

Surgical treatment of root canal filling material displaced into the maxillary sinus and subsequent implant surgery

Dohee Kim^{1,2}, Jeong Joon Han^{1,2}, Hoon Myoung^{1,2}

¹Department of Oral and Maxillofacial Surgery, Dental Research Institute, School of Dentistry, Seoul National University, ²Department of Oral and Maxillofacial Surgery, Seoul National University Dental Hospital, Seoul, Korea

Extrusion of the endodontic material is one of the possible complications of root canal treatment. Extruded root canal filling materials can cause inferior alveolar nerve injury in the mandible and inflammatory condition of the maxillary sinus in the maxilla. Additionally affected teeth often need to be extracted, requiring subsequent implant treatment. Therefore, for successful implant treatment, it is important not only to completely remove the displaced root canal material but also to ensure good healing of the surrounding tissue suitable for implant placement postoperatively. This case describes the surgical treatment of chronic maxillary sinusitis caused by migration of root canal filling material into the maxillary sinus with successful treatment outcome and implant surgery. (THE JOURNAL OF KOREAN ACADEMY OF OSSEOINTEGRATION 2023;15(1):27-31)

Key words: Root canal filling material, Maxillary sinus, Maxillary sinusitis, Dental implant, Modified endoscopic-assisted sinus surgery

INTRODUCTION

Endodontic treatment is one of the important procedures in dentistry. It is performed when the root apex is involved in the lesion that occurs in the adjacent tissue or when dental lesion causes pulpal diseases. It consists of chemo-mechanical elimination of the diseased intrapulpal tissue and filling with the materials. Extrusion of the canal filling material is one of the possible complications of root canal treatment, and it usually can be caused from overinstrumentation during canal preparation or excessive pressure during the application of the filling materials¹⁻³. Extruded canal filling materials can lead to neurosensory disturbance of inferior alveolar nerve in lower teeth, and for upper posterior teeth, that can lead to inflammatory condition of the maxillary sinus³⁻⁵. In addition, affected teeth often need to be extracted, requiring subsequent implant treatment. Therefore, for successful implant treatment, it is important not only to completely remove the displaced endodontic material but also to achieve favorable healing of the adjacent tissue suitable for implant placement postoperatively.

The aim of this study was to describe successful surgical treatment of the maxillary sinusitis caused by displacement of from extrusion of gutta percha (GP) four years ago and subsequent implant treatment.

CASE PRESENTATION

A 31-year-old female patient visited to our department with maxillary sinusitis caused from a foreign body in the right maxillary sinus (Figure 1). Three weeks before coming to the hospital, she felt discomfort in the right maxillary second molar when chewing food. There was no hypersensitivity to cold or hot water, and there was constant discomfort even during her daily activities. She received endodontic treatment and gold crown restoration on the right upper second molar at a local dental clinic four years ago. On oral examination, the maxillary second molar was negative for percussion, mobility, and palpation, while it showed positive on the biting test. The patient complained of spontaneous pain with the purulent discharge around the tooth and surrounding gingiva. There were no clinical symptoms related to the maxillary sinusitis, such as rhinorrhea, post nasal drip or hyposmia. The probing depth of the maxillary second molar was 12 mm on the distal side. The foreign body in the sinus was suspected as the canal-filling material, GP.

At first, surgical extraction of right upper second molar was performed with expectation that the foreign body would be eliminated in one piece with the tooth (Figure 2). However, despite of the try, the foreign body still remained at right maxillary sinus

Received November 18, 2023, Revised November 21, 2023, Accepted November 25, 2023

Copyright © 2023 Korean Academy of Osseointegration

Corresponding Author: Jeong Joon Han, Department of Oral and Maxillofacial Surgery, Dental Research Institute, School of Dentistry, Seoul National University, 101 Daehak-ro, Jongno-gu, Seoul 03080, Korea, Tel: +82-2-2072-4088, Fax: +82-2-762-4735, E-mail: oops01@snu.ac.kr

and purulent discharge persisted. Computed tomography images were taken to evaluate the location and amount of foreign material in the maxillary sinus, the severity of the maxillary sinusitis, and the influence on adjacent structures. The modified endo-

scopic-assisted sinus surgery (MESS) was planned for removal of foreign material.

