

PNEUMATISATION AND SIZE OF PARANASAL  
SINUSES ON CHILDREN

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**ÖZET:** Son zamanlardaki yayınlar çocuklarda sinüzitin belirlenmesinde paranazal sinüs grafisinin değerini çok şüpheli duruma getirmiştir. Biz, bu çelişkili raporlardan hareketle 100 normal, 100 sinüzitli çocukta patolojik sinüs bulgularını araştırdık. Normal asemptomatik grupta patolojik maksiller sinüs oranı %26 sinüzitli grupta ise %57 idi. En yüksek patolojik maksiller sinüs oranı normal grupta 9-11 yaşları arasında (%35), sinüzitli grupta 3-5 yaşları arasında (%66) görüldü.

Bu çalışma ile birlikte 3-14 yaş arasında 238 çocukta maksiller ve frontal sinüs ölçümleri yapıldı ve bulgular diğer çalışma serilerinin sonuçlarıyla kıyaslandı.

**ABSTRACT:** Emine OSMA, Oğuz DİCLE, Emel ADA, Nihal BAŞIBÜYÜK, Dokuz Eylül University, Faculty of Medicine. Pneumatization and size of Paranasal Sinuses in Children

Recent publications have made the value of paranasal sinus radiograph rather suspect in diagnosis sinusitis in children. In considering these conflicted reports, we have researched on pathological sinusitis findings in 100 children with sinusitis in comparison with equal number of normal children. Abnormal maxillary sinus ratio was 26% in the normal asymptomatic group, and 57 % in those with sinusitis. Incidence of abnormal maxillary sinus was the highest (35 %) between the ages 3-5 in those with sinusitis. Alongside these studies, maxillary and frontal sinus sizes were measured in 238 children between the ages 3-14, and the results were compared with the other studies.

The diagnostic dilemma of sinusitis concern the sub-acute and chronic presentation of the problem and not so much the more obvious acute presentation with fever supramaxillary or frontal tenderness and

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purulent rhinorrhea. The most definite test in diagnosis is the microscopic examination and culture of the aspiration material. But antral puncture is a difficult procedure, and the cultures of nasal secretions are not an acceptable substitute. Under these circumstances, the sinus radiography is the best indirect measure of sinus pathology (1,2). At times, certain difficulties are involved in deciding whether the frontal sinuses are to be regarded as normal or hypoplastic. There is no standard measurement on this matter, and we believe that the racial factors also have an important part to play.

**Anahtar sözcükler:** Sinüzit, Maksiller sinüzit, Sinüs büyüklüğü

**Key words:** Sinusitis, Maxillary sinusitis, Size of Sinuses.

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**MATERIAL AND METHODS :**The material of this study were obtained during a one-and-a-half-year period, July 1986 to December 1987, at the Medical School of the Dokuz Eylül University. Our patients came principally from the ear, nose and throat clinic, pediatric clinic, and the emergency room. Parental permission was obtained for each child in the normal group who had no history or physical findings of sinus or respiratory tract disease. The radiologic examination consisted of a Water's view projection and this was taken in prone position. The focal film distance was 110 cm. and no correction was made for magnification. The radiographs were analysed by two independent radiologists, and then the results were compared. Those receiving the same diagnosis from two radiologists were included in this study.

Total opacity, mucosal thickening of up to 6 mm., cyst, and alternation of bone structure were accepted as the abnormal radiologic findings. Clouding of sinuses was not considered a criteria for abnormality, since it was found in association with mucosal thickening in all cases.

For our analytical targets, the patients were divided into three group: as follows:

Group I. One hundred normal children with no history or physical findings of sinusitis or upper respiratory tract disease.

Group II. One hundred children who had signs and symptoms of sinusitis.

We investigated abnormal maxillary sinus in this two groups.

Group III. 238 children who had well aerated maxillary and frontal sinuses. In this group we measured the maximal width and height of maxillary sinus and the maximal height of frontal sinus (Fig 1).

