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Accidental Displacement of Tooth into the Maxillary Sinus During Extraction: A Review

Abstract

Accidental displacement of tooth or root fragments into the maxillary sinus during dental extraction is an uncommon but potentially serious complication in oral and maxillofacial practice. It most frequently involves maxillary posterior teeth, particularly the palatal roots of first molars, mesiobuccal roots of second molars, and third molars, due to their close anatomical proximity to the sinus floor. Displacement may occur because of thin or pneumatized sinus floors, root morphology, excessive extraction force, pre-existing pathology, or inadequate surgical technique. Clinically, patients may present with sudden disappearance of a tooth during extraction, oroantral communication, nasal regurgitation, sinus congestion, facial swelling, or purulent discharge. Diagnosis is guided by imaging modalities, with cone-beam computed tomography being the gold standard. Management involves immediate care, surgical retrieval via approaches such as Caldwell–Luc, functional endoscopic sinus surgery, or conservative intraoral techniques, and interdisciplinary collaboration. Preventive measures, prompt recognition, and tailored management are essential to minimize complications and preserve sinus and oral function.

Keywords: Maxillary sinus, Tooth displacement, Oroantral communication, Extraction complication, Sinusitis

Introduction

Accidental displacement of teeth or their fragments into the maxillary sinus during extraction, though relatively rare, remains one of the most challenging complications in oral and maxillofacial surgery due to the complex anatomical and clinical implications.[1] The proximity of the sinus floor to the apices of maxillary posterior teeth particularly the palatal roots of first molars and the mesiobuccal roots of second molars creates a natural predisposition for this complication. In certain individuals, the separation between root apices and the sinus floor can be as little as 0.3–0.5 mm, while in others the apices may even protrude into the sinus cavity, leaving only a delicate bony or mucosal barrier.[2] Anatomical variations, age-related pneumatization of the maxillary sinus, alveolar bone resorption in edentulous patients, and the presence of periapical or periodontal lesions further reduce the structural resistance of the sinus floor. Displacement typically occurs when excessive or improperly directed extraction forces, particularly with the use of elevators or apical pressure, breach this fragile barrier, often exacerbated by inadequate radiographic assessment, poor surgical technique, or limited clinical experience.[3] Once inside the sinus, displaced teeth or root fragments can remain asymptomatic or act as persistent foreign bodies that obstruct the natural ostium, interfere with mucociliary clearance, and trigger a cascade of pathological events. These include

acute or chronic maxillary sinusitis, oroantral fistula formation, recurrent infections, or in rare instances, more serious consequences such as aspiration, pneumonia, or septic thrombosis. Beyond immediate morbidity, retained dental elements within the sinus also complicate long-term oral rehabilitation, making procedures such as implant placement, sinus lift, and prosthodontic restoration more difficult.[4] This highlights the dual importance of preventive measures through careful preoperative imaging, thorough assessment of anatomical risk factors, and meticulous surgical planning as well as prompt recognition and management to minimize complications and preserve both sinus health and oral function.[5] This article gives an overview on accidental displacement of teeth into the maxillary sinus during extraction.

Review of Literature

The accidental displacement of teeth or root fragments into the maxillary sinus is considered an uncommon complication of dental extractions, with most evidence derived from case reports, small case series, or retrospective analyses due to its low occurrence. While precise prevalence figures are limited, related complications such as oroantral communication following extraction of maxillary posterior teeth have been reported to occur in approximately 0.31% to 4.7% of cases (Psillas G et al.).[6] In terms of teeth most frequently displaced, maxillary third molars account for nearly half of all documented cases, followed by the palatal roots of maxillary first and second molars, which together represent the majority of the remainder (Al Ali H et al.).[7] Premolars are less often involved, which has been attributed to their greater average distance from the sinus floor. Patient demographics reported in the literature suggest that the mean age of affected individuals is around 36 years, with most cases occurring between the third and fifth decades of life (Najem SS et al.).[8] Several studies also indicate a male predominance, with one series reporting 66.7% of cases in males (Liao W-C et al.)[9], although it has been emphasized that age and gender do not fundamentally influence the anatomical proximity of the roots to the sinus floor. Minor epidemiological trends, however, suggest a slightly greater risk in younger adults due to anatomical variations, and a higher prevalence among working-age males, possibly reflecting higher rates of dental disease and extractions in this group (Atallah HN et al.).[10]