The surgical procedures were performed under general anesthesia (Figure 3). Vestibular incision was made on the region of



Figure 1. Panoramic radiograph at initial visit. Extended gutta percha was found in the right maxillary sinus (arrows).

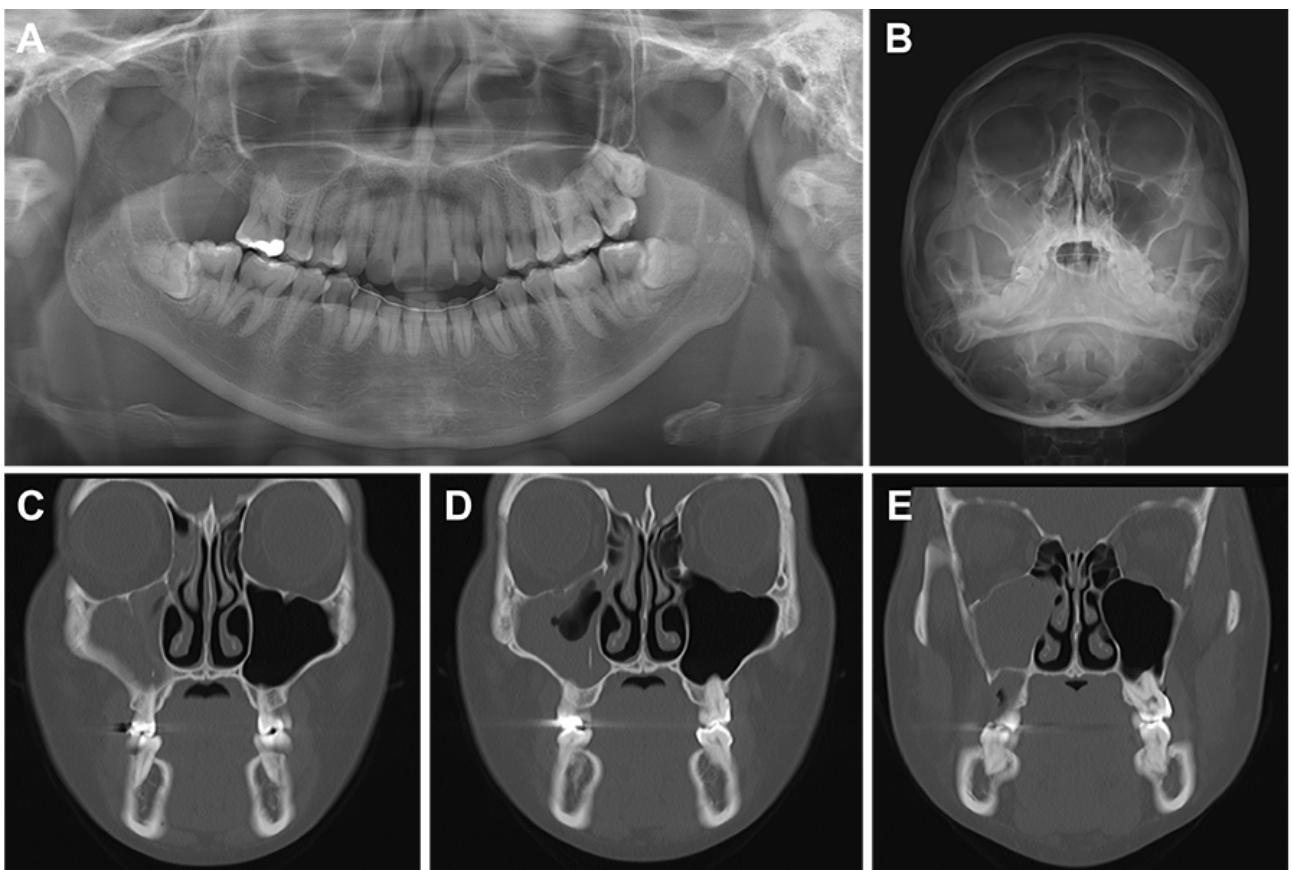


Figure 2. Panoramic radiograph (A), waters view (B), and computed tomography (C-E) after extraction of right upper second molar.

