

Modified endoscopic medial maxillectomy for zygomatic implant salvage

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ABSTRACT

Objectives: Odontogenic chronic rhinosinusitis (CRS) is an epidemiologically important disease process due, in part, to the increasingly commonplace use of dental restorative procedures such as zygomatic implantation. Traditional management of this clinical entity typically entails extraction of the infected hardware via an open or endoscopic approach. We describe a novel management strategy of odontogenic CRS following bilateral zygomatic implantation for oral rehabilitation that we surgically salvaged via a modified endoscopic medial maxillectomy.

Methods: We describe the presentation and management of a case of metachronous development of bilateral CRS subsequent to zygomatic implantation.

Results: The patient's postoperative course was characterized by marked endoscopic, radiologic, and symptomatic improvement as measured by the 22-item Sino-Nasal Outcome Test.

Conclusion: We describe a novel treatment strategy for the management of odontogenic sinusitis resulting from erroneous zygomatic implant placement. Modified endoscopic medial maxillectomy in this clinical context facilitates mucosal normalization of the affected sinus, while permitting preservation of oral function through salvage of the displaced implant.

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Chronic rhinosinusitis (CRS) is an epidemiologically important chronic inflammatory disease process with significant, well-documented economic implications.^{1,2} Despite the commonality and severity of CRS, little is known about the exact pathophysiologic mechanism that underlies this disease process. Among the multitude of causative factors that contribute to the development of CRS, a foreign body reaction to displaced synthetic hardware within the paranasal sinuses has been described in the literature.^{3–6} This foreign body reaction commonly arises in the setting of previous restorative interventions of the orbit and dentition, with disease most often manifesting in the maxillary sinus, given its intimate anatomic relationship with these structures. Management of this clinical entity typically entails foreign body extraction *via* an open or an endoscopic approach to remove the infectious nidus and allow for restoration of normal mucociliary physiology. Sinonasal surgical outcomes are promising with this strategy,^{6,7} but hardware removal

may engender functional limitations due to a loss of structural support previously provided by the implant. This is particularly relevant in the context of oral rehabilitative surgery for severe maxillary atrophy wherein zygomatic implants must be placed within the dense zygomatic buttress to anchor a fixed dental prosthesis.

The alternative to this technique often requires technically challenging bone-grafting techniques or microvascular free flaps, with longer associated healing times and donor-site morbidity. Although zygomatic implantation is successful in the vast majority of instances, a <6% incidence of iatrogenically induced CRS has been reported when all surgical protocols are taken into consideration.⁸ We describe a novel management strategy of CRS following bilateral zygomatic implantation for oral rehabilitation that we surgically salvaged *via* modified endoscopic medial maxillectomy (MEMM). This surgical approach allowed for exteriorization of the maxillary sinus, thereby facilitating maximal distribution of topically delivered medication to the diseased mucosa with symptomatic and endoscopic control, despite ongoing exposure of implanted hardware.

METHODS

A 62-year-old woman underwent bilateral zygomatic implant placement for fixed dental prosthetic rehabilitation. Before implantation, the patient reported a long-standing history of recurrent acute bacterial rhinosinusitis, which was responsive to oral antibiotics and occurred twice a year on average. Shortly after

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implantation, the patient noted an increase in the frequency of acute bacterial rhinosinusitis episodes, occurring every other month, with a return to an asymptomatic baseline between episodes. At 8 months after implantation, the patient underwent endoscopic sinus surgery of the left side, by an outside physician, which entailed an uncinectomy, maxillary antrostomy, and partial ethmoidectomy. The patient's clinical state deteriorated thereafter, with both an intensification and persistence in ipsilateral sinonasal symptoms (left-sided purulent discharge and facial pressure) without relief.

