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CASE REPORT

A conservative transnasal endoscopic and intraoral approach in a case of a maxillary dentigerous cyst

U. Consolo[1], P. Bellini[1], F. Mattioli[2] & G. Lizio[1]

[1]Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance, School of Dentistry, University of Modena and Reggio Emilia, Modena, Italy
[2]Unit of ENT, University of Modena and Reggio Emilia, Modena, Italy Modena, Italy

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Correspondence to:
Dr G Lizio
Department of Surgery, Medicine, Dentistry and Morphological Sciences with Transplant Surgery, Oncology and Regenerative Medicine Relevance
School of Dentistry
University of Modena and Reggio Emilia
Modena
Italy
Tel.: 0039 051 2088117
Fax: 0039 090 2935825
email: giuseppelizio@libero.it

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Abstract

The transoral approach for enucleation of a voluminous odontogenic lesion involving the maxillary sinus is considerably invasive and can cause irreversible damage to the ciliated mucosa with definitive loss of the normal bone morphology. Functional endoscopic sinus surgery (FESS), which increases the patency of the osteomeatal complex (OMC), involves the use of a direct approach to the lesion, facilitating the drainage of secretions and improving the ventilation. Nevertheless, FESS cannot completely enucleate large odontogenic cystic lesions, particularly dentigerous cysts associated with dislocated teeth. Accordingly, a combined transnasal endoscopic and transoral approach is desirable. Here, we report the successful use of FESS combined with a conservative intraoral approach for the treatment of a voluminous dentigerous cyst that completely occupied the maxillary sinus. In a single surgery, FESS was used to enlarge OMC and open the cystic compartment into the nasal cavity, while an intraoral approach involving the removal of a bony lid from the anterolateral wall of the maxillary sinus facilitated minimal removal of the cystic wall associated with the dislocated tooth. The bony lid was repositioned and fixed with titanium plates. Computed tomography performed at 6 months showed that the original cystic compartment, which maintained communication with the nasal cavity through the enlarged OMC, was absent, and that the sinus had recovered its healthy morphology. Computed tomography at 27 months showed the maintenance of this status with no signs of recurrence. We recommend this approach to eradicate such pathology while preserving the sinus structure and function.

Introduction

In cases of airway involvement by odontogenic cysts, the conventional Caldwell-Luc procedure facilitates complete enucleation of the lesion, although it is prone to complications due to definitive alterations in the sinus structure and function[1–3]. Decreasing the dimensions of the lesion by decompression or marsupialization, which establishes continuity of the cyst wall with the oral mucosa, is relatively simple; however, it involves the use of a stent or an obturator for maintaining the patency of the communication between the oral and cystic cavities. Moreover, strict patient compliance is necessary for prevention of food entrapment and subsequent infection in the accessory cavity[4,5]. With recent advancements in nasal endoscopy, several pathologies that nearly occupy the entire maxillary sinus have been diagnosed and treated with an endocopic transnasal approach, which preserves the ciliated mucosa and bone architecture[6]. In particular, functional endoscopic sinus surgery (FESS) is used for cases where the maxillary sinus is completely occupied by the lesion, with an accompanying

impairment in respiratory function. FESS enlarges the osteomeatal complex (OMC) for resolution of the pathology along with improved drainage of mucous secretions and ventilation of the sinus cavity. However, FESS alone is rarely adopted for the treatment of massive odontogenic cysts, particularly dentigerous ones, because it cannot eliminate the entire cystic lining and the related tooth through OMC[7,8]; a conventional intraoral approach via the canine fossa is required in such cases.[9] On the other hand, the need for complete removal of such lesions remains debatable. Although transnasal decompression of cysts in the middle or inferior nasal meatus has been proposed as a treatment option, very few cases with short follow-up periods have been reported[8,10–12]. In patients with dentigerous cysts, the responsible tooth should be removed to prevent recurrences. Therefore, a contemporary or less traumatic transoral approach should be combined with nasal endoscopy. There are several reports on the use of a transnasal endoscopy-assisted intraoral approach[3,10,13–15]. Here, we describe the successful use of a novel technique involving FESS combined with a conservative intraoral approach for the treatment of a voluminous third molar-related dentigerous cyst that completely involved the maxillary sinus.

