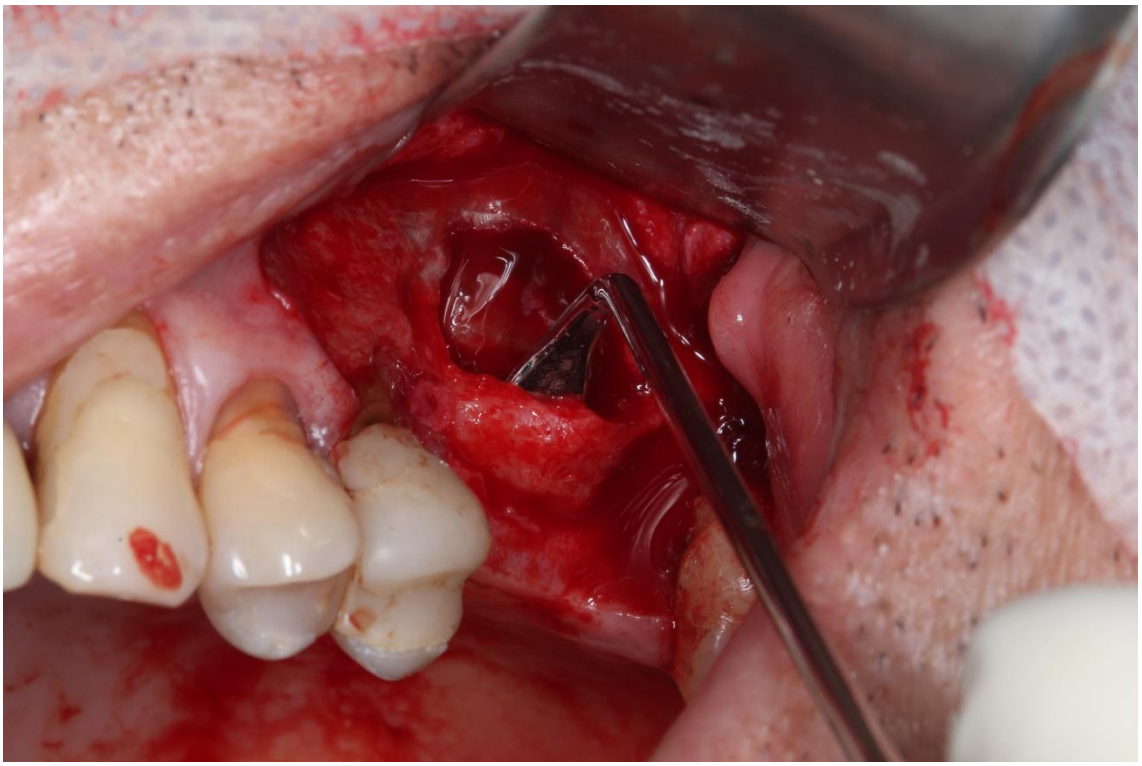
Caption: Delimited area for osteotomy.

After completion of the lateral wall osteotomy and exposure of the sinus

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membrane, careful membrane elevation was initiated using rounded sinus curettes specifically designed to avoid perforation (Figure 4).

Figure 4 – Elevation of the maxillary sinus membrane



Caption: Sinus membrane being elevated for graft placement.

Deproteinized bovine bone mineral (Bio-Oss®, Geistlich Pharma AG, Wolhusen, Switzerland) with a granule size of 1–2 mm was used. Two 0.5 g units were applied, totaling approximately 3 cm^3 in volume (Figure 5).

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Figure 5 – Graft material used for sinus augmentation



Caption: A) Graft material used for filling; **B)** Graft placed in a metal dish for

