

The ability of panoramic radiography in assessing maxillary sinus inflammatory diseases

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ABSTRACT

Purpose : To evaluate the relative diagnostic accuracy of panoramic radiography and Water's projection in maxillary sinus inflammatory diseases by comparing the radiodensities of the images with those of CT.

Materials and Methods : Panoramic radiographs, Waters' projection, and CT images from 55 subjects (110 sinuses) were included in this retrospective study. The radiodensity of each maxillary sinus in panoramic radiography was recorded separately as upper and lower divided horizontally by hard palate. In Waters' projection, the overall sinus radiodensity was recorded. The CT images were considered as gold standard.

Results : In panoramic radiography, 83 sinuses had same upper and lower radiodensity and 72 of these were consistent with those of CT, 26 sinuses had different upper and lower radiodensity and 15 of these, upper radiodensity was consistent with CT, the remaining 11, lower radiodensity was consistent with CT. One sinus had upper radiolucency with lower radiopacity and both were consistent with those of CT. Altogether 73 (66.4%) among 110 sinuses in panoramic radiography showed full agreement with CT, 26 (23.6%) showed partial agreement with CT. 9 sinuses had no lower image under the hard palate in panoramic radiography due to the smaller size of sinus. In Waters' projection, the radiodensity of 105 sinuses (95.5%) were consistent with that of CT.

Conclusion : The panoramic radiography showed 90.0% of the sinus conditions fully or partially which may appear less accurate than that of Water's view (95.5%) but with more detailed information of the inferior part of sinuses. (*Korean J Oral Maxillofac Radiol* 2008; 38 : 209-13)

KEY WORDS : Maxillary sinus; Tomography, X-ray Computed; Panoramic Radiography

The term sinusitis which implied an infection of the maxillary sinus is now more appropriately referred to as rhinosinusitis, since the American Academy of Otolaryngology standardized the terminology for paranasal sinus infections in 1996.¹ The change in nomenclature was made because the mucous membranes of the nose and paranasal sinuses (maxillary, frontal, ethmoid, and sphenoid) are all anatomically contiguous and respond similarly to medical and surgical therapy.²

The signs and symptoms consistent with a diagnosis of rhinosinusitis are classified into major and minor categories. The major factors are facial pain, pressure, facial congestion, nasal obstruction, paranasal drainage, hyposmia, and fever. The minor factors usually include headache, dental pain, halitosis, fatigue, cough, and ear pain. The minor factors achieve diagnostic significance when one or more of the major factors are present among the symptoms.²

Odontogenic etiology accounts for 10% to 12% of cases of maxillary sinusitis.³⁻⁶ Although uncommon, direct spread of dental infections into the maxillary sinus is possible due to the close relationship of the maxillary posterior teeth to the maxillary sinus. If a periapical dental infection or dental surgery procedure violates the schneiderian membrane integrity, infection will likely spread into the sinus, leading to sinusitis. An odontogenic source should be considered in individuals with symptoms of maxillary sinusitis and a history of dental or jaw pain; dental infection; oral, periodontal, or endodontic surgery; and in those people resistant to conventional sinusitis therapy.⁶

Panoramic radiography provides a good view of the maxillary sinuses bilaterally. Unilateral cloudiness or opacification of the maxillary sinus on the symptomatic side will definitely raise the suspicion for a diagnosis of rhinosinusitis. If it is difficult to ascertain a definitive etiology of dental origin, referral to an oral and maxillofacial surgeon or an otorhinolaryngologist is an appropriate consideration. In these cases, further radiographic imaging such as computed tomography may be helpful in deriving a diagnosis. But what about unilateral or bilateral opacification of the maxillary sinus on the panoramic

