Dentistry 3000

Vol 13, No 1 (2025)
ISSN 2167-8677 (online)
DOI 10.5195/d3000.2025.957

Effectiveness of Calcium Sulfate Bone Graft with Platelet Rich Fibrin in Oroantral Fistula Closure

Mahmoud Altabba, Issa Wehbeh, Ahmad Alnada

Faculty of Dentistry, Damascus University, Syria

Abstract

Objective: Oroantral communication is a common complication observed following the extraction of posterior maxillary teeth, often causing concern for both patients and general practitioners. Various methods are employed to close these communications. To identify a closure technique with minimal complications that is rapid and easily applicable by general practitioners, we evaluated the effectiveness of using calcium sulfate graft material mixed with platelet-rich fibrin, followed by clinical and radiographic assessment of closure success. **Material and Methods**: A moderate-sized oroantral communications resulting from recent tooth extractions was radiographed to confirm the size and dimensions of the communication. Subsequently, a 20 ml blood sample was collected from the patient and centrifuged to obtain two tubes containing platelet-rich fibrin. Using the first tube, a platelet-rich fibrin plug was formed, applied, and sutured at the site of the communication. Calcium sulfate graft material was then applied after being mixed with the platelet-rich fibrin clot from the second tube. The patient was followed up at intervals of: day one, day three, one week, two weeks, and six months. **Results**: We showed successful closure of oroantral communications in this case, with clinical and radiographic follow-up for 6 months post-procedure. **Conclusion**: Within the limitations of this study, it can be concluded that the technique of using calcium sulfate graft material with platelet-rich fibrin is a successful, cost-effective, and easily applicable method for managing moderate-sized oroantral communications.

Open Access

Citation: Altabba M, et al. (2025) Effectiveness of Calcium Sulfate Bone Graft with Platelet Rich Fibrin in Oroantral Fistula Closure. Dentistry 3000. 1:a001 doi:10.5195/d3000.2025.957
Received: June 6, 2025
Accepted: June 26, 2025
Published: August 13, 2025

Email: Mahmoud.tabba@damascusuniversity.edu.sy

Introduction

Oroantral communication (OAC) is an abnormal communication that results from the loss of both soft and hard tissues separating the oral cavity from the maxillary sinus [1].

The first signs that may indicate the occurrence of an oroantral communication include the presence of significant bleeding or an air bubble in the extraction socket of the removed tooth. The Valsalva test is a confirmatory diagnostic tool for this communication, as it causes air to escape through the alveolar socket [2].
There are numerous techniques described in the medical literature for the closure of this communication, each with its own indications, advantages, and disadvantages. These include vestibular flap displacement, rotational palatal flap, and cheek fat pad with a pedicle flap [3].

The sizes of oroantral openings have been classified by James Hupp into small (diameter < 3 mm), medium (3–6 mm), and large (> 6 mm) openings [4].
Small openings can heal spontaneously if their diameter is less than 2 mm [5], and the use of a Gelfoam, secured with sutures in the socket containing the communication in an "8" shape, may also help ensure complete closure [6]. On the other hand, openings larger than 2 mm but smaller than 5 mm have not been shown to close spontaneously without any intervention, according to a systematic review conducted by Visscher [7].

If the oroantral communication remains open for more than 48 hours, it may lead to the formation of a oroantral fistula, as the tract becomes lined with epithelial tissue, which increases the risk of maxillary sinus infections [1].
Several techniques have been proposed for closing oroantral communications, all of which primarily involve the closure of soft tissues [8].
Most of the methods for closing maxillary sinus openings have focused on achieving closure and preventing the formation of an oroantral fistula. However, with the development of biologically acceptable materials and the improvement of their physical and biological properties, it has become possible to focus on controlling both the short- and long-term outcomes of such closures, while minimizing the number of surgical procedures required and reducing their complications and negative effects.

Material and Methods

Intervention

A non-smoker 30-year-old-female patient was referred to the department of oral and maxillofacial surgery at the faculty of dentistry, Damascus University in 8/2024. The main complaint was pain related to the tooth 26. Intraoral examination revealed badly decayed tooth indicated for extraction.

Radiographic examination (Figure 1) revealed the presence of a long palatal root that might have been involved within the maxillary sinus. After taking the patient's medical history, it was determined that there was no contraindication to extracting the affected tooth. The roots were separated individually, and then the roots were extracted sequentially. To ensure the integrity of the maxillary sinus, we performed the Valsalva maneuver, which showed the release of air bubbles from the extraction site. When the area was rinsed with saline, fluid leakage from the oral cavity into the maxillary sinus and then into the nose was observed (Figure 2). A 3D image was taken, which revealed an opening in the maxillary sinus from the palatal root measuring an average of 4 mm.

