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Modified endoscopic medial maxillectomy for recalcitrant zygomatic implant-related chronic rhinosinusitis: A case study

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Abstract

Objective

Zygomatic implants (ZI) are used for oral rehabilitation in the edentulous maxillae with deficient alveolar bone. When maxillary sinus mucosa is violated, a foreign body reaction can lead to chronic rhinosinusitis (CRS). We sought to demonstrate that modified endoscopic medial maxillectomy (MEMM) can be used safely manage ZI-related odontogenic CRS that fails conservative management.

Methods

The clinical courses of a patient with ZI-related refractory CRS managed successfully with MEMM is described. Pre-operative clinical presentation, imaging, office endoscopies, surgical findings and techniques, and post-operative clinical and endoscopic outcomes were retrospectively reviewed.

Results

The patient presented with congestion, purulent discharge, facial pain/pressure, and hyposmia after failing antibiotic therapy and a Caldwell-Luc procedure. Pre-operative computed tomography (CT) showed implant penetration into the sinus with complete opacification and osteitis. An MEMM and anterior ethmoidectomy was performed. Post-operative management included debridements, oral antibiotics, and oral steroids. Post-operative course was characterized by mild CRS exacerbations that resolved fully with culture-directed topical and oral antibiotics as well as topical steroids. Pre-operative Sinonasal Outcome Test-22 (SNOT-22) scores was 24 compared to 0 after 13 months of post-operative follow-up. Post-treatment endoscopy revealed healthy-appearing mucosa, an intact ZI, and minimal edema or drainage.

Conclusion

This case demonstrates that MEMM is an efficacious procedure to address refractory odontogenic CRS caused by zygomatic implantation. MEMM with meticulous post-operative care may allow for zygomatic implant salvage.

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Keywords

Odontogenic; Dental sinus; Clinical outcomes research; Clinical rhinology; Medial maxillectomy; Chronic rhinosinusitis; Zygomatic implant; Endoscopic sinus surgery

1. Introduction

It is estimated that 10–30% of maxillary sinusitis cases are odontogenic in origin. Specifically, maxillary sinusitis due to dental implants and dental bone grafting procedures is becoming increasingly common [[1], [2], [3]]. One odontogenic cause of recalcitrant maxillary sinusitis that is not well studied is zygomatic implant-related maxillary sinusitis. Zygomatic implants (ZIs) are an effective option for oral rehabilitation in complex dental patients with severe maxillary alveolar bone resorption due to being edentulous. Other options for these patients include bone augmentation procedures to support traditional implant placement, such as sinus lifts, bone grafting, and apposition grafts with LeFort I osteotomy. However, these procedures incur significant costs, require staged interventions and longer treatment times, and may have higher implant failure and post-operative sinusitis rates [4,5]. ZIs bypass the need for bone augmentation by anchoring to the zygoma and have become an excellent option for oral rehabilitation in these patients with success rates as high as 95–97% [3,5].

Yet, the most common complication of ZIs is sinusitis, which is important to recognize as this implant technique becomes increasingly popular [1,3,4]. The risk of sinusitis is higher when the Schneiderian mucosa is violated or an oro-antral fistula is created, introducing oral bacteria into the sinus. Sinus mucosal violation is thought to cause

infection through a foreign body reaction and acting as a nidus for bacterial colonization [1,2]. Most of these patients will respond well to oral antibiotic therapy [4,5]. In select patients who fail medical management and maxillary antrostomy, traditional dogma involved removing the ZI [1,6,7]. However, a case report by Schwartz et al., in 2016 demonstrated it was possible to avoid ZI removal by performing a modified endoscopic medial maxillectomy (MEMM). The literature is otherwise scarce on this new application of an effective and safe surgical option [8]. We sought to raise further awareness of this novel treatment option by reporting a case of ZI-related CRS and implant salvage with MEMM.

