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The Effects of Nasal Septum Deviation on Ocular Examination Findings: Does Deviated Nasal Septum Cause Impaired Vision?

Nazal Septum Deviasyonunun Göz Muayenesi Bulgularına Etkileri: Nazal Septum Deviasyonu Görme Bozukluğuna Sebep Olur mu?

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ABSTRACT

Aim: Nasal obstruction due to nasal septum deviation is associated with systemic diseases such as cardiopulmonary disease, neurological and vascular problems. But the effect of pure nasal deviation on the ocular system has not been precisely investigated. The aim of this study was to analyze the association of nasal septal deviation with ocular examination findings.
Material and Methods: Twenty-seven adult patients underwent septoplasty and 31 controls were included in the study. The study group was conducted on patients with pure nasal septum deviation which is significantly obstructing the nasal airway (>50%). In ophthalmological examination; peripapillary retinal nerve fiber layer, macular and choroidal thickness measurements were obtained. The examination findings were compared between the study and control groups.
Results: The mean macular thicknesses at nasal-500µm were 305.89±32.79 and 287.87±25.00 in the study and control groups, respectively (p=0.021). The mean macular thicknesses at nasal-1000µm were 353.04±21.28 and 341.16±17.97 in the study and control groups, respectively (p=0.025). The mean thickness of choroid was statistically significantly different at central (p=0.036) and peripheral measurements; nasal-500µm (p=0.020); nasal-1000µm (p=0.001); nasal-1500µm (p<0.001); temporal-500µm (p=0.023) and temporal-1000µm (p=0.045). No statistically significant difference was found between the two groups according to ocular tension, thickness of cornea, keratometry, anterior chamber depth, axial length of cornea, and retinal nerve fiber layer thickness.
Conclusion: This is one of the pioneer studies evaluating the ocular examination findings in patients with nasal septum deviation. Our results indicate the increased thickness of both macula and choroid in patients with nasal septum deviation.
Keywords: Nasal septum deviation, macular thickness, choroid thickness, ocular asymmetry.

ÖZ

Amaç: Nazal septum deviasyonuna bağlı burun tıkanıklığı, kardiyopulmoner hastalık, nörolojik ve vasküler problemler gibi sistemik hastalıklar ile ilişkilidir. Ancak saf nazal deviasyonun oküler sistem üzerindeki etkisi tam olarak araştırılmamıştır. Bu çalışmanın amacı nazal septal deviasyonun oküler muayene bulguları ile ilişkisini incelemektir.
Gereç ve Yöntemler: Bu çalışmaya septoplasti yapılmış olan 27 yetişkin hasta ve 31 kontrol dahil edildi. Çalışma grubu nazal hava yolunda ciddi bir şekilde tıkanıklık (>50%) oluşturan sadece nazal septum deviasyonlu hastalar ile oluşturuldu. Göz muayenesinde; perifer retina sinir lifi tabakası, makuler ve koroid kalınlık ölçümleri elde edildi. Muayene bulguları çalışma ve kontrol grupları arasında karşılaştırıldı.
Bulgular: Çalışma ve kontrol gruplarında nazal-500µm'deki ortalama makula kalınlıkları sırasıyla 305,89±32,79 ve 287,87±25,00 idi (p=0,021). Nazal-1000µm'deki ortalama makula kalınlıkları çalışma ve kontrol gruplarında sırasıyla 353,04±21,28 ve 341,16±17,97 idi (p=0,025). Ortalama koroid kalınlığı santral (p=0,036) ve periferal ölçümlerde; nasal-500µm (p=0,020), nazal-1000µm (p=0,001), nasal-1500µm (p<0,001), temporal-500µm (p=0,023) ve temporal-1000µm (p=0,045) istatistiksel olarak anlamlı şekilde farklıydı. Oküler tansiyon, kornea kalınlığı, keratometri, ön kamara derinliği, kornea aksiyel uzunluğu ve retina sinir lifi tabakası kalınlığı açısından iki grup arasında istatistiksel olarak anlamlı bir farklılık bulunmadı.
Sonuç: Bu çalışma nazal septum deviasyonu olan hastalarda oküler muayene bulgularını değerlendiren öncü çalışmalardan biridir. Sonuçlarımız, nazal septum deviasyonu olan hastalarda hem makula hem de koroid kalınlığının arttığını göstermektedir.
Anahtar kelimeler: Nazal septum deviasyonu, makuler kalınlık, koroid kalınlık, oküler asimetri.