The case was reviewed and approved by the local research ethics committee at Damascus university (No: 032024866). A Written informed consent was obtained for publication of this report and accompanying images.

Pre-Surgical Phase

Patient Interview
A comprehensive clinical history was obtained from patients visiting the Oral and Maxillofacial Surgery Department at the Faculty of Dentistry, Damascus University, who had undergone extraction of a maxillary posterior tooth and developed an oroantral communication. This included the patient's personal information, general medical history, and dental history.

Clinical and Radiographic Examination Before the Procedure
A thorough examination of the extraction site was performed, and oroantral communication was clinically confirmed by conducting the Valsalva maneuver, along with a test for fluid passage from the oral cavity to the nasal cavity using a syringe and saline solution. The size of the communication was then assessed, and its compliance with inclusion criteria was verified radiographically through three-dimensional cone beam computed tomography (CBCT) imaging (Figure 3).

Surgical Phase

Patient Preparation and Site Preparation (Figure 4)
Initially, 20 mL of venous blood was drawn from the patient and divided into two glass tubes, each with a capacity of 10 mL. These tubes are specifically designed for the preparation of platelet-rich fibrin (PRF). The tubes were placed in a centrifuge and spun at 2700 RPM for 12 minutes [9].

After centrifugation, each tube separates into three distinct layers:

- **Red Blood Cell Layer (RCL):** The layer of red blood cells appears at the bottom of the tube.
- **Platelet-Rich Fibrin (PRF) Layer:** The middle layer, which contains the fibrin matrix enriched with platelets.
- **Platelet-Poor Plasma (PPP):** The top layer, which is plasma with a low platelet count.

The PRF gel is then extracted from the tube and separated from the red blood cells. To prepare the PRF plug, the first tube is used, and the PRF gel is placed in a cylinder within the PRF box. It is gradually compressed using a piston to obtain the final PRF plug.

After anesthetizing the patient, the area of oroantral communication is examined. Granulation tissue is removed if more than 24 hours have passed since the tooth extraction. The edges of the extraction socket are carefully inspected, and the socket is irrigated using a saline solution.

Preparation of Calcium Sulfate Graft and Mixing with Platelet-Rich Fibrin (PRF) (Figure 5)

The calcium sulfate graft is prepared by mixing the fast-set liquid with the powder to achieve the desired paste-like consistency, according to the manufacturer's instructions. The mixture is then placed into the designated grafting tray. Subsequently, the graft is combined with pieces of platelet-rich fibrin (PRF) obtained from the second tube after compressing the PRF gel using the PRF box.

Application of Platelet-Rich Fibrin Plug and Mixed Graft

The PRF plug is prepared first. Using 3/0 polyglactin (Vicryl) suture, a needle is passed through the vestibular gingiva, then through one side of the plug, and finally through the palatal gingiva without tying any knots, ensuring no flaps are raised.

The PRF plug is then gently inserted into the area of oroantral communication. The ends of the suture are held to prevent the plug from displacing into the maxillary sinus. (Figure 6).

After sealing the communication with the PRF plug, the mixed graft is applied gently over it until the entire socket is filled. The suture is then tied to secure the graft in place.

Then, we wait for 2 to 4 minutes while applying proper isolation with sterile gauze until the graft solidifies. Afterward, the graft is left exposed to the oral cavity without being covered by any membrane. The patient is instructed to bite down on a sterile gauze pad for one hour.

Post-Surgical Phase

In addition to the conventional post-extraction instructions, the following strict guidelines are provided:

1. **Avoid eating or drinking during the first two hours post-surgery.** After that, only liquids should be consumed for the first 48 hours (liquid diet), ensuring that they are not hot.
2. **Avoid rinsing the mouth for the first 48 hours** and stay away from all irritant odors.
3. **Avoid using plastic straws for drinking during the week following surgery** to prevent negative pressure, which can negatively affect the surgical site.
4. **Avoid violent sneezing and forceful expulsion of nasal secretions.** If this is necessary, the patient should keep the mouth open during sneezing to prevent sudden pressure increases within the maxillary sinus.
5. **Do not use wind instruments or whistle.**
6. **Regular follow-up appointments are necessary for monitoring.**

The patient is given a prescription for a set of medications, provided there are no contraindications. The prescription includes:

Rx
I. **Augmentin (Amoxicillin + Clavulanic Acid) 1000mg Tab, twice daily.**
Take one tablet every 12 hours for seven days.