2. Materials and methods

Institutional Review Board (IRB) approval was obtained from the Rush University Medical Center IRB. All patients are referred to otolaryngology by an oral surgeon due to CRS after ZI placement. Prior to referral, patients undergo multiple courses of antibiotics and may have undergone a Caldwell-Luc approach by oral surgery. There is a pre-operative otolaryngology consultation and oral antibiotics, antibiotic irrigations, intranasal corticosteroids, oral corticosteroids, and/or corticosteroid irrigations are often prescribed based on symptoms, nasal endoscopy findings, and culture results. Following medical treatment, thin-cut computed tomography (CT) scans were obtained.

2.1. Surgical technique

The patient underwent MEMM by a single fellowship-trained rhinologist as previously described by Wang et al. (Wang) due to recalcitrant symptoms. After endoscopic maxillary antrostomy, the posterior two thirds of the inferior turbinate is resected. A mucosal flap is raised from the nasal floor extending laterally in a subperiosteal plane over the medial maxillary wall. The medial maxillary wall is removed to the level of the nasal floor using various sinus instruments and a high-speed drill. Care is taken to not compromise the flap while drilling, preserve the anterior third of the inferior turbinate to prevent empty nose syndrome, and to not extend dissection posterior to the posterior maxillary wall to prevent injury to the descending palatine nerve and sphenopalatine artery branches. The mucosal flap is then draped back over the maxillary and nasal floor.

The nasolacrimal system is preserved.

2.2. Post-operative management

Post-operatively, patients are prescribed saline irrigations, one week of prednisone 20 mg once daily, and two weeks of either doxycycline 100 mg twice daily or a combination of trimethoprim-sulfamethaxazole (Bactrim) 800-160 mg twice daily and clindamycin 300 mg three times daily. Patients are seen in clinic 1, 2, and 4 weeks post-operatively for routine sinonasal debridements to prevent synechiae formation and crusting. If purulence is observed, culture-directed oral and/or topical antibiotics are prescribed. If significant edema was noted, steroid irrigations are started. Patients are then seen at 3 to 6-month intervals. Sinonasal Outcome Test-22 (SNOT-22) scores [9] are elicited and nasal endoscopy is performed during all appointments.

3. Results

The following text describe the pre- and post-operative disease course and treatment regimen of a patient with ZI-related CRS.

3.1. Patient course

A 53 year-old female who underwent ZI placement one year prior to presentation with subsequent sinonasal symptoms refractory to several courses of antibiotics and sinus lavage via Caldwell-Luc approach presented with intermittent episodes of facial pressure, purulent rhinorrhea, and post-nasal drip. Initial SNOT-22 score was 24. CT imaging revealed an opacified osteitic left maxillary sinus and ZI sinus penetration (Fig. 1). Nasal endoscopy revealed purulent discharge from the left middle meatus (MM), which grew Parvimonas micra. A two-week course of doxycycline and levofloxacin/mometasone rinses were prescribed. Subsequent thin-cut CT imaging illustrated persistent complete left maxillary opacification, and diffuse osteitis.

