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Case Report

# Sinus Lift with Traumatic Technique Using Heterogeneous Biomaterial Associated with Leukocyte- and Platelet-Rich Fibrin with Immediate Implant Placement: Case Report

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## Abstract

The lack of bone structure in the posterior maxilla region complicates oral rehabilitation with osseointegrated implants. In some cases, it is necessary to first perform bone grafting surgery and, after a certain period, a second surgery to place the implants. In this context, the aim of this study was to report a bone grafting surgery to gain height and volume in the maxillary sinus using heterogeneous material associated with leukocyte- and platelet-rich fibrin, with the immediate placement of osseointegrated implants to avoid the need for additional surgical interventions. The result was a shorter time required for patient clearance for the placement of prostheses on the implants and fewer surgical interventions.

**Keywords:** Sinus Floor Augmentation; Platelet-Rich Fibrin; Bone Graft

## Introduction

Insufficient height for implant placement in the posterior maxilla is a common situation following tooth loss in this region. This reduction in bone height in the edentulous posterior maxilla is caused by alveolar bone resorption and increased pneumatization of the maxillary sinus. Maxillary sinus lift surgery is an effective and predictable way to resolve the issue of inadequate bone height for implant placement in this region [15,16,17,19].

In 1977, Tatum first developed the procedure, and in 1980, Boyne and James were the first to publish research on this technique[17]. The technique is indicated when the remaining bone height is less than 5 mm [15].

There are many approaches and biomaterials used in sinus lift surgery. An access to the Schneiderian membrane is created, and then the sinus membrane is carefully elevated, and the underlying space created is augmented using bone graft material. Although autogenous bone is considered the gold standard for the procedure due to its osteogenic, osteoinductive, and osteoconductive properties, in addition to the lack of immunogenic response, the procedure with autogenous bone generates a limited volume of material for bone augmentation, especially when addressing voluminous or pneumatized sinuses. Due to these limitations, other graft materials have been proposed, including allografts, xenografts, and alloplasts, or a mixture of these materials [17,18].

There are two main approaches to the technique: transalveolar antrostomy and lateral antrostomy, with the lateral antrostomy approach being more commonly used [15,19]. However, the indications for the transalveolar approach are expanding due to advances in implantology technology [15]. Studies have indicated that the success rate of the lateral sinus lift approach is between 86%-100%, while the transalveolar approach has a success rate of 92.8%-97%, showing no significant difference in the long-term clinical outcomes between the two approaches [15].

Another point to consider in sinus lift surgery is whether implant placement will be performed in a single-stage or two-stage approach. In the single-stage approach, implants are placed at the same time as the sinus lift. In the two-stage approach, the sinus lift is performed first, followed by implant placement 4 to 6 months later [18]. For successful osseointegration in single-stage surgery, implants should have a minimum length of 10 mm and a width of 3 mm [18].

Among the biomaterials commonly used to aid tissue healing are platelet-rich concentrates. With growth factors derived from platelets, as well as growth factors produced by leukocytes, studies have reported that platelet-rich fibrin (PRF) is superior to other platelet concentrates. The fibrin present in PRF is an important adjunct protein that acts in tissue reengineering during healing, presenting a greater therapeutic advantage than traditional platelet-rich plasma [16]. PRF is an autologous platelet concentrate that contains platelet-derived growth factor (PDGF), insulin-like growth factor (IGF), vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and platelet-derived angiogenic factor [19].

Additionally, platelets secrete important proteins that modulate the response of soft and hard tissues, such as fibrin, fibronectin, and vitronectin, which act as a matrix for connective tissue and adhesion molecules, resulting in more efficient cell recruitment at the wound site [19].

In dentistry, PRF has been used in various applications, such as a tissue substitute in root coverage, a membrane in guided tissue regeneration, and as a graft material in sinus lift procedures [19]. In the field of bone regeneration, PRF has also been used alone or in combination with xenografts to promote bone healing and increase the amount of new bone by enhancing the presence of osteoprogenitor cells in the treated area. A higher concentration of platelets in the grafted area results in subsequent activation and aggregation of platelets that act as a molecular glue [19].