Eight months following the original sinonasal intervention, rigid nasal endoscopy revealed a surgically created left maxillary antrostomy, with significant purulence and polypoid changes of the maxillary sinus mucosa. The right, unoperated nasal fossa was found to be within normal limits. An endoscopically acquired culture of the left maxillary sinus was significant for *Klebsiella oxytoca*. The patient was administered a high-dose 12-day prednisone taper, a 2-week course of levofloxacin, and mupirocin sinonasal irrigation. A post-treatment computed tomography scan at 6 weeks revealed complete left-sided maxillary sinus opacification, frontal sinus, and anterior and posterior ethmoid sinus opacification, with no pathologic mucosal changes noted on the right side (Fig. 1 A). Endoscopic evaluation revealed no change in appearance of the left maxillary sinus following treatment. We proceeded with a left endoscopic total sphenoidectomy, frontal sinusotomy, and MEMM, which revealed exposed zygomatic implant hardware.

The patient did well after surgery but was subsequently lost to follow up. She returned 5 years later with exclusive right-sided sinonasal symptoms (purulence, facial pressure, and nasal obstruction), which persisted over a 3-month period, despite regular twice a day saline solution irrigations. A computed tomography revealed normalization of the left maxillary sinus following MEMM, with complete right maxillary

sinus opacification (Fig. 1 B). Endoscopic examination revealed prominent right-sided middle meatal purulence. We subsequently addressed the right side with a MEMM in addition to a complete sphenoidectomy and frontal sinusotomy (Fig. 2). Intraoperative findings were significant for exposed zygomatic implant hardware in the affected right maxillary sinus. The patient's postoperative course, which included a 2-week course of oral antibiotics (Clindamycin and Trimethoprim-sulfamethoxazole [TMP-SMX]), was uneventful, with both symptomatic and endoscopic (Fig. 3) improvement achieved and maintained with twice daily budesonide sinus irrigations.

Technique

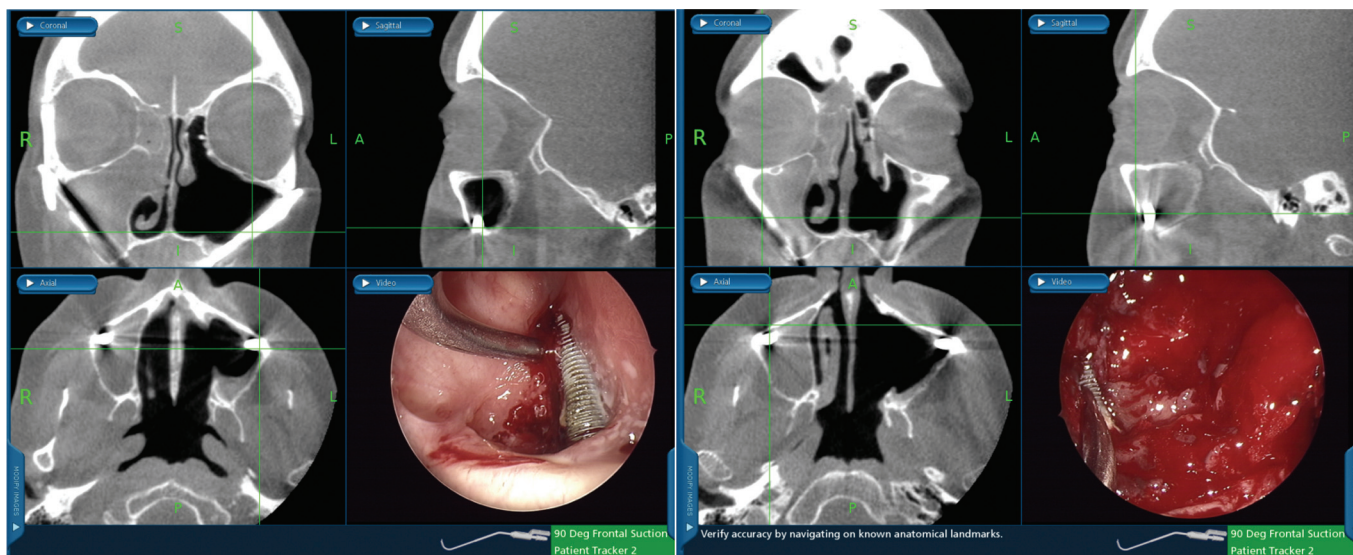
The surgical technique we use for MEMM in the management of recalcitrant maxillary sinusitis was previously described in detail.⁹ This includes creation of a medially based nasal mucosal floor flap that serves to redrape the newly exposed bony ridge that remains after extirpation of the medial maxillary wall. This technique also involves preservation of the lacrimal sac and the nasolacrimal duct.

