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EVALUATION OF RELATIONSHIP BETWEEN MAXILLARY SINUS PATHOLOGIES AND OSTIUM DIMENSION: A RETROSPECTIVE CONE BEAM COMPUTED TOMOGRAPHY STUDY

Maksiller Sinüs Patolojileri ile Ostium Boyutları Arasındaki İlişkinin Araştırılması: Bir Retrospektif Konik Işınlı Bilgisayarlı Tomografi Çalışması

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ABSTRACT

Objective: Maxillary sinus ostium is the top section of the medial wall the and is hence poorly placed from the point of view of free drainage; it opens into the narrow ethmoidal infundibulum, inflammation of which can further break drainage, so this may cause in the development of chronic maxillary sinusitis. This study aims to evaluate maxillary sinus pathologies (MSP) and their possible relation with maxillary sinus ostium dimensions.

Material and Methods: Cone Beam Computed Tomography (CBCT) scans which belong to 139 patients (52 male and 87 female) were retrospectively evaluated with regard to ostium dimensions and the presence of MSP including retention cyst and mucosal thickening. Independent Samples t-test and Pearson Chi-Square were used to for statistical analysis.

Results: No statistically significant difference was observed between patients with and without MSP in terms of ostium width (p=0.13). While the mean ostium width was 2.08 mm in the patient with MSP it was measured as 2.14 mm in patients without MSP. For all patients examined, right and left ostiums mean widths were 1.97 mm (Range 0.67-4.25) and 2.26 mm (Range 0.67-5.25), respectively. No significant difference was observed in ostium width according to gender (p≥0.05). Among all patients, 18.7% (n=26) had MSP; of these 10 were bilateral and 16 were unilateral.

Conclusion: MSP is the common finding in CBCT examinations and the results of this study showed that MSP does not seem to be associated with the ostium width.

Keywords: *Maxillary sinus, Cone Beam Computed Tomography, maxillary sinus ostium, pathology*

ÖZ

Amaç: Maksiller sinüs ostiumu sinüs medial duvarının en üst kısmıdır ve bundan dolayı yerleşimi drenaj açısından zayıftır. Bununla birlikte nazal fossaya direk açılmayıp, dar etmoidal infindibuluma açılır ki drenajı kesintiye uğratan enflamasyon kronik maksiller sinüzit gelişiminde rol oynar. Bu çalışmanın amacı maksiller sinüs patolojilerini (MSP) ve bu patolojilerin maksiller sinüs ostium boyutlarıyla olası ilişkilerini araştırmaktır.

Gereç ve Yöntemler: 139 hastaya ait (52 erkek ve 87 kadın) Konik Işınlı Bilgisayarlı Tomografi (KIBT) görüntüleri ostium boyutları ve retansiyon kisti ile mukozal kalınlaşmayı içeren MSP varlığı açısından retrospektif olarak değerlendirildi. Bağımsız Örneklem T-Testi ve Pearson Ki-Kare testi istatistiksel analiz aşamasında kullanıldı.

Bulgular: MSP olan ve olmayan hastalar arasında ostium genişliği açısından istatistiksel bir farklılık görülmedi (p=0.13). MSP olan hastalarda ortalama ostium genişliği 2.08 mm iken, MSP olmayanlarda ortalama genişlik 2.14 mm olarak ölçüldü. İncelenen tüm hastalarda sağ ve sol ostium genişlik ortalamaları sırasıyla 1.97 mm (Aralık 0.67-4.25) ve 2.26 mm (Aralık 0.67-5.25) olarak bulundu. Cinsiyete göre ostium genişliği açısından istatistiksel farklılık görülmedi (p≥0.05). Tüm hastalar arasında %18.7 (n=26) hastada MSP izlenirken, bunlardan 10 tanesi çift taraflı, 16 tanesi ise tek taraflıdır.

Sonuç: MSP, KIBT araştırmalarında en yaygın bulgu olup, bu çalışmanın sonuçları göstermektedir ki MSP ile ostium genişliği ilişkili bulunmamıştır.