To obtain PRF, blood is centrifuged at high speed to separate it into three layers within the tube: red blood cells at the bottom, platelet-poor plasma at the top, and an intermediate layer the "buffy coat" where most leukocytes and platelets concentrate [20].

The aim of this case report is to demonstrate that the single-stage surgical approach using heterogeneous bone associated with platelet-rich fibrin to gain bone in the maxillary sinus region during implant placement provides adequate resistance for rehabilitation.

## Case Report

Patient SOR, 53 years old, presented with a compromised fixed metal prosthetic piece fracture in the region of teeth 26 and 27, with early involvement of teeth 25 and 28.

Initially analyzing the panoramic radiograph and after presenting several treatment alternatives to the patient, we opted for rehabilitation with implant-supported prostheses. We identified the need for bone volume gain in height in the region of teeth 26 and 27 due to the local defect present, evidenced by bone tissue absorption because of the left maxillary sinus floor, as seen in figure 1.

After taking the medical history and analyzing the lab tests, no abnormalities were observed. Among the possibilities for reconstruction and implant placement, we chose the traumatic technique of opening the lateral wall of the sinus. On the same day, the fractured prosthetic piece was removed, and we accessed the area of the teeth to be rehabilitated, as shown in figure 2.

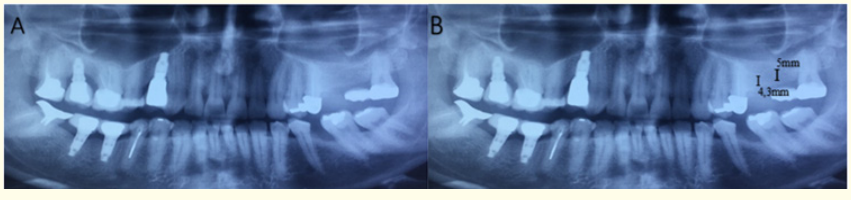


**Figure 1:** Panoramic radiograph top view (A) and panoramic radiograph top view with approximate measurement of the remaining bone (B).

Preoperatively, 1g of amoxicillin and 8mg of dexamethasone were prescribed, both administered 1 hour before the surgical procedure as a prophylactic measure.

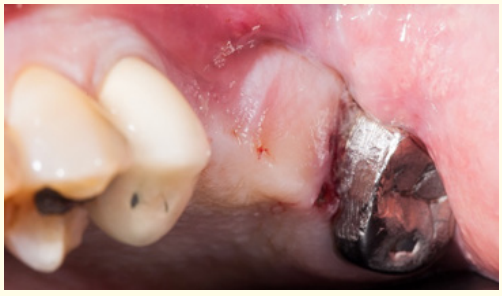

**Figure 2:** Immediate view after removing the prosthesis.

For surgery, extraoral antisepsis was performed with 2% chlorhexidine and intraoral antisepsis with 0.12% chlorhexidine.

Venous blood was collected from the forearm using a scalp vein set for vacuum blood collection (21Gx3/4x7, BD Franklin Lakes, NJ, USA), as shown in figure 3.

**Figure 3:** 21G scalp vein set for vacuum blood collection.

In 10 ml tubes (BD Vacutainer Serum, BD, Franklin Lakes, NJ, USA) without added anticoagulants, bovine thrombin or any other chemical agents, and immediately taken for centrifugation (Kasvi Digital, China) using the Choukroun centrifugation protocol, as shown in figures 4 and 5.

**Figure 4:** Timing of venous access.

**Figure 5:** Balanced arrangement of tubes in the Kasvi centrifuge.

The formed PRF clots were placed in the container designated by the manufacturer, following the process for forming autologous PRF membranes. The time required to collect the 8 tubes was 193 seconds. The centrifuge was set at 2,500 RPM for 10 minutes.

We performed an infiltrative anesthetic technique with 4% articaine with 1:100,000 epinephrine (Nova DFL, Rio de Janeiro, RJ, Brazil), making relaxing incisions in a trapezoidal shape with the base facing upwards, with access points in the regions of teeth 25 and 28 and the crest between 25 and 28, followed by elevation of the mucoperiosteal flap and exposure of the operative field, as shown in figure 6.

