

Appropriate surgical management of tooth periapical lesions causing maxillary sinusitis to closure of oroantral fistula: a case report

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Purpose: Unlike mandibular teeth, periapical lesions of maxillary teeth, especially in the posterior region, are often located near the maxillary sinus. This proximity increases the likelihood of acute or chronic maxillary sinusitis. Consequently, the extraction of posterior maxillary teeth with periapical lesions associated with sinusitis requires significant caution and expertise. Improper or inexperienced extraction techniques can lead to complications such as oroantral fistula formation or the displacement of teeth into the maxillary sinus. This paper aims to introduce effective methods for the extraction and management of posterior maxillary teeth in cases of maxillary sinusitis caused by periapical lesions.

Materials & Methods: In this case, the patient underwent the extraction of left maxillary teeth #16, #17, and #18, along with the removal of surrounding maxillary sinusitis and periodontitis lesions. The maxillary sinus was treated using an endoscope, followed by nasal gauze packing. A crestal bony defect in the oral cavity was covered with platelet-rich fibrin (PRF), and then a water-soluble titanium mesh (Ti-mesh) was used for fixation with screws. PRF was applied again for additional coverage, and a mucosal releasing incision was made followed by suturing to ensure proper healing and closure.

Results: Five days postoperatively, the sinus packing gauze was removed through the nasal cavity, and the patient reported a reduction in pain. Ten days after surgery, exposure of the titanium mesh (Ti-mesh) was observed intraorally; however, irrigation did not reveal any involvement of the maxillary sinus. At the 1-month and 2-month follow-ups, the patient reported no pain, and no oroantral fistula was observed. Though the Ti-mesh remained exposed intraorally, mucosal epithelialization was noted between the mesh. At the 3-month follow-up, the exposed Ti-mesh was removed. Waters' views taken at the 1-, 2-, and 3-month intervals showed progressive healing and recovery of the maxillary sinus.

Conclusions: In the management of maxillary sinusitis caused by periapical lesions, the extraction of the causative teeth, removal of the associated maxillary sinus inflammation, and the use of platelet-rich fibrin (PRF) and titanium mesh (Ti-mesh) can effectively prevent the formation of an oroantral fistula. Additionally, this approach may reduce the likelihood of medication-related osteonecrosis of the jaw (MRONJ) associated with osteoporosis medications, making it a highly effective treatment strategy. (THE JOURNAL OF KOREAN ACADEMY OF OSSEOINTEGRATION 2024;16(1):31-36)

Key words: Platelet rich fibrin, Oroantral fistula, Titanium mesh, Maxillary sinusitis, Tooth periapical lesion

INTRODUCTION

The posterior maxilla is structurally closely related to the maxillary sinus. As the dentition, including deciduous, adolescent, and permanent teeth, develops from infancy through adolescence, the surrounding bone structure undergoes changes, resulting in the pneumatization of the maxillary sinus extending toward the apices of the maxillary teeth. This anatomical proximity explains why periapical lesions of the posterior maxillary teeth can easily involve the maxillary sinus¹.

A pathological connection between the maxillary sinus and the oral cavity is referred to as an oroantral fistula (OAF). This condition may result from insufficient surgical skill or the displacement of a tooth or dental fragment into the maxillary sinus. OAF can lead to maxillary sinus infections via the oral cavity and cause discomfort due to the migration of food particles or liquids from the oral cavity through the maxillary sinus into the nasal cavity. Oroantral fistula (OAF) is sometimes also referred to as oroantral communication (OAC) or oroantral connection. Pathologically, OAF specifically refers to cases where an OAC has un-

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dergone epithelialization, forming a persistent fistulous tract. The formation of OAF can significantly impact a patient's quality of life, leading to chronic discomfort, recurrent sinus infections, and functional disturbances. Consequently, various surgical techniques, including the use of different types of flaps, are employed to close and manage OAF effectively, aiming to restore both function and quality of life². Among the various methods to prevent the formation of an oroantral fistula (OAF), the most ideal approach is to directly seal the defect with mucosal coverage, promoting natural healing. However, if epithelialization occurs as a result of airflow through the oroantral communication (OAC) before the mucosal regeneration is complete, the OAC can develop into a persistent OAF. This highlights the importance of early and effective closure of the communication to prevent epithelialization and subsequent fistula formation³.