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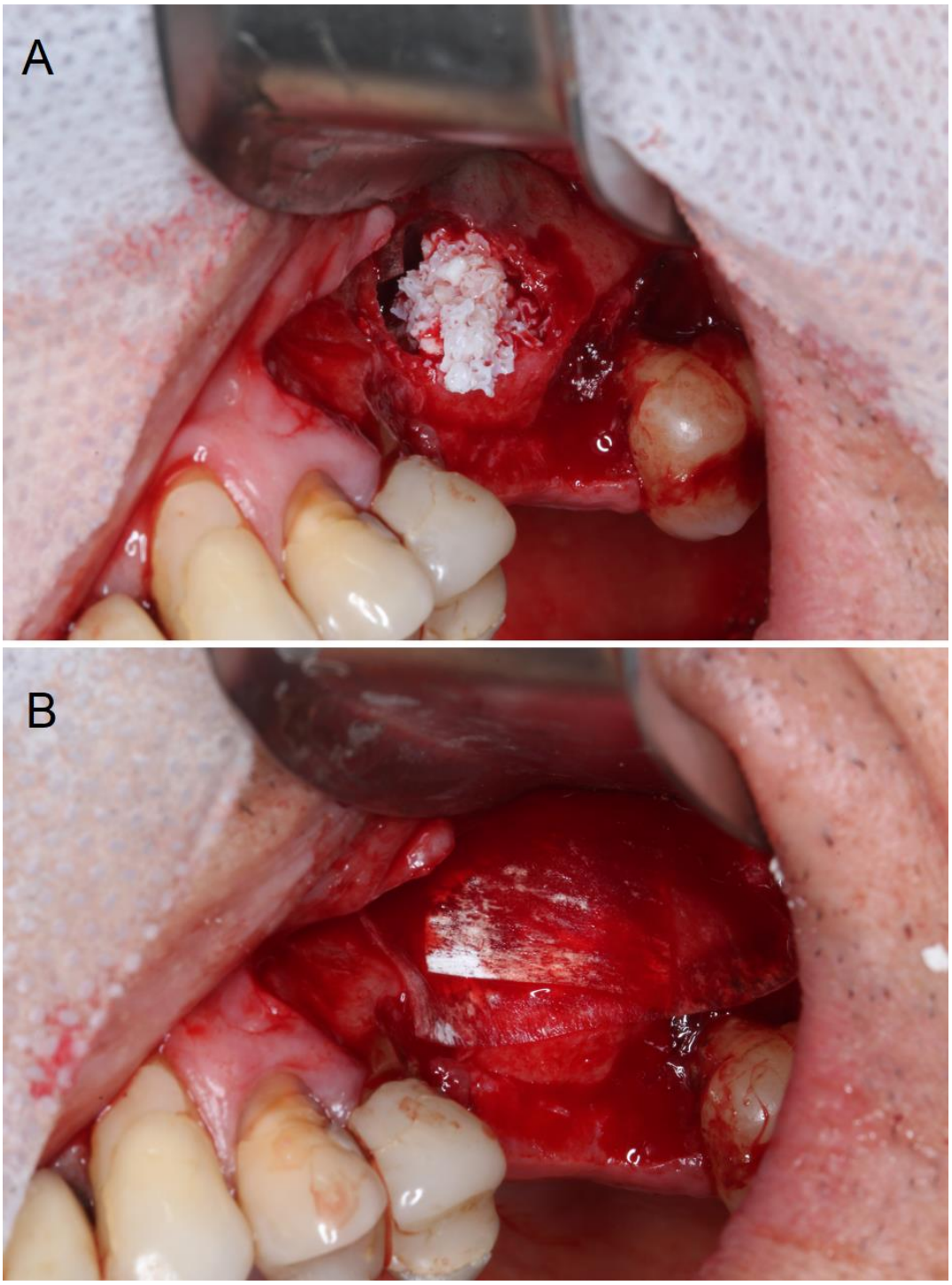
hydration with sterile saline solution.

The graft material was placed in a metal container and hydrated with sterile saline solution. The elevated sinus membrane and the lateral wall were covered with a xenogeneic bovine cortical bone membrane (GenDerm®, Baumer, Brazil) in order to prevent possible membrane perforation during graft placement and to avoid connective tissue migration into the grafted site, respectively (Figures 6A and 6B). Wound closure was performed with interrupted sutures using 5-0 polyamide suture (Blue Nylon 5-0, Tech Suture, Brazil) (Figure 7).

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Figure 6 – Graft accommodation within the maxillary sinus cavity