Etiology, Risk Factors, and Complications

Accidental displacement of teeth or root fragments into the maxillary sinus is a multifactorial complication arising from anatomical, pathological, and procedural factors, with consequences that may present immediately or be delayed if not promptly addressed.[11] A thin or pneumatized sinus floor, commonly observed in older individuals or those with anatomical variations, provides only minimal bony separation between the sinus and dental roots, thereby increasing the likelihood of sinus perforation during extractions. Root morphology also plays a critical role, with fused, conical, or divergent roots particularly the palatal roots of maxillary first and second molars and the single roots of third molars in close sinus proximity posing heightened risk.[12] Inadequate surgical planning and technique, including insufficient preoperative imaging, lack of operator experience, or improper elevator use, further contribute to displacement, while excessive apical force during extractions can directly propel dental fragments into the sinus cavity. Pre-existing conditions such as periapical lesions, cysts, or localized bone destruction may also weaken the bony partition and facilitate migration. Clinically, immediate consequences often include sudden pain, bleeding, oroantral communication, and the disappearance of a tooth or root during extraction, signaling sinus involvement.[13] If untreated, delayed complications may ensue, with retained fragments acting as foreign bodies that precipitate chronic maxillary sinusitis, persistent oroantral fistula formation, or a foreign body reaction characterized by granulomatous changes and possible cyst development. In severe or neglected cases, infection can spread beyond the maxillary sinus to involve adjacent paranasal sinuses, the orbit, or even intracranial and deep fascial spaces, underscoring the importance of timely diagnosis and intervention.[14]

Clinical Presentation and Diagnosis

Displacement of a tooth or root into the maxillary sinus is usually associated with distinct clinical signs that, if recognized early, can aid in timely diagnosis and management. The most characteristic feature during extraction is the sudden disappearance of a tooth or root fragment from the socket, particularly in relation to maxillary molars and third molars, which should immediately raise suspicion of sinus

involvement. Patients may also present with an oroantral communication, sometimes confirmed by visible communication or the bubbling of air through the socket on exhalation.[15] In cases where an oroantral fistula develops, nasal regurgitation of liquids while drinking is a notable symptom. Additional manifestations include unilateral sinus congestion, facial pressure or tenderness, localized swelling over the maxilla, postnasal drip, foul odor (cacosmia), and, in advanced or infected cases, purulent or foul-smelling nasal or oral discharge. Diagnosis relies on a combination of clinical suspicion and imaging.[16] While periapical radiographs may be useful for localizing small fragments, their interpretation is limited by overlapping anatomical structures. Orthopantomography (OPG) provides a broader overview and can help screen for displaced teeth or roots within the sinus, but cone-beam computed tomography (CBCT) is considered the gold standard. CBCT offers three-dimensional visualization, precise localization of the foreign body, detailed assessment of its relationship to sinus walls, and evaluation of associated mucosal thickening or sinusitis, thereby guiding surgical planning. Differential diagnoses should also be carefully considered, as fractured fragments may remain within the socket or adjacent soft tissues rather than the sinus, and missing fragments could alternatively have been swallowed or aspirated, in which case radiographic absence in the sinus and urgent evaluation of gastrointestinal or respiratory tracts are necessary.[17]