Therefore, promoting mucosal healing before epithelialization occurs is a critical concept in preventing the formation of an oroantral fistula (OAF). To achieve this, various materials have been utilized, including autogenous bone, membranes, and platelet-rich fibrin (PRF). Among these, the use of autogenous bone and PRF has been extensively documented in the literature as effective approaches for sealing oroantral fistulas and facilitating healing³.

As mentioned in various studies, platelet-rich fibrin (PRF) is obtained by centrifuging blood at a specific time and speed, which results in three distinct fractions: the upper part, which is platelet-poor plasma; the middle part, which consists of a fibrin clot and is the platelet-rich portion; and the lower part, composed of erythrocytes. The platelet-rich fibrin, as it dehydrates, releases growth factors that play a crucial role in mucosal and bone healing. Systematic reviews have demonstrated the effectiveness of PRF in the management of oroantral fistulas, where it has been used to promote healing and prevent complications such as fistula formation⁴.

Titanium mesh (Ti-mesh) has already been widely used in various oral and maxillofacial surgical fields. Specifically, it has been employed in combination with various flap techniques to effectively close oroantral fistulas^{5,6}. Due to its hydrophilic properties, Ti-mesh has become a valuable material for use in the oral cavity, offering easy handling and minimal technique sensitivity. This ease of use has made it a popular choice in numerous oral surgical procedures, where it can provide stable support and facilitate healing, especially in the context of oroantral fistula repair⁷.

In the treatment of maxillary sinusitis, many studies have reported the use of endoscopy to remove the infected maxillary sinus membrane, thereby promoting healing. This technique is commonly employed to facilitate the restoration of the healthy Schneiderian membrane, which is essential for the proper healing of the sinus lining. By using endoscopic techniques, surgeons can effectively clear the infection and provide a controlled environment for the healing of the sinus membrane, improving outcomes and reducing complications⁸.

Therefore, this paper aims to present an ideal approach for the treatment of patients with fibrotic lesions at the apices of teeth causing maxillary sinusitis. By proposing appropriate surgical interventions, the goal is to prevent and manage the formation of oroantral fistulas that may arise from extractions, offering an effective method for addressing both the underlying sinusitis and the prevention of fistula formation.

MATERIAL AND METHOD

1. Patient story

The patient is a 71-year-old female who presented to the Department of Oral and Maxillofacial Surgery at Incheon St. Mary's Hospital on July 18, 2024, with primary complaints of right maxillary tooth pain and migraine. Her medical history includes osteoporosis, for which she has been on zoledronate therapy since 2018, and hypertension. Additionally, she suffered a knee fracture due to osteoporosis, with a bone mineral density (BMD) of -2.6, and received zoledronate and Prolia injections over a three-year period.

Clinical examination revealed grade 2 to 3 mobility in teeth #16, #17, and #18 on the right maxilla. A panoramic radiograph showed bone resorption from the apex of tooth #16 to tooth #18, with particularly evident dentin caries extending to the cervical region of tooth #17. Opacification of the right maxillary sinus was observed, and subsequent facial CT imaging revealed lesions at the apices of teeth #16, #17, and #18 associated with maxillary sinusitis extending to the ostiomeatal complex (Figure 1). The patient exhibited all five classic symptoms of chronic maxillary sinusitis: nasal obstruction, headache, periorbital pressure, postnasal drip, and olfactory disturbance.

Under general anesthesia, teeth #16, #17, and #18 were extracted. Concurrently, fibrous inflammatory tissue surrounding the extraction sites was excised. The lesions related to maxillary