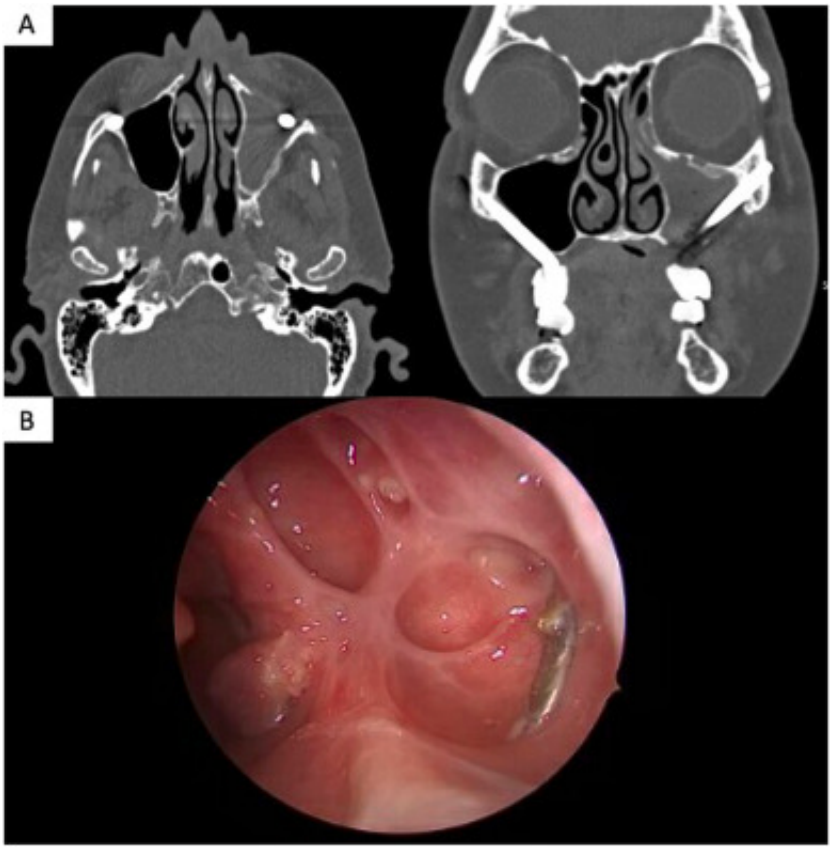

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Fig. 1. (A–B). A). Pre-operative axial and coronal CT images showing ZI penetration of the left maxillary sinus with an anterior bony defect and complete maxillary and partial anterior ethmoid sinus opacification. B). Well healed left maxillary sinus 3.5 months post-operatively with visualization of the ZI penetrating the sinus without surrounding granulation or infection.

The patient underwent a left MEMM and anterior ethmoidectomy. Intra-operatively, there was purulence in the maxillary sinus, polypoid edema, and visualization of the left ZI. Cultures grew coagulase-negative Staphylococcus and alpha-hemolytic Streptococcus species. Post-operatively, the patient performed saline irrigations and completed one week of prednisone 20 mg daily and a two-week course of once daily 500 mg oral levofloxacin. One week postoperatively, the patient reported continued congestion, SNOT-22 score was 12, and endoscopy showed expected postoperative changes. At one month, there was purulent discharge from the left maxillary sinus with a SNOT-22 score

of 23. Cultures grew heavy Staphylococcus aureas and Streptococcus viridans. Linezolid and gentamicin/mometasone irrigations twice daily were prescribed, and one month later, SNOT-22 was 6 and endoscopic exam showed healthy sinus mucosa. The patient remained asymptomatic over a 13-month period with a SNOT-22 score of 0 and healthy healed mucosa in the maxillary sinus with an intact ZI (Fig. 1).

4. Discussion

In the present study, we report a case of ZI-related CRS refractory to medical therapy with implant salvage using an extended approach to the maxillary sinus. This case builds upon a report by Schwartz et al. describing their success with ZI salvage with the MEMM technique [2] and sought to raise further awareness of this advantageous surgical option for patients at risk of requiring implant removal due to recalcitrant sinusitis.

The most common complication of ZI is sinusitis, and although the overall incidence is low at about 3–4% the otolaryngology community will likely progressively see more of these patients as the incidence of dental implant procedures overall, and ZIs specifically, increases rapidly [1,[3], [4], [5]]. The vast majority of chronic maxillary sinusitis from ZIs is likely managed successfully with antibiotics with or without a standard maxillary antrostomy [1,2,7,8]. However, a subset of patients will have persistent disease. It is not entirely clear which patients will fail this standard management, but several risk factors have been identified. These include decreased mucociliary clearance, Th2 helper cell imbalance, bacterial biofilms, previous Caldwell-Luc or inferior meatal window procedures leading to scarring and loculations, immunodeficiency, odontogenic sources, and persistent inflammatory sources [10,11]. It is thought that the intra-sinus penetration of the ZI leads to a foreign body reaction and possibly a nidus for bacterial and fungal colonization [2]. In the present case study, risk factors for failed medical management included prior Caldwell-Luc procedure, an odontogenic source, and a persistent inflammatory reaction around the nidus (ZI). Two groups, Felisati et al. and Chiapasco et al. reported surgical cure rates of over 90% with standard maxillary antrostomy for refractory odontogenic sinusitis related to dental implants or bone augmentation procedures, but importantly, implant removal was necessary [1,6].

