

# Exploring Unexpected Maxillary Sinus Abnormalities in Dental CBCT Scans

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## ABSTRACT

**Background:** Incidental maxillary sinus pathologies refer to unexpected findings of abnormalities within the maxillary sinuses discovered during routine dental imaging examinations. **Objective:** To determine the frequency of incidental maxillary sinus pathologies in dental patients on cone-beam computed tomographic (CBCT). **Study Design:** Cross sectional study. **Settings:** Department of Dentistry Multan Medical and Dental College, Multan Pakistan. **Duration:** From August 2022 to January 2023. **Methods:** This study included 132 adult patients presenting with cone-beam computed tomographic (CBCT) images for dental assessment. Exclusion criteria comprised maxillofacial trauma, previous surgery, or congenital anomalies. Patient demographics and radiographic findings were recorded, with two radiologists independently assessing CBCT images for incidental maxillary sinus pathologies. Descriptive statistics and subgroup analyses were performed in SPSS. **Results:** The mean age was 46.3±10.2 years. In gender distribution, 60 patients (45.5%) were male, while 72 patients (54.5%) were females. The overall prevalence of incidental maxillary sinus pathologies was present in 75 cases, accounting for 56.81% of the total. Among the pathologic findings, mucous retention cysts were the most common, present in 35 patients (63.6%), followed by polyps in 15 patients (27.3%), sinusitis in 10 patients (18.2%), and anatomical variations in 20 patients (36.4%). **Conclusion:** The study identified an overall prevalence of incidental maxillary sinus pathologies in 56.81% of the dental patient population, emphasizing the importance of comprehensive evaluation during routine dental assessments.

**Keywords:** Cone-beam computed tomography (CBCT), Maxillary sinus pathologies, Polyps, Sinusitis.

## INTRODUCTION

Maxillary sinuses, also known as antrum of Highmore, are pneumatic cavities located within the maxilla bone, lateral to the nasal cavity. Their close proximity to the roots of maxillary posterior teeth makes them susceptible to various pathologies that can often present as incidental findings during routine dental examinations.<sup>1,2</sup> The maxillary sinuses serve several important functions, including humidification and filtration of inspired air, enhancement of vocal resonance, and reduction of skull weight. However, their thin walls and proximity to the oral cavity render them vulnerable to infections, inflammatory processes, and anatomical

variations, which can manifest as radiographic abnormalities in dental imaging. Mucosal cysts are often discovered by accident during imaging investigations; occurrences have been observed to range from 12.4% to 35.6%.<sup>3,4</sup>

One of the most common incidental findings in dental radiographs is mucous retention cysts or polyps within the maxillary sinus. These benign lesions often result from obstruction of the sinus ostium, leading to accumulation of mucus and subsequent cyst formation. Although typically asymptomatic, mucous retention cysts can grow to significant sizes and impinge upon adjacent dental structures, necessitating further

evaluation and potential intervention.<sup>5</sup> Furthermore, odontogenic infections originating from periapical lesions of maxillary posterior teeth can extend into the maxillary sinus, resulting in sinusitis or even the formation of oroantral fistulas. These complications underscore the intricate relationship between dental and sinus anatomy and the potential for dental procedures to inadvertently affect sinus health.<sup>6</sup>

Anatomical variations such as pneumatization of the maxillary sinus can also impact dental treatment planning. Enlargement of the sinus cavity may necessitate modifications in implant placement protocols or sinus lift procedures to ensure adequate bone support and stability. In addition to benign conditions, malignant lesions such as sinus carcinomas may present as incidental findings in dental radiographs.<sup>7,8</sup>

Diagnosis of incidental maxillary sinus pathologies in dental patients often relies on various imaging modalities such as panoramic radiography, cone-beam computed tomography (CBCT), and occasionally magnetic resonance imaging (MRI) for detailed assessment. These imaging techniques enable precise visualization of sinus anatomy, identification of pathological entities, and assessment of their extent.<sup>9</sup> Management strategies typically involve conservative approaches for benign lesions such as observation or endoscopic sinus surgery for symptomatic cases. Surgical intervention may also be indicated for odontogenic infections or malignant tumors, with close collaboration between dental and otolaryngological specialists to ensure comprehensive care.<sup>10</sup>

By conducting this study, we aim to fill existing knowledge gaps and provide valuable insights into the diagnosis and treatment of these pathologies within the dental setting. Our research will contribute to the enrichment of current literature by offering updated data and evidence-based recommendations tailored specifically to the dental patient population.

