Prevalence of incidental paranasal sinus opacification in dental paediatric patients

Bong-Hae Cho, Yun-Hoa Jung

Department of Oral and Maxillofacial Radiology, College of Dentistry, Pusan National University

ABSTRACT

Purpose : The purpose of this study was to determine the prevalence of sinus opacification among dental paediatric patients.

Materials and methods : Two hundred and eight Cone Beam Computed Tomography (CBCT) scans of dental patients under the age of 18 were reviewed for sinus opacification. Patients with any sinus-related signs or symptoms were excluded.

Results : The overall prevalence of sinus opacification was 48.1%. The ethmoid (28.4%) and maxillary (27.8%) sinuses were most frequently affected. There were no statistically significant differences for both age and gender.

Conclusion : The high prevalence of sinus opacification in asymptomatic children emphasizes the necessity of clinical correlation. (***Korean J Oral Maxillofac Radiol 2008; 38 : 219-23***)

KEY WORDS : Child; Cone-beam computed tomography; Sinusitis

Introduction

Paranasal sinusitis is a common clinical problem in general practice. Diagnosis of sinusitis is complicated, especially in children, because of fewer specific signs and symptoms.[1] Patients who do not respond to medication or are planning surgical treatment need a radiographic examination to confirm the diagnosis.

Stankiewicz et al.[2] reported that more than 50% of the patients who met the criteria of a symptom-based definition of rhinosinusitis had a negative CT scan and were treated unnecessarily with antibiotics. They recommended the use of the CT in addition to clinical evaluation to increase the accuracy of the clinical diagnosis. Wald et al.[3] pointed out that sinusitis is a clinical diagnosis which can be ruled out by negative image findings. CT is the most useful imaging tool to diagnose sinusitis.[4,5] However, the main disadvantages of cost and high radiation dosage limit its application.[6,7]

In the late 1990s, CBCT was introduced and has provided opportunities for dental practitioners to obtain multiplanar imaging. Even though CBCT has been known to have low soft-tissue resolution, it easily identifies sinus opacification. CBCT would be a good alternative for CT in evaluating paranasal sinus inflammation, especially in paediatric patients who are more sensitive to radiation than adults.

There have been a number of studies reporting that, even in children examined for indications other than sinus disease, radiographic abnormalities in sinuses commonly manifested.[8-14]

Glasier et al.[8] examined the cranial CT scans of 101 children and identified paranasal sinus abnormalities in 31% of the upper respiratory inflammation (URI)-positive group and in 26% of the URI-negative group. Diament et al.[9] prospectively studied 137 consecutive paediatric patients referred for a CT of the brain and orbit, and presented that an overall 45% of the patients had incidental sinusitis, with similar findings with Lesserson et al.[10] Choi et al.[11] analyzed CT scans of 162 children who had no signs or symptoms of paranasal sinusitis, and reported that one or more sinus opacifications were found in 47% of the patients.

The incidence of paranasal sinus inflammation in a dental paediatric population has not been published. The purpose of this study is to investigate the prevalence of paranasal sinus opacification in paediatric patients presenting with dental problems.

Materials and Methods

1. Materials

The study population comprised 208 child patients of 98

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Correspondence to : Dr. Yun-Hoa Jung

Department of Oral and Maxillofacial radiology, College of Dentistry, Pusan National University, Busan 602-739 Korea

