RESEARCH PAPER

Evaluating the Morphology, Location and Frequency of Accessory Maxillary Ostia – A Cross-Sectional Study Using Cone Beam Computed Tomography (CBCT).

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ABSTRACT
Introduction: The purpose of this study is to evaluate accessory maxillary ostia (AMO) with the use of cone beam computed tomography (CBCT) to aid preoperative assessment of the maxillary sinus before performing sinus-related dental surgeries and any treatment in maxillary posteriors. **Objective:** To evaluate the morphology, location and frequency of accessory maxillary ostia - A Cross – sectional study using cone beam computed tomography (CBCT). **Methods:** CBCT images of 50 patients having 100 maxillary sinuses bilaterally are evaluated from the age of 18-45 years. AMOs were seen in all three sections axial, coronal, sagittal CBCT views and the collected data were statistically analyzed. **Results:** PMO was present bilaterally in 98.0% patients. 74% were presented with single AMO and 18% with multiple AMOs. Most of the AMOs (90.0%) were located within the region of the nasal fontanelle or hiatus semilunaris. While 16% AMOs were located outside the region of the nasal fontanelle or hiatus semilunaris. We found 84% ovoid, 8% round and 6% slit-shaped AMO. 92% symptomatic patients in our study population found to be statistically significant ($p < 0.001$) indicating that AMO presence is strongly correlated with the presence of sinus-related symptoms.
Conclusion: Dentists must recognize the prevalence, location and morphology of AMO for judicious use of CBCT in preoperative treatment planning in the posterior maxilla and maxillary sinus related surgery like sinus lift procedures.
Keywords: Primary maxillary ostium (PMO), Accessory maxillary ostium (AMO), Cone Beam Computed Tomography (CBCT), Maxillary sinus
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INTRODUCTION

The maxillary sinus, the largest of the paranasal sinuses, is of significant interest to dentists and otorhinolaryngologists.[1]Maxillary sinus has a natural opening , primary maxillary ostium (PMO) which is located at the junction of the medial wall of the maxillary sinus and the floor of the orbit.[2] Patency of PMO contributes to an adequate drainage from the sinus into the hiatus semilunaris, the middle meatus and then the nasal cavity.[3] Therefore, PMO helps to maintain a physiological and healthy condition of the maxillary sinus.[4]While the accessory maxillary ostium (AMO) is any extra opening other than the PMO present in the region of the nasal fontanelle (NF) or hiatus semilunaris (HS).[5] The presence of an AMO enables to increase the ventilation rate of the maxillary sinus and leads to an inverse drainage from the middle meatus into the sinus.[6]This results in a reduced nitric oxide concentration and mucus accumulation in the

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sinus leading to pathological changes such as mucosal thickening, mucous retention cyst formation and maxillary sinusitis.[7] So, accurate assessment of maxillary sinus health is essential before sinus-related
dental surgeries. Because these procedures can alter sinus physiology and increase the risk of postoperative sinusitis.[8] CBCT has been recommended to identify anatomical variations or pathological changes in the maxillofacial region, particularly in the maxillary sinus.[9] The purpose of this study is to evaluate accessory maxillary ostia (AMO) with the use of cone beam computed tomography (CBCT) to aid preoperative assessment of the maxillary sinus before sinus-related dental surgeries and any treatment in maxillary posteriors.

Aim & objectives - To evaluate the morphology, location and frequency of accessory maxillary
.ostia - A Cross – sectional study using cone beam computed tomography (CBCT).

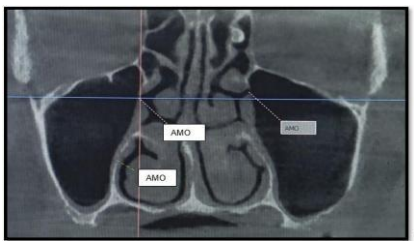
Material and methods: This is a Cross-Sectional study done in the outpatient department of Shree Bankey Bihari Dental College and Research Center, Ghaziabad, Uttar pradesh , India for a duration of 1 year. CBCT images of 50 patients having 100 maxillary sinuses bilaterally are evaluated from the age of 18-45 years in axial, coronal, sagittal CBCT sections using Vatech Smart Plus Dental CBCT machine with Field of view (FOV – 10 X 8.5 mm with exposure parameters of 94 kVp, 8.1 mA, 0.2 x 0.2 x 0.2 mm resolution, 14-bit, focal spot 0.5mm, scan time – 18 Sec, interval 1 mm, slice thickness 1mm).