Anahtar Kelimeler: *Konik Işınlı Bilgisayarlı Tomografi, maksiller sinüs, maksiller sinüs ostiumu, patoloji*

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INTRODUCTION

The ostium of maxillary sinus is located on the highest part of the medial wall of the sinus and improper mucociliary activity of the mucosa in the maxillary sinus which is in charge of poor free drainage and it opens into the narrow ethmoidal infundibulum instead of direct opening into the nasal mucosa, so the inflammation of its adjacencies area can further hamper drainage (1,2). Capelli and Gatti reported the amount of mucosal thickening associated with maxillary sinus inflammation and then confirmed its potential correlation with common anatomical variants (Haller cell, concha bullosa, maxillary accessory ostium, etc). After all, they introduced the relationship between thickening of the sinus mucosa and obstruction of the maxillary ostium (3). Radiographically, the healthy maxillary sinus has many loci and lobulations with clearly defined margins. As it is air filled, the sinus seems radiolucent. In the event of a diseased sinus, a clinician may see clouding (opacifying), mucosal thickening, and/or accumulation of fluid (4). The prevalence of mucosal thickening and cystic lesion occurrence for maxillary sinus have been reported at 27% and 9%, respectively (5). In order to investigate symptomatic pathologic conditions of the maxillary sinus, panoramic radiographs are widely used and obtainable. In panoramic radiographs, not every area in field of view is correctly identified and allocated. In addition to that, the lesions with diameter less than 3 mm indicate poor detection rates in maxillary sinus (6).

CBCT has been widely used in recent years with low-dose radiation and high resolution in dentomaxillofacial area. (7). Also CBCT scans provide a considerably valuable diagnostic and clinical tool for maxillary sinus pathologies as well as for anatomical variations (8).

The aim of this retrospective study is to evaluate maxillary sinus pathologies and their possible relation with maxillary sinus ostium dimensions by using CBCT.

MATERIALS AND METHODS

We designed a retrospective study comprising of the images of 139 patients (52 male and 87 female) who visited Bolu Abant İzzet Baysal University, Dentistry Faculty between the years 2015 and 2017. Approval was obtained from the Bolu Abant İzzet Baysal University Faculty of Medicine Ethics Council (Date: 28.12.2017; number: 2017/194). The age of the study population was ranged between 15 and 25 years, with the mean age of 19.7 ± 4.2 years. CBCT scans had been prescribed for various reasons such as implant planning, third molar extraction, orthodontic treatment etc. Scans involving maxillary sinuses and maxillary sinus ostium were reviewed searching for MSP and ostium width. Poor quality images and unsuitable field of view for detection of MSP and for the measurement of ostium were excluded. The maximum dimension of ostium width was measured on the coronal image. The ostium widths were evaluated according to gender and MSP.

CBCT scans were obtained using I-Cat (Imaging Sciences International, Hatfield, PA, USA). 120 kVp, 15 mA, 16x7 mm FOV were imaging parameters. The images were examined by one investigator (experience of 10 years in Dentomaxillofacial Radiology). 0.3 mm slices in the axial planes, 1 mm slices in sagittal planes and 1 mm slices in the coronal planes if necessary panoramic images were reconstructed for the estimation of MSP. For calibration and evaluation of intraexaminer reliability randomly selected 20 CBCT images were measured twice with 10 days interval. All measurements were repeated after 2 weeks by the same investigator, and the mean of the 2 measurements was used in the statistical analysis. Independent Samples t-test and Pearson Chi-Square tests were applied to compare groups means and to determine the statistical significance of group differences. The significance level was set at $p>0.05$.

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RESULTS

When we examined the association of ostium width and MSP, no statistically significant difference was found between patients with and without MSP according to ostium width (p=0.13). While the mean ostium width was 2.08 mm in the patient with MSP it was measured as 2.14 mm in patients without MSP.

For all patients evaluated, right and left ostiums mean widths were 1.97 mm (range 0.67-4.25) and 2.26 mm (range 0.67-5.25), respectively (Table 1).

No statistically significant difference was observed in ostium width according to gender ($p \geq 0.05$) (Table 2).

Among the patients, 18.7% (n=26) had MSP, of these 18 were bilateral and 8 were unilateral and 20 (7.1%) had retention cyst, 24 (8.6%) had mucosal thickening.

Table 1: Descriptive Statistics of Right and Left Ostium Dimensions

	N	Minimum	Maximum	Mean	Std. Deviation
Right Ostium	139	0.67	4.25	1.97	0.70
Left Ostium	139	0.67	5.25	2.26	0.75
Total	278	0.67	5.25	2.12	0.74

Table 2: Right and Left Ostium Descriptive Statistics According to Gender.