Tel) 82-51-240-7474, Fax) 82-51-245-8388, E-mail) yhjung@pusan.ac.kr

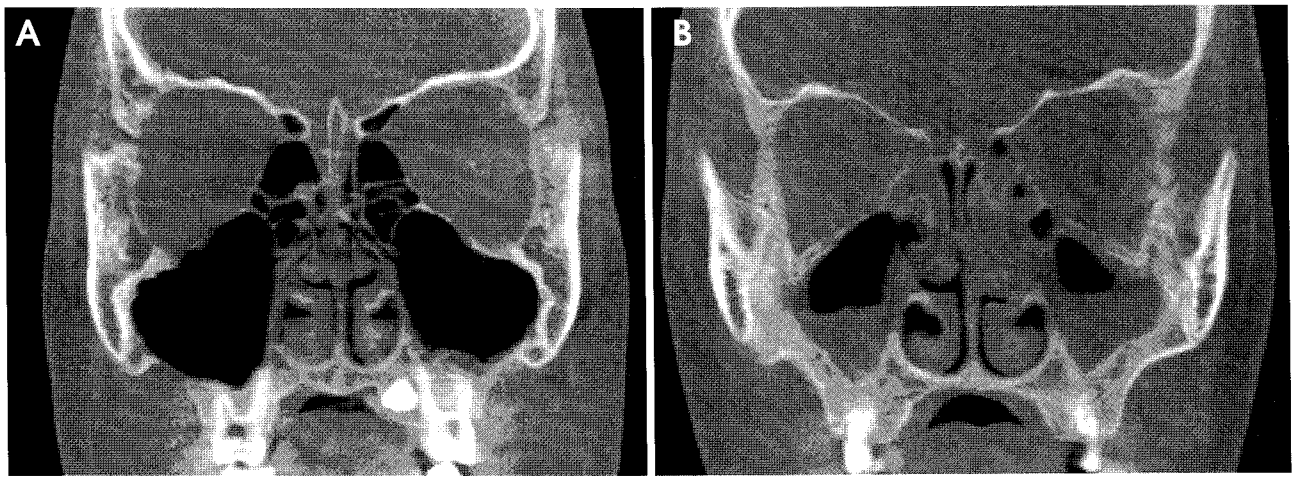

Fig. 1. Examples of grading scale for maxillary sinus opacification. A. Clear (right) & Mild (left), B. Moderate (right) & Severe (left).

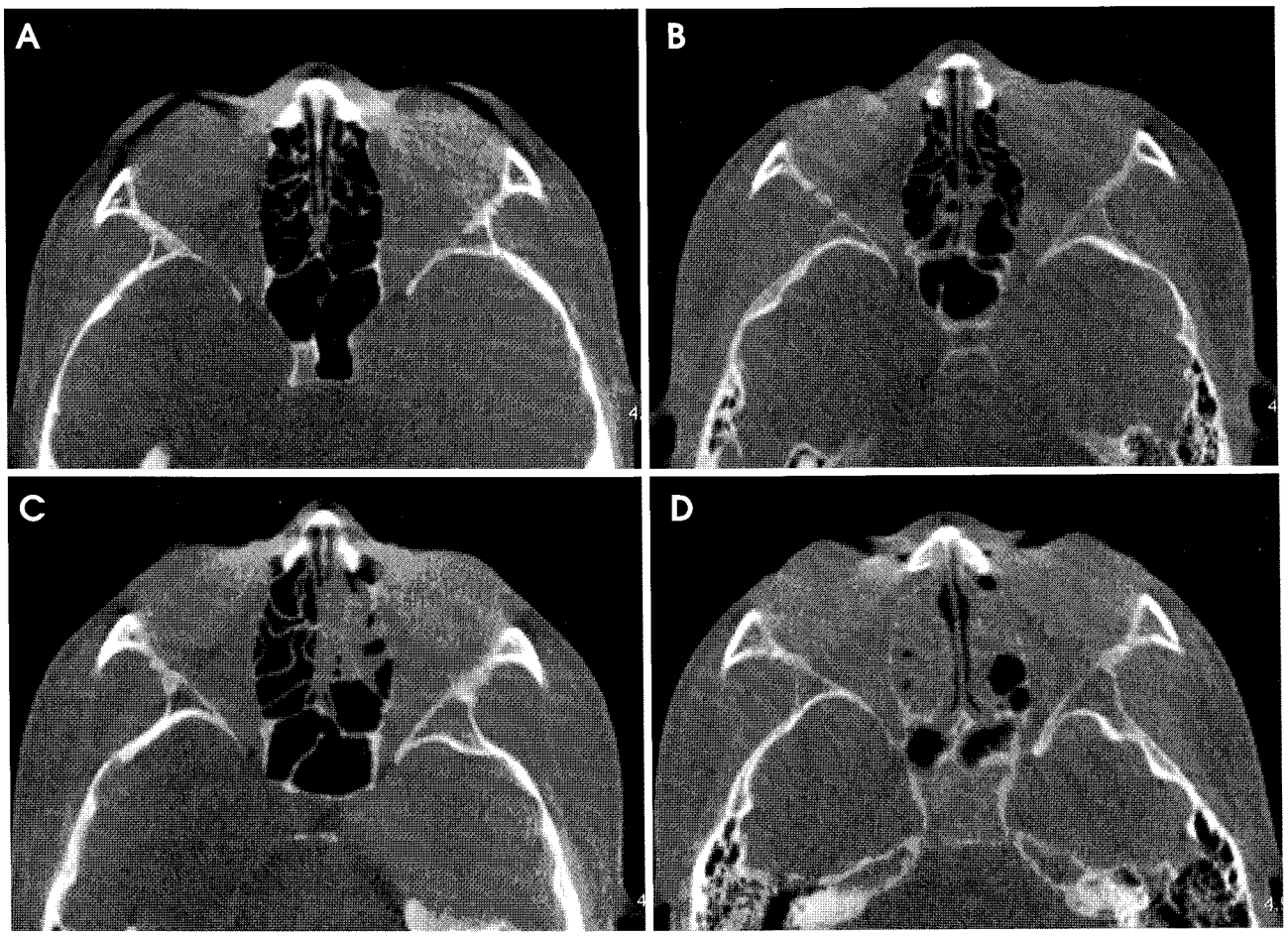

Fig. 2. Fig. 1. Examples of grading scale for ethmoid sinus opacification. A. Clear, B. Mild, C. Moderate, D. Severe.