Case report

A 20-year-old man who was referred to our surgical division by his dentist for further evaluation of a suspected cystic lesion involving the left maxillary sinus. There were no clinical signs or symptoms, and the dentist suspected a lesion after assessing a panoramic radiograph obtained as part of a routine dental check-up. At the first examination, there were no clinical symptoms or any extra- or intraoral signs of pathology. All the teeth in the left maxillary segment appeared vital in thermal and electric pulp testing. The maxillary left third molar was absent. The panoramic radiograph showed an indefinite radiolucent area involving the alveolar process in the maxillary left molar region, which superimposed the left maxillary sinus as a radiopaque shadow. The maxillary left third molar showed anterior dislocation (Fig. 1). Computed tomography (CT) showed a voluminous radiopaque area occupying almost the entire left maxillary sinus, with thinning of the external sinus bone walls, involvement of the middle meatus, and disappearance of OMC. The third molar was mesially and laterally dislocated (Fig. 2). We tentatively diagnosed a dentigerous cyst associated with third molar impaction or a keratocyst with secondary third molar involvement. A single surgery involving FESS combined with a transoral approach under general anaesthesia was planned. First, FESS was performed to enlarge OMC and establish a communication between the internal cystic cavity and the left middle meatus. The left nasal cavity was decongested and injected with local anaesthetic solution (2% lidocaine and 1:100 000 adrenaline). Following retraction of the nostril with a Killian speculum, a 0°–45°, 4-mm rigid optical endoscope was inserted. OMC was identified and enlarged by resection of the uncinate process using an angled microdebrider. The cystic bony capsule was penetrated, the cystic fluid was immediately drained, and a direct communication with the middle meatus was established (Fig. 3). Next, the buccal sulcus and palatine mucosa on the left side were infiltrated with a local anaesthestic solution (2% lidocaine and 1:100 000 adrenaline), and an intrasulcular incision extending from the distal aspect of the left maxillary canine to the second molar was placed. A full-thickness mucoperiosteal flap was reflected and the anterolateral bony wall of the left maxillary sinus was exposed. A rectangular bony lid measuring approximately 2 × 1.5 cm was created using piezosurgery instruments and carefully raised for direct access to the soft cystic wall and the embedded tooth, which was immediately evident after removal of the bone lid. The tooth was removed along with a minimal portion of the cystic wall, which was sent for histopathological examination. The bony lid was placed in its original position and fixed with miniplates and mini-screws (Fig. 4); the mucoperiosteal flap was sutured with 4.0 Vicryl. A fatty gauze dressing was rolled up and placed in the left nasal vestibule for 5 h to prevent bleeding. Ceftriaxone was intravenously administered at a loading dose of 2 g on induction and continued at 2 g/day from the day

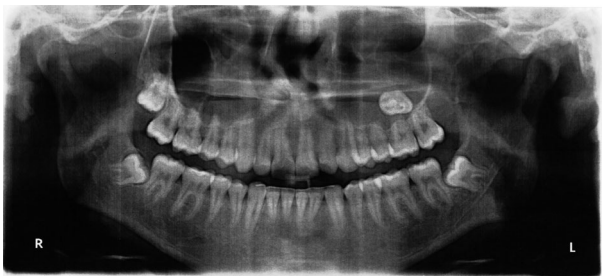

Figure 1 Preoperative panoramic radiograph. The radiograph shows an indefinite shadow in the left infraorbital region, with anterior dislocation in the sinusal cavity of the maxillary left third molar.

Figure 2 Preoperative coronal and axial computed tomography images. The entire left maxillary sinus is obstructed by a voluminous radiopaque lesion blocking the osteomeatal complex associated to the third upper molar dislocated in the sinus. The coronal scans show the erosion of the posterior wall of the sinus and the invasion of the pterigo-palatine fossa.

