Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 32s (2025)
https://www.jneonatalsurg.com

Evaluation and Correlation of Maxillary Sinus Mucosal Thickening with Periapical Lesions: A CBCT Study

Dr. Sahithi Ram. Vatram[1], Dr. Mrudula Raju. B[2], Dr. Prashanthi[3], Dr. Buddha Syam Deepthi[4], Dr. Lakshmi Sasi Poluri[5], Dr. Vyshnavi Durga Gandhi[5]

[1]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India (Corresponding Author)

[2]Reader, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

[3]Senior Lecturer, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

[4]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

[5]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

[6]Postgraduate Student, Department of Oral Medicine and Radiology, St. Joseph Dental College, Duggirala, Eluru, Andhra Pradesh, India

Corresponding Author

Dr. Sahithi Ram Vatram

.Cite this paper as: Dr. Sahithi Ram. Vatram, Dr. Mrudula Raju. B, Dr. Prashanthi, Dr. Buddha Syam Deepthi, Dr. Lakshmi Sasi Poluri, Dr. Vyshnavi Durga Gandhi, (2025) Evaluation and Correlation of Maxillary Sinus Mucosal Thickening with Periapical Lesions: A CBCT Study. *Journal of Neonatal Surgery*, 14 (32s), 8672-8677

ABSTRACT

Introduction: Maxillary sinus is the principal paranasal sinus which assumes a pyramid-shaped depression within the maxilla, possessing a typical volume of 12.5 mL. During the culmination of dento-maxillo-facial development, the maxillary floor attains its definitive anatomical features, leading to a close spatial relationship between the teeth and the sinus floor. CBCT is the most widely used radiographic method for diagnosing maxillary sinus pathology due to its superior resolution in identifying both osseous and soft tissue structures. **Aim:** The aim of the present study is to assess the mucosal thickening of maxillary sinus and its relationship to periapical lesions. **Materials & Methods:** This academic study focuses on analyzing Cone Beam Computed Tomography (CBCT) scans from a cohort of 40 individuals. The research aims to identify apical lesions in posterior maxillary teeth, specifically related to sinus mucosal thickness, establish anatomical correlations between maxillary sinuses and teeth, and categorize these connections.

Results: Class 4 mucosal thickening (4–10 mm) demonstrated the highest mean value (6.18 mm). A significant association was observed between periapical lesions and MT ($p < 0.001$), while gender had no significant influence ($p = 0.298$). Periapical abscesses and endo-Perio lesions were most frequently associated with sinus mucosal changes. **Conclusion:** Periapical pathology significantly influences sinus mucosal thickening. CBCT proves to be an invaluable diagnostic tool in evaluating sinus-dental relationships, aiding in clinical decision-making

Keywords: Maxillary Sinus, Mucosal Thickening, Periapical Lesions, CBCT

1. INTRODUCTION

The maxillary sinus, located within the maxilla and characterized by a mean volume of approximately 12.5 mL, is the largest and most prominent of the paranasal sinuses. Shaped like a pyramid, it communicates with the nasal cavity through the middle nasal meatus and the nasal vestibule, making it more susceptible to infection than other paranasal sinuses due to its anatomical proximity to both the nasal and oral cavities. Odontogenic factors, such as dental infections and periapical lesions, are estimated to be responsible for 10–12% of maxillary sinusitis cases, underscoring the importance of dental health in sinus pathologies. Traditionally, two-dimensional radiographs have been used for assessing dental infections, but their limitations include difficulties in visualizing periapical anomalies and distinguishing the true relationship between root apices and the sinus floor. The advent of cone-beam computed tomography (CBCT) represents a significant advancement in dental radiology, allowing clinicians to obtain high-resolution, three-dimensional images of the teeth and surrounding structures for improved diagnosis and treatment planning. This study aims to evaluate mucosal thickening (MT) of the maxillary sinus and explore its potential association with periapical lesions, utilizing the enhanced diagnostic power of CBCT imaging.

2. AIM

To evaluate the mucosal thickening of the maxillary sinus and investigate its correlation with periapical lesions using CBCT imaging

3. MATERIALS AND METHODS

CBCT scans of 40 individuals (mean age 43.9 ± 8.8 years, aged 20–60 years) were analyzed in axial and coronal views to identify:

Apical lesions in posterior maxillary teeth,

The anatomical relationship between sinus and teeth,

Categorization of mucosal thickening at the sinus floor.