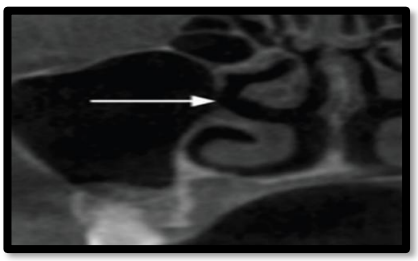
METHODOLOGY - Patients were selected based on specific inclusion and exclusion criteria. Further, the detailed history of the patient was taken supported by a nasal symptoms questionnaire or Symptom Severity Score Sheet according to Lund- Mackay/ Lund – Kennedy symptom severity criteria [10]and Sino-Nasal Outcome Test (SNOT-22) [11] in both English and Hindi format was taken.

Symptom Severity Score Sheet -

symptoms	None	Mild	moderate	Severe
	0	1	2	3
Sneezing				
Blocked nose				
Thick nasal discharge				
Watery nasal discharge				
Postnasal drip				
Reduced sense of smell				
Headache				
Fever				
Toothache				
Pain on bending head				
Lethargy , Fatigue				
Coughing				
Bad breath				
Nasal pain and sensation of pressure				
Tenderness to pressure over sinus				
Breathing problem				
Local rise temperature				

First, the presence of the PMO was recorded as either radiologically absent or radiologically present
Afterward, the sinuses were evaluated for the presence of AMO (radiologically absent/present) and number of AMOs with a single AMO or sinus with multiple AMOs. (figure 1)





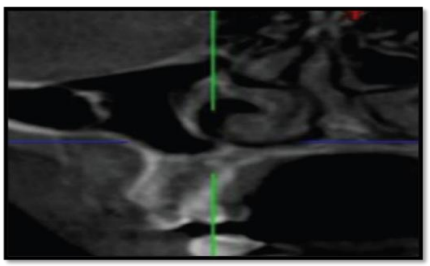
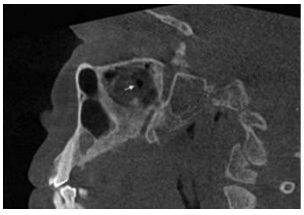
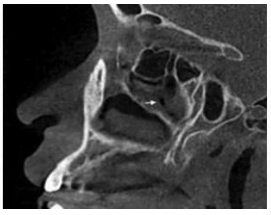


Figure 1 **Figure 2** **Figure 3**

Then, the location of the AMO was assessed in coronal CBCT views by its position on the medial wall of the maxillary sinus and was evaluated as AMO located within the region of NF/ HS (Figure 2) or AMO located outside the region of NF and HS (Figure 3)

Additionally, the shape of the AMO was assessed in the adjusted sagittal CBCT view as round [Figure 4], ovoid [Figure 5], and slit [Figure 6] shaped. Also, the sinuses was analyzed for any pathology. Once the data was collected, AMO characteristics were correlated with symptom severity to rule out the evidence of any maxillary sinus pathology.





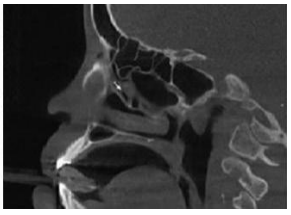


Figure 4 **Figure.5** **Figure.6**

Statistical analysis -The collected data was entered in an MS office excel spreadsheet and analyzed using the Statistical Package for the Social Sciences (**SPSS**) software, version **22.0**. The Chi-square test Mann–Whitney U test, Fisher's exact tests was applied for categorical variables. The *P* value was set at. 005 which is statistically significant. **Results:** PMO was present bilaterally in 98.0% patients. The prevalence of AMO bilaterally in our study showed 92% AMO of right and left maxillary sinus. **(Table 1, Graph 1).** 74% were presented with single AMO and 18% with multiple AMOs. Most of the AMOs (90.0%) were located within the region of the nasal fontanelle or hiatus semilunaris. While 16% AMOs were located outside the region of the nasal fontanelle or hiatus semilunaris. We found 84% ovoid, 8% round and 6% slit-shaped AMO. 92% symptomatic patients in our study population found to be statistically significant ($p < 0.001$) indicating that AMO presence is strongly correlated with the presence of sinus-related symptoms.