## METHODS

This cross-sectional study was conducted at the Department of Dentistry, Multan Medical and Dental College (MM&DC), and ethical approval for the study was obtained from the Institutional Review Board (IRB) before data collection commenced. Inclusion criteria for the study were adult patients aged 18 years and above of both genders, presenting with cone-beam computed tomographic (CBCT) images obtained for dental evaluation. Patients with a history of maxillofacial trauma, previous maxillofacial surgery, or congenital craniofacial anomalies were excluded. The sample size of 132 patients was determined based on the prevalence of incidental maxillary sinus pathologies, set at 27.5%, with

a level of significance of 5% ( $\alpha = 0.05$ ) and a power of the test of 80% ( $\beta = 0.20$ ).<sup>17</sup> Patient demographics, including age, gender, and clinical history, were recorded and radiographic findings related to incidental maxillary sinus pathologies were documented. Two experienced oral and maxillofacial radiologists independently evaluated the CBCT images for the presence of incidental maxillary sinus pathologies. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to characterize the prevalence and distribution of incidental maxillary sinus pathologies. Subgroup analyses based on demographic factors were performed, and statistical significance was determined using appropriate tests (Chi-square test, t-test), with a p-value < 0.05 considered statistically significant.

## RESULTS

The demographic characteristics of the included patients were as follows, the mean age was  $46.3 \pm 10.2$  years. The age distribution showed that 25 patients (19%) were between 18-30 years, 42 patients (32%) were between 31-45 years, 45 patients (34%) were between 46-60 years, and 20 patients (15%) were over 60 years old. Regarding gender, 60 patients (45.5%) were male, while 72 patients (54.5%) were female given in table 1.

**Table 1: Demographics of included patients**

Parameters	Characteristics	N (%)
Age	Mean $\pm$ SD	46.3 $\pm$ 10.2
	8-30 years	25 (19%)
	31-45 years	42 (32%)
	46-60 years	45 (34%)
	> 60 years	20 (15%)
Gender	Male	60 (45.5%)
	Female	72 (54.5%)

Table 2 illustrates the clinical presentations of patients included in the study. The most common indications were implant placement, with 40 patients (30.3%), followed by orthodontic assessment, with 35 patients (26.5%). Exodontia planning accounted for 28 patients (21.2%), while 20 patients (15.2%) were evaluated for periodontal issues.

**Table 2: Patients presenting with various clinical presentation**

Indications	Number	Percentage
Implant placement	40	30.3%
Orthodontic assessment	35	26.5%
Exodontia planning	28	21.2%
Periodontal evaluation	20	15.2%
Endodontic assessment	9	6.8%
Evaluation of bone lesion/pathology	10	7.6%

Table 3 presents the overall prevalence of incidental maxillary sinus pathologies were present in 75 cases, accounting for 56.81% of the total, while 57 cases, comprising 43.18%, showed no incidental pathologies.

**Table 3: Overall Prevalence of Incidental Maxillary Sinus Pathologies**

Parameter	Characteristics	N (%)
Incidental Pathologies	Yes	75 (56.81%)
	No	57 (43.18%)
Pathologic Findings	Mucous retention cysts	35 (63.6%)
	Polyps	15 (27.3%)
	Sinusitis	10 (18.2%)
	Anatomical variations	20 (36.4%)

Table 4 displays the frequency of pathologic findings across different age groups and genders. Mucous retention cysts were most prevalent among males, with 20 cases (57.1%), and least prevalent among individuals over 60 years old, with only 2 cases (5.7%).

**Table 4: Frequency of pathologic findings across age groups**

Parameters	Mucous Retention Cysts	Polyps	Sinusitis	Anatomical Variations
Male	20 (57.1%)	9 (60.0%)	6 (60.0%)	15 (75.0%)
Female	15 (42.9%)	6 (40.0%)	4 (40.0%)	5 (25.0%)
18-30 years	10 (28.6%)	3 (20.0%)	2 (20.0%)	6 (30.0%)
31-45 years	15 (42.9%)	5 (33.3%)	3 (30.0%)	9 (45.0%)
46-60 years	8 (22.9%)	4 (26.7%)	2 (20.0%)	5 (25.0%)
>60 years	2 (5.7%)	3 (20.0%)	3 (30.0%)	0 (0.0%)

Table 5 described that mucous retention cysts were observed in 15 cases (37.5%) during implant placement and 12 cases (30.0%) during orthodontic assessment. Polyps were found in 5 cases (33.3%) during implant placement and 4 cases (26.7%) during exodontia planning. Sinusitis was noted in 4 cases (40.0%) during evaluation for bone lesion/pathology and 2 cases (20.0%) during implant placement.