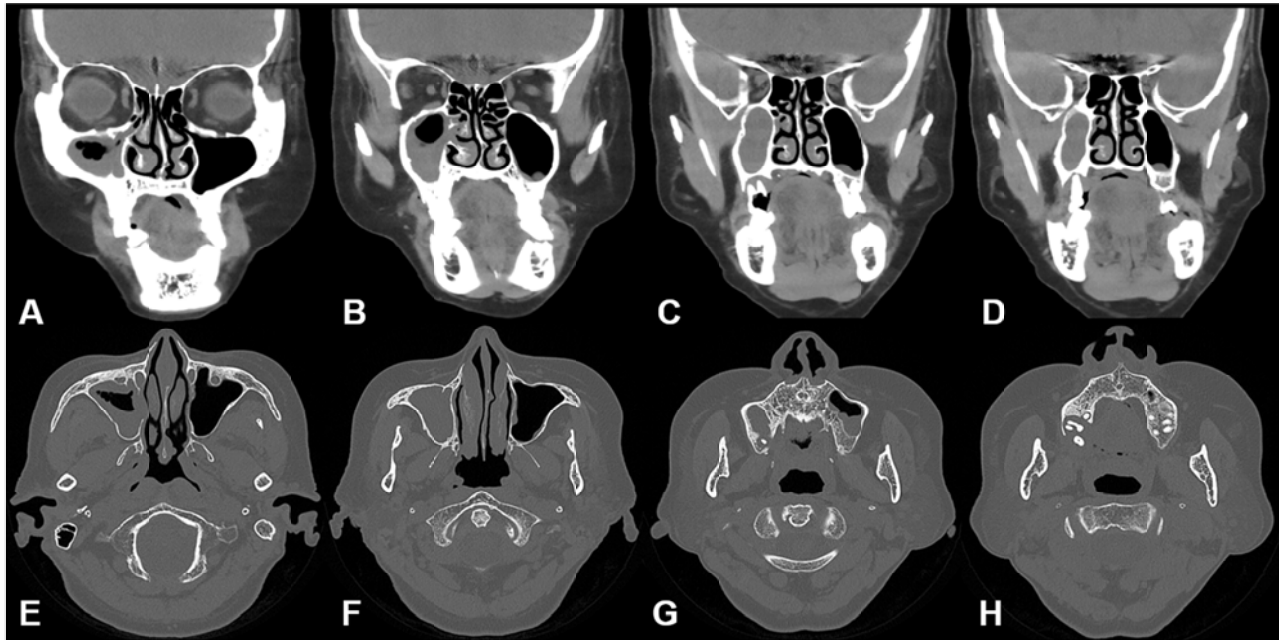


Figure 1. Preoperative facial CT views: Coronal view (A~D), Axial view (E~H).

sinusitis were removed using endoscopic guidance and rhinofor-
ceps, followed by multiple irrigations with normal saline. Sinus
packing was performed via the ostium, and the extraction sockets
were covered using a three-layer closure technique involving
platelet-rich fibrin (PRF), titanium mesh, and releasing mucosal
direct closure.

Postoperative assessments included Waters' view radiographs
conducted at one-week post-surgery, with panoramic radio-
graphs analyzed at one, two, and three months postoperatively.
Clinical photographs and symptom assessments were conducted
to evaluate treatment outcomes.

RESULTS

1. Panoramic view

Preoperatively, bone resorption was observed in the maxillary
bone around teeth #16, #17, and #18. One week postoperatively,
the area was stabilized with titanium mesh (Ti-mesh), but the
socket had not yet fully healed, resulting in a lower bone density,
which appeared as reduced opacity on the radiograph. However,
by the 1-month follow-up, ossification (new bone formation) be-
gan around the Ti-mesh, and opacity increased around the mesh,
showing a stable healing pattern. Upon comparing the panoramic
radiographs taken at 2 months and 3 months post-surgery, there
was a noticeable increase in opacity, indicating further healing

and bone maturation around the Ti-mesh (Figure 2).

2. Waters' view

The comparison of preoperative, operative day, and postoper-
ative Waters' view radiographs taken at 1 week, 2 months, and 3
months showed the following findings: At 1 week postopera-
tively, opacity was observed due to the presence of blood clot and
hematoma, which is typical after surgery. However, by the
1-month follow-up, the opacity had significantly decreased, indi-
cating the resolution of the initial postoperative changes. At 2
months and 3 months post-surgery, the radiographs showed nor-
mal findings, with no further signs of sinus opacification, con-
firming successful healing of the maxillary sinus and surrounding
structures (Figure 3).