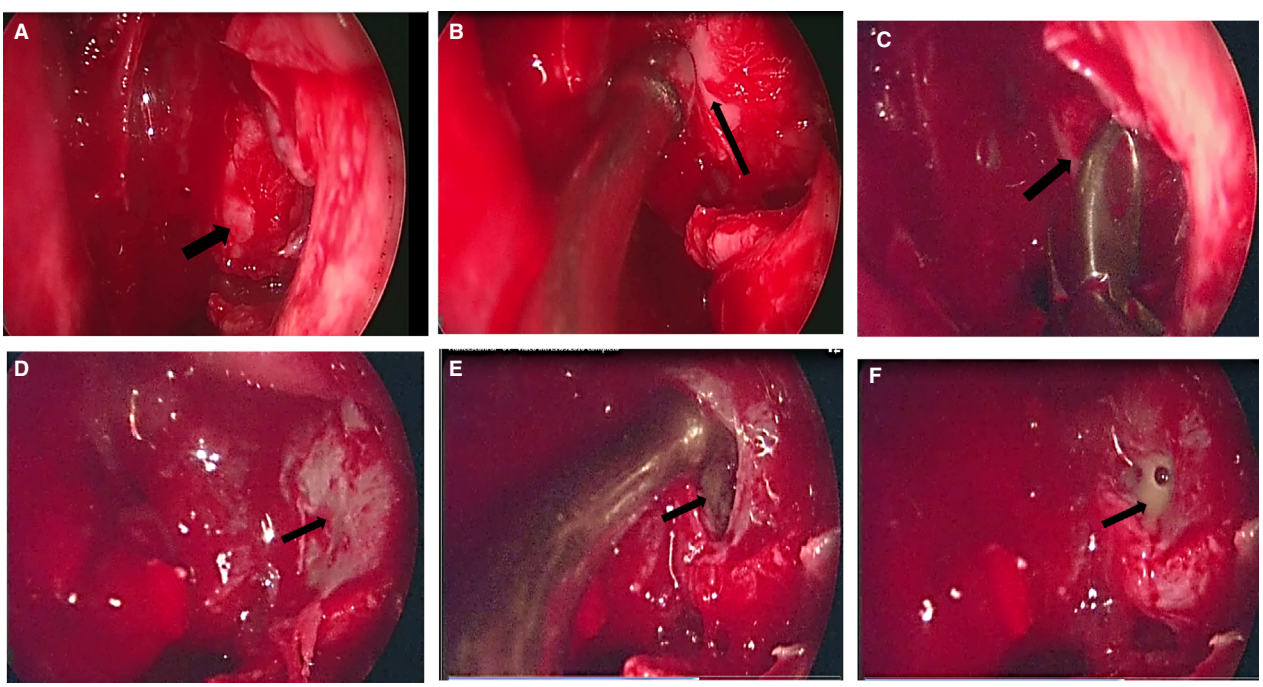

Figure 3 (A–F) Endoscopic view of perforation of the cystic capsule after the enlargement of the OMC. (A) the bony capsule of the cystic cavity (arrow) in the sinus after the enlargement of OMC; (B) the suction tool in contact with the bony capsule of the cystic cavity (arrow); (C) forceps tool disrupting the bony capsule of the cystic cavity (arrow); (D) the cystic wall (arrow) after the disruption of the surrounding bony capsule; (E) the cystic wall disrupted (arrow) with the suction tool enlarging the hole; (F) the cystic inner liquid coming out (arrow).