INTRODUCTION

Nasal obstruction is one of the most common complaints in otolaryngology practice. Nasal obstruction might be associated with many different factors such as; nasal septum deviation (NSD), turbinate hypertrophy, nasal valve problems, nasal polyposis, etc. (1-4). NSD is responsible for a significant proportion of nasal obstruction problems (2,3). The literature supports the association of nasal obstruction with other system diseases such as cardiopulmonary disease, neurologic, and vascular problems. The increase of upper airway pressure secondary to upper airway obstruction (UAO) is highly associated with pulmonary hypertension and right ventricular dysfunction in both children and adult population (5). The nasal vaults account for more than 50% of total airway resistance (6). Nasal obstruction due to NSD is associated with increased resistance of the upper respiratory track, increased CO_2 concentration, and decreased O_2 saturation in arterial blood (7,8). Hypoxia and response to hypoxia may cause vasoconstriction and increase arterial resistance (4). The ocular system has a very sensitive and vulnerable blood supply and can be adversely affected by many chronic hypoxic and inflammatory processes. In the literature, the effects of chronic hypoxic conditions such as obstructive sleep apnea syndrome (OSAS) and obstructive pulmonary disease on the ocular system have been studied (9,10). But, the effect of pure nasal deviation on the ocular system has not been precisely investigated. Şahin et al. (11) in their study investigating the effects of NSD on choroidal thickness showed that the choroidal thickness decreased in patients with NSD and there was a significant increase after surgery.

In this study, we aimed to assess whole other ocular examination findings besides the choroidal thickness in patients with NSD.

MATERIAL AND METHODS

This study was conducted at the Department of Otolaryngology between June 2018 and September 2018. The study was approved by the local ethics committee (Ethics Committee of Düzce University Faculty of Medicine, dated: 18.06.2018, and numbered: 77) and all participants provided written informed consent according to the Helsinki declaration.

Twenty-seven adult patients underwent septoplasty and 31 controls were included in the study. The study group was conducted on patients with pure NSD which is significantly obstructing the nasal airway (>50%). Patients with other abnormal exam findings such as nasal turbinate hypertrophy, allergic rhinitis, or nasal polyposis were excluded from the study. The control group was randomly conducted among the patients in the otorhinolaryngology clinic who had neither nasal obstruction symptoms nor any significant nasal obstruction findings in physical examination. All participants were evaluated about comorbid diseases and the followings were accepted as exclusion criteria: 1) diabetes mellitus, 2) coronary heart disease, 3) hypertension, 4) chronic kidney disease, 5) chronic obstructive pulmonary disease (COPD), 6) diagnosed ocular diseases (such as ocular surgery, ocular trauma, anterior or posterior segment disease, glaucoma, etc.), and 7) history of snoring or witnessed apnea. A life quality questionnaire (nasal obstruction symptom evaluation, NOSE) was applied to the study group (1). We categorized the study group as does not have any significant difficulty, very mild, moderate, fairly, and severe difficulties on the NOSE index (Table 1). All participants were evaluated by experienced otolaryngology and ophthalmology physicians. The findings were recorded by the otolaryngologist: Age, gender, comorbid diseases, main complaint, duration of the main complaint, the severity of nasal obstruction, history of allergy, nasal examination, and flexible nasopharyngoscopy findings. Patients with nasal obstruction other than NSD were excluded from the study.