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
Right Ostium	Male	52	1.95	0.71	0.09	0.90	3.84
	Female	87	1.99	0.70	0.07	0.67	4.25
	Total	139	1.97	0.70	0.05	0.67	4.25
Left Ostium	Male	52	2.18	0.78	0.10	0.90	3.71
	Female	87	2.31	0.73	0.07	0.67	5.25
	Total	139	2.26	0.75	0.06	0.67	5.25

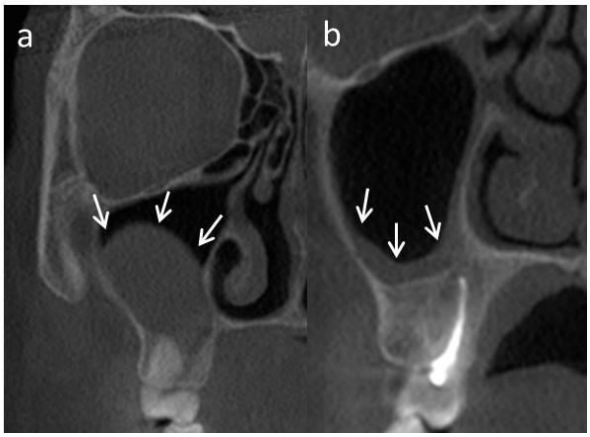

Figure 1. Examples of maxillary sinus pathologies are demonstrated in coronal CBCT images with white arrows a) Retention cyst b) Mucosal thickening

DISCUSSION

Radiography is frequently used to diagnose the maxillary sinus diseases. Maxillary sinus can be visualized on the panoramic radiograph, Water's view, computed tomography, magnetic resonance imaging and CBCT (1). CBCT is commonly used for the paranasal sinuses in maxillofacial area that provides some advantages like the lower dose compared with CT. Furthermore, CBCT presents an isotropic voxel size allow diagnosis of complex structures in multiplanar reconstructions (9). Da Silva et al

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evaluated the floor of 1000 maxillary sinuses in terms of pathologic finding using CBCT (10).

The result of the study showed that mucosal thickening was the most commonly found alteration (37.5% of examined sinuses), followed by mucous retention pseudocyst (7.1%). In the current study contrary to Da Silva et al mucosal thickening ratio was found quite lower (37.5%) (10).

Aksakallı et al researched the relationship between maxillary sinus pathological signs and skeletal malocclusion based on CBCT (11). The results exhibited that there was no relationship between the skeletal malocclusion and sinus pathologies. Nevertheless, there were significant differences in the maxillary sinus membrane thicknesses between the groups. Previous studies have also reported that seasonal variations may be related to increased number of sinus membrane pathologies (12,13). Odontogenic infections and periodontal problems may also induce an inflammatory process in the adjacent sinus membrane and are stated to cause 58% to 78% of sinus mucosal thickening (14,15). When the membrane becomes thinner or thicker, the perforation rate is increased (16). Vallo et al determined a prevalence of mucosal changes in the maxillary sinus of 7% for polypoidal mucosal thickening and 12% for mucosal thickening in 5021 samples panoramic radiographs. In the present study mucosal thickening was found as 8.6% (15). Yıldırım et al investigated the prevalence of maxillary sinus pathologies in relation to gender (17). Their results showed a significant association between gender and mucosal thickening and mucosal appearance. Also, the authors estimated that mucosal abnormalities were more prevalent in male patients with the ratio of 39.7%. In return, Patel et al found no difference between the genders (5). In the Yeung et al study, in 40 sinuses (12.9%) retention cysts were detected (18). The mean dimension of the mucous retention cysts was 6.28 ± 2.93 mm. In our study, the ratio of mucous retention cysts in maxillary sinus was found 7.1%.

Khojastepour et al concluded that the relationship between mucosal thickening of the maxillary sinus and size of the sinus ostium was not statistically significant (19). This result exhibits that maxillary sinusitis may be a primary condition rather than a condition originating from mechanical obstruction of the sinus ostium. In line with Khojastepour et al when we examined the ostium width, no statistically significant difference was observed between patients with and without MSP (19). In another research by Zang et al it was shown that the increase of the ostium diameter of the maxillary sinus did not affect the sinus temperature and ventilation (20). It provides a reference for quantification of clinical endoscopic maxillary sinus surgery.

In the current research, the relationship between ostium dimension and the maxillary sinus pathologies were investigated. In conclusion, the results of this study confirmed that although MSP is a common finding in CBCT examinations it does not seem to be associated with the ostium width. Further research is necessary to better understand and confirm our results.

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