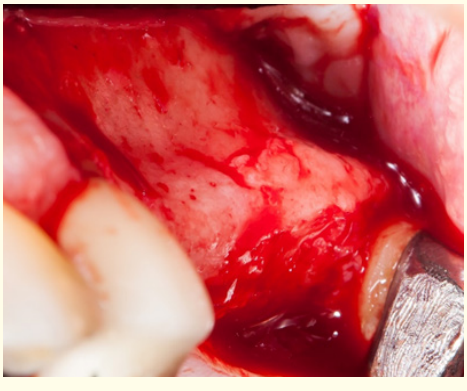

**Figure 6:** Elevation of the flap after incision with exposure of the lateral wall of the maxillary sinus – operative field.

Next, the lateral wall of the maxillary sinus was accessed using a Bullet Access® drill (Critéria Biomateriais, São Paulo, SP, Brazil) (Figure 7), coupled to a 20:1 contra-angle, rotating at 1,500 RPM, with abundant irrigation with 0.9% sodium chloride saline solution directly at the tip of the drill to maximize cooling (Figure 8).


**Figure 7:** Bullet Access® (Critéria Biomateriais, São Paulo, SP, Brazil).

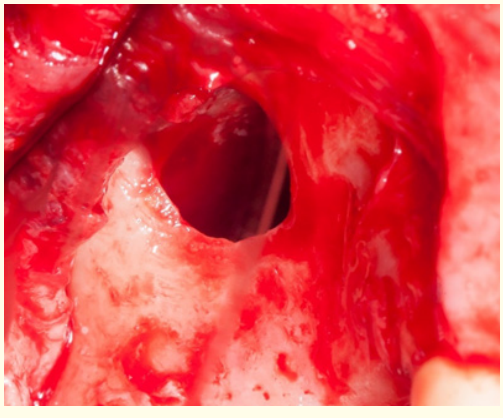

**Figure 8:** Traumatic access of the maxillary sinus.

After the access, the access window was enlarged using a Bullet Enlargement® drill (Critéria Biomateriais, São Paulo, SP, Brazil), as shown in figure 9.


**Figure 9:** Bullet Enlargement® Drill (Critéria Biomateriais, São Paulo, SP, Brazil).

We performed gentle and precise sinus elevation using CLSM® sinus elevation curettes (Supremo, Caieiras, SP, Brazil), as shown in figure 10.

We gently lift the sinus membrane without complications.

Then, bone drilling was performed using drills to install the implants, according to the manufacturer's specifications. Sequentially, we used a 2.0mm lance drill at 1200 RPM, 2.0mm, 2.5mm and 2.8mm helical drills at 800 RPM and a countersink drill to create the entry profile of the BIOHE 3 external hexagon cylindrical implant. 75X13 (Bioconect, Itapira, SP, Brazil) in the 26th and 27th regions. The implants were inserted with an adapter and internal threading at 40 RPM, with a torque of 25 and 30 NCM, respectively, measured by a digital torque meter integrated into the milling motor and implant installation, as shown in figures 10 and 11.