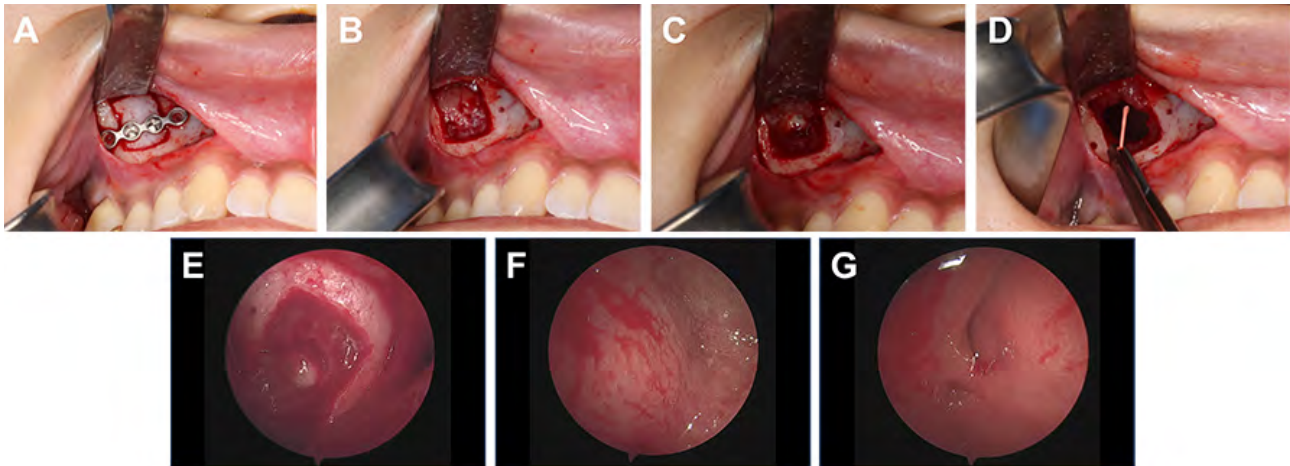


Figure 3. Intraoperative clinical (A~D) and endoscopic photos (E~G) during the modified endoscopic-assisted sinus surgery.

right upper second premolar and first molar area with a length of approximately 3 cm. After elevation of the mucoperiosteal flap, the antero-lateral wall of the maxillary sinus was exposed and the bony window for the access to the sinus cavity was designed. Using a rotary instrument with a 0.5 mm round bur, bony windows was created. To minimize the time it takes to reposition the bony window to its original position, a microplate was secured to the bony window prior to complete separation of the bony window. Particularly, the vertical osteotomy was performed first, followed by fixation of the plate, horizontal osteotomy, and removal of the bony window. After accessing the inside of the maxillary sinus, GP was found and removed with the inflamed sinus mucosa under endoscopic view. To regenerate the maxillary sinus mucosa after surgery, the normal maxillary sinus membrane was preserved as much as possible, and the periosteum beneath the inflamed mucosa was also preserved. After confirmation of the patency of the maxillary ostium using endoscope and CT evaluation, the bony window was repositioned and fixed using the microplate. Wound closure was performed using layer-by-layer technique. Postoperative instruction, such as the conventional instruction after sinus-related surgery, was provided to the patient.