II. **Ibuprofen 400mg Tab, three times daily.**
Take one tablet every 8 hours after meals for two days.

III. **Oxymetazoline HCL 0.05%.**
Spray in the nostril corresponding to the side of the oroantral communication, three times a day for five days.

Clinical and Radiological Follow-up

The patient is clinically evaluated at intervals (second day, third day, one week, and two weeks) post-surgery(Figure 7). Healing is monitored and graded on a scale from 1 to 5 according to the Landry criteria.

Radiological evaluation is performed using cone-beam computed tomography (CBCT) imaging 6 months after the procedure.

Results

The application of this method showed successful closure of oroantral communication clinically and radiographically after 6 months of follow-up.

Discussion

Maxillary sinus perforation is considered one of the potential complications following the extraction of maxillary posterior teeth. The incidence of oroantral communication (OAC) following extractions in the posterior maxilla ranges from 0.31% to 4.79% [5]. Platelet-rich fibrin (PRF) is a fibrin-based biomaterial that promotes angiogenesis and directs epithelial cell migration across its surface. It accelerates wound healing and provides protection for the surgical site [10].

The objective of this case report was to evaluate the efficacy of platelet-rich fibrin combined with calcium sulfate graft material in the closure of oroantral communication post-extraction of maxillary posterior teeth, as well as in the preservation of the alveolar ridge. PRF was chosen due to its richness in growth factors, cytokines, and platelets that enhance both soft and hard tissue healing [11]. Calcium sulfate was selected as a biocompatible material with a well-documented history of clinical use. It has been employed in periodontal regeneration, endodontic repair, alveolar bone resorption cases, and sinus augmentation procedures. However, to date, it has not been reported in the closure of oroantral communication [12]. Moreover, calcium sulfate forms a barrier against fibroblast migration, eliminating the need for membrane application or flap elevation following graft placement [12,13].

The success of OAC closure was confirmed using the following criteria:

- Valsalva maneuver test with observation of air bubble leakage.
- Presence of fluid leakage through the nose.
- Necessity for a second surgical intervention.
- Development of an oroantral fistula.

Cone-beam computed tomography (CBCT) imaging was performed at two time points: pre-operatively and six months post-procedure. Changes in alveolar ridge height and width were monitored, in addition to assessing radiographic bone density at the OAC site. After six months, radiographic density ranged between 570 Hounsfield Units (HU) and 919 HU, with a mean value of 785.91 HU, consistent with D3 bone quality. This indicates a substantial improvement in bone radiodensity attributed to the combined use of PRF and calcium sulfate.

This radiodensity enhancement may be due to PRF's contribution to increasing bone density through the presence of growth factors, such as transforming growth factor (TGF), which stimulates osteoblast proliferation during normal socket healing. Furthermore, the fibrin scaffold promotes neovascularization, supports immune cell activity, and reduces inflammation. Calcium sulfate also plays a critical role, as its dissolution increases local calcium ion concentrations, stimulating osteoblastic activity [14]. Additionally, it lowers the pH upon resorption, facilitating the release of bone morphogenetic proteins (BMPs) from adjacent bone. This is followed by the formation of hydroxyapatite carbonate layers like natural bone mineral, which later remodels during bone maturation [12]. Historadiographic studies have shown that calcium sulfate grafts are fully resorbed within nine months and replaced by mature lamellar bone [15], indicating its significant role in bone regeneration [13].

Minor reductions in both vertical and horizontal dimensions of the alveolar ridge were observed six months post-closure compared to pre-operative values. This suggests that the combination of calcium sulfate and PRF effectively minimized, but did not entirely prevent, post-extraction bone resorption.

Finally, a significant reduction in the radiographic diameter of the oroantral communication was observed six months post-grafting, decreasing from 4 mm to 0 mm. Statistical analysis revealed a significant difference between pre- and post-grafting OAC diameters, confirming the clinical effectiveness of the applied treatment.

Conclusions

The application of calcium sulfate and PRF clot led to a complete closure when treating oroantral communication.

References

1.Krishanappa, S. K. K., Prashanti, E., Sumanth, K. N., Naresh, S., Moe, S., Aggarwal, H., & Mathew, R. J. (2016). Interventions for treating oro-antral communications and fistulae due to dental procedures. Cochrane Database of Systematic Reviews (5). ,1-16.

