

# Prevalence of Maxillary Sinus Pathologies amongst Dental Patients in a Tertiary Hospital in Nepal

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## ABSTRACT

**Introduction:** Maxillary sinus examination is of utmost importance for dentists, given its close proximity to the upper posterior teeth. While many studies have utilised Computed Tomography (CT) or Cone Beam Computed Tomography (CBCT), there remains a scarcity of research exploring maxillary sinus abnormalities through panoramic radiography.

**Objective:** To determine the prevalence of maxillary sinus pathologies in the dental patients by using digital panoramic radiographs performed for maxillofacial diagnostic purposes.

**Methodology:** An analytical cross-sectional study was conducted over four months (from 2020 October to 2021 January) in Department of Oral Medicine and Radiology, Nepal Medical College with a convenient sample size of 310 patients aged 16 years to 70 years undergoing panoramic radiography. Maxillary sinus pathologies were assessed visually by a single examiner using digital panoramic radiographs, excluding patients with trauma history or poor quality images. Pathologies such as mucosal thickening, sinus polyps, antral pseudocysts, non-specific opacification, periostitis, and antrolith were identified and recorded, and statistical analysis was performed using SPSS version 20, with level of significance set at  $p < 0.05$ .

**Result:** The study included 310 panoramic radiographs, with 166 (53.55%) females and a mean age of  $34.07 \pm 14.08$  years. The overall prevalence of sinus pathology was 229 (73.87%), with mucosal thickening 116 (37.42%) and non-specific opacification 92 (29.68%) being the most common findings, and no significant association was found between maxillary sinus pathology and gender or age group.

**Conclusion:** Maxillary sinus abnormalities are frequently observed in asymptomatic individuals undergoing dental evaluation. Hence, a comprehensive panoramic image evaluation including maxillary sinus, with selective three-dimensional imaging can facilitate early diagnosis, treatment, and monitoring of the patient.

**Keywords:** Maxillary sinus; pathology; prevalence; radiography.

## INTRODUCTION

The maxillary sinus is the largest sinus among the paranasal sinuses, present bilaterally.<sup>1</sup> The study of the maxillary sinus is crucial for dentists due to its proximity to upper posterior teeth. This fact renders the maxillary sinus susceptible to mimicking

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odontogenic diseases, while odontogenic diseases may extend to the sinuses or imitate sinus diseases.<sup>2</sup> Literature indicates a high prevalence of maxillary sinus pathologies among patients with dental issues, particularly periodontal disease and periapical lesions, accounting for 58% to 78% of cases involving maxillary sinus thickening.<sup>3</sup> Mucosal thickening and mucosal cysts are commonly observed radiological findings, often incidentally detected during various radiological investigations.<sup>4</sup>

There is paucity of studies on maxillary sinus abnormalities using panoramic radiography, with most studies done using Computed Tomography (CT) or Cone Beam Computed Tomography (CBCT) or either focussed on maxillary sinus dimensions.<sup>5-8</sup> Panoramic radiography's widespread usage, easy availability, cost-effectiveness, and low radiation dose along with its ability to provide a comprehensive view of bilateral maxillary sinuses in a single image make it a preferred diagnostic tool for this study.<sup>9,10</sup> Hence, the present study was conducted with the aim to determine the prevalence of maxillary sinus pathologies among the dental patients attending a tertiary hospital in Nepal by using digital panoramic radiographs.

## METHODOLOGY

An analytical, cross-sectional study was conducted in the Department of Oral Medicine and Radiology, College of Dental Sciences and Hospital (CODSH), Nepal Medical College (NMC) from 2020 October to 2021 January. The study was conducted after ethical approval from Institutional Review Committee of Nepal Medical College (Reference number: 014-077/078) and verbal permission from Head of Department of Oral Medicine and Radiology for assessing the radiographs from the Radiology Department. The sample size of 310 was calculated using Slovin's formula;  $n = N / 1 + Ne^2 = 307.6$  (Approximately 310); Where,  $n$  = minimum desired sample size;  $N$  = assumed number of patients undergoing panoramic radiography in four months (calculated on the basis of the dental radiology register) = 1332;  $e$  (margin of error) = 0.05 (5%).