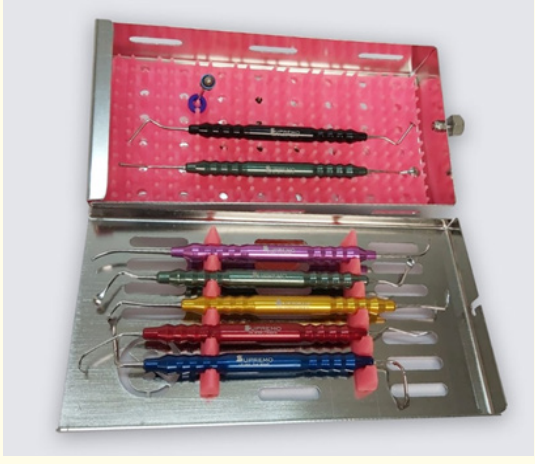

**Figure 10:** CLSM sinus lifting curettes (Supremo, Caieiras, Brazil).

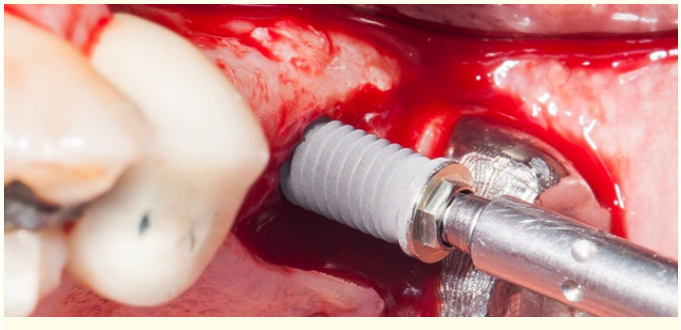

**Figure 11:** Installation moment of the first external hexagon implant.

After insertion of the implants, particulate biomaterial of heterogeneous origin was prepared, coarse-grained Lumina Bone Porous® (Critéria Biomateriais, São Paulo, SP, Brazil), moistened with supernatant liquid (Figure 12) extracted from the PRF present after processing. of previously produced membranes.

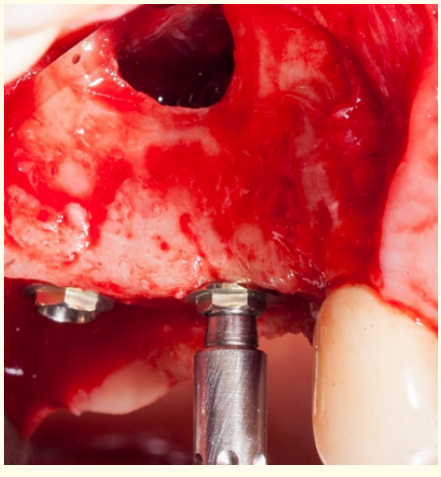

**Figure 12:** Installation of the second external hexagon implant.

We place the prepared biomaterial through the vestibular access window, surrounding all structures present in the sinus cavity, taking the utmost care not to exceed or create any type of laceration in the sinus membrane and avoiding excessive compression of this material against the floor of the maxillary sinus, completely filling the space. designated. The implant protection caps (cover screws) (Bioconect, Itapira, SP, Brazil) were then installed (Figure 13).

**Figure 13:** Installation of the second external hexagon implant.

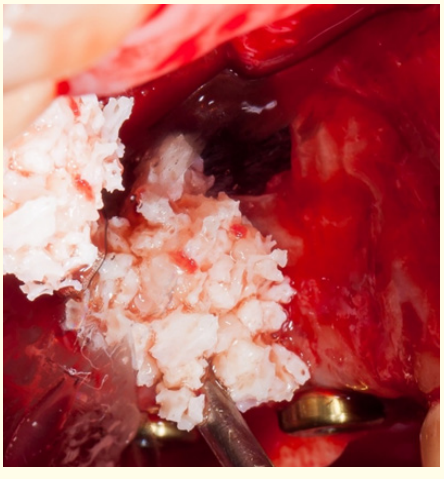

**Figure 13:** Arrangement of the biomaterial inside the maxillary sinus cavity.

After complete filling, we placed the fibrin-rich plasma membranes against the side wall, entirely covering the access window, which was already properly filled with implants and particulate biomaterial moistened with the supernatant extracted from the compression of the PRF membranes (Figure 14).

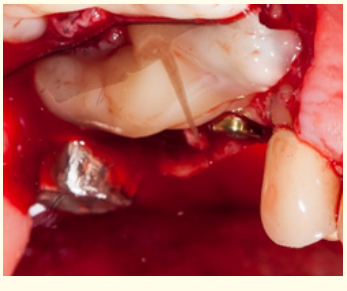

**Figure 14:** Arrangement of membranes over the access.

All incisions were synthesized with MicroNylon 5-0 nylon thread (microsuture, São Paulo, Brazil), using a continuous technique (Figure 15).

We conducted postoperative analyzes after 3, 7, 15, 30, and 60 days. And after 180 days, as shown in figure 16. We requested a new radiographic examination after 12 months with the prostheses already installed, as seen in (Figure 17).

