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Review article

Maxillary Sinusitis of Odontogenic Origin: Global Prevalence, Risk Factors, Diagnosis, and Management: A Review

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Abstract
Maxillary sinusitis of odontogenic origin (MSOO) is a distinct clinical entity and is frequently misdiagnosed, where sinus inflammation is directly caused by dental pathology or iatrogenic dental procedures rather than infection of the respiratory system. Historical estimates suggested a low prevalence; the widespread use of three-dimensional imaging (CBCT) has revealed a significantly higher incidence of disease. This study aims to critically review and compare the results from major international research published between 2023 and 2026 in high-impact journals, to provide a current global perspective on the prevalence of MSOO, determine the relative role of the risk factors, and use this information to create practical evidence-based recommendations. We conducted a comprehensive search in PubMed, Scopus, and Web of Science. The search terms included "Odontogenic Sinusitis," "Prevalence," "Risk Factors," and "Maxillary Sinus Pathology." The search focused on peer-reviewed articles published between January 2023 and March 2026 that utilized of three-dimensional imaging (CT/CBCT). The selected literature was reviewed and data were synthesized narratively with direct analysis of study findings, methodologies, and populations. The percentages and odds ratios presented in this analysis were deduced through a cross-synthesis of contemporary three-dimensional (CBCT) literature, rather than relying on isolated prevalence values. The updated analysis confirms a pooled global prevalence of MSOO ranging from 40.2% to 51% of maxillary sinus pathology, with MSOO cases accounting for an average of 45.6% overall and rising to 79.63% in patients with unilateral maxillary sinusitis associated with ipsilateral dental lesions. Periapical lesions significantly increase the likelihood of sinus mucosal thickening, conferring an odds ratio (OR) ranging from 2.43 to 3, the primary risk factor (OR 2.43-3). Furthermore, oro-antral communication (OAC) represents a major determinant, elevating the odds of sinusitis by 3.8 times and dramatically increasing the odds of mucosal thickening by 16,8 times. The anatomical proximity, specifically a distance of less than 3.32 mm between the sinus floor and dental lesions, further increases the severity of sinus involvement, with the maxillary first molar representing the most frequently involved tooth in endodontic-related maxillary sinusitis. In addition, the past decade has witnessed a remarkable increase in implant-related maxillary sinusitis. Regarding diagnosis, three-dimensional CBCT imaging is essential for detecting subtle osseous and endodontic defects that remain undetected on conventional radiographs. Regarding management, prioritizing the elimination of the dental source prior to or simultaneously with functional endoscopic sinus surgery (FESS) yields a combined success rate approaching 97%, underscoring the necessity of standardized interdisciplinary co-management protocols between dental and ENT clinicians.
***Keywords**: Maxillary Sinusitis; Odontogenic Infection; Periimplantitis; CBCT Imaging.*

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Introduction

Maxillary sinusitis of odontogenic origin (MSOO) is an inflammatory condition of the maxillary sinus caused by various dental conditions, including periapical infections, and complications from dental procedures such as extractions, endo-periodontal surgery, or implant placements[1,2] . Due to the close anatomical proximity between the roots of the maxillary posterior teeth and the floor of the maxillary sinus, dental pathologies can easily penetrate the thin cortical bone to involve the Schneiderian membrane[3] .

For decades, MSOO sat on the margins of clinical awareness as a rare condition accounting for only 10% to 12% of all maxillary sinusitis cases[1,4]However, this percentage was based on studies using two-dimensional radiographs that are routinely available in dental practice, such as panoramic radiographs (OPG) and conventional periapical radiographs, which failed to recognize the complex relationship between oral lesions and MS. The widespread use of cone-beam computed tomography (CBCT) in daily dental examinations has increased the extent of the prevalence of odontogenic sinusitis. The recent evidence suggests that the prevalence is three to five times higher.[1,2] Vitali et al. (2023) reported a pooled prevalence rate of 51% per sinus and 50% per patient[1] .

As the worldwide prevalence of dental implants and sinus floor augmentations increases, the rate of iatrogenic odontogenic sinusitis is also elevated[5,6] . The purpose of this review is to provide an updated critical review that synthesizes the best evidence published between 2023 and 2026, drawing preferentially on studies in high-impact journals. This update is critical for clinical decision-making and emphasizes the need for interdisciplinary cooperation among dentists, oral surgeons, and otolaryngologists.

