

Open Access to a Closed Sinus: Caldwell-Luc Management of Dual Dental Foreign Bodies: A CT-Guided Surgical Resolution

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Abstract

Case Report

Accidental migration of dental structures into the maxillary sinus is a rare but potentially severe iatrogenic complication that may lead to chronic sinusitis, mucosal inflammation, or orbital involvement. We report the case of a 31-year-old woman presenting with simultaneous migration of the upper left third molar and its orthodontic bracket into the left maxillary sinus and infratemporal fossa following dental extraction. Management by Caldwell-Luc approach allowed complete removal of the foreign bodies, curettage of the sinus cavity, and elimination of an unexpected cotton fragment. Postoperative recovery was uneventful, with complete symptom resolution by day 7.

Keywords: Maxillary sinus, foreign body, Iatrogenic complication, Caldwell-Luc approach, Third molar extraction.

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INTRODUCTION

Iatrogenic foreign bodies in the maxillary sinus remain uncommon but well-recognized in oral and maxillofacial practice. They may originate from dental extractions, implant procedures, or endodontic treatment. The displaced material acts as a persistent irritant, leading to mucosal thickening, infection, or sinus obstruction. Displacement of a maxillary third molar into the sinus is already rare; migration combined with orthodontic material is exceptional and increases the risk of infection and delayed healing. The present case illustrates an unusual combination of a tooth, bracket, and cotton fragment within the maxillary sinus and infratemporal fossa, managed surgically through a Caldwell-Luc approach. The report emphasizes the diagnostic process, surgical rationale, and postoperative management, in comparison with previously described strategies.

CASE REPORT

A 31-year-old woman, allergic to pollen and dust, was referred for removal of a foreign body from the left maxillary sinus. Two weeks earlier, an attempted extraction of tooth 28 had resulted in accidental displacement of the tooth and its orthodontic bracket beyond the socket.

On admission, the patient reported only mild discomfort in the left maxillary region. Facial examination was normal, with no swelling or asymmetry (Figures 1–2). Intraoral inspection showed healthy mucosa and a healed extraction site, without evidence of oroantral communication.



Figure 1: Frontal preoperative view of the patient showing mild left maxillary tenderness without facial asymmetry



Figure 2. Intraoral preoperative view showing healed extraction site of tooth 28, intact mucosa, and absence of oroantral communication

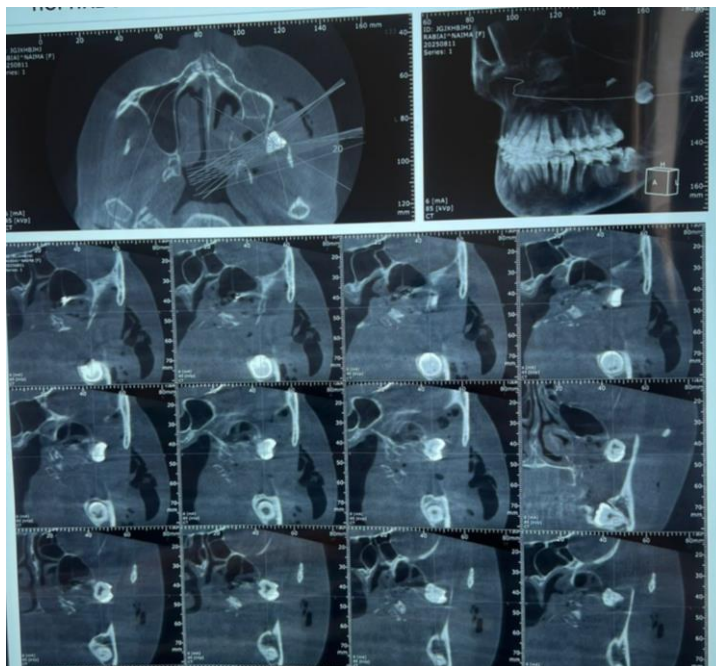
Panoramic radiography revealed two radiopaque foreign bodies in the left maxillary sinus (Figure 3).



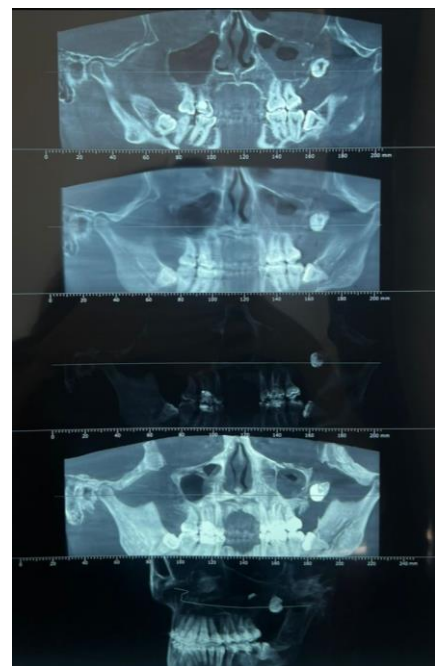
Figure 3. Panoramic radiograph showing radiopaque foreign body in the left maxillary sinus region