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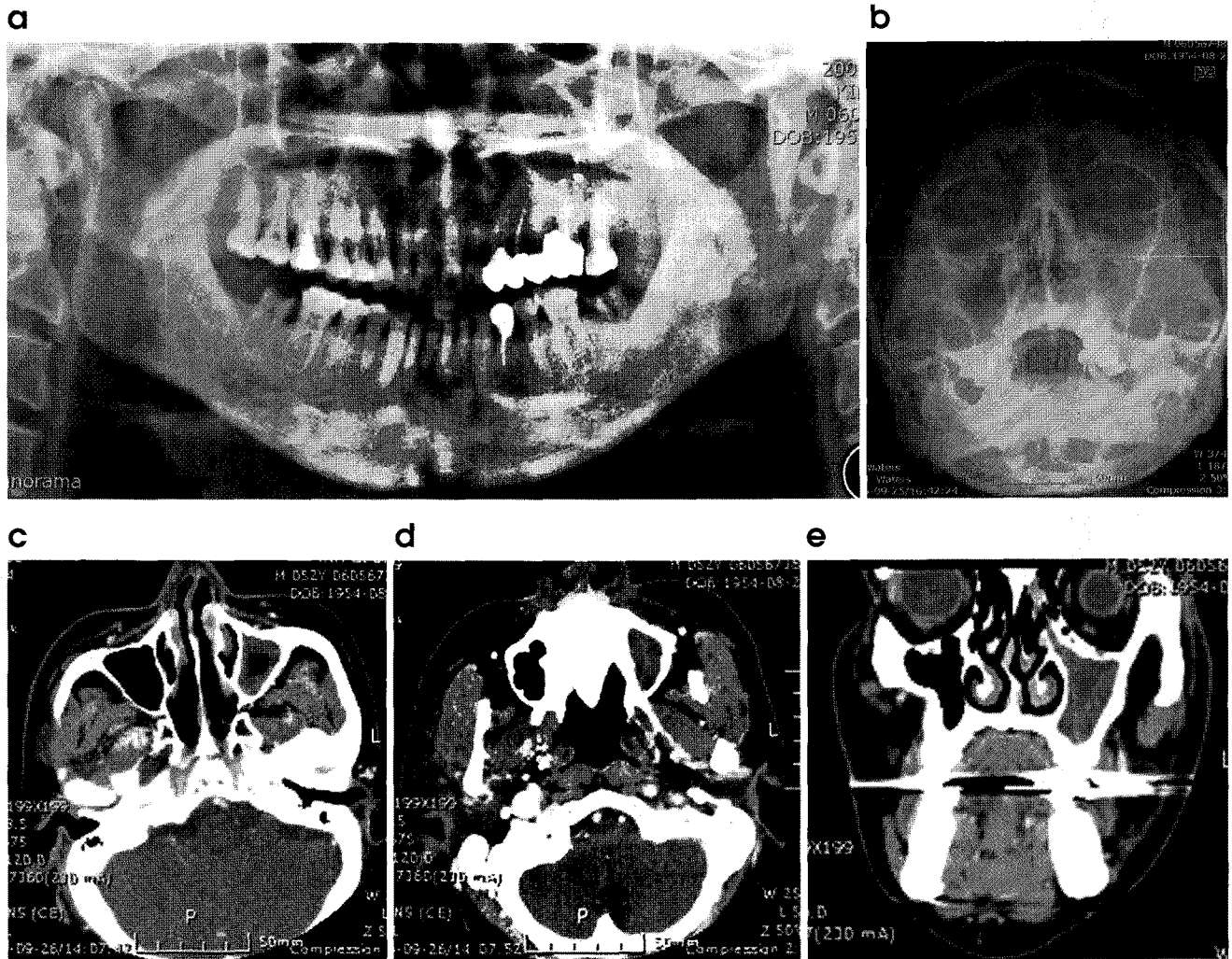


Fig. 1. (a) Left maxillary sinusitis with upper and lower radiopacity in panoramic view; (b) Left maxillary sinusitis with increased radiopacity in Waters' view; (c), (d), (e) Left maxillary sinusitis with increased radiopacity in CT.

radiography without any symptoms?

Lee et al.⁴ studied the incidence of undiagnosed apical disease in acute unilateral sinusitis and evaluated the role of panoramic radiography. Their results was an incidence of 10 % and conclude that panoramic radiography are not justified in the routine investigation of acute sinusitis. Larheim and Westesson⁷ demonstrated a false-positive unilateral opacification of maxillary sinus panoramic view with normal coronal CT image. But Bünger and Schroeder⁸ said panoramic radiography is a useful routine ENT examination for the basal parts of the maxillary sinus diseases.

The present paper studies the diagnostic importance of panoramic radiography in maxillary sinus inflammatory diseases since this technique, which has proved its work in dentistry for many years, often offers a valuable alternative beyond the supplementary evidence provided by routine radiological tech-

niques.

