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Incidental Maxillary Sinus Findings in CBCT Scans: A Retrospective Analysis

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ABSTRACT

Anatomical variations and pathologies of the maxillary sinus can complicate surgical procedures, making it essential for maxillofacial radiologists to recognize such radiographic signs. This study aimed to determine the prevalence of incidental findings in the maxillary sinus region using cone beam computed tomography (CBCT). A retrospective cross-sectional study was conducted by analyzing CBCT scans of 60 patients who had undergone imaging solely for dental-related issues. The scans were reviewed for sinus abnormalities, with findings were recorded based on frequency and whether they were unilateral or bilateral. Mucosal thickening emerged as the most common incidental finding, followed by the presence of sinus septa. Less common findings included sinus floor discontinuity and the presence of root canal sealer in the sinus. Notably, significant maxillary sinus pathologies can be present without producing symptoms. Therefore, it is crucial for oral radiologists to thoroughly evaluate the entire CBCT volume and report any unusual findings to the referring clinician.

Keywords: Maxillary sinus, Incidental findings, CBCT, Mucosal thickening, Sinus pathology

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Introduction

Dental professionals often encounter maxillary sinus issues when reviewing radiographs taken for tooth-related concerns. Interestingly, many of these sinus abnormalities are discovered by chance in patients who show no symptoms. These incidental findings typically arise during radiographic evaluations for implants, root canal treatments, impacted teeth, or orthodontic work [1].

A range of imaging tools—from basic X-rays to advanced scans—can be used to view the maxillary sinus. While CT scans are known for their accuracy, they are expensive and involve higher radiation exposure [2, 3]. Cone beam computed tomography (CBCT), now commonly used in dental settings, offers a practical alternative. Although CBCT has limitations in soft tissue detail, it still helps detect conditions like inflammation or sinus blockages [4].

Research has shown that the frequency of incidental sinus findings in patients without symptoms can vary widely, with reported rates ranging from about 11% to nearly 70% [5–9]. These abnormalities include a mix of conditions—developmental, inflammatory, cystic, calcified, or even tumors [10]. Among these, inflammatory changes are most frequently observed and may appear as thickened sinus lining (mucosal thickening) or cloudy sinus areas (sinus opacification) [11]. An air-fluid level may also suggest an acute sinus infection [12].

Cysts within the sinus, such as retention cysts or mucoceles, may also show up on scans. Retention cysts form when gland ducts become blocked, leading to a buildup of fluid that appears as a dome-shaped radiopaque area in scans [13]. Mucoceles, on the other hand, can grow larger and damage surrounding bone due to blocked drainage, often showing complete sinus opacification [14]. In chronic inflammation, the sinus lining may fold and form polyp-like growths [15].

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Other rare findings include antroliths—mineral deposits that form around debris in the sinus. These typically don't cause symptoms and are found incidentally during imaging. They appear as clearly outlined radiopaque masses and may show layered internal patterns [16–18].

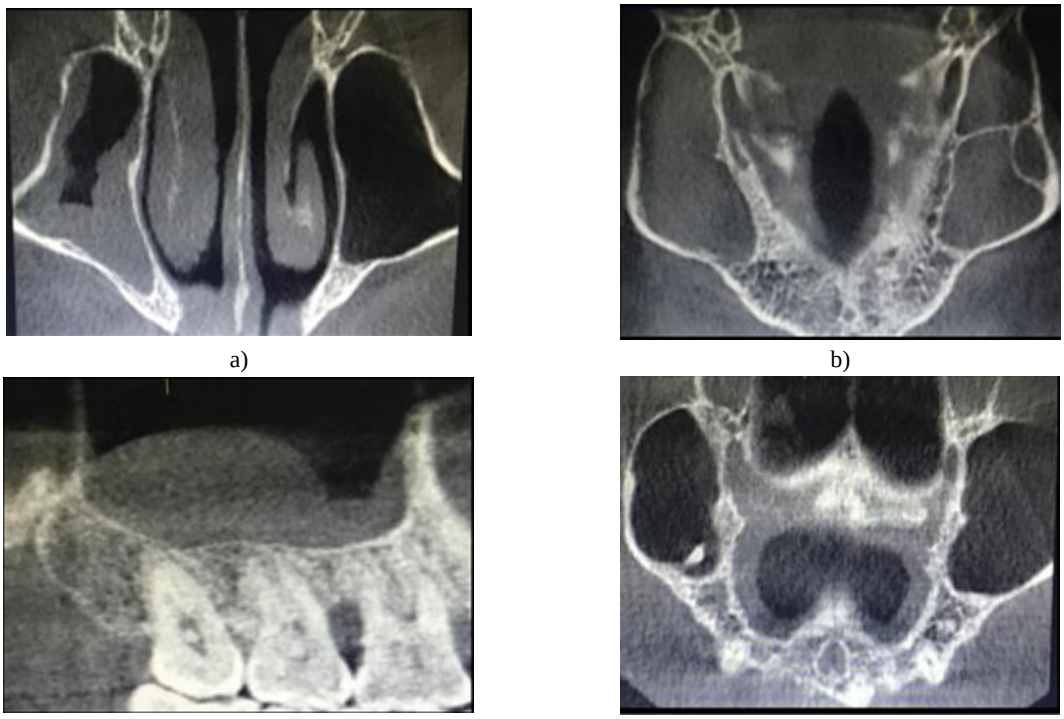
Since many of these conditions may go unnoticed without imaging, it's important for dental professionals interpreting CBCT scans to examine the entire image thoroughly. Being able to spot and report unusual findings can help ensure patients receive the right follow-up care. This study focuses on assessing how often such incidental findings occur in the maxillary sinus area through CBCT.