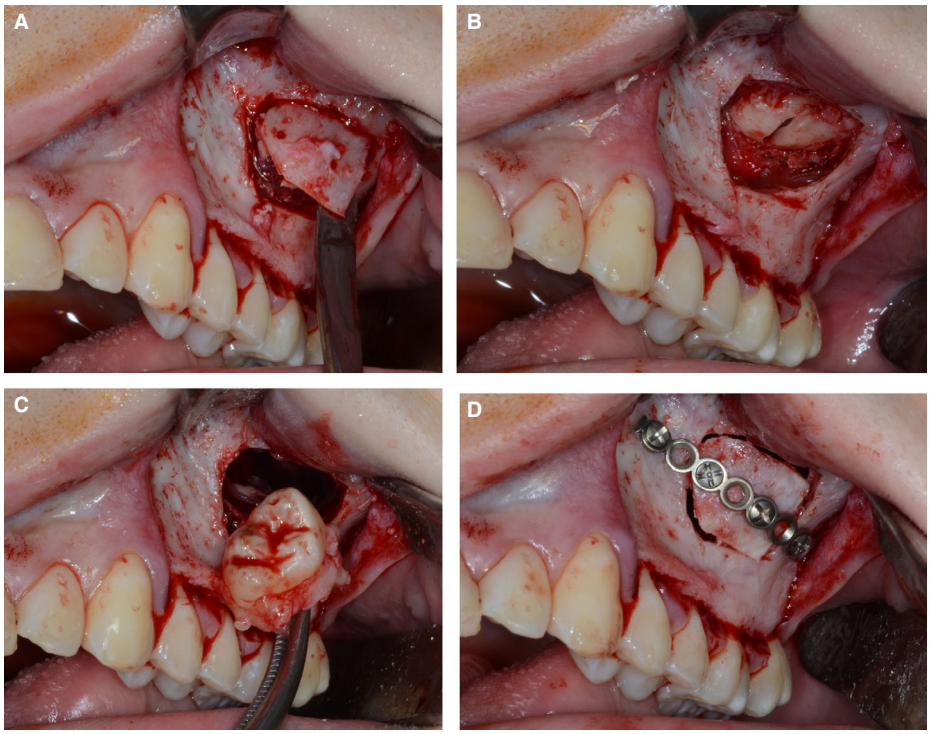

Figure 4 (A–D) Intraoral access to the cyst after removal of a rectangular bony. (A) the removal of the lid; (B) the exposure of the cystic wall and of the associated tooth crown; (C) the removal of the tooth; (D) The lid subsequently replaced and fixed in the original position.

after surgery for 7 days, along with a non-steroidal analgesic (ketoprofen) for 7 days. The patient was instructed to avoid brushing and trauma in the surgical area, adhere to a soft diet for 1 week, and maintain appropriate oral hygiene, which included twice-daily rinsing with 0.2% chlorhexidine mouthwash. He was discharged the day after surgery, and his post-operative course was uneventful apart from the development of facial hematoma and post-operative pain. Histopathological analysis of the cystic wall showed a lining of stratified squamous epithelium and fibrous tissue, which were compatible with a diagnosis of dentigerous cyst. A month after surgery, the patient showed no clinical signs or symptoms. CT showed initial and progressive inflation of air in the cystic compartment (Fig. 5). At 6 months after surgery, CT showed an enlarged and patent OMC with a wide communication between the left sinus cavity and the left middle meatus. The anatomical structure of the maxillary sinus appeared normal, with a well-aerated space and the presence of a minimal radiopacity in the posterior part of the left sinus cavity, close to the pterygopalatine fossa (Fig. 6). This was attributed to partially mineralized tissue, which was identified as fibrotic tissue in a further magnetic resonance imaging examination (Fig. 7). CT performed at 27 months after surgery showed no changes from the 6-month findings, with no signs of recurrence (Fig. 8).

Discussion

Dentigerous cysts involving the maxillary sinus are clinically silent and difficult to detect on routine panoramic radiographs, on which they show a diffuse radiopacity in the area of the maxillary sinus along with displacement of the related tooth[9,16]. Therefore, delayed diagnosis is common, and clinicians end up facing large lesions invading the entire sinus, with compression of the nasal cavity, nasolacrimal canal and orbital pavement; OMC occlusion; and dislocation of the associated tooth in various directions[16]. The clinical situation may become quite complex if the classic signs and symptoms of a sinus disease, such as swelling, headache, facial pain, respiratory obstruction, rhinorrhea and epiphora appear[9]. On CT images, these lesions appear as radiopacities with well-circumscribed margins associated with upward displacement of the sinus floor and a thin bony rim[9,16]. The treatment of these pathologies should depend on their location, the position of the related tooth and the extent of sinus