Materials and Methods

Panoramic radiographs, Waters' projection, and CT images from 55 subjects (110 sinuses) were included in this retrospective study. They were 34 males and 21 females ranging from 14 to 74 years of age (mean 43.5 years). The radiodensity of each maxillary sinus in panoramic radiography was recorded separately as upper and lower divided horizontally by hard palate. In Waters' projection, the overall sinus radiodensity was recorded. The radiodensity of sinus was recorded as radiolucent when the density of sinus was comparable to that of the eye of the same side of the same patient. The CT images were considered as gold standard. Conditions which cause localized image shadows such as mucosal thickening, fluid level or mu-

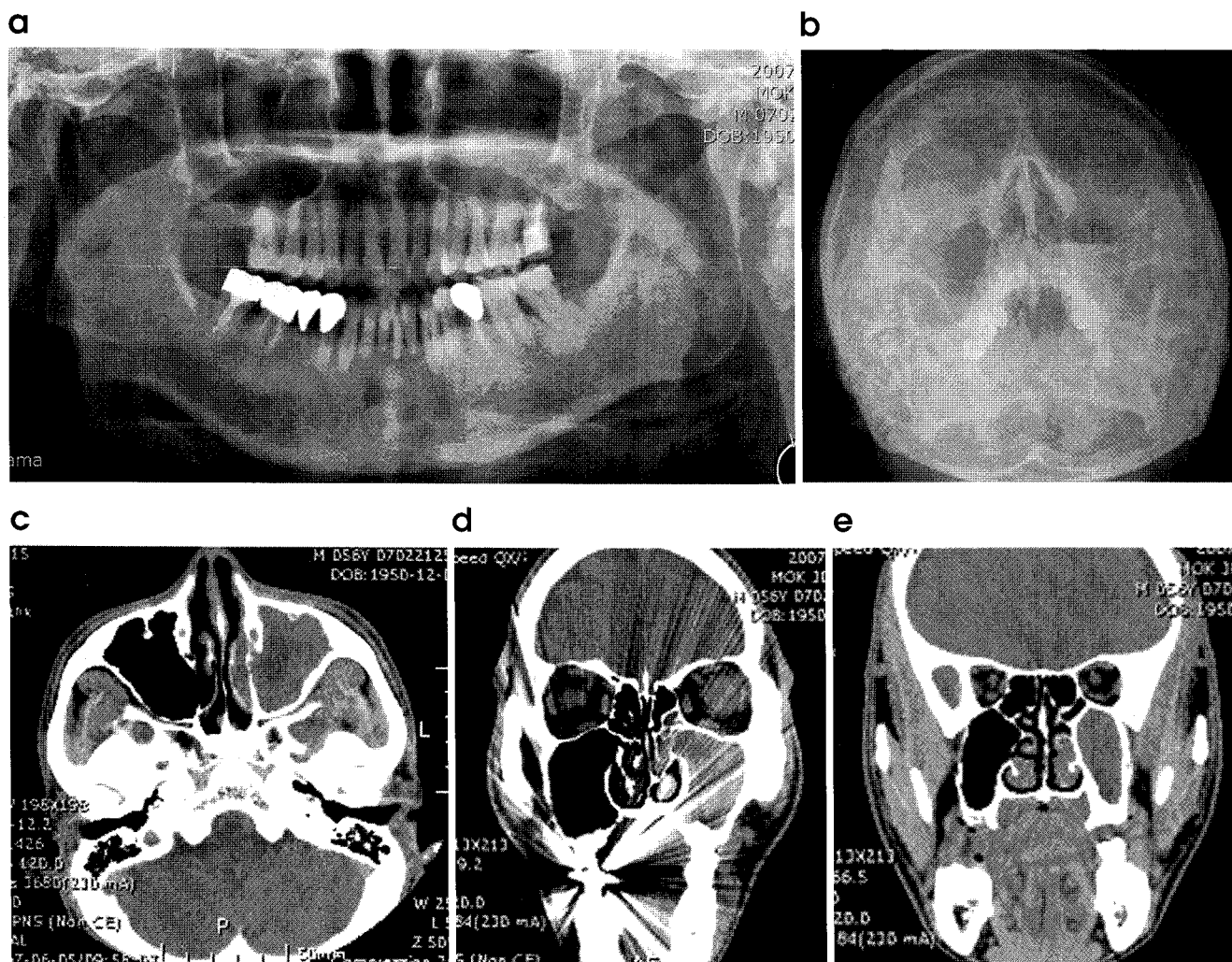


Fig. 2. (a) Fluid in left maxillary sinus showing as lower radiopacity in panoramic view; (b) Fluid level of left maxillary sinus best showing in Waters' view; (c), (d), (e) Fluid in left maxillary sinus appear as overall radiopacity in CT with patient supine position.