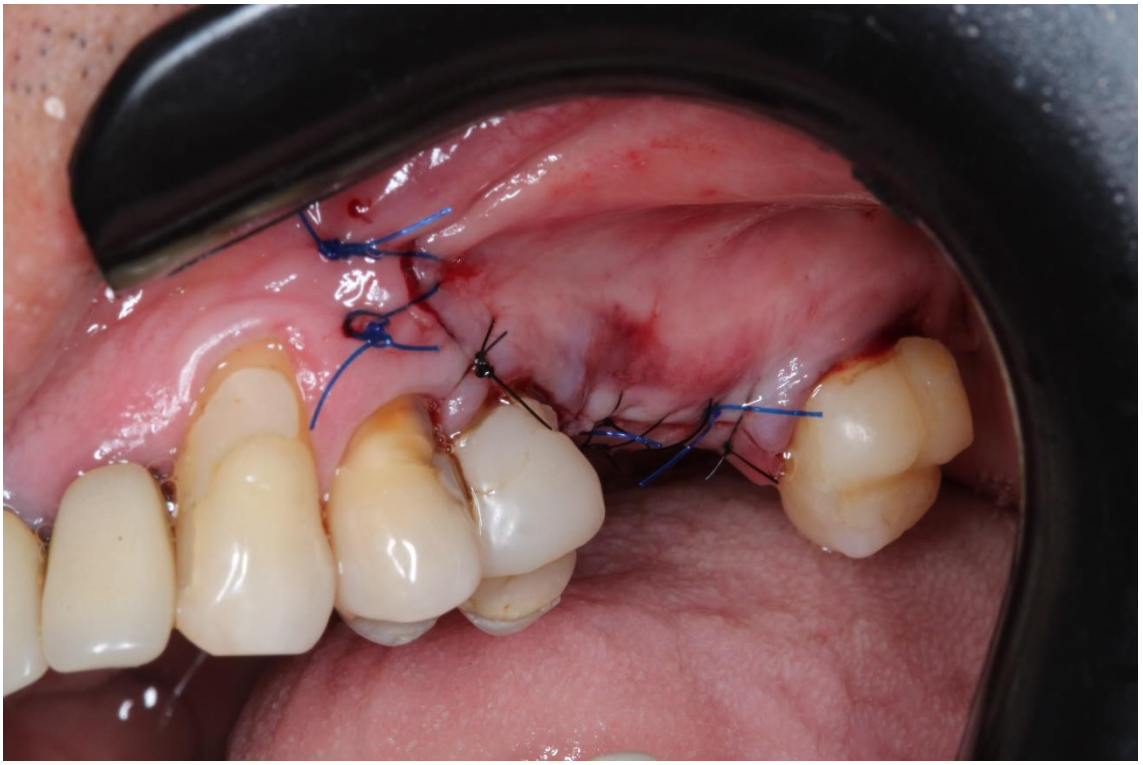


Caption: A) Graft accommodated and compacted within the maxillary sinus; **B)** Coverage with a resorbable collagen membrane.

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Figure 7 – Wound closure with sutures



Caption: Sutures performed at the surgical site.

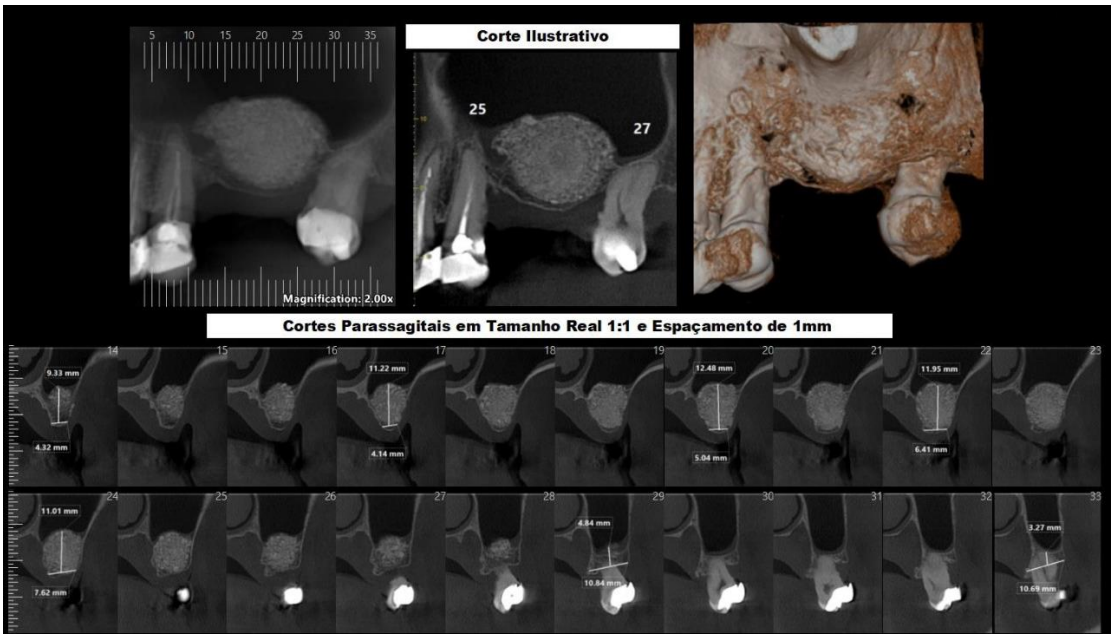
The patient received postoperative instructions regarding diet during the first two days, rest, careful oral hygiene, and avoidance of nose blowing. The following medications were prescribed: amoxicillin 500 mg every 8 hours for 7 days, nimesulide 100 mg every 12 hours for 2 days, and dipyrone 500 mg every 6 hours for 2 days. No postoperative complications were observed, and sutures were removed after two weeks, with excellent healing.