Mucosal thickness was classified as:

Class 1: No mucosal thickening

Class 2: 0–2 mm

Class 3: 2–4 mm

Class 4: 4–10 mm

Class 5: >10 mm

Inclusion: Teeth from first premolar to second molar, Periapical abscess, granuloma's, Endodontically treated teeth & Endo-Perio lesions, Adjacent missing teeth, Periodontal abscess
Exclusion: 3rd molars, patients with recent sinusitis, previous endodontic therapy, trauma, cysts, tumors, orthodontic therapy, adjacent missing teeth, implants, periodontal abscess, and age outside 20–60 years.

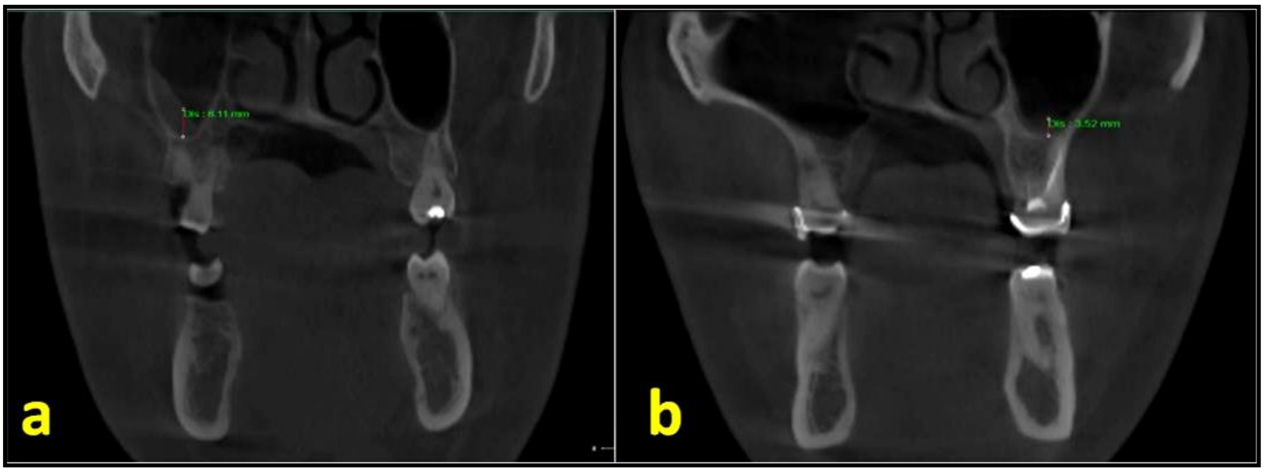

Figure showing the measurement of mucosal thickening in coronal view a) In decay tooth b) In endodontically treated tooth

4. RESLTS & OBSERVATION

The present study comprised a total sample of 40 subjects. The mean age of the study subjects was 43.97 ± 8.8 years with age ranging from 20-60 years in both males and females. Among them 40% were females and 60% were males.

Table: 1 Comparison of presence of periapical lesions between males and females among the study subjects

			GENDER		P-value
			Females	Males	
LESION	No Lesion	Count	3	4	
		%	42.9%	57.1%	

	Peri apical abscess	Count	7	11	0.298
		%	38.9%	61.1%	
	Periapical Granuloma	Count	1	0	
		%	100.0%	0.0%	
	Endo Perio Lesion	Count	2	3	
		%	40.0%	60.0%	
	Root canal treated tooth	Count	0	4	
		%	0.0%	100.0%	
	Adjacent to missing teeth	Count	2	0	
		%	100.0%	0.0%	
	Periodontal abscess	Count	1	2	
		%	33.3%	66.7%	

This tabular form shows the comparison of presence of periapical lesions between males and females. The p-value associated with the comparison of oral lesions between Females and Males is 0.298, indicating no strong evidence for a significant association between gender and the type of oral lesion.

Table 2: Distribution of study subjects according to age group

Age group	Percent
21-30	10.0
31-40	30.0
41-50	35.0
51-60	25.0
Mean age	43.97±8.8

Table 3: The distribution of various lesion types among different classes of mucosal thickening

			Class				P-value
			1	2	3	4	
LESION	No Lesion	Count	7	0	0	0	0.000*
		%	100.0%	0.0%	0.0%	0.0%	
	Peri apical abscess	Count	0	4	9	5	
		%	0.0%	22.2%	50.0%	27.8%	
	Periapical Granuloma	Count	0	0	0	1	
		%	0.0%	0.0%	0.0%	100.0%	
	Endo Perio lesion	Count	0	0	1	4	
		%	0.0%	0.0%	20.0%	80.0%	
	Root canal	Count	0	0	1	3	

	treated tooth	%	0.0%	0.0%	25.0%	75.0%	
	Adjacent to missing teeth	Count	0	0	2	0	
		%	0.0%	0.0%	100.0%	0.0%	
	Periodontal abscess	Count	1	1	1	0	
		%	33.3%	33.3%	33.3%	0.0%	

From the above tabular form Class 4 notably exhibited Periapical Granulomas (100.0%), Endo-Perio lesions (80.0%), and Root canal treated teeth (75.0%). The P-value of 0.000 indicates a significant association between lesion types and classes.