2.Fragiskos, F. (2007). Perioperative and postoperative complications Oral Surgery (pp. 181-203): Springer.

3.Fatani, B., Fatani, A., & Alomar, A. (2020). Oro-Antral Communication and Fistula: A Review of the Literature, Saudi Journal of Oral and Dental Research, e3-e9.

4.Hupp, J. R., Tucker, M. R., & Ellis, E. (2013). Contemporary Oral and maxillofacial surgery-E-book: Elsevier Health Sciences.,123-131.

5. Mourão, C. F. d. A. B. (2019). Which treatments are best for oro-antral fistulae? Evidence-based dentistry, 20(2), 44-45.

6. Le, B. T., & Woo, I. (2007). Management of complications of dental extractions. A peer reviewed publication.,4-16.

7. Visscher, S. H., van Minnen, B., & Bos, R. R. (2010). Closure of oroantral communications: a review of the literature. Journal of oral and maxillofacial surgery, 68(6), 1384-1391.

8. Sandhya, G., Reddy, P. B., Kumar, K. J., Reddy, B. S., Prasad, N., & Kiran, G. (2013). Surgical management of oro-antral communications using resorbable GTR membrane and FDMB sandwich technique: a clinical study. Journal of maxillofacial and oral surgery, 12(3), 254-259.

9.Ghanaati, S., Booms, P., Orlowska, A., Kubesch, A., Lorenz, J., Rutkowski, J., Landes, C., Sader, R., Kirkpatrick, C., Choukroun, J. 2014. Advanced platelet-rich fibrin: a new concept for cell-based tissue engineering by means of inflammatory cells. J Oral Implantol, 40, 679-89.

10.Shah, R., Thomas, R., & Mehta, D. (2017). An Update on the Protocols and Biologic Actions of Platelet Rich Fibrin in Dentistry. The European journal of prosthodontics and restorative dentistry, 25(2):64-72.

11.Caruana, A., Savina, D., Macedo, J. P., & Soares, S. C. (2019). From Platelet-Rich Plasma to Advanced Platelet-Rich Fibrin: Biological Achievements and Clinical Advances in Modern Surgery. Eur J Dent, 13(2):280-286.

12.Gupta H, Pandey A, Agarwal R, Mehra H, Gupta S, Gupta N, et al. (2024). Application of calcium sulfate as graft material in implantology and maxillofacial procedures: A review of literature. Natl J Maxillofac Surg; 15:183-7.

13.Yahav, A., Kurtzman, G. M., Katzap, M., Dudek, D., & Baranes, D. (2020). Bone Regeneration: Properties and Clinical Applications of Biphasic Calcium Sulfate. Dental Clinics; 64(2), 453-472.

14.Boyle KK, Sosa B, Osagie L, Turajane K, Bostrom MP, Yang X. (2019). Vancomycin-laden calcium phosphate-calcium sulfate composite alloes bone formation in a rat infection model. PloS One;14:e0222034.

15.Laino, L., Troiano, G., Giannatempo, G., Graziani, U., Ciavarella, D., Dioguardi, M., Lo Muzio, L., Lauritano, F., Cicciu, M. (2015a). Sinus Lift Augmentation by Using Calcium Sulphate. A Retrospective

12 Months Radiographic Evaluation Over 25 Treated Italian Patients. Open Dent J, 9: 414-9.

Figure 1. A panoramic image before the extraction of tooth 26.

Figure 2. An image after the extraction and the occurrence of sinus perforation.

Vol 13, No 1 (2025) DOI 10.5195/d3000.2025.957

Figure 3. A CBCT image in the coronal section before the procedure, showing the sinus perforation at the palatal root.