Patients between the age group 16 years to 70 years undergoing panoramic radiography were selected

for the study using convenience sampling. Those with history of trauma or poor quality radiographic images were excluded. The digital panoramic radiographs of the selected patients was visually analysed for any maxillary sinus pathologies by single examiner and was recorded along with patients' demographic details. Each sinus (two per case) was treated as a separate and independent entity for evaluation. All panoramic images were viewed as Joint Photographic Experts Group (JPEG) images. Various pathologies were considered including mucosal thickening, sinus polyp, antral pseudocyst, non-specific opacification, periostitis, and antrolith, based on Nunes et al. classification.<sup>2</sup>

Mucosal thickening was characterised by soft tissue density areas exceeding three millimetre(s) (mm) without cortical bone. Sinus polyps showed soft tissue density extensions adjacent to thickened sinus mucosa and antral pseudocyst appeared as dome-shaped soft tissue density areas without cortical bone and intact sinus floor. Additionally non-specific opacification indicated partial or total homogeneous sinus opacification, while periostitis presented as thick, laminated, opaque areas near the sinus floor.

Data were entered into Microsoft Excel and exported to IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk, N.Y., USA) for further analysis. Descriptive statistics were presented in the form of frequency and percent. Chi-square test was used to find association of the distribution of maxillary sinus pathologies with gender and age groups. Level of significance was set at  $p$ -value  $<0.05$ .

## RESULTS

A total of 310 panoramic radiographs of patients were included in the study and 620 maxillary sinuses were assessed. Of the total, majority 166 (53.55%) were females. The age of the patients ranged from 16 years to 70 years with mean age  $34.07 \pm 14.08$  years. Most of the patients belonged to age group 16-29 years 145 (46.77%) (Table 1).

Out of 620 maxillary sinuses assessed, 329 (53.1%) exhibited sinus pathology. The overall prevalence of at least one sinus pathology among the patients

was 229 (73.87%). Among the various sinus pathologies, majority of the patients had mucosal thickening 116 (37.42%) followed by non-specific opacification 92 (29.68%) (Table 2).

Most of the patients had mucosal thickening bilaterally 52 (44.83%), sinus polyp on left side 14 (48.28%), antral pseudocyst on left side 15

(40.54%), non-specific opacification bilaterally 41 (44.57), periostitis bilaterally 12 (57.14%) and antrolith bilaterally two (66.67%) (Table 3).

There was no statistically significant association of maxillary sinus pathology with gender (p-value 0.231) and age group (p-value 0.064) (Table 4).

**Table 1: Socio-demographic characteristics of the patients.**

Characteristics		n (%)
Gender	Male	144 (46.45)
	Female	166 (53.55)
Age group (years)	16-29	145 (46.77)
	30-44	89 (28.71)
	45-59	57 (18.39)
	60-70	19 (6.13)
Total		310 (100)

**Table 2: Distribution of maxillary sinus pathology among the study participants (N = 310).**

Maxillary sinus pathology	n (%)
Mucosal thickening	116 (37.42)
Sinus polyp	29 (9.35)
Antral pseudocyst	37 (11.94)
Non-specific opacification	92 (29.68)
Periostitis	21 (6.77)
Antrolith	3 (0.97)
Overall (at least one sinus pathology)	229 (73.87)

**Table 3: Distribution of maxillary sinus pathology according to affected side.**

Maxillary sinus pathology	Affected side		
	Right n (%)	Left n (%)	Bilateral n (%)
Mucosal thickening (n = 116)	28 (24.14)	36 (31.03)	52 (44.83)
Sinus polyp (n = 29)	11 (37.93)	14 (48.28)	4 (13.79)
Antral pseudocyst (n = 37)	9 (24.32)	15 (40.54)	13 (35.14)
Non-specific opacification (n = 92)	22 (23.91)	29 (31.52)	41 (44.57)
Periostitis (n = 21)	5 (23.81)	4 (19.05)	12 (57.14)
Antrolith (n = 3)	1 (33.33)	-	2 (66.67)

