

# RETROSPECTIVELY COMPARISON OF NASAL SEPTUM AND MAXILLARY SINUS RADIOLOGICAL FINDINGS IN CONE BEAM COMPUTED TOMOGRAPHY AND PANORAMIC RADIOGRAPHY

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## ABSTRACT

**Objective:** The aim of this study is to compare panoramic radiography and cone beam computed tomography (CBCT) for visibility of maxillary sinus retention cyst, septa, Haller cell and nasal septum deviation.

**Material and Method:** A total of 588 maxillary sinus and 294 nasal septum of 294 patients with both panoramic radiography and CBCT images were evaluated. The presence of Haller cell, maxillary sinus septa, retention cyst and nasal septum deviation were evaluated first in CBCT images and then panoramic radiography and recorded. With the data obtained, the two methods were compared by using Chi-square test.

**Results:** Statistically significant difference was found when the frequency of Haller cell, maxillary sinus septa and nasal septum deviation seen on panoramic radiography was compared with CBCT ( $p<0.05$ ). No statistical difference was found when the frequency of retention cyst seen on panoramic radiography was compared with CBCT ( $p>0.05$ ).

**Conclusion:** While panoramic radiography was found to be insufficient in the radiological evaluation of Haller cell, maxillary sinus septum and nasal septal deviation, it was found to be close to CBCT in the evaluation of retention cyst.

**Keywords:** Cone beam computed tomography, panoramic radiography, nasal septum, Haller cell, septa.

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# KONİK IŞINLI BİLGİSAYARLI TOMOGRAFI VE PANORAMİK RADYOGRAFİDE NAZAL SEPTUM VE MAKSİLLER SİNÜS RADYOLOJİK BULGULARININ RETROSPEKTİF OLARAK KARŞILAŞTIRILMASI

## ÖZET

**Amaç:** Bu çalışmanın amacı panoramik radyografi ve konik ışınli bilgisayarlı tomografi (KIBT)'yi maksiller sinus retansiyon kisti, septa, Haller hücresi ve nazal septum deviasyonunun görülebilirliği için karşılaştırmaktır.

**Materyal ve Metot:** Toplamda 294 hastaya ait 558 maksiller sinus ve 294 nazal septum panoramik radyografi ve KIBT görüntüsü değerlendirildi. Haller hücresi, maksiller sinus septası, retansiyon kisti ve nazal septum deviasyonu varlığı önce KIBT görüntülerinde daha sonra panoramik radyografide değerlendirildi ve

kaydedildi. Elde edilen veriler ile bu iki yöntem ki-kare testi kullanılarak karşılaştırıldı( $p<0,05$ ).

**Bulgular:** Panoramik radyografide görülen haller hücresi, maksiller sinus septası ve nazal septum deviasyonu görülme sıklığı KIBT ile karşılaştırılınca istatistiksel olarak anlamlı farklılık bulundu( $p<0,05$ ) Panoramik radyografide görülen retansiyon kisti görülme sıklığı KIBT ile karşılaştırılınca istatistiksel olarak anlamlı farklılık bulunmadı ( $p>0,05$ ).

**Sonuç:** Haller hücresi, maksiller sinus septası ve nazal septumun radyolojik olarak değerlendirilmesinde panoramik radyografi yetersiz iken, bu yöntemin retansiyon kisti değerlendirmesinde KIBT'ye yakın olduğu bulundu.