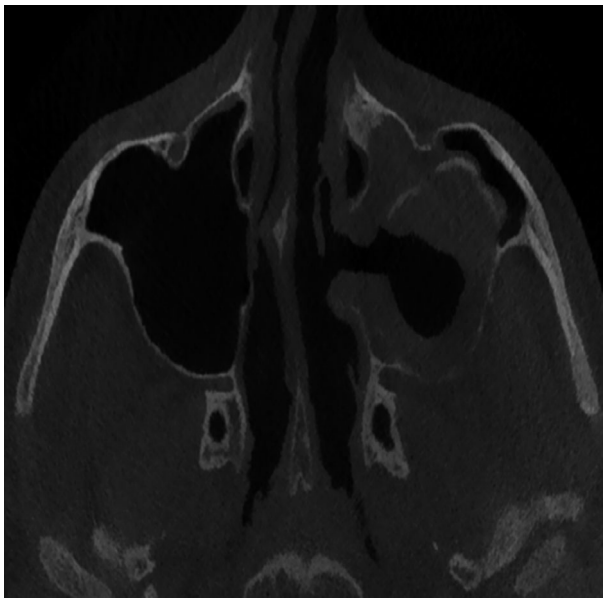

Figure 5 Axial computed tomography image obtained at 1 month after surgery. The patient was treated with functional endoscopic sinus surgery (FESS) combined with an intraoral approach. The radiolucency in the cystic compartment testifies the presence of inflated air.

involvement. Moreover, the treatment plan should consider the possibility of functional impairment and the need to not only avoid further iatrogenic injuries but also recover respiratory function, particularly in cases showing larger lesions. Preservation of the Scheiderian membrane and the bony architecture of the maxillary antrum will facilitate recovery of the mucociliary physiology with relative sinus clearance, typical laminar airflow and satisfactory drainage of mucous secretions[8].

A direct transoral approach for enucleation requires wider mucosal flaps and more bone removal, with the possibility of damage to nerves, vascular bundles, tooth roots and the sinus mucosa. The conventional Caldwell-Luc procedure, which establishes a communication between the sinus and the inferior meatus through partial fracture of the anteromedial and inferior nasal walls, is capable of causing relative post-operative discomfort, swelling, hematoma and complications such as oroantral fistulae and impaired mucous drainage into the nasal cavity, which can lead to iatrogenic sinusitis[8,17–20]. Other post-operative problems include toothache, facial paresthesia due to extensive sinus mucosa removal, loss of the anterolateral sinus wall with facial asymmetry and epiphora, which is caused by damage to the nasolacrimal canal during the creation of a communication between the sinus and inferior nasal meatus[3].

Transoral decompression/marsupialization aids in decreasing the lesion volume in order to facilitate more conservative enucleation that preserves the anatomical structure, although it has its own drawbacks[4,5].