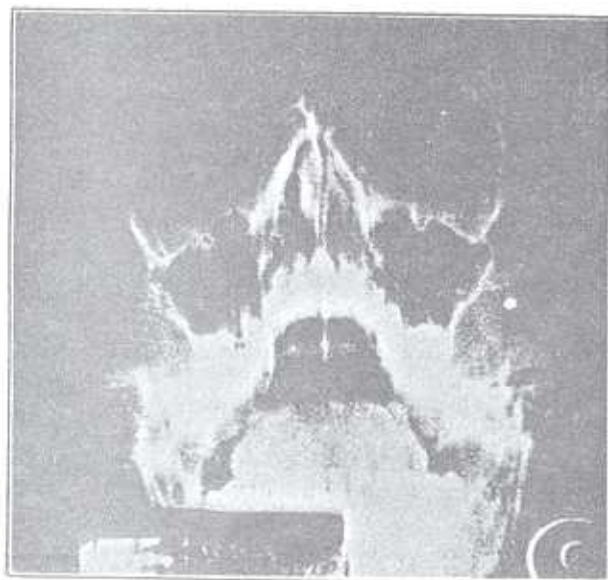


Fig 1: Landmarks for measurements of maxillary and frontal sinuses  
 AB=line between orbital roofs. CD=Maximal height of frontal sinus  
 EF=Maximal width of maxillary sinus GH=Maximal height of maxillary sinus.

Table 1: Number and percentage of abnormal maxillary sinus in normal and diseased children.

Age in Years	Group I: Normal		Group II: Sinusitis		Total	
	No.	%	No.	%	No.	%
	1		8		9	
3-5	9	11	12	66.6	21	42.8
6-8	8	27.5	20	62.5	28	46
9-11	29		32		61	
	12	35	15	45.5	27	42.2
12-14	34		33		67	
	5	18	14	61	19	37.2
	28		23	51		

**RESULTS :** Group I. of the 52 males and 48 females, with a mean age of 9.6 years (range 3-14), 26 children (26 %) had abnormal maxillary sinus radiographs. This percentage was elevated to 32 % when the other sinuses (frontal and ethmoid) were included in the study. Table I shows the percentage comparison of abnormal maxillary sinuses in the different age groups of normal and diseased children.

Group II. There were 59 males, 41 females, with a mean age of 8.8 years (range 3-14) in this group. 57 out of 100 (57 %) had maxillary pathologies on the sinus radiographs. If frontal and ethmoid sinus pathologies are added to maxillary abnormalities this percentage would stand at 69%. Table II shows the various radiographic pathologies of maxillary sinuses in the groups of normal and diseased children.

Group III. We measured well aerated maxillary and frontal sinus pair on 238 children. There were 119 males and 119 females. The number of males and females were equal in different age groups.

Table 2: Criteria of maxillary sinusitis

	Group I:		Group II:	
	Normal		Sinusitis	
	No.	%	No.	%
Opacity	22	11	52	26
Mucosa thickening	15	7.5	31	15.5
Cyst	-	-	1	2.5
Bone changes	2	1	-	-
Normal	161	80.5	112	56

**Maxillary sinuses:** In 47 (19.7 %) cases the width, and in 59 (24.7%) cases the height of maxillary sinus were equal in both sides. In 11 (2.3%) of the children one side was wider (5 mm. or up to 5 mm.) than the other. There was no significant difference between the size of right and left sinuses, and we could not find statistically significant difference between the mean values of the males and females sinuses. Table III. shows the mean widths and heights of the males and females in different age groups.

Table 3: Mean widths and heights of pneumatized maxillary sinuses in different age groups.

Age in years	Mean width in mm.			Mean height in mm		
	Males	Females	Total	Males	Females	Total
3-5	19.33	18.77	19.05	19.85	20.83	20.39
6-8	22.82	23	22.91	26.5	27.52	26.93
9-11	24.71	25	24.85	30.13	29.32	29.72
12-14	24.42	27	25.71	32	34.15	33.08

**Frontal sinuses:** There were 27 (5.6 %) aplasia of frontal sinuses in 238 children. 157 (32.9 %) were below the orbital roofs while 292 (61.4 %) at or above this level. In 14 years of age 16.6 % frontal sinuses were still below the orbital roofs. Shape of two frontal sinuses were rarely the same. In 17 (7 %) cases heights of both sides were equal. The mean heights and the position according to orbital roofs are seen on Table IV.