At 6 months after surgery, the microplate used for fixation of the bony window was removed and implant installation (Anyone, Megagen, Daegu, Korea) was performed (Figure 4). During the postoperative follow-up periods, no significant postoperative complications, such as recurrence of the sinusitis, increased haziness, any sensory disturbance related to the infraorbital nerve, and other postoperative complications that can be usually occur after maxillary sinus surgery, were observed.

DISCUSSION

During dental procedures such as root canal treatment, tooth extraction, and dental implant surgery, the maxillary surgery is one of the most important anatomic structures that dentists have to consider. The maxillary sinus is an air-containing space located within the maxilla on both sides and is in contact with the alveolar process of the maxilla inferiorly, the zygomatic bone laterally, and the inferior orbital floor superiorly. There is a possibility of perforation of the maxillary sinus through the root apex during dental treatment of maxillary teeth close to the sinus. The distance between the maxillary sinus and the teeth varies depending on the position of the teeth, and usually the posterior teeth are closer to the maxillary sinus floor than the anterior teeth⁶. According to the previous studies that analyzed the vertical and horizontal distances between the teeth and the maxillary sinus, the first and second molars were close to the maxillary sinus floor in the vertical dimension, so the probability of protruding the root into the maxillary sinus was higher than that of an anterior teeth and premolars⁷. Even at horizontal dimension, the apex of the root of the maxillary posterior teeth is closer to the maxillary sinus cavity, as the lowest point of the maxillary sinus is located between the buccal root and the palatal root. In the patient of this study, it was observed that the root canal filling material invaded the maxillary sinus through the root apex during endodontic treatment of the maxillary second molar. Therefore, it could be recommended that clinicians should be careful at all times, keeping in mind that foreign bodies can be injected through the apex of the tooth due to poor instrumentation or excessive root canal filling during maxil-