alous retention cyst were also recorded. The panoramic radiographs were obtained by 2002 CC Proline (Planmeca Co., Helsinki, Finland). The image receptor was Kodak DirectView CR-975 digital radiography systems (Eastman Kodak Co., New York, NY). Water's projections were obtained by FCR system (Fuji Photo Film Co., Ltd., Tokyo, Japan). The axial and reconstructed CT scans were obtained by multichannel QXi (GE Medical System, Milwaukee, WI, USA).

Results

In panoramic radiography, 83 sinuses had same upper and lower radiodensity and 72 of these were consistent with those of CT, 26 sinuses had different upper and lower radiodensity and 15 of these, upper radiodensity was consistent with CT, the remaining 11, lower radiodensity was consistent with CT.

One sinus had upper radiolucency with lower radiopacity and both were consistent with those of CT. Altogether 73 (66.4%) among 110 sinuses in panoramic radiography showed full agreement with CT, 26 (23.6%) showed partial agreement with CT. 9 sinuses had no lower image under the hard palate in panoramic radiography due to the smaller size of sinus. In Waters' projection, the radiodensity of 105 sinuses (95.5%) were consistent with that of CT.

Discussion

Common use of panoramic radiography gives more chance to check opaque antrum preliminarily. Whyte and Chapeikin⁹ commented that the demonstration of an opaque antrum on a plain radiograph or cross-sectional imaging leads to consideration of an extensive differential diagnosis but computed tomo-