Table 4: Mean heights of frontal sinuses in different age groups.

Age in Years	Mean height in millimeters.		
	Males	Females	Total
3-5	5.75	6.62	6.18
6-8	12.33	14.53	13.18
9-11	17.90	20.00	18.95
12-14	20.40	23.20	21.18

**Discussion:** Although paranasal sinus radiography is the most commonly used tool for diagnosis of maxillary sinusitis, specificity of it in pediatric age group is still an undetermined issue. The highest (35 %) rate of abnormal maxillary sinus was obtained in asymptomatic children at 9-11 age group while the lowest (11 %) was seen in 3-5 age group. The results were exactly opposite in the same age groups of children with sinusitis. We thought that this depends on the subacute or chronic presentation of the problem in the pediatric ages. Table V. Shows a comparison of the percentage of abnormal sinus radiographs in normal and diseased children between this study and the other series. In normal asymptomatic children there is an obvious parallelism to the results of the series studied by Mareah (3) and Odita (4) however we differ with the high results obtained by Shopfner (5), and the lower values cited by Kovatch (6). The highest (66.6 %) rate of abnormal maxillary sinus was

seen at 3-5 age group in children with sinusitis. We concluded, as indeed did Shopfner, that upper respiratory tract infections, most frequently seen in these ages, have a great role on the abnormality of maxillary sinuses. Redundant mucosa of sinus or crying which was postulated by Caffey (7) may be the reason of opaque sinus in infancy but is somewhat irrelevant as far as this particular age group is concerned.

Table 5.: Comparison of the different studies about pathologic maxillary sinuses in normal and diseased children

Study	Age in years	Normal		Sinusitis		
		No. in Group	Abnormal No: %	No. in Group	Abnormal No: %	
	Preschool		30			
<u>Mareh</u>	12		15			
<u>Shopfner and Rossi</u>	2-14	82	40 48.7	113	53 47	
<u>Kovatch et al.</u>	1-16	31	2 6.5			
<u>Odita et al.</u>	3-14	62	16 25.8	55	19 34.5	
<u>Present Study</u>	3-14	100	16 26	100	57 57	

In 19.7 % of cases the widths of maxillary sinuses were equal on both sides in this study. Schaeffer (as cited by Mareh) reported that 15 % of cases had equal widths of sinus. This percentage is 50 % in Odita's study. There is a sharp contrast between our findings and those in the latter. Table VI. shows a comparison of the mean widths of a maxillary sinuses between our findings and those of Odita and Schaeffer. The values of this study and Odita's are comparable but our findings are rather higher than the values of Schaeffer's study for all age groups

Table 6. Comparison of maxillary sinus size in different studies

Age	Schaeffer 1936		Present Study		Odita
	Cited by Mareh (8)		Height,mm	Widht,mm	et al
	Height mm	Width,mm			Width,mm
3	11-12	9-10	17.6	17.8	
6	15-17	16-17	25.5	22	
10	17.5-18	19-20	28.8	24	
14			34.6	27	
15	18-20	19-20			
3-6				19.8	16.46
7-11				24.3	21.67
12 and above				25.7	25.60

We could find comparatively few reports about the size of frontal sinuses. Davis and Haas (as cited in Maresch) and Maresch (8) agree that the frontal sinus is seen above the nasion between 2.5-3 years of age. In this study all of the children under 5 years of age had frontal sinuses below the orbital roofs. However as is seen in Table VII. after 8 years of ages mean heights of frontal sinuses of our children are higher than the values of the radiologic study of Schaeffer and the anatomical study of Davis. But 14 years of age 16.6 % of cases frontal sinuses are still below the orbital roofs. We thought that severe infections of paranasal sinuses early in life have an important role on the development of frontal sinuses.

Table 7: Comparison of frontal sinus heights in the different studies.

Age	Schaeffer 1936 Cited by Maresch(8)	Davis 1918* Cited by Maresch(8)	Present Study
3-4	2.5	3.8- 5.3	5.6
7-8	9.5	3.8-11.3	14.7
10-11	12.5	14.3-15.8	20.7
13-14	12.0	18.8-20.3	23.0

\* Anatomical study

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