Oftalmological Examination

All participants underwent a complete ocular examination, including assessment of best corrected visual acuity, ocular motility, pupillary reflexes, slit-lamp biomicroscopy, intraocular pressure (IOP) measurement with Goldmann applanation tonometry, gonioscopy with three-mirror contact lenses, ultrasound central corneal thickness (CCT) measurement (Echoscan US 500; Nidek Co. Ltd, Aichi, Japan), and dilated fundus examination. Peripapillary retinal nerve fiber layer (RNFL), macular, and choroidal thickness measurements were obtained using EDI-OCT (SD-OCT; Heidelberg Engineering, Heidelberg, Germany). Ophthalmological examinations and optical coherence tomography (OCT) scans were performed by an experienced ophthalmologist unaware of the clinical information of the participants. We performed all measurements three times and used the average of the measurements for the statistical analyses.

The examination findings were compared between the study and control groups. Also, examination findings were compared according to the NOSE index.

Statistical Analyses

Normality assumption was examined with Shapiro-Wilk test. Comparison of study and control groups for continuous data were done with Independent sample t-test.

Table 1. Nasal obstruction symptom evaluation index (1)

	Not a problem	Very mild problem	Moderate problem	Fairly bad problem	Severe problem
Nasal congestion or stuffiness	0	1	2	3	4
Nasal blockage or obstruction	0	1	2	3	4
Trouble breathing through my nose	0	1	2	3	4
Trouble sleeping	0	1	2	3	4
Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

Pearson chi-square test was used to analyze categorical variables. Descriptive statistics were given with mean and standard deviation for continuous data, and with frequency and percentage for categorical data. IBM SPSS v.22 was used for statistical analyses and the statistical significance level was considered as 0.05.

RESULTS

A total of 58 participants were included in the study. There were 27 and 31 patients in the study and control groups, respectively. There were 16 (59.3%) males and 11 (40.7%) females in study group; 21 (67.7%) males and 10 (32.3%) females in control group. The mean ages of the study and control groups were 33.22±13.51 and 34.42±12.78 years, respectively (Table 2). There was no statistically significant difference between the two groups according to age (p=0.730) and gender (p=0.503). The mean duration of complaints of the patients was 3.92 years.

The mean macular thicknesses at nasal-500μm were 305.89±32.79 and 287.87±25.00 in the study and controls, respectively (p=0.021). The mean macular thicknesses at nasal-1000μm were 353.04±21.28 and 341.16±17.97 in the study and controls, respectively (p=0.025). The sub-macular choroidal thickness at all locations was thicker in the NSD group compared to the control group. The mean thickness of choroid was statistically significantly different at central (p=0.036) and peripheral measurements, nasal-500μm (p=0.020); nasal-1000μm (p=0.001); nasal-1500μm (p<0.001); temporal-500μm (p=0.023), and temporal-1000μm (p=0.045). Table 3 summarizes the ocular examination findings.

There was no statistically significant difference was found between the two groups according to ocular tension, thickness of cornea, keratometry (K1, K2), anterior chamber depth (ACD), axial length of cornea (Table 4), and RNFL thickness (Table 5).

There was no correlation between ocular examination findings and the NOSE index.

DISCUSSION

The nasal septum is an anatomic structure located in the anteroposterior direction in the nose and divides the nasal passage as left and right nares. The nasal septum has bony and cartilage components. The deviation of the nasal septum is usually associated with trauma or congenital abnormalities. The deviated nasal septum leads to breathing difficulties, headache, sleep disturbance, coronary heart diseases, and many neurologic diseases (12,13).