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General Prevalence

The prevalence of MSOO has experienced a marked increase with the widespread adoption of CBCT imaging, while studies relying on panoramic radiography consistently reported a prevalence ranging between 10% and 15%, contemporary CBCT-based studies have not recorded any rate below 26%, with percentages typically fluctuating between 40%and 51%. This paradigm shift was further substantiated by the landmark meta-analysis of Vitali et al. (2023)[1], which pooled data from 31 studies involving over 19,000 patients, demonstrating a pooled prevalence rate of 51% per sinus and 50% per patient. These findings have been supported by independent international studies; Haylaz et al.(2024) in Turkey reported a rate of 40.2% via prospective evaluation of 600 patients[2]. A ratio nearly identical to 41% was observed by Alrowis et al. (2023) in Saudi Arabia within a cross-sectional study of 212 patients suffering from chronic periodontitis[4]. Consequently, the convergence of three independent studies from three different countries, utilizing the same imaging modality despite variations of populations and research designs, on a 40.2% to 51% prevalence range underscores a robust consistency that rules out single- setting selection bias. Although the overall prevalence of odontogenic sinusitis is clinically significant, the most influential figure in diagnosis is that reported by Zhao et al, (2025) *in BMC Oral Health*[7].

In their analysis of 185 patients with sinusitis, they categorized the cases based on the presence of ipsilateral odontogenic infection. The results demonstrated that 79.63% (approximately 4 out of 5 cases) of unilateral maxillary sinusitis was accompanied by an ipsilateral odontogenic infection[7]. This proportion reinforces the premise that unilateral sinusitis is attributable to odontogenic infection. This significant result warrants the immediate referral of all patients presenting wit h unilateral sinusitis to oral and maxillofacial surgery to rule out an odontogenic origin, thereby preventing delayed dental management after medical and endoscopic interventions have failed. This recommendation is further substantiated by Tröltzsch (2024) *in the Otolaryngology Clinic of North America,* who explicitly states that unilateral sinusitis in adults should be considered odontogenic until proven otherwise.

The anatomical consideration

Of the four paired paranasal sinuses, the maxillary sinus is especially predisposed to dental disease, and this is due to its anatomical location: the sinus floor lies in direct contact with the root apices of the maxillary posterior teeth, most critically the first and second molars. In many individuals, there is no meaningful cortical bone separating the root apex and the sinus floor; we noticed this during surgical procedures we performed on the upper jaw as orthognathic surgery.

Zhao et al. (2025), in *BMC Oral Health*, provided the most precise quantification and delineation of this relationship between MS and upper teeth, analyzing CT imaging from 968 consecutive patients with sinusitis. They established 3.32 mm as a critical threshold: when the distance between the floor of MS and the margin of an odontogenic lesion fell below 3.32mm, the radiological index of sinusitis rose significantly and independently, regardless of the nature of dental pathology[7].

A complementary analysis by Liu et al. (2025) found that root –sinus distance less than 2 mm was independently linked to severe mucosal thickening exceeding 10mm[8]. Together, these studies transform an anatomical observation into a clinical measurement: CBCT root - sinus distance less than 3.32 mm serves as a critical indicator for sinusitis even in the absence of clinical symptoms

Risk Factors

Periapical Pathology

According to all contemporary studies, periapical pathologies (including periapical granulomas, cysts, and abscesses) are the most consistent independent risk factor for MSOO. This is because these pathologies harbor a polymicrobial mix of anaerobic bacteria, which exert cytotoxic effects on the Schneiderian membrane (the lining of the MS) through the thin or completely absent bone barrier between the root apex and MS.

The two independent studies consistently demonstrate that periapical lesions significantly elevate the odds of sinus thickening – Alghofaily et al. (2023) in Saudi Arabia followed 380 patients and found that periapical pathosis increased the odds of mucosal thickening by OR 2.43[9], while Yüksel et al. (2025) in Turkey applied a stricter mucosal threshold (>2mm) and reported odds 3.0[10]. The marginal variance in their reported odds ratios attributable strictly to the different diagnostic thresholds utilized to define the severity of mucosal thickening.