RESULTS

The patient's postoperative course was characterized by marked symptomatic and endoscopic improvement (Fig. 3). Postoperative imaging 5 years after the initial left-sided MEMM demonstrated normalization of the left maxillary sinus mucosa (Fig. 1 B). A significant symptomatic improvement was likewise noted as measured by the 22-item Sino-Nasal Outcome Test (SNOT-22), a psychometrically validated disease-specific quality-of-life instrument for use in CRS, which was previously used to assess outcomes of surgical intervention in CRS.¹⁰ The patient's SNOT-22 scores prior to and 2 weeks following the initial left-sided MEMM were 30 and 16, respectively. The patient's SNOT-22 scores before and 2 weeks and 8 weeks after the sec-



Figure 1. Pre- (A) and postoperative (B) computed tomography (CT) scans. (A) Preoperative CT demonstrates the presence of bilateral zygomatic implants, with evidence of significant unilateral (left) maxillary and ethmoid sinus opacification. (B) Postoperative CT captured 5 years after the initial left-sided modified endoscopic medial maxillectomy demonstrates mucosal normalization on the left, with development of contralateral disease in the context of the ongoing presence of bilateral zygomatic implants.



(A)

(B)

Figure 2. Intraoperative triplanar view of the maxillary sinus cavities. An intraoperative endoscopic view of left (A) and right (B) maxillary sinus cavities, with triplanar localization using an image guidance system. Captured at the time of the patient's second right-sided modified endoscopic medial maxillectomy (MEMM), these images demonstrate intrasinus exposure of the implants, with mucosal normalization of the previously treated, left maxillary sinus (A) and diseased mucosa of the right (B), untreated maxillary sinus.

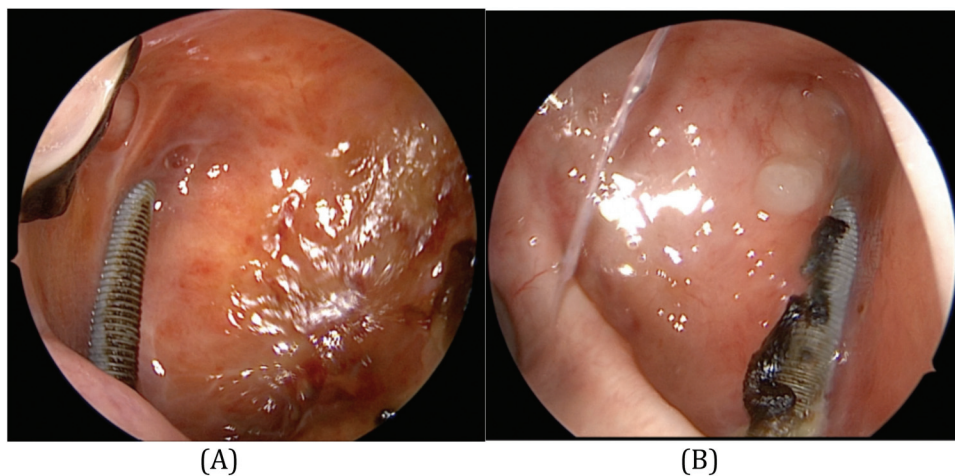
ond, right-sided MEMM were 26, 10, and 9, respectively. As per the study by Hopkins *et al.*¹⁰ that psychometrically validated the SNOT 22, a value of 9 corresponds to a score seen in healthy, patients without CRS.