Transnasal endoscopy is becoming increasingly useful for the treatment of odontogenic pathologies in the maxillary sinus because it is minimally invasive and improves the patency of OMC to facilitate satisfactory mucous drainage and respiratory function[17,21]. Under the guidance of an endoscopic visual system, a lesion can be reached on the basis of its characteristics and location. The endoscope passes through the middle nasal meatus to widen OMC, as in FESS, or the inferior nasal meatus to perforate the lateral wall of the nasal cavity. Some authors have stated that FESS must be considered as the first choice for treatment for oral surgery complications involving the maxillary sinus, such as sinusitis after accidental tooth or dental implant migration or an iatrogenic oroantral fistula[21]. However, the FESS approach rarely achieves complete enucleation of cystic lesions invading the maxillary sinus when used alone[7,10,12,22,23], because it cannot remove the entire epithelial capsule and, in cases of dentigerous cysts, the related tooth. Moreover, the procedure is highly dependent on operator skills and the position of the cyst and related tooth and requires excessive destruction of the anatomical structure that defines OMC[3]. Therefore, an interesting application of transnasal endoscopy is marsupialization/decompression of sinus cysts before a definitive secondary approach[10,24]. The opening of a cyst via a transnasal approach does not require the use of a drainage tube or self-management of the surgical window by the patient, with a lower possibility of accessory pouch infection due to minimal food impaction and the natural clearance mechanism of the ciliary mucosa that progressively replaces the odontogenic cystic epithelium[10]. Nevertheless, apart from a study on nasolabial cysts[13,25,26] and cases report on keratocystic lesion[11,27], only two studies have reported the use of properly defined transnasal marsupialization[8,28], with less than 15 successfully treated cases and a 6–36-month follow-up period without recurrences; all these cases were treated with inferior meatal antrostomy. Other studies report about total or partial removal of the cyst lining[12,29], which is not actually marsupialization. With regard to dentigerous cysts, very few cases have been treated with an endoscopic nasal approach, and it remains unclear whether the related tooth can be removed without an increase in the risk of lesion recurrence.