A third perspective was added by Zhang et al. (2023) *in Heliyon*, who examined 380 Chinese patients with periapical lesions and they found mucosal thickening rates ranging from 38% to 66% depending on anatomical proximity, confirming that the anatomical barrier, or lack of it, is an amplifier of periapical risk anddirectly influencesthe spread of infection to the MS[3].

Oroantral communications (OAC)

An OAC (a direct perforation connecting the oral cavity to the maxillary sinus, most frequently after maxillary molar extraction) eliminates the natural barriers between the oral flora and the sinus mucosa, permitting direct and continuous bacterial contamination. The size of this risk was quantified by Yüksel et al. (2025) in their Turkish CBCT-based Study. They

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found that an OAC increases the odds of frank sinusitis by 3.8 times and the odds of mucosal thickening by 16.8 times (the highest single odds ratio reported for any risk factor in reviewed literature)[10]. Furthermore, Sabatino et al. (2023) published a study in *Antibiotics* on 28 MSOO cases arising from classical dental complications including OAC, where FESS was required in 82% of cases[11]. These figures leave no doubt that an OAC is a dental emergency from a sinusitis perspective; therefore, primary surgical closure using a buccal advancement flap or buccal fat pad flap should be performed immediately

Endodontic treatment

Endodontic procedures represent a notable iatrogenic risk factor for MSOO. As previously mentioned, this is primarily attributed to the close anatomical proximity between the roots of maxillary posterior teeth and the floor of the maxillary sinus. Procedure errors–including over-instrumentation, extrusion of irrigants (e.g., sodium hypochlorite), intracanal medicaments, or obturation material, as well as inadequate obturation and missing canals (such as the MB2 in maxillary molars) – can significantly compromise maxillary sinus health. These events facilitate bacterial spread, foreign body reactions, and chemical irritation, which can consequently lead to mucosal thickening, sinus opacification and clinical sinusitis[12–14]. Nelke et al. (2026), published in the *Journal of Clinical Medicine,* examined odontogenic sinusitis and its etiologic factors. They reported that Endodontic treatment modalities were among the most common contributors to odontogenic sinusitis[14].

Based on Systematic reviews and CBCT-based studies, the extrusion of root filling materials into the maxillary sinus occurs in 10% to 16% of endodontically treated posterior maxillary teeth in close proximity to the sinus floor[12,15,16]. According to a recent review by Monteiro et al. (2026), the maxillary first molar is the tooth most frequently associated with such extrusions, up to 59% of reported cases, primarily during the initial treatment (93%)[12] and these findings align with observations of Kaimal& Patil,(2023)[17].

Furthermore, recent clinical studies have demonstrated a strong link between prior endodontic treatment on adjacent teeth and the development of fungal infection of the maxillary sinus (e.g., aspergillosis), with extrusions of root canal sealers or gutta-percha implicated in 75% -89% of cases, where the extruded materials act as a nidus that promotes and exacerbates the growth of fungal species, especially Aspergillus type[12,18].

Dental implants

The past ten years has witnessed a consequential shift in the causes MSOO, manifested in the remarkable increase of implant-related maxillary sinusitis,this is clear in study of D'Orto et al.2024 in the *Journal of Osseointegration,* where they analyzed 127 MSOO cases and found dental implant or peri-implantitis responsible in 39.24% more than extraction complications (17.6%), caries (13.7%), and endodontic procedures (11.8%) combined.[5] This is also noted by Park et al. (2023) in *The Laryngoscope:* implant protrusion length into the maxillary sinus is the stronger predictor of sinusitis severity.[19] Furthermore, Kimet al.(2025) in *Scientific* Reports demonstrated that implant-related MSOO has a distinct microbiological signature: higher rates of Aspergillus fungal co-infection, longer diagnostic delay, and more frequent intraoperative membrane perforation than non-implant MSOO[20] All pointing to a qualitatively different clinical entity that demands its own management approach.

Diagnosis

A multidisciplinary approach involving both clinical examination and advanced imaging is essential for accurate diagnosis of MSOO.