Materials and Methods

This retrospective study analyzed cone beam computed tomography (CBCT) scans of 60 patients who were referred to the oral radiology department at a dental college. Only those scans that captured either the upper jaw alone or both jaws, providing a clear view of both maxillary sinuses, were selected for review.

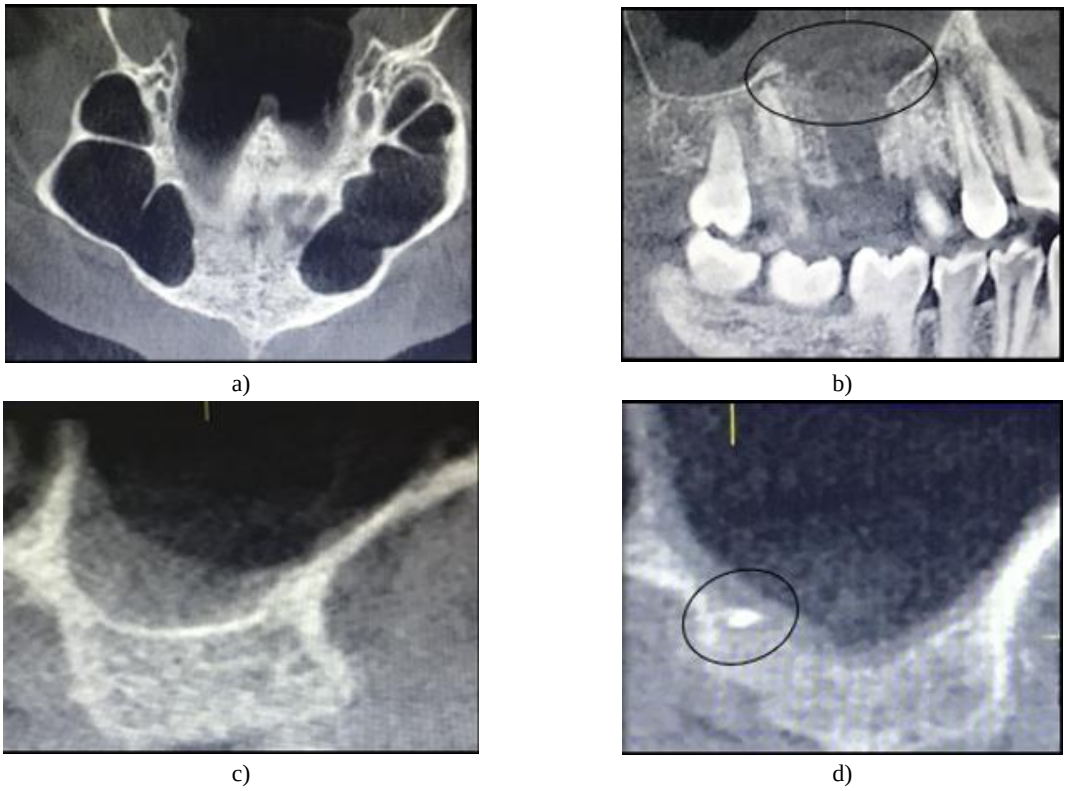
Inclusion criteria focused on patients who underwent imaging solely for dental-related issues. Scans of patients with clinical signs suggestive of sinus disorders were excluded. Additionally, individuals under the age of 18 years or over the age of 50 years were not considered for the study.

A mucosal lining thicker than 3 mm was classified as abnormal and considered a pathological finding **(Figure 1)**. Any uniformly radiopaque lesion with a rounded or polyp-like shape, regardless of its origin, was recorded as a polypoidal thickening (PT). Along with identifying the types of sinus findings **(Figure 2)**, the study also noted whether the abnormalities affected one side (unilateral) or both sides (bilateral) of the sinus region.



a) b) c) d)

Figure 1. a) right maxillary sinus displaying mucosal thickening exceeding 3 mm; b) axial CBCT view showing complete opacification of both maxillary sinuses, indicating bilateral involvement; c) sagittal CBCT view revealing a polypoidal thickening within the sinus cavity; d) axial CBCT section demonstrating a small antrolith located in the right maxillary sinus



a) b) c) d)

Figure 2. a) presence of septations observed in both maxillary sinuses; b) sagittal CBCT view showing disruption of the sinus floor at a previous extraction site; c) cross-sectional CBCT image identifying an air-fluid level suggestive of acute sinus involvement; d) radiographic evidence of root canal sealer material extending into the sinus cavity

Results and Discussion

The most prevalent incidental finding was MT, followed by separations, OPA, air-fluid level, PT, antrolith, and sinus floor discontinuity. Root canal sealant was observed in one case, which was the least prevalent abnormal finding. In addition, most of the pathologies had a bilateral presentation, whereas less than half of the cases showed a unilateral involvement **(Figures 3 and 4)**.