Dental CT scan confirmed the presence of the tooth in the retrozygomatic fat of the infratemporal

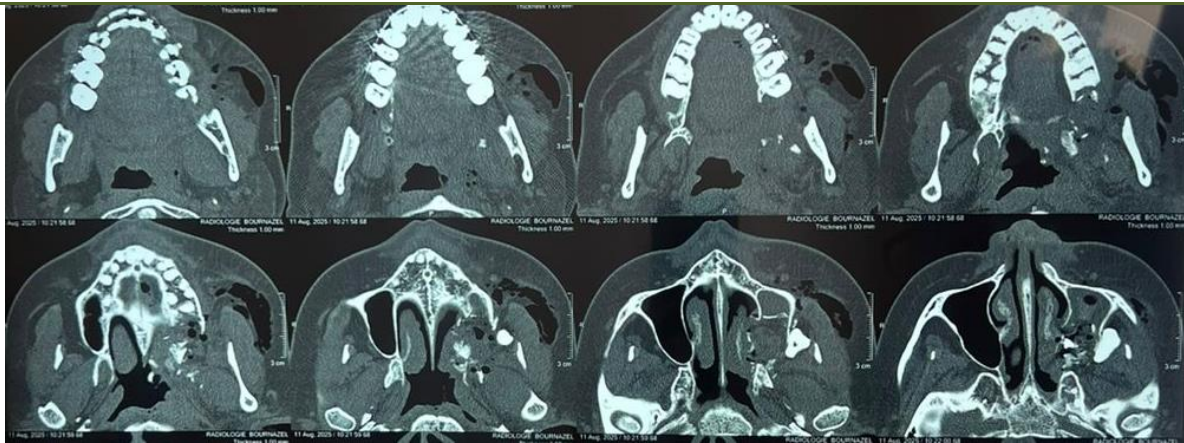
region and a metallic bracket within the sinus cavity (Figures 4).



A



b



c

Figure 4 a, b and c. Dental CT scan section showing tooth 28 displaced into the retrozygomatic fat and metallic bracket within the left maxillary sinus

Under general anesthesia, a Caldwell-Luc approach was chosen because of the double localization—sinus and infratemporal fossa. After a

vestibular incision in the canine fossa and elevation of a mucoperiosteal flap, a bony window was created in the anterior sinus wall (Figure 8).



Figure 8. Intraoral view after flap elevation showing the anterior wall of the maxillary sinus

Both foreign bodies were identified and removed. A small cotton fragment, probably left inadvertently during the initial dental procedure, was also discovered and extracted.

The sinus was irrigated abundantly with saline, the inflamed mucosa curetted, and the flap repositioned and sutured (Figures 9-10).

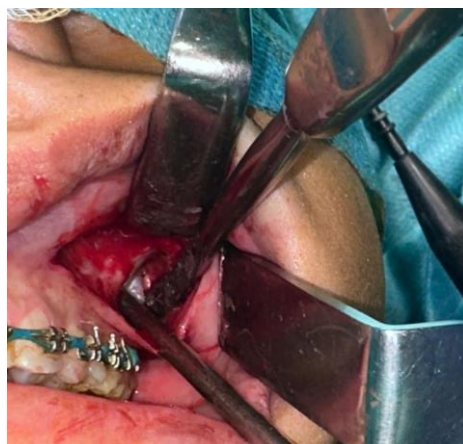


Figure 9. Identification of the foreign body during Caldwell-Luc approach

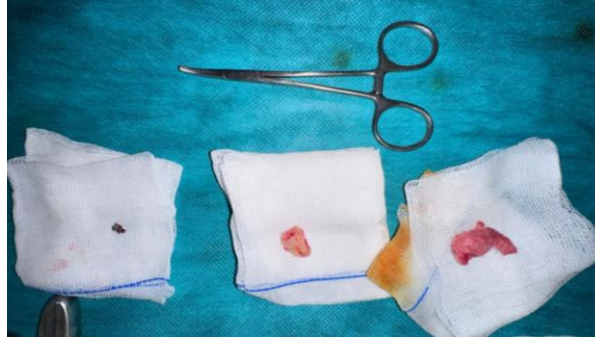


Figure 10: Retrieved tooth, orthodontic bracket, and cotton fragment placed on the surgical field

Histopathologic examination of the removed mucosa revealed inflammatory changes consistent with a foreign-body reaction. Postoperative therapy combined amoxicillin/clavulanic acid (1 g/125 mg BID $\times$ 7 days), oral prednisone (1 mg/kg/day $\times$ 5 days, then tapered), intranasal corticosteroid spray for 7 days, and saline irrigations. Recovery was favorable; at day 7, the patient was asymptomatic, with normal nasal breathing and no local tenderness.