**Table 4: Association of maxillary sinus pathology with gender and age group.**

Variables Present n (%)		Sinus pathology		p-value
		Absent n (%)		
Gender	Male	111 (77.1)	33 (22.9)	0.231
	Female	118 (71.1)	48 (28.9)	
Age group (in years)	16-29	98 (67.6)	47 (32.4)	0.064
	30-44	67 (75.3)	22 (24.7)	
	45-59	48 (84.2)	9 (15.8)	
	60-70	16 (84.2)	3 (15.8)	
Total		229 (73.9)	81 (26.1)	NA

Chi-square test, p-value <0.05 statistically significant\* NA: Not applicable

## DISCUSSION

Maxillary sinus pathologies are often discovered incidentally during various radiological investigations, including panoramic radiography, CT scans, Magnetic Resonance Imagings (MRIs), and CBCT. Panoramic radiographs, commonly used for dental assessments including implants, pathology, impacted teeth and orthodontics, incorporate the maxillary sinus area as well, particularly its floor and posterior wall. This allows for concurrent evaluation of sinus conditions during routine examinations.<sup>5</sup> Hence, this study was undertaken to determine the prevalence of maxillary sinus pathologies in dental patients undergoing panoramic radiography.

The current study evaluated 310 digital panoramic radiographs, covering 620 maxillary sinuses, for pathology and the prevalence rate of maxillary sinus pathology was found to be 229 (73.87%), which is almost similar to the prevalence rate (72.00%) reported by Tadinada et al.<sup>11</sup> in the United States (US) population. On the contrary, few studies<sup>2,12</sup> utilising different imaging modalities have reported prevalence rates ranging from 10.9% to 69.1%. These variations could be attributed to differences in radiographic techniques, reasons for obtaining radiographs, expertise levels of evaluators, sample size, population demographics, and criteria for defining abnormalities.

In the present study, mucosal thickening was found to be the most common maxillary sinus pathology 116 (37.42%) followed by non-specific opacification 92 (29.68%) and antral pseudocysts 37 (11.94%). This contrasts with a study by Jawahar et al.<sup>13</sup> where antral pseudocysts were most prevalent. The findings of current study align with various studies<sup>7,11</sup> consistently showing mucosal thickening as predominant one, irrespective of imaging modality. Opacification was found to be the second most common finding after mucosal thickening in the present study, similar to a study by Raghav et al.<sup>5</sup> but in contrast to a study by Rosado et al.<sup>2</sup> in which sinus polyps were found to be the second most common sinus pathology. Additionally, this study found a higher prevalence of periostitis compared to Rosado et al.<sup>2</sup> while the prevalence of antrolith was similar to a study among Lebanese population<sup>10</sup> but was slightly lower than a study in Brazil.<sup>2</sup>

The present study showed that most of the study participants had mucosal thickening, non-specific opacification, periostitis and antroliths bilaterally and Sinus polyps and antral pseudocysts on the left side. This contrasts with a study by Rege et al.<sup>7</sup> in which right-sided dominance was found for polyps and opacification and antral pseudocysts were mainly found on the left.

The current study found no statistically significant

association of sinus pathology prevalence with age and gender, consistent with various studies.<sup>5,7,14</sup> Although not statistically significant, the sinus pathologies appeared more frequently in higher proportion of females and older adults in the present study, in contrast to other studies suggesting higher rates in males and in their thirties.<sup>5,13</sup>

The present study suggests that panoramic radiography can aid in the early detection and evaluation of maxillary sinus pathologies in asymptomatic patients. However, the study has several limitations. The present study lacks participant standardisation across medical and dental histories, racial characteristics, and socioeconomic factors. Panoramic radiographs, while useful, have limitations such as structure overlap and unequal magnification, potentially leading to inaccuracies in depicting anatomy and pathology, and potential invisibility of maxillary sinus pathology on the medial wall.<sup>2,11</sup> Additionally, the study being conducted in a single dental hospital limits the generalisability of the results.

## CONCLUSION

Maxillary sinus abnormalities are highly prevalent in the asymptomatic dental patients. Hence, a comprehensive evaluation of the panoramic image including maxillary sinus and utilising 3D imaging whenever necessary can facilitate early diagnosis, treatment, and monitoring of the patient. The study also emphasises the importance of radiographic examiners being knowledgeable about maxillary sinus pathologies, their radiographic appearance, and their clinical significance.

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