Figure 3. Prevalence of incidental findings in the maxillary sinus

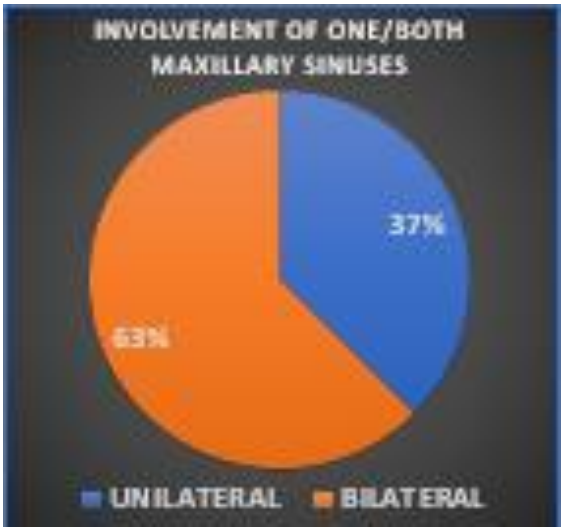


Figure 4. Percentage of pathologies with unilateral/ bilateral involvement

Out of the 60 patients analyzed in this study, 80% of CBCT scans revealed incidental findings related to the maxillary sinus, while 20% showed no abnormalities. This aligns with the findings of Mamta Raghav *et al*. who reported a 59.7% incidence of incidental sinus findings [4].

Among the various abnormalities, mucosal thickening (MT) was the most common (31.66%), followed by septations (18.33%). Typically, normal sinus mucosa measures about 0.8–1 mm in thickness. However, literature does not consistently define the pathological threshold for mucosal thickening, with proposed diagnostic cutoffs ranging from 1-6 mm. While Pazera *et al.* [19] considered 1 mm as pathological, this study followed the 3 mm criterion suggested by Lana *et al.* [20]. Such variations in diagnostic thresholds and differing inclusion criteria likely explain the inconsistency in prevalence rates across studies.

Ritter *et al*. [21] identified mucosal thickening, opacification (OPA), and polypoidal thickening (PT) as the most frequent findings. However, unlike our study, many previous works have grouped septations with other anatomical findings without reporting their prevalence independently. Given their significance in pre-surgical planning, especially in procedures like implant placement and sinus lifts, highlighting the high frequency of septations is clinically relevant [22].

In comparison, the prevalence of OPA (11.66%) and PT (6.66%) was relatively low in this study but aligned with findings from Lim CG *et al*. who used CT imaging [23]. Mucous retention cysts and antrochoanal polyps, both presenting as polypoid lesions on imaging, appear as dome-shaped radiopacities. Due to their similar radiographic appearance, especially with fluid density on CT, they are often grouped, as was done in this study following Lana *et al.* [20].

Air-fluid levels, observed in 9.3% of patients, suggest acute sinus pathology when present alongside mucosal thickening. This radiographic pattern can point to acute on chronic sinusitis, depending on the degree of sinus opacification and fluid accumulation.

Antroliths, or calcified masses in the sinus, are relatively rare, with a documented prevalence of 0.15%–4.54% in the literature. In this study, the incidence was 1.3%, consistent with other reports.

Foreign bodies may enter the maxillary sinus during tooth extractions, root canal procedures, or other surgical interventions. We observed foreign material in the sinus in 0.3% of cases, a lower rate compared to Lana *et al*.'s 1.6% finding [20].

Oroantral fistulas (OAFs)—often resulting from surgical procedures—are significant complications that require timely management to restore sinus health. While earlier studies, including those by Rege *et al*. and Price *et al*. reported OAF incidences of 2.2% and 2.7%, respectively, this study found only 0.3% of cases, despite examining patients undergoing CBCT for implant planning [24, 25].

Conclusion

This study identified a notably high prevalence of incidental maxillary sinus findings on CBCT imaging. As these anomalies often occur in asymptomatic patients, it is imperative for oral radiologists to thoroughly assess the

entire scan volume, not just the region of clinical interest. Prompt identification and reporting of both pathological and incidental findings are essential to prevent potential complications during dental or surgical procedures.

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Conflict of Interest: None

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Ethics Statement: None

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