Nine months after the maxillary sinus elevation procedure, a new cone-beam computed tomography (CBCT) scan was requested and performed to evaluate bone volume gain (Figure 8).

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Figure 8 – CBCT confirming bone volume gain



Caption: CBCT for confirmation of bone volume gain.

After confirmation of the bone volume obtained through grafting approximately 11 mm in height and 5 mm in thickness, as observed on tomographic sections implant placement was planned three months after the new tomography. Two implants measuring 3.75 × 8 mm were indicated. Preoperative medication included amoxicillin 500 mg (two capsules one hour before surgery) and dexamethasone 4 mg (two tablets one hour before surgery).

Antisepsis was performed using 0.12% chlorhexidine intraorally and 2% chlorhexidine extraorally. After placement of the sterile surgical drape, anesthesia of the greater palatine nerve and the middle and posterior superior alveolar nerves was performed using the terminal infiltrative technique with 2% mepivacaine hydrochloride associated with epinephrine 1:100,000 (DFL, Brazil). A crestal incision was made followed by mucoperiosteal flap elevation to expose the surgical area. Sequential drilling was performed for osteotomy site preparation using pilot and tapered drills (2.0, 3.5, and 3.75 mm, respectively) under constant irrigation with sterile saline prior to implant placement.

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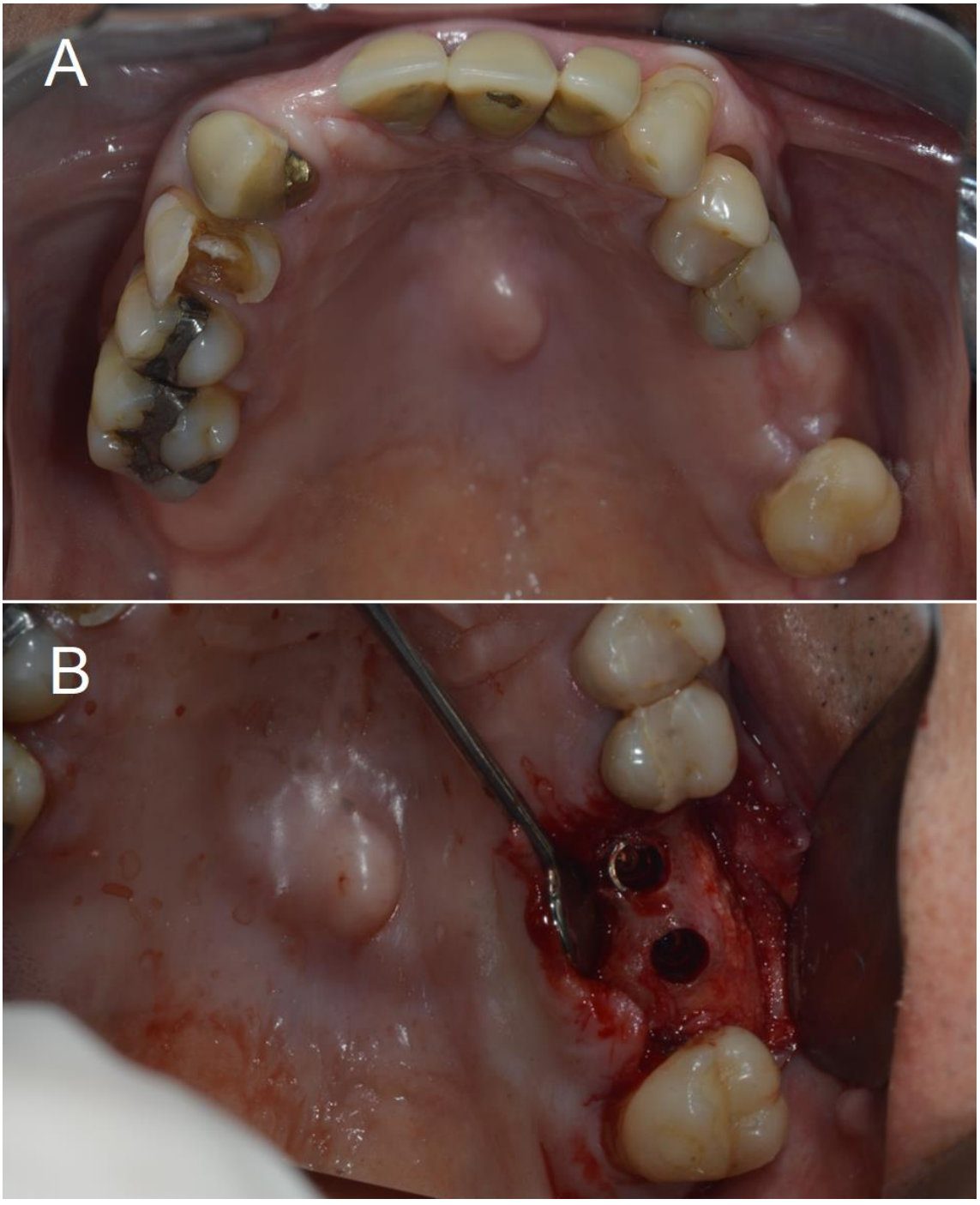
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The implants were installed with insertion torque greater than 35 Ncm, achieving good primary stability. This was confirmed by a panoramic radiograph taken one month postoperatively (Figure 9).