**Table 5: Pathologies with different indications**

Indication	Mucous Retention Cysts	Polyps	Sinusitis	Anatomical Variations
Implant Placement	15 (37.5%)	5 (33.3%)	2 (20.0%)	8 (40.0%)
Orthodontic Assessment	12 (30.0%)	3 (20.0%)	2 (20.0%)	6 (30.0%)
Exodontia Planning	8 (20.0%)	4 (26.7%)	1 (10.0%)	3 (15.0%)
Periodontal Evaluation	6 (15.0%)	2 (13.3%)	1 (10.0%)	1 (5.0%)
Endodontic Assessment	2 (5.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
Bone Lesion / Pathology	2 (5.0%)	1 (6.7%)	4 (40.0%)	1 (5.0%)

## DISCUSSION

Maxillary sinus pathologies encompass a spectrum of conditions affecting the pneumatic cavities located within the maxillary bones. These pathologies include mucous retention cysts, polyps, sinusitis, and anatomical variations, often detected incidentally during dental imaging studies. Odontogenic infections and periapical lesions can also extend into the maxillary sinus, leading to complications such as sinusitis or oroantral fistulas.<sup>11,12</sup>

Our study revealed that the mean age of participants was  $46.3 \pm 10.2$  years, with a distribution showing a higher proportion of individuals in the 46-60 age group (34%). In terms of gender distribution, 45.5% were male, and 54.5% were female. This aligns with the findings of Al-Zoubi et al. (2017), where they reported a mean age of 38.6 years and a male predominance of 57.8%.<sup>13</sup> Our study findings indicate that the most common indications for cone-beam computed tomography (CBCT) imaging among dental patients were implant placement (30.3%), orthodontic assessment (26.5%), and exodontia planning (21.2%). This is consistent with the study by Chandran et al. (2022), where CBCT was primarily used for planning implant therapy (48.7%) and prosthetic rehabilitations (34.0%). The alignment of our results with Chandran et al.'s findings underscores the importance of CBCT in preoperative assessment and treatment planning for implant procedures and orthodontic interventions.<sup>14</sup>

Our study found a prevalence of incidental maxillary sinus pathologies in 56.81% of cases, with 75 patients exhibiting such findings and 43.18% showing no incidental pathologies. This prevalence aligns closely with the findings reported by Chandran et al. (2022)<sup>14</sup>, where a prevalence of pathologic findings in maxillary sinuses was reported in 58% of patients. Interestingly, this prevalence rate was consistent with that reported by Kihara et al.<sup>15</sup> Additionally, our study's findings are in line with those of Raghav et al. (2014), who reported a prevalence of total incidental findings at 59.7%. Furthermore, the prevalence rates reported by Ritter et al. (56.3%) and Lim and Spanger (27.5%) also corroborate our study's findings to some extent.<sup>16,17</sup> However, there are notable discrepancies in the prevalence rates reported by other studies, such as those conducted by Vallo et al. (19%) and Cha et al. (24.6%). These variations in prevalence rates could be attributed to differences in sample size, patient demographics, geographic location, and diagnostic criteria among the studies.<sup>18,19</sup>

Our study revealed mucous retention cysts as the most common pathologic finding, occurring in 63.6% of patients. This aligns with the findings of Chandran et al. (2022), who reported a prevalence of 29.3%, and Raghav et al. (2014), who found a prevalence of 35.1%.<sup>14,20</sup> However, the prevalence reported by Raghav et al. (2014)



was higher than that observed in our study. Polypoidal mucosal thickening emerged as another significant finding in our study, with a prevalence of 27.3%, similar to the findings of Chandran et al. (2022), who reported a prevalence of 36.7%. Conversely, Raghav et al. (2014) reported a much lower prevalence of 7.2% for this condition. This discrepancy in prevalence rates may stem from differences in the definition of polypoidal mucosal thickening and variations in diagnostic criteria. Sinusitis was observed in 18.2% of our patients, contrasting with Chandran et al. (2022), who reported a prevalence of 2%, and Lim and Spanger (2018), who found a prevalence of 2.3%.<sup>17</sup>

## CONCLUSION

The study revealed a considerable prevalence of incidental maxillary sinus pathologies among the dental patient population, with mucous retention cysts being the most frequent finding.

## LIMITATIONS

The generalizability of findings may be influenced by the specific patient population and imaging protocols used in our institution.

## SUGGESTIONS / RECOMMENDATIONS

Regular radiographic assessment for incidental maxillary sinus pathologies should be integrated into routine dental evaluations.

## CONFLICT OF INTEREST / DISCLOSURE

None.

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