Management

The management of accidental displacement of teeth or roots into the maxillary sinus requires a structured approach that combines immediate measures, appropriate surgical intervention, and coordinated interdisciplinary care. In the initial phase, attempts to forcibly retrieve the fragment through the extraction socket should be avoided, as this may result in deeper displacement or injury to the sinus membrane. Instead, the socket should be secured with primary closure if oroantral communication is suspected, thereby reducing the risk of infection and migration.[18] Patients may be started on antibiotics, analgesics, and nasal decongestants when signs of infection or sinusitis are present, alongside instructions to avoid actions such as nose blowing, sneezing with the mouth closed, or Valsalva maneuvers, all of which can exacerbate the communication. Definitive management involves surgical retrieval, with the choice of approach determined by the size, location, and chronicity of the displaced fragment. The Caldwell–Luc procedure, a traditional method involving the creation of a bony window in the canine fossa, allows direct visualization and reliable removal but is associated with greater morbidity.[19] Functional Endoscopic Sinus Surgery (FESS), in contrast, represents a minimally invasive alternative, utilizing nasal endoscopy through the natural maxillary ostium to retrieve foreign bodies while simultaneously addressing sinus pathology, offering reduced trauma and faster recovery. Modified transalveolar approaches have also gained attention, employing small intraoral bony windows or piezoelectric instruments, sometimes in conjunction with endoscopic assistance, to preserve sinus anatomy and expedite healing. In select cases where the fragment remains accessible via the socket or immediate entry, conservative intraoral retrieval can be performed successfully without resorting to extensive procedures. Given the complexity of sinus-related complications, interdisciplinary collaboration with otolaryngologists is often essential, particularly for cases requiring endoscopic management or those complicated by chronic sinusitis. Postoperatively, patients are typically prescribed a regimen including antibiotics (such as amoxicillin–clavulanate), analgesics, and nasal decongestants, along with sinus precautions and regular follow-up involving both clinical and radiographic evaluation to ensure complete resolution and to prevent recurrence or delayed complications.[20]

Comparison of Surgical Management Techniques

Surgical Approach	Description / Technique	Indications	Advantages
Caldwell–Luc Procedure	Creation of a bony window in the anterior maxillary wall (canine fossa) to access the sinus and remove displaced teeth or fragments.	Displaced teeth not retrievable through the socket, chronic sinusitis, large fragments, or delayed cases.	Direct visualization, high success in complete retrieval, allows simultaneous management of sinus pathology.
Functional Endoscopic Sinus Surgery (FESS)	Minimally invasive approach using nasal endoscopy to access the sinus via the natural ostium for fragment retrieval and sinus cleaning.	Small to medium fragments, early intervention, cases with sinusitis or ostial obstruction.	Less invasive, preserves sinus anatomy, faster recovery, minimal facial swelling.
Modified Transalveolar / Intraoral Window Approach	Small intraoral bony window created over the displaced fragment, sometimes combined with endoscopic guidance or piezoelectric instruments.	Fragments accessible via alveolar bone, immediate post-extraction displacement, small to medium fragments.	Minimally invasive, preserves sinus structure, shorter recovery, avoids nasal entry.
Conservative Intraoral Retrieval	Retrieval through the extraction socket using careful instrumentation, often immediately after displacement.	Immediate detection of displacement, fragment accessible through the socket.	Simple, minimally invasive, avoids additional surgery.

Conclusion

Accidental displacement of teeth or roots into the maxillary sinus, though rare, is a significant complication that necessitates immediate attention to prevent serious sequelae. Early intervention is paramount, as prompt diagnosis and appropriate management can mitigate the risk of chronic sinusitis, oroantral fistula formation, and other associated complications. Studies have demonstrated that timely surgical retrieval of displaced dental fragments, even in asymptomatic cases, is crucial to prevent the development of sinus pathology. Preventive measures, including thorough preoperative assessment, careful surgical technique, and awareness of anatomical variations, play a vital role in reducing the incidence of such displacements. Ultimately, a tailored approach that considers the individual patient's circumstances and the specific characteristics of the displacement is essential for optimal outcomes.

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