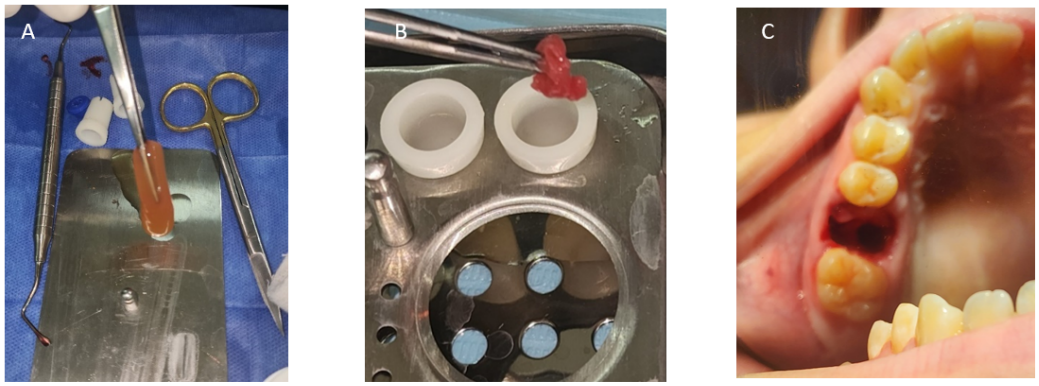

Figure 4. Patient preparation and site preparation. A. Platelet-rich fibrin (PRF) gel after separation, B. Platelet-rich fibrin (PRF) plug, C. The perforation site after curettage.

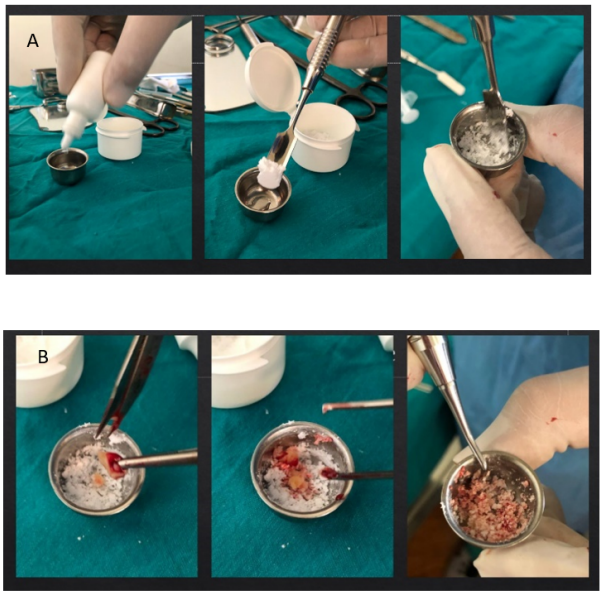

Figure 5. Preparation of calcium sulfate graft and mixing with Platelet-Rich Fibrin (PRF); A. Graft mixing according to the manufacturer's instructions, B. Graft mixed with pieces of platelet-rich fibrin (PRF).

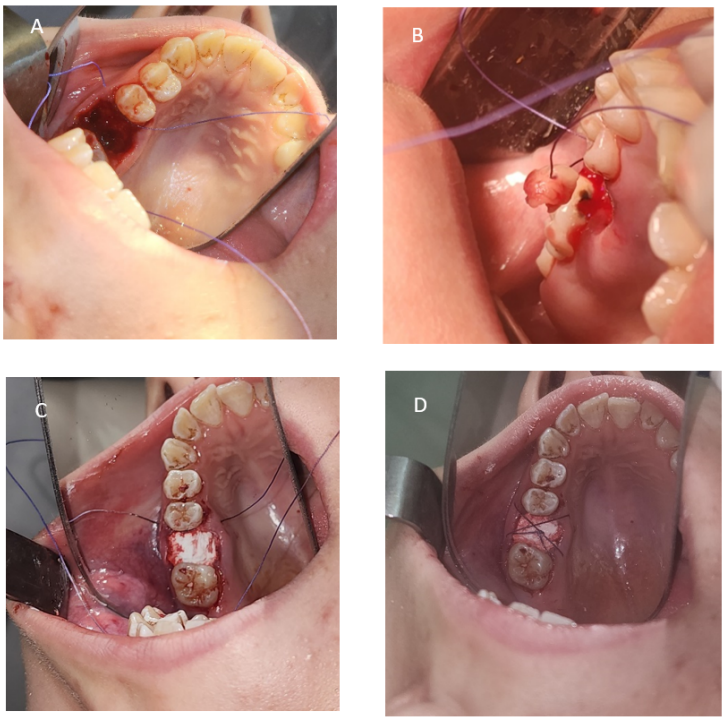

Figure 6. Application of Platelet-Rich Fibrin plug and mixed graft: A. Passing the suture initially through the buccal gingiva, B. Passing the suture through the platelet-rich fibrin (PRF) plug, C. Application of the calcium sulfate graft mixed with platelet-rich fibrin (PRF), D. Graft hardening and performing the X-shaped suture.

Vol 13, No 1 (2025) DOI 10.5195/d3000.2025.957

Figure 7. Post-surgical phase. A: Follow-up on the next day, B: Follow-up after 3 days, C: Follow-up after one week, D: Follow-up after two weeks.