3. Clinical Photo Taking

1) On the Day of Surgery

All surgeries were performed under general anesthesia, and
postoperatively, clomoxin injection (amoxicillin sodium 500 mg,
potassium clavulanate 100 mg) and NSAIDs were administered,
followed by close monitoring of the patient's progress. After the
extraction of the teeth and removal of maxillary sinusitis and fi-
brotic lesions at the apices of the teeth using endoscopic tech-
niques, the sinus was packed with gauze, followed by the appli-
cation of platelet-rich fibrin (PRF), titanium mesh (Ti-mesh), and

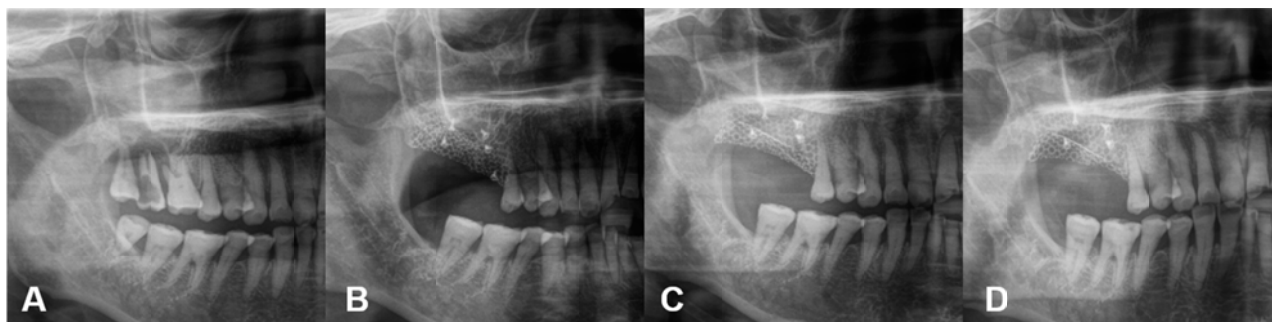


Figure 2. Preoperative panoramic view (A), Panoramic view on the day of surgery (B), One-month postoperative panoramic view (C), Two months postoperative panoramic view (D), Three months postoperative panoramic view (E).

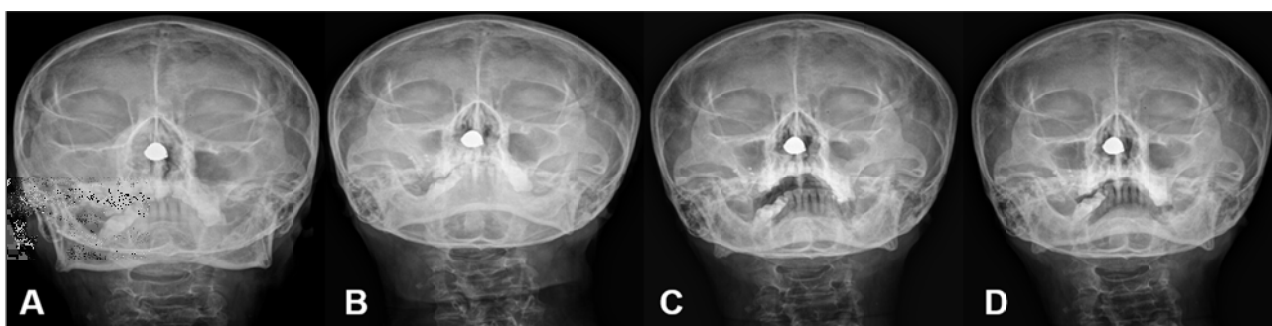


Figure 3. Waters' view on the day of surgery (A), One month postoperative (B), Two months postoperative (C), Three months postoperative (D).

gingival suturing. Upon comparison of the postoperative images, no oroantral fistula was observed at 1 month, and the patient reported no symptoms. However, exposure of the Ti-mesh was noted, and mucosal epithelialization was observed beneath the mesh.

At the 2-month follow-up, Ti-mesh exposure was still present, but the area of exposure had decreased. At this point, the Ti-mesh was adjusted using a high-speed round bur to expose the mucosa underneath, promoting direct healing. At the 6-month follow-up, the Ti-mesh was removed, and bone grafting is planned beneath the mucosa to further support healing and restore the bone structure (Figure 4~6).

2) One Month Post-Surgery

Exposure of the Ti-mesh was observed, but the patient did not report any symptoms of oroantral fistula, nor was there any invasion of oral food into the sinus. Additionally, the patient did not complain of symptoms related to maxillary sinusitis, such as nasal congestion, abnormal odor, postnasal drip, tenderness, or headache (Figure 6).