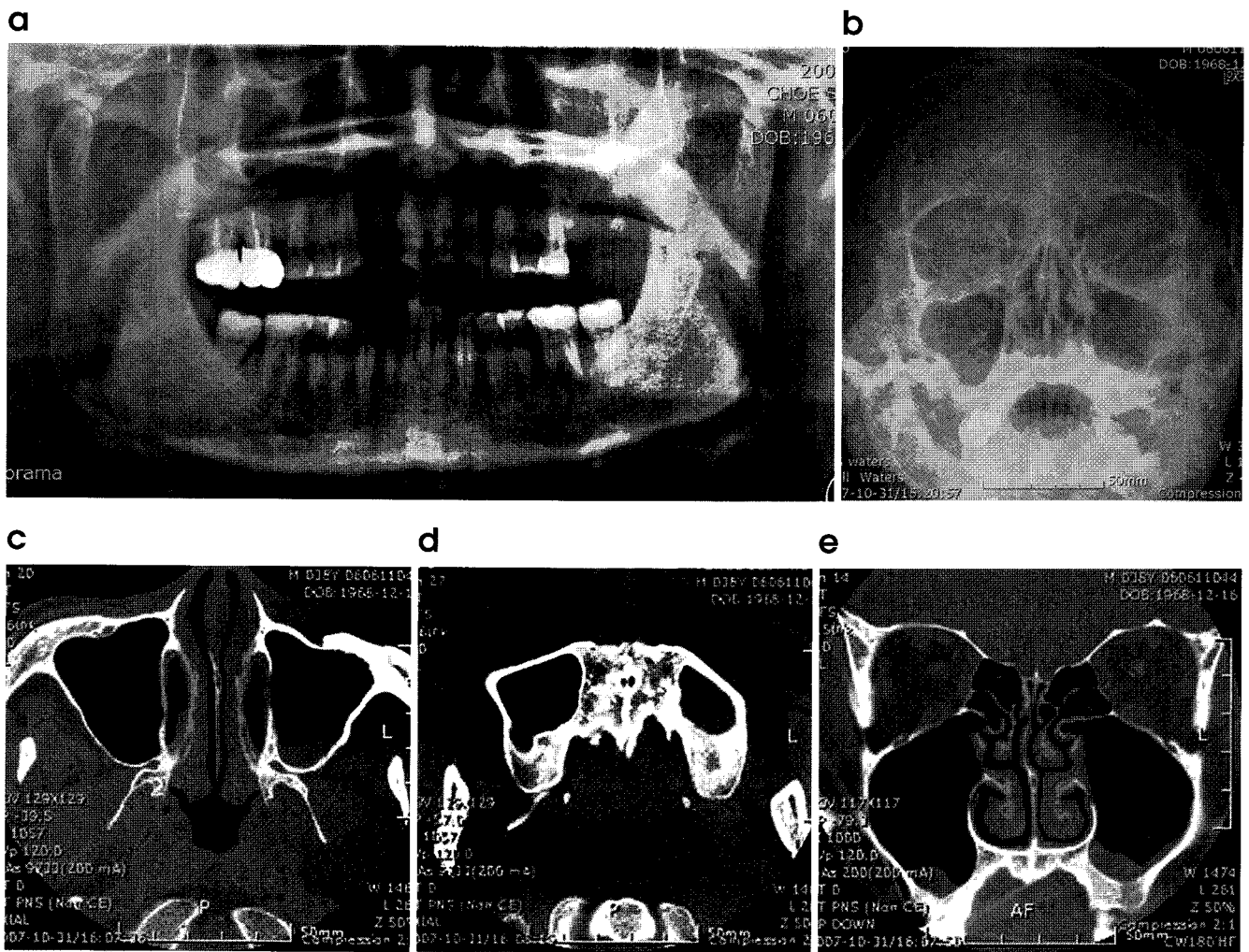


Fig. 3. (a) Left maxillary sinus shows upper and lower radiopacity in panoramic view; (b) Mucosal thickening of lower part of left maxillary sinus in Waters' view; (c), (d), (e) Mucosal thickening of lower part of left maxillary sinus in CT.

graphy remains the most useful technique in coming to a specific diagnosis.

Obha¹⁰ experimentally demonstrated that most of the anterior and posterior walls of the maxillary sinus are superimposed upon the medial wall in the pantomogram. The anterior wall occupies the lateral third of the maxillary sinus. Anterior, posterior, and medial walls do not appear as anatomic landmarks on the pantomogram. Later Obha et al.¹¹ experimentally demonstrated that the bony defects in the mediosuperior and medioinferior regions of the posterior wall of the maxillary sinus were readily detected by panoramic radiography, but those in the laterosuperior or centre were not. Perez and Farman¹² showed that the panoramic dental radiographs detected simulated radiopaque lesions more frequently than periapical and occlusal techniques tested, but generally distorted the position of the defect and consistently did not reveal radiolucent

defects. Computerized tomography proved to be the most accurate technique used in detection of simulated lesions on all the surfaces of the maxillary sinus.

In 1976, Obha¹³ concluded panoramic radiography was found to be a better radiologic approach than the Water's projection for the detection of cyst-like densities in the maxillary sinus, cloudiness of the maxillary sinus and sclerotic change of adjacent bony structures were better demonstrated on the Water's view, and these two techniques supplement each other and both should be used in order to obtain a more accurate diagnosis of maxillary sinus disease. Later in 1990, he experimentally demonstrated a mass with a diameter of 10 mm situated on the posterior wall or floor of the maxillary sinus was shown better by panoramic radiography.¹⁴ The Waters' projection was less effective; the mass, especially on the floor of the sinus, was not clearly demonstrated due to superimposition of the maxil-

lary molar teeth.

In this study, among the 73 (66.4%) sinuses in panoramic radiography which showed full agreement with CT, 42 sinuses were radiolucent and 30 sinuses were radiopaque, and 1 had upper radiolucency with lower radiopacity. Among the 11 sinus which had same upper and lower radiodensity but inconsistent with those of CT, 5 sinuses were radiolucent and 6 were radiopaque. The cause of inconsistency were presence of septa, mucosal thickening, cyst or smaller size including post-operative changes. The main cause of upper inconsistency in 11 of 26 sinuses which had different upper and lower radiodensity was overlapping of inferior nasal concha over the sinus in panoramic radiography. The 15 sinuses which showed inconsistent lower radiodensity included cyst or fluid which always appeared as radiopaque shadow in CT but not always in panoramic or Waters' projections. Conclusively the panoramic radiography showed 90.0% of the sinus conditions fully or partially which may appear less accurate than that of Water's view (95.5%) but with more detailed information of the inferior part of sinuses.

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