Table 1. Distribution of Subjects According to Bilateral AMO

Category	Frequency	Percent
Absent	4	8.0
Present	46	92.0
Total	50	100.0

GRAPH 1: Distribution of Subjects According to Bilateral AMO

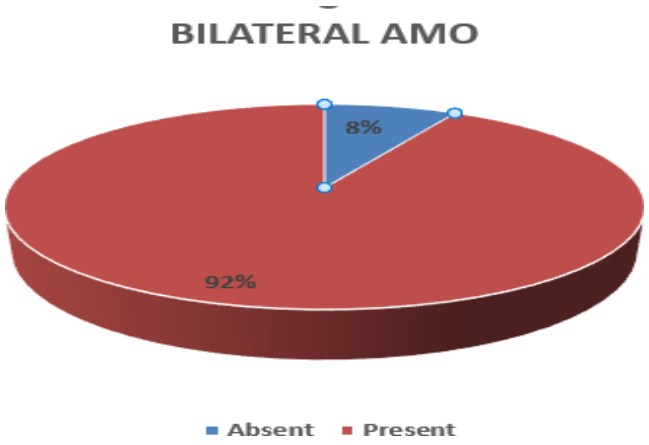
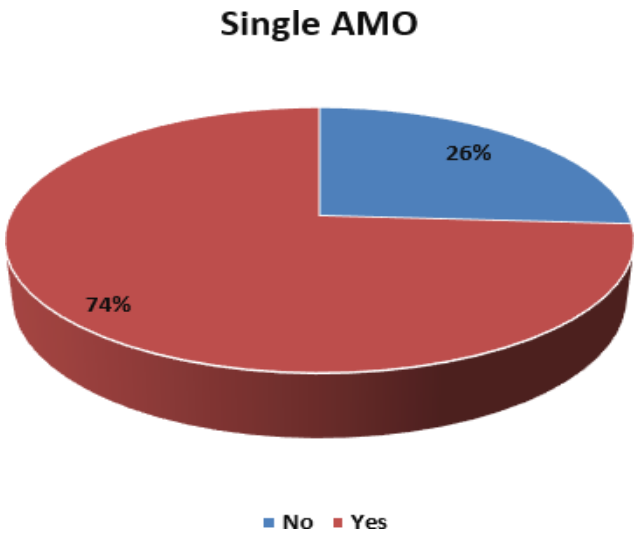


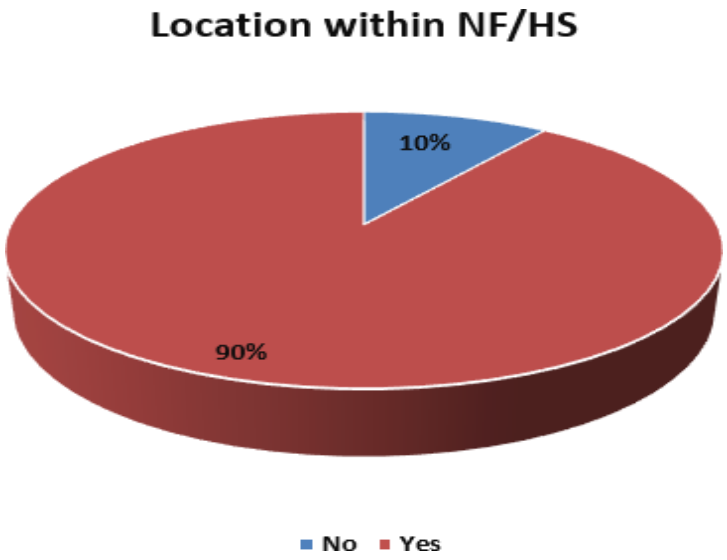
Table 2. Distribution of Subjects According to Frequency, location and morphology of AMO.

AMO		FREQUENCY	PERCENT
FREQUENCY			
	SINGLE	37	74
	MULTIPLE	9	18
LOCATION			
	Within NF/HS	45	90
	Outside NF/HS	8	16
SHAPE			
	Ovoid	42	84
	Round	4	8
	Slit	3	6

GRAPH 2: Distribution of Subjects According to single AMO



GRAPH 3: Distribution of Subjects According to location within NF/HS.



GRAPH 4: Distribution of Subjects According to ovoid shape.

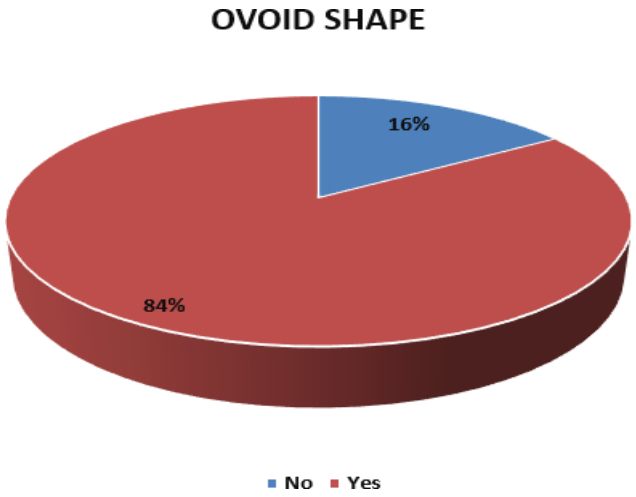
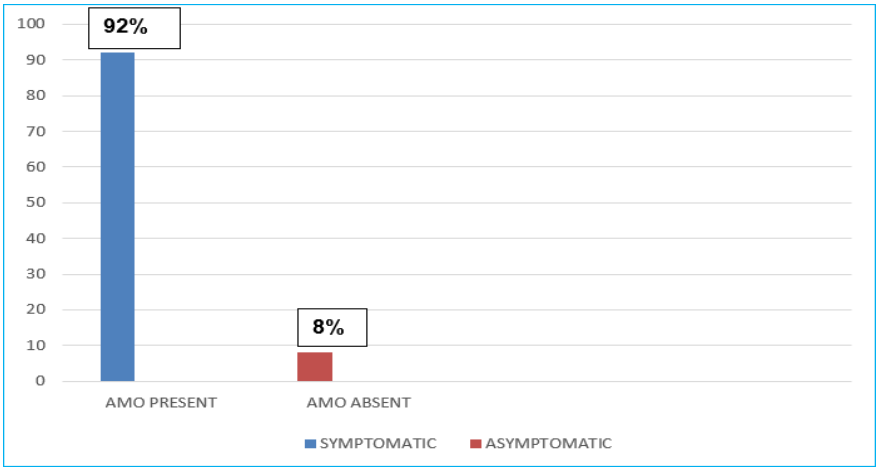