DISCUSSION

Our case is a noteworthy example of metachronous development of bilateral odontogenic CRS subsequent to zygomatic implantation. The staggered fashion in which the patient's mucosal disease was surgically addressed elucidated the effectiveness of MEMM with mucosal normalization of the initially operated side at the time of presentation for the patient's contralateral symptomatology. Overall, the case highlights a novel

management strategy for salvage of exposed zygomatic implants, which enables preservation of oral function while allowing for symptomatic and endoscopic disease control.

The vast majority of chronic maxillary sinusitis can be managed effectively with a standard middle meatal antrostomy, with reported success rates approaching 90%.¹¹ A small but significant subset of patients will persistently manifest signs and symptoms of ongoing mucosal inflammation deemed recalcitrant to standard medical and surgical therapies. Risk factors for recalcitrant maxillary sinusitis are well established in the literature and include innate or acquired mucociliary dysfunction, immunologic impairments, biofilm colonization, and odontogenic disease.¹² MEMM has been



(A)

(B)

Figure 3. Postoperative endoscopic appearance of maxillary sinus cavities (A) Right maxillary sinus cavity 1 month after modified endoscopic medial maxillectomy (MEMM) visualized using a 70° endoscope. (B) The previously addressed left maxillary sinus cavity is likewise visualized, with evidence of mucosal normalization following remote (>5 years) MEMM.

shown to be a safe and effective surgical approach for refractory chronic maxillary sinusitis with multiple case series reporting disease resolution in up to 80% of patients with previously recalcitrant disease.¹²⁻¹⁵ Long-term follow-up of this patient cohort has confirmed lasting clinical benefit from surgery, with sustained symptomatic improvement for up to 7 years postoperatively.¹⁵ Although the exact mechanism of improvement after MEMM has yet to be elucidated, proposed theories include improved distribution of topical therapy, improved mechanical debridement of mucus and biofilms, and facilitation of gravity-dependent sinus drainage.¹²

Chronic maxillary sinusitis in the setting of previous oral restorative procedures represents a subset of recalcitrant maxillary sinusitis that deserves special attention. It is estimated that, up to 40% of chronic maxillary sinusitis is odontogenic in origin,¹⁶ with dental implants accounting for a small portion of these cases given their limited associated complication rate. Nonetheless, there seems to be an increasing incidence of dental implant-related maxillary sinusitis due, in part, to the increasingly commonplace use of these procedures. An infectious process ensues in these instances after penetration of the Schneiderian lining of the sinus, with the resultant exposed hardware generating a foreign body reaction.⁴ A number of cases series of implant-induced sinusitis described surgical protocols that addressed this clinical entity, all of which stress the necessity of implant removal either through an open or an endoscopic approach.^{4,7,17} The investigators argue in favor of implant removal due to potential periimplant osteitis with concerns that sinusitis might persist without accounting for the infectious nidus.⁴

Our case suggests that sinus-exposed implants may be salvaged in view of preserving oral function by exteriorizing the sinus *via* a MEMM. The exact mechanism for mucosal normalization in this context was unclear. We suspect that a low-grade inflammatory process likely persists postoperatively due to hardware exposure, potentially inducing a state of mucociliary dysfunction. By rendering the sinus gravity dependent and facilitating distribution of topical anti-inflammatory agents, budesonide, the underlying mucosal inflammation and impaired mucociliary drainage can be adequately managed, allowing for symptomatic relief. This observation parallels the favorable outcomes seen in cystic fibrosis-related CRS following MEMM. Although MEMM does not correct the underlying mucociliary dysfunction in these patients, a prospective postoperative evaluation of this patient cohort has uniformly demonstrated a marked improvement in sinonasal disease outcomes.⁹

CONCLUSION

Our case demonstrates a novel treatment strategy for the management of odontogenic sinusitis resulting

from erroneous zygomatic implant placement. MEMM in this clinical context facilitates mucosal normalization of the affected sinus while permitting preservation of oral function through salvage of the displaced implant.

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