**Anahtar kelimeler:** Konik ışınli bilgisayarlı tomografi, panoramik radyografi, nazal septum, Haller hücresi, septa.

## INTRODUCTION

Panoramic radiography is a practical technique used in the imaging of a large area such as mid-face bones (nasal cavity, orbita and maxillary sinus) and teeth.<sup>1</sup> However, panoramic radiography has some disadvantages such as superimposition of anatomic structures, undesired magnifications and lacking cross-sectional assessment.<sup>2</sup> Computed tomography (CT) is considered as the golden standard in the assessment of paranasal sinus.<sup>3,4</sup> However, due to its advantages such as low radiation dose, high resolution and low scanning time, cone beam computed tomography (CBCT) can be used as an alternative to CT in paranasal sinus imaging.<sup>3,5</sup> CBCT, which has a continually increasing use for 3 dimensional imaging in maxillofacial radiology, was first introduced in 1998.<sup>6</sup> There are studies conducted by using panoramic radiography and CBCT images of the pathology and anatomic variations of maxillary sinus.<sup>1,4,7-18</sup> Of these variations, Haller cells occur with the migration of anterior ethmoid cells to the orbital floor and the base of the maxillary sinus.<sup>7</sup> In images, Haller cell is seen below the ethmoid bulla, along the maxillary sinus in the lowest part of the lamina orbitalis.<sup>19</sup> Retention cysts are dome-like opacities caused by blockage of mucus secreting glands in the maxillary sinus wall.<sup>8</sup> The cortical bone protrusions that extend from the lateral or inferior walls of the maxillary sinuses to the sinus are called septa.<sup>20</sup> Nasal septum showing a tilt in coronal section images according to midsagittal line is considered as nasal septum deviation.<sup>21</sup>

The aim of this study is evaluate the visibility of maxillary sinus retention cyst, septa, Haller cell and nasal septum deviation by comparing panoramic radiography and CBCT, which are two commonly used methods in dentistry.

## MATERIAL AND METHODS

This retrospective study was approved by İnönü University Scientific Research and Publication Ethics Committee (2019/5-14).

## Sample

In our study, 588 maxillary sinus and 294 nasal septum of 294 patients were evaluated. CBCT and panoramic radiography images in the archives of oral and maxillofacial radiology department were evaluated. In this department, generally a panoramic radiography assessment is first made in patients who refer for the first time. If panoramic radiography is insufficient, CBCT scanning is made and evaluated for cases that require more detailed imaging. Since an appointment in three weeks is given at the latest for CBCT scanning, most of the patients with CBCT image have panoramic images of three weeks ago. The study was carried out by reaching the archive panoramic images of patients with field of view (FOV) width CBCT image including the study area. It was considered as sufficient to be able to see the nasal cavity, all the walls of maxillary sinus and infundibulum as the study area. Exclusion criteria were pathology related with maxillary sinus, presence

of fibrous dysplasia, dental implant and images which did not have sufficient clarity.

### Imaging Procedure

Panoramic radiography images obtained by using Planmeca Proline XC (Helsinki, Finland) were used. Scanning time was 18s, kVp was 66 and mA was 5. Images of the patients were taken when they were standing at ski position. Panoramic radiographies were evaluated by using Romexis software program. Newtom 5G (Verona, Italy) was used to obtain CBCT images. Images were taken with maximum 20 mA, standard 110 kVp exposure factors with cone beam technique. The images were taken when the patients were in supine position, with the Frankfort plane perpendicular to the ground. Scanning period was 18 seconds, while the exposure period was 3,6 seconds. Images with a FOV width of 18 × 16 or 15 × 12 centimetre and a voxel value of 0.3, 0.25 and 0.2 mm were used. CBCT images were evaluated by using coronal sections and multiplanar reformat (MPR) images. CBCT images were evaluated by using New Tom (NNT) software.

### Image Evaluation

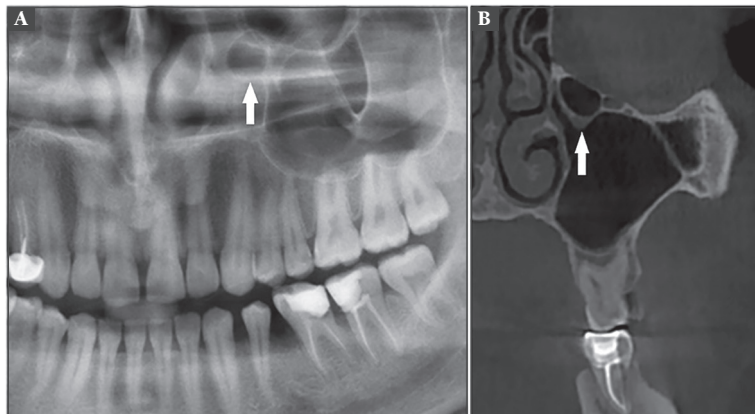
The images were evaluated by two experienced oral radiologist (CBCT and panoramic). When there was a disagreement between these two oral radiologists, the opinion of a third experienced oral radiologist was taken. Panoramic radiographies were evaluated first. Two week waited for eliminate of memorial bias. Later, CBCT images were evaluated. The examiners were blinded out to patient information.