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Figure 9 – Before and after implant placement in the previously grafted area



Caption: A) Before surgical procedure; **B)** After implant placement in the regions of teeth 26 and 27.

After implant placement, a six-month healing period was observed to allow osseointegration prior to prosthetic rehabilitation. Mini abutments were installed

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(Figure 10) with a torque of 32 Ncm, followed by placement of a screw-retained metal-ceramic fixed prosthesis (Figure 11).

Figure 10 – Mini abutments installed



Caption: Mini abutments installed over the implants.

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Figure 11 – Prosthesis installed over mini abutments



Caption: Final aspect of the screw-retained prosthesis over the mini abutments.

3. Discussion

The present study reported a maxillary sinus elevation procedure using deproteinized bovine bone mineral graft through the lateral window technique, followed by implant placement in the grafted region.

The lateral window technique for sinus elevation with grafting is considered predictable (Monje, et al., 2014). For simultaneous implant placement associated with sinus grafting, a residual bone height of at least 6 mm is recommended to ensure better primary stability (Raghoebar, et al., 2019). In the present clinical case, the posterior maxillary alveolar ridge height was less than 3 mm, thus justifying the lateral window approach. This technique is indicated for critical defects and severely atrophic maxillae; however, it requires a two-stage surgical approach for implant placement and consequently a longer overall rehabilitation time (Wallace, et al.,

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2012).

Autogenous bone graft has historically been considered the gold standard due to its osteogenic, osteoinductive, and osteoconductive properties. However, studies have shown no statistically significant difference between biomaterials and autogenous bone regarding implant survival rates in maxillary sinus augmentation procedures (Artzi, 2020). In order to reduce donor site morbidity associated with autogenous graft harvesting, deproteinized bovine bone mineral was used in this study. This graft material presents favorable success rates (Carrão; DeMatteis, 2015), exhibits osteoconductive properties, and supports clot maturation, leading to new bone formation through neovascularization and migration of osteoprogenitor cells (Wallace, et al., 2012).

The lateral sinus access in this case was performed through a linear crestal incision with releasing incisions to allow adequate visualization of the surgical field (Monje, et al., 2014). Although a round diamond bur was used for lateral wall osteotomy, some authors advocate the use of piezoelectric devices due to their lower risk of membrane perforation during osteotomy (Li, et al., 2013; Öncü; Kaymaz, 2017).

Sinus membrane perforation is a significant concern, as it represents the most frequent complication associated with sinus lift procedures (Díaz-Olivares, et al., 2021). Reported rates of membrane perforation range from 18% to 35% (Pikus, 2008). In most cases, this complication can be managed during the same surgical procedure (Öncü; Kaymaz, 2017), and several techniques have been described for membrane repair (Kumar, et al., 2018). In the present case, no membrane perforation occurred. Additionally, a resorbable membrane was placed over the graft, functioning as a protective barrier to help maintain sinus membrane integrity.

Implant survival rates in grafted sites using either autogenous bone or deproteinized bovine mineral graft are reported to exceed 90% (Raghoebar, et al., 2019). Twelve months after the grafting surgery, the patient underwent implant placement. The literature suggests that implant rehabilitation is typically performed approximately nine months after sinus grafting procedures (Wallace, et al., 2012).

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5. Conclusion

Based on the narrative literature review conducted and the clinical outcomes observed in the present case, it can be concluded that careful planning using complementary imaging exams such as cone-beam computed tomography, combined with meticulous execution of maxillary sinus membrane elevation through the lateral window technique, represents a predictable option for patients requiring vertical bone augmentation in the posterior maxilla for implant-supported rehabilitation.

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