Table 3: Relationship of AMO Existence with Pathology

			AMO		Total
			ASYMPTOMATIC	SYMPTOMATIC	
AMO	PRESENT	N	0	46	46
		%	0.0%	100.0%	100.0%
	ABSENT	N	4	0	4
		%	100.0%	0.0%	100.0%
Total		N	4	46	50
		%	8.0%	92.0%	100.0%
P VALUE					0.001

GRAPH 5: Relationship of AMO Existence with Pathology.



Discussion: In our study, 49(98%) of the 50 patients observed had a visible PMO bilaterally reaffirming its consistency as a fundamental anatomical structure.

Prevalence of accessory maxillary ostia -The prevalence of AMO in our study showed 92% AMO bilaterally often associated with mucosal rupture, changes in the ostiomeatal complex leading to chronic sinus inflammation. The high prevalence of AMO in our study is more than that of all the previous studies as conducted by Swamy A, Sarumathi T. (2023) [4] who reported bilateral AMO prevalence rate 73%. 74% patients were presented with single AMO and 18% with multiple AMOs. This finding was in accordance with the study done by Swamy A, Sarumathi T. (2023) [4] found 62% single AMO, Yeung AW,etal. (2019) [12] found 45.5% having single AMO and 17.9% patients with multiple AMO.

Location of accessory maxillary sinus ostia – In our study, most of the AMOs (90.0%) were located within the region of the nasal fontanelle or hiatus semilunaris. While 16% AMOs were located outside the region of the nasal fontanelle or hiatus semilunaris , aligning strongly with the previous studies conducted by Hung K,etal (2020) [5] reported that 81.1% AMOs were located within the region of NF/HS and 18.9% AMOs located outside the region of NF/HS.

Shape of accessory maxillary sinus ostia - We found 84% ovoid, 8% round and 6% slit-shaped AMO , aligning with the previous studies conducted by Swamy A, Sarumathi T. (2023) [4] who reported the majority of the AMOs were of an ovoid shape (58.2%) followed by a round shape (26.7%) and slit shape (15.1%).Similarly, Mahajan A et al. (2017) [13] reported oval shape AMO in 19.04% .

All individuals exhibiting AMOs were symptomatic (92%), while all AMO-absent subjects remained asymptomatic (8%). Using SNOT-22 nasal symptoms questionnaire, Symptoms were recorded as present or absent in our study to correlate AMO characteristics with symptom severity score. Symptoms like sneezing, blocked nose, thick or watery nasal discharge, postnasal drip, headache, fever, toothache, pain on bending head, lethargy, fatigue, tenderness to pressure over sinus, breathing problem and local rise temperature were corelated with AMO presence or absence. A strong association was observed in our study between presence of AMO and sinus-related symptoms as well as mucosal thickening (MT) of the maxillary sinus, predisposing patients to chronic maxillary sinusitis.

Conclusion: This study reinforces the clinical relevance of accessory maxillary ostia as common anatomical findings strongly associated with sinonasal pathology and

symptoms. We as dentists must know the status of the maxillary sinus before treating maxillary posteriors which is near the sinus. This could be valuable for the assessment of maxillary sinuses before treating sinus-related surgeries like impacted tooth extraction, endoperiosteal lesions, odontogenic related maxillary sinus surgeries, placement of dental implants and sinus lift performed in maxillary posteriors. such procedures may alter the sinus's physiological condition and increase the chances of postoperative sinusitis. In order to use CBCT wisely for preoperative treatment planning in the posterior maxilla, dentists must be aware of the prevalence, location, and morphology of AMO.

Future Implications: Future research should adopt a multidisciplinary, standardized, and longitudinal approach to determine the true etiological and clinical significance of accessory maxillary ostia, ultimately improving diagnosis, treatment planning, and surgical outcomes in sinonasal disease

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