Air cells located below the ethmoid bulla, on the maxillary sinus roof, at the base of the orbital and within ethmoid infundibulum were considered as Haller cells (Figure 1). Cortical bone protrusion extending from inferior or lateral wall to maxillary sinus was considered as septa (Figure 2).

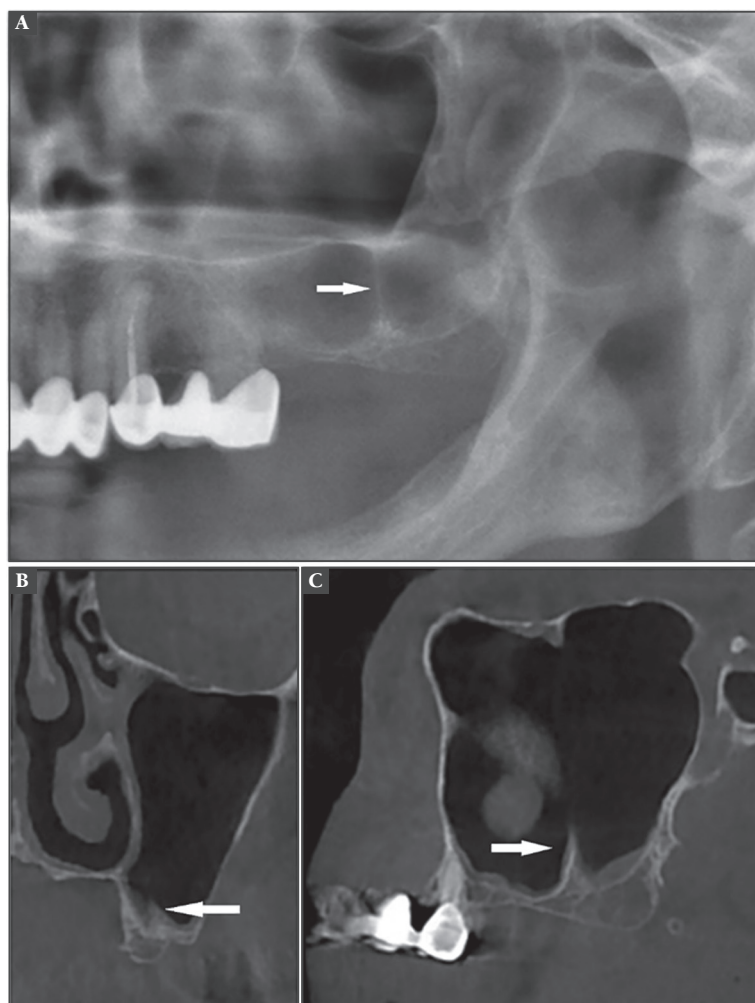
Dome-like opacifications in the maxillary sinus were considered as mucous retention cyst (Figure 3). Any tilt in the nasal septum was considered as deviation (Figure 4).

### Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS), version 20.0. Chi-square test was used to determine the differences between the groups ( $p < 0.05$ ).