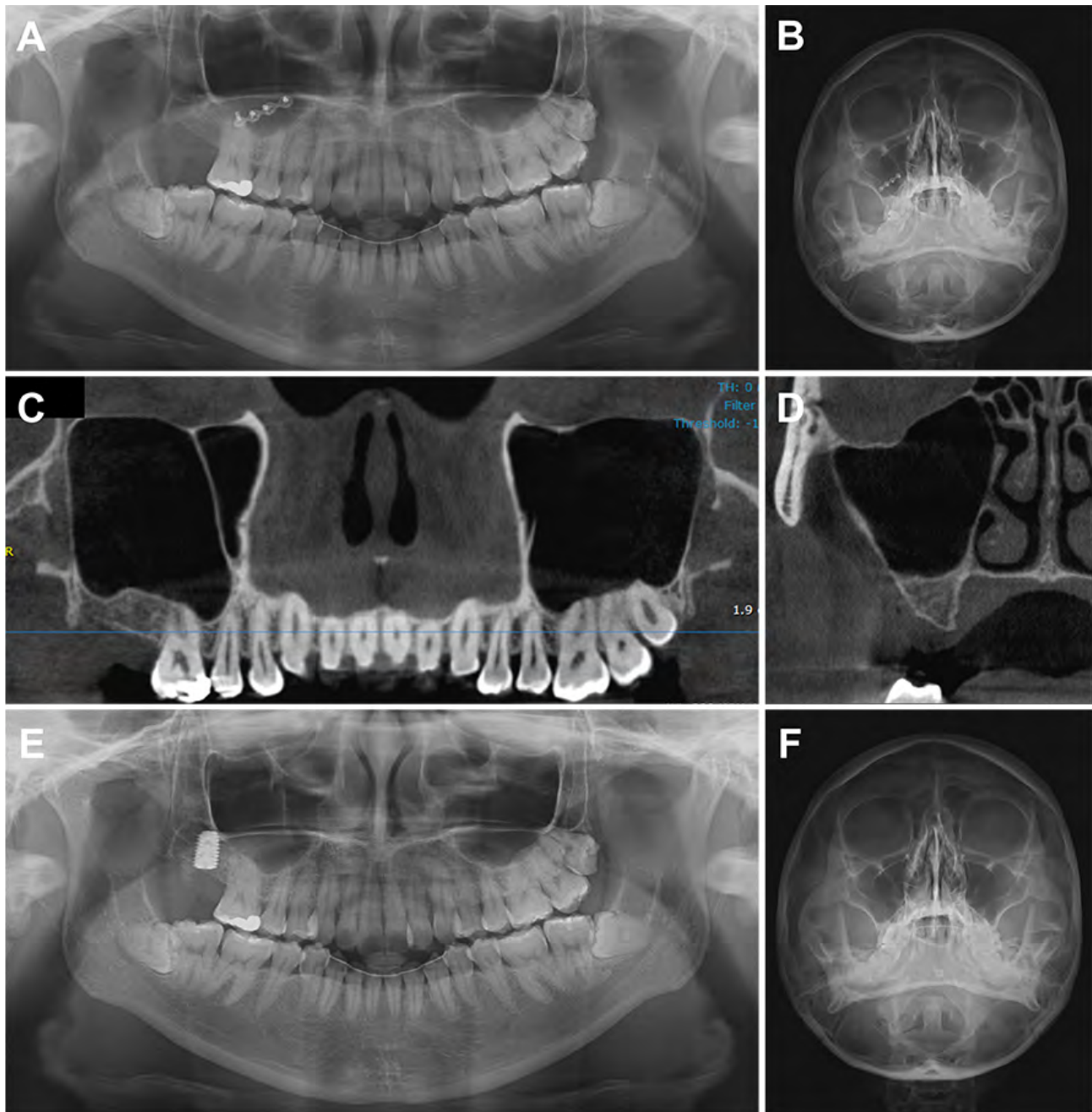


Figure 4. Postoperative radiographic examination. (A, B) 4 months after modified endoscopic-assisted sinus surgery; (C, D) Immediately before implant surgery; (E, F) immediately after implant surgery.

lary posterior root canal treatment.

Foreign bodies that have entered the maxillary sinus, such as tooth fragments, root canal filling materials, or fractured dental instruments, may remain without causing any pathological changes or symptoms, but may also cause various maxillary sinus diseases including delayed healing of gingival granulomas or apical lesions caused by an acute inflammatory response, acute and chronic sinusitis, and fungal infection of the maxillary sinus^{1-3,5,8}.

Batur and Ersev¹ reported that there were no clinical symptoms and no pathological changes in the maxillary sinus radiologically in a patient who was observed for 5 years without surgery after root canal sealer was leaked into the maxillary sinus. In contrast, in the study by Giardino, et al.⁵, overfilling of the root canal sealer led to aspergillosis of the maxillary sinus in healthy patient. Kim, Kim and Han³ also reported occurrence of chronic maxillary sinusitis after leakage of the calcium hydroxide which is used for

endodontic medicament. In terms of GP, Yamaguchi, Matsunaga and Hayashi⁸ reported a case where the GP entered the maxillary sinus during endodontic treatment performed 3 years ago and was surgically removed. In that case report, patient did not any clinically uncomfortable symptoms, however, showed chronic maxillary sinusitis in radiographic examination. In a study by Kobayashi⁹, displaced GP resulted to aspergillosis of the maxillary sinus without any clinical symptom. In contrast, in the present study, the patient also had invasion of GP to the maxillary sinus after root canal treatment 3 years ago, but she felt discomfort during the mastication and the causative tooth showed bone resorption with deep periodontal pocket on distal side.