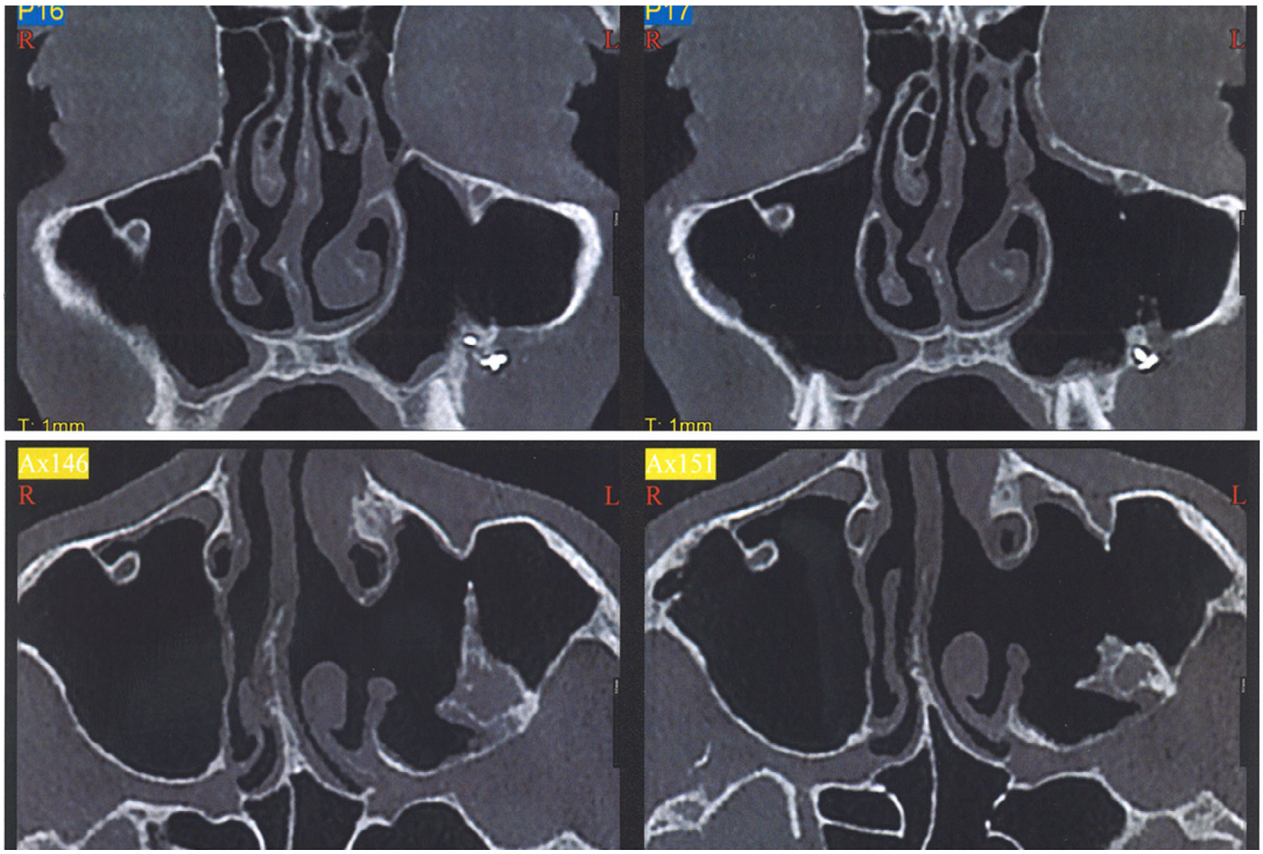

Figure 6 Coronal and axial computed tomography images obtained 6 months after surgery. The patient was treated with functional endoscopic sinus surgery (FESS) combined with an intraoral approach. The osteomeatal complex (OMC) is enlarged. The sinus cavity is well aerated and adequately communicating with the middle meatus. A minimal radiopacity can be seen in the posterior portion of the sinus in the axial scans.

Transnasal tooth removal using FESS has been reported only in cases where the tooth is small and located close to OMC[9,21,30].

A contemporary approach involving the combination of a transnasal endoscopic and transoral approach can help clinicians in quickly resolving odontogenic sinus pathologies without damage to the anatomical structure. A collaboration between an oral surgeon and an otorhinolaryngologist skilled in nasal endoscopy is common in cases requiring iatrogenic

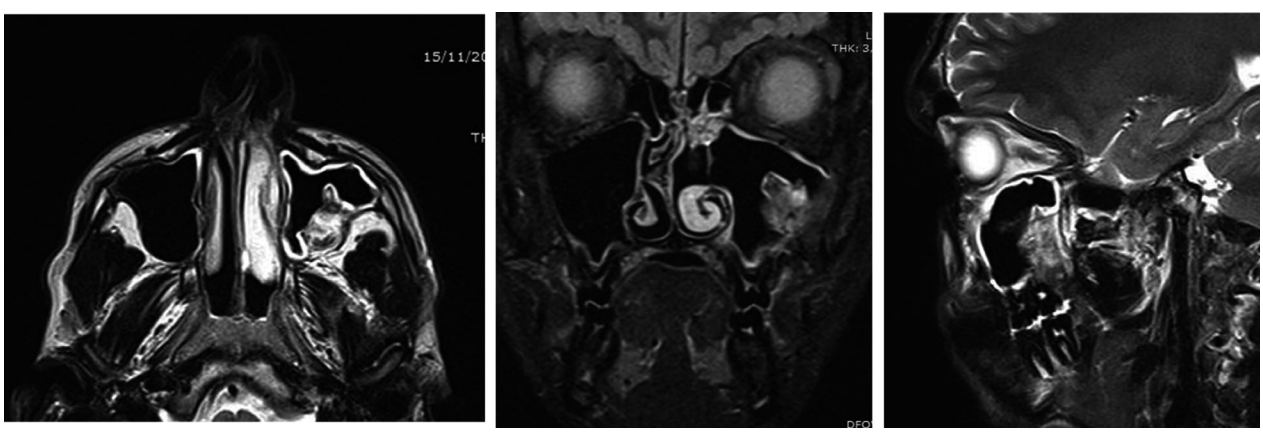

Figure 7 Axial, coronal and sagittal MRI images obtained 6 months after surgery. The fragment in the posterior portion of the sinus appears white and was diagnosed as fibrotic tissue.