**Figure 1.** Cropped panoramic radiography (A) and coronal CBCT image (B) show a Haller cell (arrow).

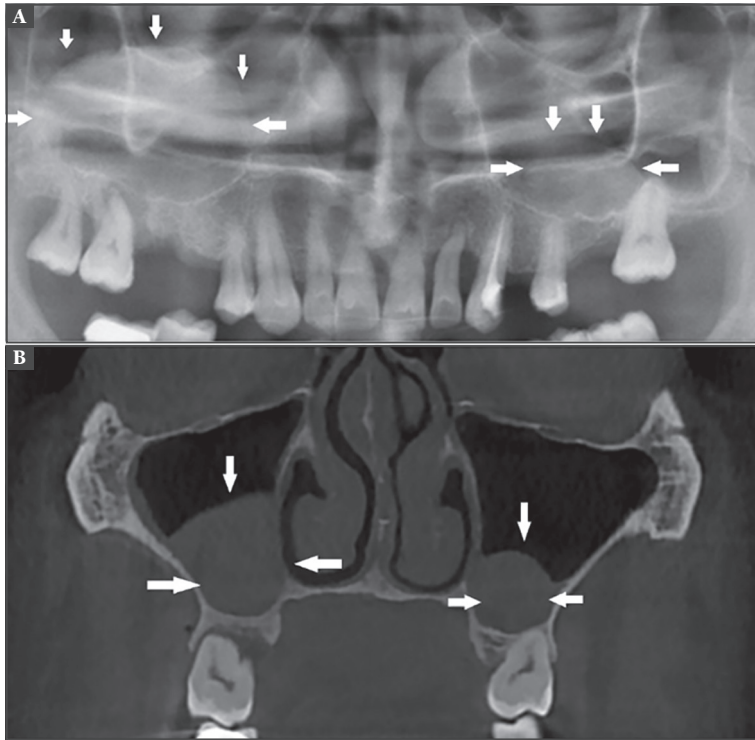


**Figure 2.** Cropped panoramic radiography (A), coronal (B) and sagittal CBCT image (C) show a maxillary sinus septa (arrow).

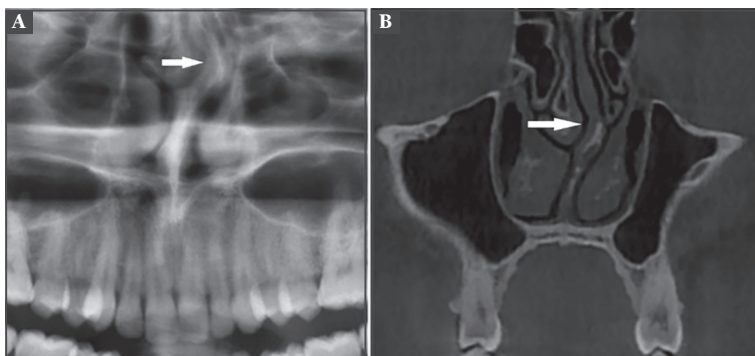
### RESULTS

162 (55.1%) of the 294 patients included in the study were female, while 132 (44.9%) were male. The patients were between 19 and 83 years old and the average value was  $36.63 \pm 13.87$ . While Haller cell was found in 162 (27.6%) images with panoramic radiography, it was found in 197 (33.5%) images with

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**Figure 3.** Cropped panoramic radiography (A) and coronal CBCT image (B) show bilateral retention cysts (arrow).



**Figure 4.** Cropped panoramic radiography (A) and coronal CBCT image (B) show a nasal septal deviation (arrow).

CBCT. Significant difference was found in the statistical comparison of panoramic radiography and CBCT methods for detectability of Haller cell (Table,  $p=0.027$ ).

While maxillary sinus septum was found in 147 (25%) images with panoramic radiography, it was found in 305 (51.9%) images with CBCT. Significant difference was found in the statistical comparison of panoramic radiography and CBCT methods for detectability of maxillary sinus septum (Table,  $p<0.001$ ).

While retention cysts were found in 152 (25.9%) images with panoramic radiography, it was found in 163 (27.7%) images with CBCT. No significant difference was found in the statistical comparison of panoramic radiography and CBCT methods for detectability of retention cyst (Table,  $p=0.469$ ).

While nasal septum deviation was found in 128 (43.5%) images with panoramic radiography, it was found in 216 (73.5%) images with CBCT. Significant difference was found in the statistical comparison of panoramic radiography and CBCT methods for detectability of nasal septum deviation (Table,  $p<0.001$ ).

## DISCUSSION

The present study evaluated whether Haller cell, maxillary sinus septum, retention cysts and nasal septum deviation could be detected correctly with panoramic radiography. This evaluation was made by comparing the panoramic radiography images and CBCT images of the same patient. In recently published guidelines, it has been stated that CBCT is an appropriate technique in detecting maxillary sinus peripheral anatomy and pathology.<sup>22,23</sup> In a recent study which compared panoramic radiography and CBCT in maxillary sinus area, CBCT was considered as the golden standard and CBCT has been stated to be reliable in this area.<sup>24</sup> In the general radiological evaluation of orofacial complex, panoramic radiography is the most commonly used two-dimensional imaging tool used by many dentists.<sup>25</sup> Panoramic radiographies have some limitations that can cause misdiagnosis such as superimposition formation, distortion and magnification.<sup>25</sup> However, in literature, there are studies about maxillary sinus area conducted only with panoramic radiography.<sup>7,9,12,13,15</sup>

Haller cells can cause symptoms such as orofacial pain, sinusitis, nasal obstruction, nasal respiratory problems, headache, mucocoeles and cough. In studies conducted with panoramic radiography, the incidence of Haller cells has been found as 10%-38.2%.<sup>7,9</sup> In studies conducted with CBCT, the incidence of Haller cells has been found as 23.6-68%.<sup>10,11</sup> In our study, while the incidence of Haller cells was found as 27.6% in panoramic radiography, it was found as 33.5% with CBCT. Statistically significant difference was found between these two values. As a result of the studies they conducted, Solanki and Raina stated that Haller cells could be seen clearly in panoramic graph.<sup>12,13</sup> However, the results of our study showed that panoramic graph was insufficient in showing Haller cells when compared with CBCT.