3) Two Months Post-Surgery

The exposed Ti-mesh was adjusted using a high-speed round bur to reveal the intact mucosa beneath, which helped promote perfect healing. Again, the patient did not report any symptoms of maxillary sinusitis, including nasal congestion, abnormal odor, postnasal drip, tenderness, or headache (Figure 6).

DISCUSSION

In this case, the use of platelet-rich fibrin (PRF) and titanium mesh are highlighted as materials that are not operator-sensitive and are easy to use. They are especially effective for bone augmentation, making them ideal for oral surgery applications⁹. However, the aspect of the procedure that could be considered operator-sensitive is the management of maxillary sinusitis. Although this paper does not focus extensively on this aspect, it is a complex procedure requiring an understanding of the structural position and function of the sinus using an endoscope. This complexity necessitates further study on the role and dynamics of the ostiomeatal complex, a critical structure in sinus drainage connecting the anterior ethmoid cells, maxillary sinuses, and frontal

sinuses. Its components include the maxillary sinus opening, uncinat process, ethmoid bulla, ethmoidal infundibulum, and hiatus semilunaris¹⁰. Ensuring the patency of these structures and the removal of infected sinus membranes are crucial components of

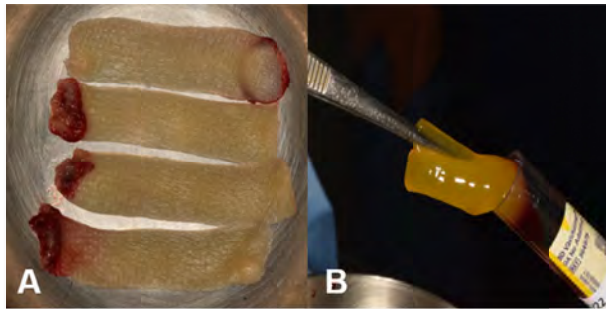


Figure 4. Platelet-rich fibrin after centrifugation used on the day of surgery (A, B).

successful surgery.

The key consideration in this case report is that premature tooth extraction and bone grafting may contribute to the development of Medication-Related Osteonecrosis of the Jaw (MRONJ). The patient has been receiving zoledronate and Prolia injections since 2018, with a Bone Mineral Density (BMD) measurement indicating osteoporosis at -2.6. Consequently, efforts were made to minimize invasiveness during extraction and surgical management of the perialveolar soft tissue, aiming to prevent bone bleeding. Moreover, the use of Platelet-Rich Fibrin (PRF) not only enhances bone formation and reduces inflammation but also plays a significant role in preventing medication-induced osteomyelitis¹¹.

Therefore, in terms of the currently debatable concept of a drug holiday, only zoledronate was held to avoid potential rebound effects, while the Prolia injections were continued without