DISCUSSION

The maxillary sinus is anatomically predisposed to accidental penetration during dental and orthodontic procedures because of its proximity to the apices of the molar teeth [1, 10]. Iatrogenic foreign bodies within the sinus have been extensively reported in the literature, yet the simultaneous displacement of a third molar and orthodontic bracket remains exceedingly rare [11]. The reported frequency of dental-related sinus foreign bodies varies between 0.6 % and 3 % of maxillary sinus pathologies [12, 13]. When left untreated, such materials can provoke recurrent sinusitis, mucosal edema, and bacterial or fungal colonization [14].

Early imaging plays a crucial role in identifying both the foreign body and its relationship with vital anatomical structures. While panoramic radiographs can provide an initial overview, computed tomography (CT) or cone-beam CT (CBCT) offers superior accuracy and spatial localization [15, 16]. In our case, CT imaging precisely delineated the two distinct foreign objects—one within the sinus cavity and the other in the retrozygomatic fat—allowing us to plan the surgical approach accordingly. Similar findings have been emphasized by Pereira *et al.*, (2022) and Abel *et al.*, (2021), who noted that multiplanar CT is indispensable in evaluating posteriorly displaced dental materials.

The Caldwell-Luc approach, introduced by George Caldwell in 1893 and Henri Luc in 1897, remains a time-tested and versatile technique for accessing the maxillary sinus [17]. Although endoscopic sinus surgery has become the preferred route in many centers, Caldwell-Luc retains an essential role in cases involving large, metallic, or posteriorly displaced objects, or when

endoscopic access is limited [18, 19]. In our patient, given the dual localization—sinus and infratemporal fossa—and the metallic nature of the bracket, an open trans-antral approach was judged safer and more effective. The wide exposure it provided allowed complete visualization, retrieval of both foreign bodies, and inspection of the sinus cavity, revealing an unexpected retained cotton fragment.

The removal of this cotton piece was particularly significant, as retained materials can act as chronic irritants and perpetuate inflammation [20]. Histologically, chronic foreign-body reactions lead to granulomatous inflammation, mucosal fibrosis, and sometimes bone remodeling [21]. The specimen from our patient revealed inflammatory changes consistent with a foreign-body reaction, confirming this pathophysiologic mechanism. Similar mucosal alterations were described by Esposito *et al.*, (2021) and De Freitas *et al.*, (2021) in cases of long-standing sinus foreign bodies.

While several authors advocate the endoscopic transnasal approach for small or anteriorly located objects because of its reduced morbidity and faster healing [22, 23], the transoral Caldwell-Luc route remains the method of choice when the foreign body is large, metallic, or posteriorly situated [24]. Saibene *et al.*, (2021) reported successful endoscopic retrieval in 85 % of cases, yet the Caldwell-Luc technique was preferred for complex or multi-object situations [25]. Likewise, Mehra *et al.*, (2022) and De Freitas *et al.*, (2021) reaffirmed the reliability of Caldwell-Luc in foreign bodies extending to the infratemporal fossa or posterior sinus wall. The present case fits precisely within these indications, and our results confirm the continued relevance of this classical approach.

Postoperative management combining amoxicillin/clavulanic acid, oral corticosteroids, intranasal steroid spray, and saline irrigations proved effective in preventing secondary infection and promoting rapid mucosal recovery. This regimen mirrors the recommendations of Cho *et al.*, (2022) and Sano *et al.*, (2023), who found that such combined therapy enhances sinus drainage and reduces postoperative edema. Our patient experienced complete resolution of

symptoms within seven days, with no recurrence at follow-up—consistent with outcomes reported by Selcuk et al.,(2019) and Kiran et al.,(2020) after Caldwell-Luc removal of displaced molars.

Comparing our experience with the literature highlights several key lessons. First, prompt imaging and early surgical referral are essential to avoid chronic infection or deeper migration [26]. Second, careful intraoperative inspection is mandatory, as unexpected retained materials such as cotton or root fragments may otherwise persist undetected. Finally, while minimally invasive endoscopic approaches dominate current trends, the Caldwell-Luc procedure remains indispensable in selected cases, offering unmatched access and control in the posterior maxilla.

In summary, the success of our management demonstrates that the Caldwell-Luc approach continues to hold an important place in contemporary maxillofacial surgery. The technique ensures complete removal, direct sinus inspection, and effective debridement, particularly when inflammation or multiple foreign bodies coexist. Our case exemplifies how combining thorough pre-operative imaging, classical trans-antral exposure, and evidence-based postoperative care can result in excellent functional and anatomical outcomes.

CONCLUSION

Foreign-body migration into the maxillary sinus remains a rare but clinically relevant iatrogenic event. Thorough imaging, early multidisciplinary assessment, and tailored surgical management are essential to avoid chronic sinus disease. The Caldwell-Luc approach, though traditional, continues to provide reliable access and control in complex posterior cases. Our experience demonstrates that meticulous intraoperative exploration, complete sinus debridement, and appropriate postoperative therapy can ensure full recovery and prevent recurrence.

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