males and 110 females. The patients were 6 to 18-year-olds with a mean age of 12.0. All patients presented for dental treatment took CBCT images at Pusan National University from January 2007 to June 2008. The reason they took CBCT imaging was either for tooth impaction or orthodontic evaluation.

Patients who had a clinical suspicion of sinus disease were excluded from the study.

2. Methods

CBCT scans were obtained with DCT Pro (Vatech, Kihung, Korea) consisting of an X-ray tube, a source collimator, and an amorphous-silicon flat-panel detector. CBCT scans were performed with a rotation of 360 degrees for data acquisition. The exposure factors were field of view 20 × 19 cm, 90 kVp, 4-5 mA, and an exposure time 24 seconds. Images were reconstructed using a high spatial frequency reconstruction algorithm. The acquired image data consists of a 14-bit scale with a 0.568 mm^3 voxel size.

Two experienced oral and maxillofacial radiologists read the CBCT images for sinus opacification. To specify the severity of mucosal inflammation, opacification was graded as follows: 0=clear, 1=mild (less than one-third of the sinus), 3=moderate (from one third through two-thirds), or 4=severe (greater than two-thirds of the sinus). Frontal, ethmoid, sphenoid, left and right maxillary sinuses were separately evaluated for the absence or presence of opacification. If the sinus was not developed, it was regarded as clear. In cases of disagreement among the examiners' findings, the two specialists discussed the results together and reached a consensus.

To calculate statistical significance, we divided the patients into the age groups of 6-9, 10-12, 13-15, and >15 years and chose the highest rate among five sinus scans as the overall rate of the patient. The data were analyzed by the Spearman rank correlation coefficient between age group and sinus opacification, and χ^2 test to determine if gender shows any statistically significant difference. Significance levels were set at 0.05.

Table 1. Paranasal sinus findings of the patients

	Sinuses, N (%)				
	Frontal	Ethmoid	Sphenoid	Maxillary (Rt. & Lt.)	All sinuses*
Clear	179 (86.1)	149 (71.6)	189 (90.9)	300 (72.1)	108 (51.9)
Mild	17 (8.2)	36 (17.3)	12 (5.8)	72 (17.3)	62 (29.8)
Moderate	6 (2.9)	18 (8.7)	3 (1.4)	21 (5.0)	21 (10.1)
Severe	6 (2.9)	5 (2.4)	4 (1.9)	23 (5.5)	17 (8.2)

*Classification based on the highest rate among five paranasal sinus scans

Results

The overall incidence of sinus opacification in this study is shown in Table 1. The number of patients who had sinus opacification in at least one sinus was 100 (48.1%). The ethmoid (28.4%) and maxillary (27.8%) were among the most frequently involved sinuses and 9 (4.3%) patients had pansinusitis. Table 2 shows the distribution by age and gender.

No correlation was found between the age of the patients and the sinus abnormality ($r=-0.09$ $P=0.18$). Also, there was no statistically significant difference between male and female patients ($P=0.30$).

Discussion

CBCT is a new multiplanar imaging modality, which is more cost- and radiation-effective than the conventional CT. To avoid giving additional doses to the children, we used the existing CBCT images as a diagnostic tool of sinus inflammation. We found no difficulties in defining sinus opacification with these images.

There are ample literatures regarding the incidence of sinonasal imaging abnormalities in children with or without sinus symptoms.[8-19] These studies reported the frequency of sinus abnormalities from 18%[8] to 47%[11] in asymptomatic children and from 31%[8] up to 81%[18] in the symptomatic group.