Table 4: Mean distribution of mucosal thickness among different classes

Class	N	Mean	Std. Deviation	F value	P value
1	8	0.0000	0.00000	82.593	0.000*
2	5	1.6500	0.31337		
3	14	3.1893	0.61141		
4	13	6.1862	1.37788		

Class 4 has the highest mean value of 6.1862 followed by class 3(3.18). The statistical analysis reveals a significant difference among these groups, as indicated by the notably low p-value of 0.000.

Table 5: Mean distribution of mucosal thickness among different pathologies

	N	Mean	Std. Deviation	F value	P value
No Lesion	77	0.0000	0.00000	12.873	0.000*
Periapical Abscess	118	3.4844	1.60544		
Periapical Granuloma	11	7.8700			
Endo Perio lesion	55	6.4020	1.85142		
Root canal treated tooth	44	4.7975	1.55740		
Adjacent to missing teeth	22	3.7000	1.73948		
Periodontal abscess	33	1.3767	1.25914		

The mean distribution of mucosal thickness across different dental conditions indicates varying levels of involvement or changes in the mucosa associated with each condition. "No Lesion" presents the lowest mean mucosal thickness, suggesting minimal or no detectable changes in the mucosa within this category. "Periapical abscess," "Endo Perio lesion," and “Endodontically treated teeth" show higher mean mucosal thicknesses, indicating potential mucosal alterations related to these conditions.

5. DISCUSSION

The present findings reinforce and extend previous research on the strong correlation between dental infections—primarily periapical lesions—and mucosal thickening of the maxillary sinus. According to Jouhar et al. (2023), a significant association between periapical changes in posterior maxillary teeth and sinus membrane thickening was established using CBCT, highlighting the diagnostic value of three-dimensional imaging in uncovering subtle relationships not visible on conventional radiographs[1]. Shanbhag et al. (2013) analyzed CBCT scans and found that the likelihood of sinus mucosal thickening greater than 2 mm was nearly 10 times higher in patients with periapical lesions when compared to healthy controls[2]. This dramatic increase underscores how infectious processes at tooth apices can provoke adjacent sinus pathology—presumably via direct extension of inflammation through thin bone or anatomical communication. Other studies support this route of infection and note that teeth in close proximity to the sinus floor present a particular risk for odontogenic maxillary sinusitis (OMS)[3,4]. The prevalence of OMS in the clinical population has been consistently high across several large-scale studies and meta-analyses. Vital et al. (2023) reported a pooled prevalence of about 50% for sinusitis cases with an odontogenic origin[5], while Zhao et al. (2025) found nearly 80% of unilateral sinusitis cases with coexisting dental lesions—emphasizing the clinical importance of thorough dental assessments in sinusitis workups[3]. Psillas et al. (2020) further corroborated that OMS represents up to 51.8% of unilateral maxillary sinusitis cases, with periapical and periodontal disease being primary contributors[4]. Beyond dental infections, factors such as poor restorations, root proximity, failed endodontic treatments, and marginal periodontitis also contribute to sinus mucosal changes, as identified in both imaging studies and systematic reviews[124]. The CBCT imaging modality plays a crucial role in diagnosis and management, offering clear visualization of the anatomical relationship between dental roots and the sinus floor, the extent of bone destruction, and the degree of mucosal response[1,2,6]. CBCT's superiority over traditional radiography is underlined in the literature. The modality enables clinicians to avoid underdiagnosis or misclassification of the odontogenic origin of sinus pathology, which is critical for proper treatment planning, whether it involves dental interventions or ENT management[1,5,1]. While this study and the cited literature confirm the dominant role of odontogenic factors in sinus thickening, other less common etiologies—such as fungal infections, trauma, tumors, or systemic diseases—should also be considered in differential diagnosis, especially in refractory or atypical cases[46]. Still, the mounting evidence from radiographic, clinical, and epidemiological studies underscores the pressing need for multidisciplinary collaboration between dental and medical professionals in the diagnosis and treatment of maxillary sinus disease[1,2,4]