Traditionally, failed medical management of CRS related to ZI would also require implant

removal. This has significant functional costs to the patients, as these patients' options for oral rehabilitation are often limited and surgically extensive. In addition, ZIs incur a significant financial cost with various websites quoting prices well over $10,000 per side [[12], [13], [14], [15]]. Thus, the utilization of the MEMM technique to help resolve ZI-related CRS introduces a unique relief for these patients to salvage their implant(s). In the present case, the patient had a dramatic SNOT-22 reduction from 24 pre-operatively to 0 after 13-months of follow-up. This SNOT-22 reduction is also clinically significant, as the minimum clinically important difference in SNOT-22 in surgically managed CRS patients has been reported to be 9 [16]. This is coupled with objective endoscopic findings that demonstrated normalization of healthy maxillary sinus mucosa after several months of follow-up (Fig. 1).

Prior works have demonstrated the success of MEMM for the treatment of recalcitrant maxillary sinusitis due to various etiologies with long-term follow-up [8,10,11]. Wang et al. reported a success rate of 80% overall and as high as 90% for culture negative patients [11]. Costa et al. reported a high success rate for MEMM and advocated for MEMM as primary surgery for cystic fibrosis patients due to high failure rates with traditional maxillary antrostomy [10]. Theories related to MEMM's success revolve around gravity-dependent drainage of the sinus in patients with inherent or acquired mucociliary dysfunction, improved access for in-office diagnosis of exacerbations and debridements, and easier instillation of topical therapies. This is supported by the fact that the patient in our case study was successfully treated for post-operative CRS exacerbations with culture-directed topical antibiotics and steroid irrigations. Exacerbations were evidenced by maxillary sinus edema and purulence with positive culture results. Visualization of the sinuses for diagnosis and culturing was significantly improved. Accordingly, it is the current authors' opinion that patients with ZI-related CRS may require MEMM as primary surgical treatment given the high failure rate of medical management and risk factors for failing traditional maxillary antrostomy.

The limitations of this study are largely attributable to its case study design and retrospective nature. Yet, a clinically significant reduction in SNOT-22 scoring was observed over a long-term follow-up of 13 months. Additionally, not all patients with ZI-related CRS are necessarily homogeneous; while this patient had a risk of recalcitrant

CRS due to her prior Caldwell-Luc procedure, other patients may not have undergone prior surgery or trialed medical therapy yet. Some patients may also endorse general risk factors for CRS such as smoking or diabetes mellitus that were not present in this case [17]. Other patients may require more extensive endoscopic sinus surgery, including a posterior ethmoidectomy, frontal sinusotomy, and/or sphenoidotomy, and discerning proportional reductions in SNOT-22 scoring from MEMM relative to the other sinus procedures may be difficult. Future case series and cohort studies are necessary to strengthen the aforementioned findings and perform subgroup analyses based on risk factors.

5. Conclusion

This case study raises further awareness of a novel treatment for patients with odontogenic maxillary sinusitis from ZIs. MEMM may offer an avenue for ZI salvage with symptom reduction, mucosal normalization, and preserved oro-dental function through better access for sinus visualization and topical medical instillation.

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CRediT authorship contribution statement

Vidit Talati: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. **Lindsay Fleischer:** Data curation, Formal analysis, Writing – original draft. **Peter Filip:** Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft. **Paul S. Petrungaro:** Conceptualization, Methodology, Supervision, Writing – original draft. **Bobby A. Tajudeen:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal

relationships that could have appeared to influence the work reported in this paper.

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