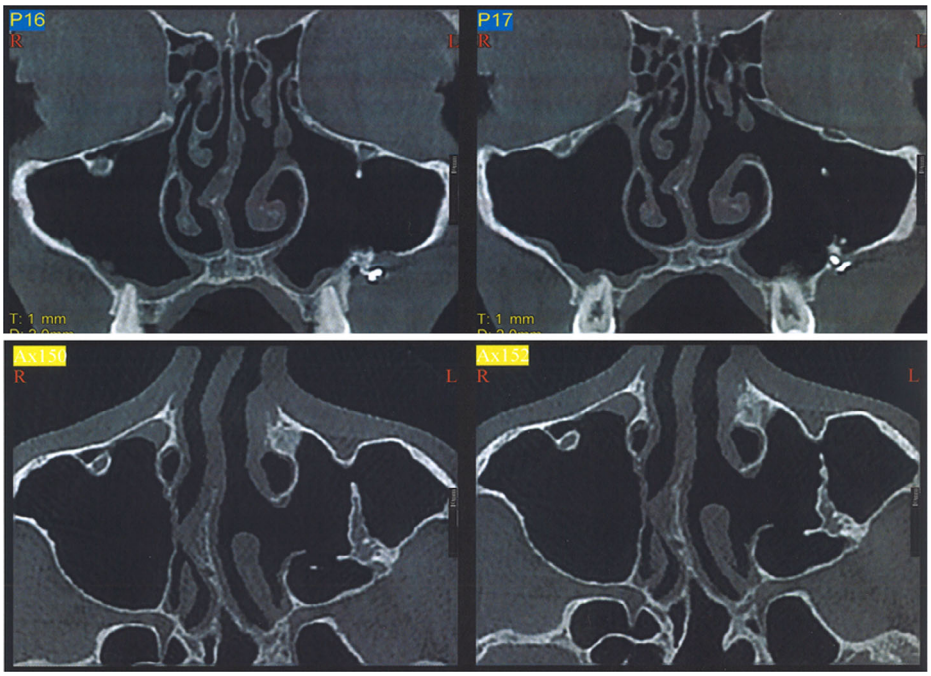

Figure 8 Coronal and axial computed tomography images obtained at 27 months after surgery. The patient was treated with functional endoscopic sinus surgery (FESS) combined with an intraoral approach. There are no changes from the 6-month findings, with no signs of recurrence.

oroantral fistula closure in the presence of odontogenic sinusitis[2,31]. Some authors used a combined approach for complete removal of a keratocyst occupying the entire maxillary sinus in order to minimize the risk of orbital floor fracture, which can occur when the oral approach is used alone[10]. In addition, a minimally invasive, endoscopically assisted transoral approach with better illumination and magnification was adopted to avoid injuries to the sinus wall and invasion of surrounding structures such as the orbit and infratemporal and pterygopalatine fossae[3,27,32,33].

For the present case, we selected FESS combined with an intraoral surgery to avoid surgical re-entry, considering the position and dimension of the lesions. The treatment aimed to restore the maxillary sinus anatomy and function lost because of the presence of the cystic cavity. Thus, perfect recovery of the sinus dimensions and air content was achieved without lesion recurrence. Removal of the cystic compartment via an intraoral approach could have disrupted the integrity of the sinus walls and increased the possibility of a partial or complete remnant of the bony cystic wall inside the sinus. In addition to causing lesion recurrence, the presence of epithelial remnants and a residual bony cystic walls could have hesitate in an internal accessorial room formation to be bony filled for internal osteogenic progressive processes, thus compromising the inner sinus structure and function. In the present cases, the patency of OMC achieved by FESS re-established the laminar air flow with satisfactory drainage of mucous secretions. Moreover, bony wall removal for transoral access was minimized by the preparation of a small bony lid with a regular shape. The bony lid approach was adopted by Xu *et al.*[3] for enucleation of dentigerous cysts invading the maxillary sinus without transnasal endoscopic guidance. This technique causes less trauma and bone loss. Moreover, in situ repositioning of the lid, which was perfectly incorporated during the healing process, maintained the integrity of the anterolateral wall of the maxillary sinus preventing facial soft tissues from depression and facilitated complete sinus relining with ciliated epithelium. The sinus function was completely restored, and the sinus radiologically appeared as a well-aerated cavity without septa or bone-filled cavities at only 6 months after surgery.

Conflict of Interest

None.

Ethical Approval

The procedure performed in this case report that involving an human participant was in accordance

with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from the patient involved in this case report.

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