To remove foreign bodies in the maxillary sinus, two surgical approaches can be performed: 1) endonasal endoscopic sinus surgery (ESS); 2) intraoral transmaxillary approach with direct access to the maxillary sinus^{3,10}. ESS has become the mainstay in treating maxillary sinus disease, however, it has several limitations in removing foreign bodies located at the floor of the sinus, or in treating odontogenic maxillary sinusitis. Accordingly, in treating odontogenic maxillary sinusitis, the intraoral transmaxillary approach such as the Caldwell-Luc procedure (CLP) have been frequently used. In a study by Brooks and Kleinman², GP displaced into the maxillary sinus was successfully removed using the CLP. Tanasiewicz, et al.¹¹ also successfully removed root canal filling material from the maxillary sinus through CLP. However, CLP may cause several postoperative complications, such as atrophy of the maxillary sinus, hypoesthesia of the midface, occurrence of postoperative maxillary cyst, and bone defect¹². In addition, the postoperative healing pattern is not predictable, making it difficult to achieve oral rehabilitation including implant treatment.

In the present study, the displaced GP and surrounding inflamed mucosa were removed using MESS. MESS is a procedure that combines the intraoral and endonasal approaches. Briefly, only pathological lesion or foreign body within the maxillary sinus is removed under endoscopic view through intraoral transmaxillary approach, and if the ostium is obstructed, widening of the ostium is performed using endonasal approach^{3,10,13}. Another feature is that bony window created to access the maxillary sinus is fixed in its original position using rigid fixation. MESS has been successfully performed to treat various maxillary sinus diseases

previously, and favorable postoperative healing after MESS has been reported¹³. In the patients of this study, MESS also resulted in complete bone healing around the bony window and healing of the maxillary sinus membrane without pathological lesions. Based on this, the subsequent implant surgery was also performed successfully.

REFERENCES

1. Batur YB, Ersev H. Five-year follow-up of a root canal filling material in the maxillary sinus: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;106:e54-e56.
2. Brooks JK, Kleinman JW. Retrieval of extensive gutta-percha extruded into the maxillary sinus: use of 3-dimensional cone-beam computed tomography. *J Endod* 2013;39:1189-1193.
3. Kim D, Kim Y, Han JJ. Removal of Calcium Hydroxide Paste Leaked Into the Maxillary Sinus. *Ear Nose Throat J* 2023;1455613231191378.
4. Byun SH, Kim SS, Chung HJ et al. Surgical management of damaged inferior alveolar nerve caused by endodontic overfilling of calcium hydroxide paste. *Int Endod J* 2016;49:1020-1029.
5. Giardino L, Pontieri F, Savoldi E, Tallarigo F. Aspergillus mycetoma of the maxillary sinus secondary to overfilling of a root canal. *J Endod* 2006;32:692-694.
6. von Arx T, Fodich I, Bornstein MM. Proximity of premolar roots to maxillary sinus: a radiographic survey using cone-beam computed tomography. *J Endod* 2014;40:1541-1548.
7. Kang SH, Kim BS, Kim Y. Proximity of Posterior Teeth to the Maxillary Sinus and Buccal Bone Thickness: A Biometric Assessment Using Cone-beam Computed Tomography. *J Endod* 2015;41:1839-1846.
8. Yamaguchi K, Matsunaga T, Hayashi Y. Gross extrusion of endodontic obturation materials into the maxillary sinus: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007;104:131-134.
9. Kobayashi A. Asymptomatic aspergillosis of the maxillary sinus associated with foreign body of endodontic origin. Report of a case. *Int J Oral Maxillofac Surg* 1995;24:243-244.
10. Kim SM. Definition and management of odontogenic maxillary sinusitis. *Maxillofac Plast Reconstr Surg* 2019;41:13.
11. Tanasiewicz M, Bubilek-Bogacz A, Twardawa H et al. Foreign body of endodontic origin in the maxillary sinus. *J Dent Sci* 2017;12:296-300.
12. Low W. Complications of the Caldwell-Luc operation and how to avoid them. *Australian and New Zealand journal of surgery* 1995;65:582-584.
13. Han JJ, Sodnom-Ish B, Eo MY et al. Schneiderian membrane regeneration after lateral bony window repositioning in modified endoscopic-assisted maxillary sinus surgery: transmission electron microscopy evaluation. *J Craniofac Surg* 2022;33:e701-e706.