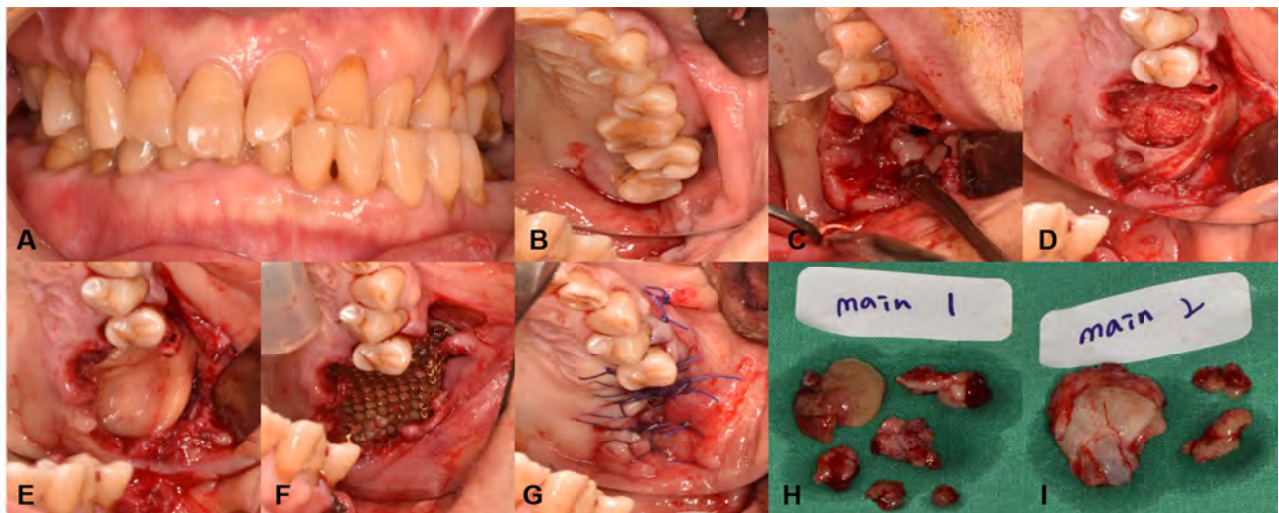


Figure 5. Clinical photographs on the day of surgery: Patient occlusion (A), Clinical image of the surgical site in the right maxilla (B), Removal of infected maxillary sinus tissue post-extraction (C), Clinical photo after gauze packing of the maxillary sinus (D), Clinical image showing platelet-rich fibrin coverage of the surgical site (E), Coverage with titanium mesh (F), Mucosal direct closure (G), Main mass of maxillary sinusitis at the apices of teeth #16, #17, and #18 (H, I).

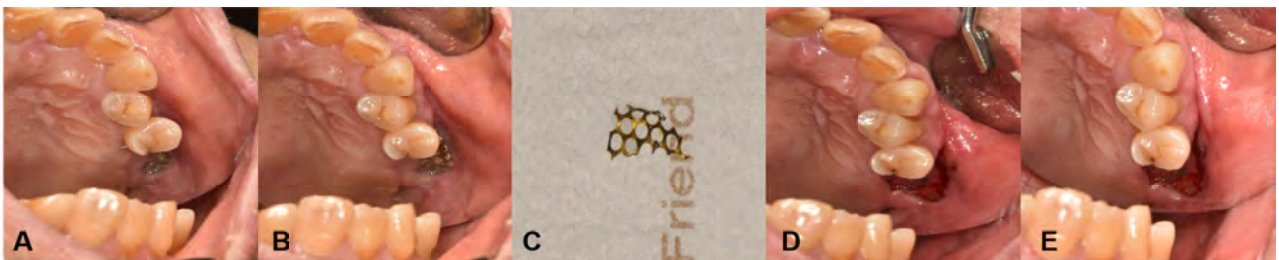


Figure 6. Clinical photographs one month postoperative, showing exposed titanium mesh in the oral cavity (A, B). Removal of the titanium mesh at two months postoperative (C), and removal of the exposed titanium mesh at two months postoperative (D, E).

interruption. Considering the positive outcomes observed with the combined use of PRF and titanium mesh, it is anticipated that future developments in titanium mesh that retain PRF could be effectively applied in various oral and maxillofacial surgical procedures.

Additionally, the patient reported difficulty in dietary intake due to the absence of bilateral molars, leading to the need for bone reconstruction and implant placement as subsequent considerations. Consequently, a plan is in place to remove the titanium mesh and perform bone grafting subperiosteally after a minimum of six months. PRF is expected to be utilized during this intervention, as it may effectively address any fistulas that may arise during the procedure.

In this paper, surgical procedures were conducted with a deep understanding of these anatomical structures and the operative processes involved in treating maxillary sinusitis. Postoperative analysis was conducted using Waters' view, panoramic radiographs, and assessment of the patient's specific symptoms. Upon follow-up, the patient showed no remaining symptoms of maxillary sinusitis, such as nasal obstruction, postnasal drip, foul odor, headache, or tenderness, indicating successful healing.

CONCLUSION

The management of dental treatments related to various forms of maxillary sinusitis requires meticulous surgical precision. Even minor inadequacies in technique may result in significant complications for the patient, such as the development of oroantral fistulae and recurrence of maxillary sinusitis. This study advocates for the appropriate surgical management of odontogenic diseases causing maxillary sinusitis using platelet-rich fibrin (PRF) and titanium mesh. By implementing these techniques, we aim to effectively prevent the formation of oroantral fistulae and reduce

the likelihood of recurrent maxillary sinusitis, thereby establishing an ideal surgical approach.

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