The present study found a 48.1% incidence of sinus opacification, which is consistent with the prior studies.[9,11,14] Most of the researches on the prevalence of sinus abnormalities in asymptomatic paediatric patients reported the incidence over 40%.[9,10,13,14] Similar incidences from the studies for the Korean population were documented. Choi et al.[11] reported a 47% incidence in patients over 1 year and Nam et al.[12] detected 40.9% in the paediatric population. On the other hand,

Table 2. Distribution of paranasal sinus findings by age and gender

		Age group (years), N (%)				Gender, N (%)	
		6-9	10-12	13-15	>15	Male	Female
All sinuses*	Clear	22 (52.4)	35 (46.1)	36 (60.0)	15 (50.0)	46 (46.9)	62 (56.4)
	Mild	8 (19.0)	25 (32.9)	18 (30.0)	11 (36.7)	29 (29.6)	33 (30.0)
	Moderate	5 (11.9)	10 (13.2)	4 (6.7)	2 (6.7)	13 (13.3)	8 (7.3)
	Severe	7 (16.7)	6 (7.9)	2 (3.3)	2 (6.7)	10 (10.2)	7 (6.4)
	Total	42 (100)	76 (100)	60 (100)	30 (100)	98 (100)	110 (100)

*Classification was based on the highest rate among five paranasal sinus scans

Glasier et al.[8] reported that 18% of patients older than 1 year had incidental abnormalities. However, there is one thing we must take into account. Glasier et al.[8] and Choi et al.[11] indicated that the abnormalities were more prevalent in the under 1 year age group. Many previous studies[8,9,11,12] consisted of the population ranging from 1 year or less, differing from the 6 year minimum of our study. Of these studies, only Glasier et al.[8] and Choi et al.[11] presented data which could be demarcated by age 6. When recalculating their data for the children of 6 years or more, the incidence of Glasier et al.[8] was dropped to 15.1% and that of Choi et al.[11] came to 23.4% or 43.8% depending on the absence or presence of URI, respectively. Compared to these results, our incidence is considered a little high. The discrepancies may be partly due to the use of various imaging techniques, but mainly because of the difference in the selected criteria. Choi et al.[11] did not include the frontal and sphenoid sinuses in the study. In addition to these reasons, population characteristics, criteria used to define *asymptomatic*, and seasonal conditions were addressed to explain the discrepancies among the assorted studies.[13,15,20]

The distribution of sinus involvement in our study was consistent with previous studies.[9,10,12] The most commonly affected sinuses were the ethmoid and maxillary, showing a prevalence of around 30%.

Age has been reported as an influencing factor for sinus CT abnormalities in several studies.[9,19] Diament et al.[9] reported that the age group of 1 to 2-year-olds showed significantly higher rates of abnormalities while those for the 13 to 17-year-olds were considerably lower. Van der Veken et al.[19] reported that younger children up to the age of 7 to 8 years seem to be prone to inflammatory changes of all sinuses. However, Lesserson et al.[10] found that the rates of sinus abnormalities in asymptomatic children under 18 do not depend on age. Tatli et al.[15] reported that no correlation was found between the patient age and sinus abnormality. Cotter et al.[14] found no statistically significant difference, even though children aged 2-4 and 9-12 had an increased prevalence of abnormalities. Our study also showed no correlation between the study population and the severity of the sinus opacification.

Gender does not seem to make any difference in sinus abnormality. Even though Havas et al.[21] reported a male predominance in the study using symptomatic adults as the subject, our study showed no statistically significant distinction, which is in accordance with other previous studies.[9,15,22]

The significance of abnormal sinus images and their relationship to clinical disease remains a controversial issue. It can be inferred from the high frequency of reported radiographic abnormalities in asymptomatic patients that a certain range of sinus opacification falls into normality. Thus, history and physical examination should be taken into consideration when interpreting radiographic images.[23] Lesserson et al.[10] proposed, therefore, that the finding of sinus opacification or mucosal thickening in all asymptomatic children is incidental, and without clinical correlation, is not predictive of a clinically significant sinus disease. Kristo et al.[13] reported that about half of the abnormal sinus MRI findings had resolved or improved without any intervention in the follow-up examination. They concluded that as incidental findings, sinus abnormalities should be interpreted as normal and do not indicate any need for treatment in children imaged for purposes other than sinus disease. Manning et al.[17] also asserted that positive image findings in the absence of a clinical history do not define a diagnosis of sinusitis in children, but reflects an ongoing or resolving upper respiratory tract infection. Children with asthma and allergic rhinitis had an incidence and severity of sinus disease similar to that in random paediatric patients.[14]

Although we excluded the patients with sinus-related signs and symptoms, a large percent of the patients showed sinus opacification. One assumption is that, because complaints are less common in young children[24] and the symptoms of sinusitis are often unspecific, some patients may still have sinus-related problems. Nevertheless, the more plausible explanation is that sinus opacification may be present in association with other sinus conditions, like a history of URI, asthma, and allergies.

In summary, our results indicate that sinus opacification is prevalent in the dental paediatric population, and that adequate clinical correlation, along with radiographic findings, need to be evaluated before treatment.

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