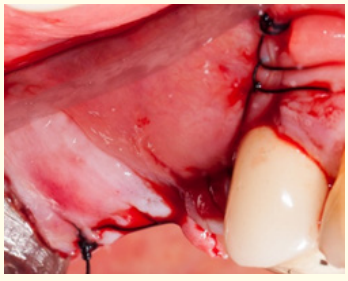

**Figure 15:** Continuous suture along the entire length of the incision.

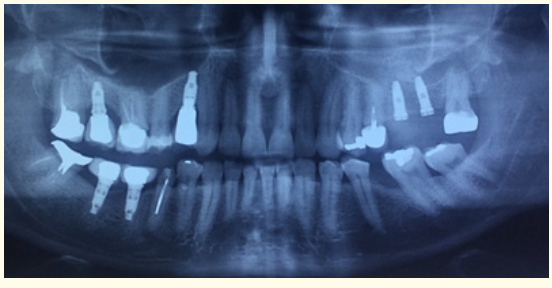

**Figure 16:** Control radiograph after 6 months

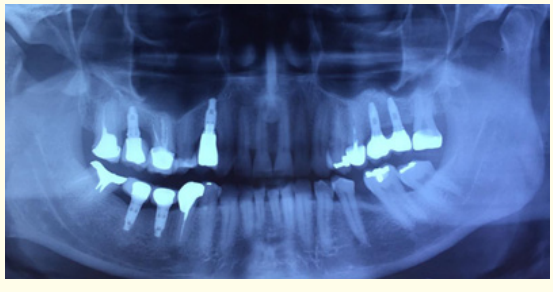

**Figure 17:** Radiographic control after 12 months.

## Discussion

Surgical and rehabilitative planning leads to the most appropriate technique for accessing the sinus cavity: traumatic or atraumatic technique and whether the implants can be installed at the same surgical time or only after the maturation of this bone graft[8,14]. In this report, the traumatic Tantum technique was used after planning based on clinical, radiographic, and laboratory examinations, reaching the conclusion that this would be the most appropriate intervention.

Among the techniques, we can mention membrane elevation and filling the space with heterogeneous biomaterial, followed by implant placement after bone maturation. Another method involves sinus membrane elevation, filling the cavity with a bone substitute, and placing the implants during the same surgical procedure [1,5,14]. In our case, we put the implants during the same surgical procedure as the membrane elevation because the bone conditions were favorable and consistent with the literature on this technique.

After analyzing the exams, we conducted prior planning. We performed the surgery delicately and precisely to achieve primary stability of the implants in a minimal region of remaining bone of about 5 millimeters, without accidents to the membrane through a surgical approach that allowed sufficient visualization of the operative field. Since one of the risks is the implants falling into the maxillary sinus due to the lack of primary stability[1,4,5], we took the necessary precautions and care during the procedure.

The immediate placement of implants at the same surgical time as bone grafting is a significant advance, as it avoids another surgical procedure and reduces the time needed to rehabilitate the patient with prostheses on implants. Furthermore, it reduces postoperative discomfort, time off work and medication administration [1,4,5,8,14].

Better results were obtained with the association of L-PRF, allowing the patient to be released for definitive rehabilitation six months after the surgical procedure.

## Conclusion

Adequate medical history, diagnosis and good planning are essential for the most appropriate indication of the rehabilitative procedure and successful treatment.

The treatment plan will correspond to the needs of the area to be treated. Therefore, knowing how to identify and respect the anatomy and limits of the posterior region of the maxilla is essential for choosing the surgical technique and reducing the risk of failure during the surgical procedure.

Therefore, in a region with bone remnants around 5mm in height in the maxillary sinus region, the traumatic technique of accessing the lateral wall of the maxillary sinus and placing heterogeneous biomaterial associated with the L-PRF is completely viable. As benefits, we avoid multiple surgical sessions to install implants and bone grafts, reduce morbidity by not using autogenous bone, avoiding injuries in another region - the donor area, and reduce

postoperative discomfort by administering just one medication per period.

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