Clinicalpresentations

The clinical presentation of MSOO is diverse. Patients most frequently present with unilateral purulent nasal discharge, foul smell (cacosmia) an unpleasant taste, and ipsilateral facial pain or pressure. Additionally, signs such as nasal obstruction, hyposmia, and tooth tenderness to percussion are commonly observed, often accompanied by a history of recent dental interventions in the upper jaw[21–23]. Importantly, some patients may present without dental symptoms, as chronic odontogenic lesions frequently remain asymptomatic despite invading the MS[1,3]. This often leads to a diagnostic oversight in radiological evaluations [24].The clinician should exercise a high index of suspicion of MSOO when the patient presents with unilateral sinus involvement[7].

Imaging modalities

OPG and periapical radiographs are often insufficient to rule out MSOO due to overlapping structures; CBCT remains the cornerstone of MSOO diagnosis. In a 2024 international consensus published in the *International Journal of Oral Science,* Lin et al. established CBCT as the gold standard diagnostic tool for evaluating MSOO. It is highly sensitive in detecting sinus opacifications and mucosal thickening exceeding 2 mm, allowing for precise three-dimensional visualization of the relationships between the dental pathology and the sinus floor[21], which conventional radiography lacks. Haylaz et

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al.(2024) found odontogenic sinus pathology in 40.2% of patients on CBCT who would have appeared unremarkable on panoramic film[2]. Despite the technical solution that provides the CBCT, Schnieder et al.(2025) in *The Laryngoscope* showed that human awareness remains the limiting factor: the odontogenic origin of maxillary sinusitis was missed by radiologists inthe majority of cases, demonstrating that accurate diagnosis depends on practitioner experience and awareness rather than the capability of the imaging tool alone[24]

Treatment

Not every case requires surgery. Management of mild or uncomplicated cases of MSOO depends primarily on removing the dental source of infection. Thorough orthograde endodontic treatment of the responsible tooth or extraction of non-restorable teeth is often sufficient to eliminate the origin of infection and allows the secondary sinus infection to resolve spontaneously in many patients, without the need for direct sinus intervention[12,25].

Conversely, Sakkas et al. (2026) demonstrated that performing endoscopic sinus surgery (ESS) without removing the underlying dental pathology is the primary factor leading to recurrence of maxillary sinusitis[26]

Szczurowsk et al. (2025) in the *Journal of Clinical Medicine* followed 114 patients with purely endodontic maxillary sinusitis after root canal treatment alone and found complete sinus resolution in 76.36%. Positive predictors include use of chlorhexidine in the final irrigation protocol and multi- visit protocols, while flare-ups and multiple retreatment reduce success[25].

However, in more advanced cases, particularly those with persistent symptoms or significant sinus involvement. Multidisciplinary collaboration and development of standardized evidence-based guidelines are essential to ensure patients receive timely and effective care. Albu and Roman (2025) in *Medicina* found that combining medical management withFESS andsimultaneous dental and surgical management in a single -stage procedure increases the probability of success to over 97%[23].

Recommendations

Based on synthesized evidence, the following recommendations are provided:

1- Conduct a dental assessment prior to nasal endoscopy for any patient presenting with unilateral maxillary sinusitis to rule out an odontogenic origin.
2- Routinely use CBCT imaging when posterior maxillary dental disease is suspected or when planning implants in that region.
3- Treat the dental etiology prior to or simultaneously with FESS, never after.
4- Establish standardized referral protocols between dental clinics and ENT departments to facilitate co-management of complex MSOO cases.

Conclusion

The maxillary sinusitis of odontogenic infection (MSOO) is a common under-recognized condition. The transition from two-dimensional to three-dimensional imaging has revolutionized the diagnosis and therapeutic management of this condition; the prevalence range of MSOO is closer to 40–51% of maxillary sinus pathology and rises to nearly 80% in unilateral sinusitis associated with ipsilateral dental disease. The successful management of MSOO depends fundamentally on identifying and removing the primary dental source of infection. Management of MSOO in 2026 requires mandatory CBCT imaging and a multidisciplinary collaborative protocol. Clinicians must prioritize the unilateral rule; any unilateral maxillary sinusitis must be investigated for a dental origin. In conclusion, future research should focus on prospective multicenter trials using standardized imaging protocols and broader global cohorts. Clinically, early identification and intervention in dental clinic practice remain the primary objective.

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