6. CONCLUSION

Within the limitations of this study, mucosal thickness varies with Periapical abscess, endodontically treated teeth, Endo-Perio lesions. The anatomic connection between periapical lesions and the maxillary sinus floor affected the development of maxillary sinus MT. The use of CBCT in dental practice is becoming more prevalent. CBCT can show the maxillary sinuses in a medium-to-large field-of-view volume that spans the maxillofacial area. Other diseases that might affect the maxillary sinus mucosal thickness include Fungal infections, allergic diseases, benign and malignant lesions, and trauma are all possibilities.In future, further studies can be done to determine & detect the root of spread of odontogenic infections up-to maxillary sinus(indirectly)

REFERENCES

[1] Jouhar R, Alkhames HM, Ahmed MA, Almadeh NM, Faheemuddin M, Umer MF. CBCT Evaluation of Periapical Pathologies in Maxillary Posterior Teeth and Their Relationship with Maxillary Sinus Mucosal Thickening. Healthcare (Basel). 2023 Mar 7;11(6):787.

[2] Shanbhag S, Karnik P, Shirke P, Shanbhag V. Association between periapical lesions and maxillary sinus mucosal thickening: a retrospective cone-beam computed tomographic study. J Endod. 2013 Jul;39(7):853-7.

[3] Zhao Y, Huang S, Xu M, Wang Y, Zhang X, Wang K, Lin J. Characteristics and risk factors in odontogenic maxillary sinusitis from different dental infections: a retrospective study based on sinus CT imaging. BMC Oral Health. 2025 Feb 26;25(1):308.

[4] Psillas G, Papaioannou D, Petsali S, Dimas GG, Constantinidis J. Odontogenic maxillary sinusitis: A comprehensive review. J Dent Sci. 2021 Jan;16(1):474-481.

[5] Filipe Colombo Vitali, Pablo Silveira Santos, Carla Massignan, Lucianne Cople Maia, Mariane Cardoso, Cleonice da Silveira Teixeira,Global Prevalence of Maxillary Sinusitis of Odontogenic Origin and Associated Factors: A Systematic Review and Meta-Analysis,Journal of Endodontics, 2023, 49 (4),369-381.

[6] Peñarrocha-Oltra S, Soto-Peñaloza D, Bagán-Debón L, Bagan JV, Peñarrocha-Oltra D. Association between maxillary sinus pathology and odontogenic lesions in patients evaluated by cone beam computed tomography. A systematic review and meta-analysis. Med Oral Patol Oral Cir Bucal. 2020 Jan 1;25(1):e34-e48.

[7] Goller-Bulut D, Sekerci AE, Köse E, Sisman Y. Cone beam computed tomographic analysis of maxillary premolars and molars to detect the relationship between periapical and marginal bone loss and mucosal thickness of maxillary sinus. Med Oral Patol Oral Cir Bucal. 2015 Sep 1;20(5):e572-9.

[8] Yeung AWK, Hung KF, Li DTS, Leung YY. The Use of CBCT in Evaluating the Health and Pathology of the Maxillary Sinus. Diagnostics (Basel). 2022 Nov 16;12(11):2819.

[9] Kuligowski P, Jaroń A, Preuss O, Gabrysz-Trybek E, Bladowska J, Trybek G. Association between Odontogenic and Maxillary Sinus Conditions: A Retrospective Cone-Beam Computed Tomographic Study. J Clin Med. 2021 Jun 27;10(13):2849.

[10] Brañas GV, Grisolia BG, Iuliano RG, Gualtieri A, Lenarduzzi A, Renou SJ, Rodríguez PA. Relation between periapical lesions and sinus membrane thickening assessed by Cone Beam Computed Tomography. Acta OdontolLatinoam. 2018 Dec;31(3):164-169.

[11] Sakir M, ErcalikYalcinkaya S. Associations between Periapical Health of Maxillary Molars and Mucosal Thickening of Maxillary Sinuses in Cone-beam Computed Tomographic Images: A Retrospective Study. J Endod. 2020 Mar;46(3):397-403. doi: 10.1016/j.joen.2019.12.004. Epub 2020 Jan 23.

[12] Lu Y, Liu Z, Zhang L, Zhou X, Zheng Q, Duan X, Zheng G, Wang H, Huang D. Associations between maxillary sinus mucosal thickening and apical periodontitis using cone-beam computed tomography scanning: a retrospective study. J Endod. 2012 Aug;38(8):1069-74. doi: 10.1016/j.joen.2012.04.027. Epub 2012 Jun 20.

[13] Regnstrand T, Torres A, Petitjean E, Lambrechts P, Benchimol D, Jacobs R. CBCT-based assessment of the anatomic relationship between maxillary sinus and upper teeth. Clin Exp Dent Res. 2021 Dec;7(6):1197-1204. Doi: 10.1002/cre2.451. Epub 2021 May 22