Septas extending within maxillary sinus have clinical importance for dental implants to posterior region. Studies conducted have compared the incidence of maxillary sinus septum in CT, CBCT and panoramic radiography. In their comparative study, Alkurt *et al.* found the frequency of detecting septa with panoramic radiography as 23.1% and as 29.8% with

CBCT and there was statistical difference between these values.<sup>14</sup> Kasabah *et al.* found the incidence of septa as 26.5% in panoramic graph and as 35.9% in CT, while Maestre Ferrin *et al.* found this rate as 53.3% in panoramic graph and as 70% in CT.<sup>26,27</sup> In our study, while the incidence of septa was 25% in panoramic radiography, it was found as 51.9% in CBCT. Statistically significant difference was found between these two values. Although Lang and Schulze stated that panoramic radiography could be used for septa assessment, it has been concluded in our study and other studies that panoramic radiography is not a suitable method in septa assessment.<sup>14,24,26,27</sup>

Retention cysts are asymptomatic lesions of the maxillary sinuses filled with mucus and they are mostly noticed in radiographic examinations and they don't require treatment. If maxillary sinuses grow large enough to block the maxillary sinus ostium, they can cause symptoms.<sup>28</sup> The presence of retention cyst is not an obstacle to sinus lift operation for implant surgery.<sup>29</sup> However, clinical and radiological examination is required to differentiate it from other pathologies that require treatment such as mucosal thickening and polyp.<sup>30</sup> The incidence of retention cyst has been found as 2-13% in studies conducted with panoramic radiography.<sup>15,16</sup> The incidence of retention cyst has been found as 2.9-20.5% in studies conducted with CBCT.<sup>17,18</sup> In our study, while the incidence of retention cyst was found as 25.9% in panoramic radiography, it was found as 27.7% in CBCT. No statistically significant difference was found between these two values. According to this result, the use of panoramic radiography can be safe in taking the images of retention cyst.

Nasal cavity consists of several anatomical formations and septum supports these nasal structures. As a result of nasal septal deviation, clinical problems can occur such as snoring, esthetical problems, airway resistance development and congestion.<sup>31</sup> To the best

**Table.** Comparison of haller cell, septa, retention cyst and nasal septal deviation between radiographic techniques.

	Panoramic n(%)	CBCT n(%)	p value	X <sup>2</sup> value
Haller cell	162(27.6)	197(33.5)	0.027	4.91
Maksillary sinus septa	147(25)	301(51.9)	p<0.001	89.71
Retention cyst	152(25.9)	163(27.7)	0.469	0.525
Nasal septal deviation	128(43.5)	216(73.5)	p<0.001	54.24

CBCT: Cone beam computed tomography

of our knowledge, there are no studies in literature related with nasal septum evaluation in panoramic radiography. Nasal septum deviation was evaluated in panoramic radiography for the first time in this study. The incidence of nasal septum deviation has been found as 12.6-73.7% in studies conducted with CBCT.<sup>4,17</sup> In our study, while the incidence of nasal septum deviation was found as 43.5% in panoramic radiography, it was found as 73.5% in CBCT. Statistically significant difference was found between these two values. According to the results of our study, panoramic radiography was found to be insufficient in showing nasal septal deviation when compared with CBCT.

The limitations of this study can be the absence of size measurements of Haller cell, retention cysts and maxillary sinus septas and the absence of exact locations of septa and retention cysts. However, this study presents significant results in terms of oral radiology and forensic medicine.

## CONCLUSION

The results of this study showed that panoramic radiography is insufficient in radiological examination of Haller cell, maxillary sinus septum and nasal septal deviation, while it is close to CBCT in radiological imaging of maxillary sinus retention cyst.

\*The authors declare that there are no conflicts of interest.



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