It is known that the nasal airway forms 50% of total airway resistance and nasal obstruction has a critical role in physiologic pulmonary ventilation. People start breathing through their mouths when nasal obstruction occurs. This situation is called “upper airway resistance” which is associated with impaired pulmonary ventilation (14). Many studies have shown that chronic nasal obstruction causes impaired pulmonary ventilation (15,16). Upper airway resistance is caused to decreased pulmonary oxygenation and increased heart/pulmonary rates. Increased breath rate doesn’t allow optimal gas exchange. Thus, deviation of the nasal septum causes upper airway resistance, hypoxia, hypercapnia, and increased intrathoracic pressure. All these changes may affect sympathetic and parasympathetic balance (17). The deviated nasal septum is strongly associated with many comorbid diseases owing to hypoventilation (4,18). The effects of chronic nasal obstruction due to NSD on the pulmonary system are similar to other chronic hypoxic situations such as OSAS and COPD.

Table 2. Demographics of study and control groups

	NSD (n=27)	Control (n=31)	p
Age (year)	33.22±13.51	34.42±12.78	0.730
Gender, (n %)			
Male	16 (59.3)	21 (67.7)	0.503
Female	11 (40.7)	10 (32.3)	

NSD: nasal septum deviation

Table 3. Thickness of macula and choroid

	NSD (n=27)	Control (n=31)	p
CM	236.85±54.02	224.87±25.44	0.298
NM-500	305.89±32.79	287.87±25.00	**0.021**
NM-1000	353.04±21.28	341.16±17.97	**0.025**
NM-1500	356.89±16.82	349.03±17.46	0.088
TM-500	297.67±24.28	291.00±19.31	0.249
TM-100	336.81±21.54	329.32±12.72	0.121
TM-1500	328.26±21.68	322.42±12.82	0.227
CC	398.15±70.74	351.32±91.76	**0.036**
NC-500	395.41±72.46	345.35±84.64	**0.020**
NC-1000	392.59±73.74	318.48±79.73	**0.001**
NC-1500	386.07±74.73	294.81±79.24	**<0.001**
TC-500	400.22±62.08	353.58±85.80	**0.023**
TC-1000	392.59±65.32	351.26±85.44	**0.045**
TC-1500	380.37±64.29	339.90±89.79	0.057

NSD: nasal septum deviation, CM: central macula, NM: nasal macula, TM: temporal macula, CC: central choroid, NC: nasal choroid, TC: temporal choroid

Table 4. Ocular examination findings

	NSD (n=27)	Control (n=31)	p
OT-Right	13.93±2.68	13.40±2.61	0.453
TC-Right	553.89±41.33	525.61±91.63	0.145
K1	43.25±1.31	43.55±1.05	0.339
K2	44.03±1.10	43.40±3.61	0.385
ACD	3.02±0.39	3.20±0.35	0.062
Axial length	22.66±0.66	22.94±0.63	0.096

NSD: nasal septum deviation, OT: ocular tension, TK: thickness of cornea. K1-K2: keratometry, ACD: anterior chamber depth

Table 5. Retinal nerve fiber layer thickness

	NSD (n=27)	Control (n=31)	p
T	71.93±8.15	70.39±11.82	0.572
TS	140.89±22.62	133.00±25.78	0.224
NS	112.07±29.97	107.77±21.98	0.532
N	82.81±16.00	81.90±24.92	0.871
NI	113.96±21.18	119.23±27.20	0.420
TI	149.81±19.57	143.61±23.22	0.280
G	103.11±10.18	101.00±9.59	0.420

NSD: nasal septum deviation, T: temporal, TS: temporal superior, NS: nasal superior, N: nasal, NI: nasal inferior, TI: temporal inferior, G: global

The association between NSD and the ocular system is understudied. Unfortunately, there is not enough data analyzing the effects of NSD on the ocular system. In our study, we found that macular and choroidal thickness was increased in the NSD group in comparison with healthy controls.

This result is very interesting and one of the pioneer studies analyzing the ocular system findings of NSD. The pathophysiology of changes in the ocular system is still unclear. However, this association might be related to increased upper airway resistance and impaired vascular compliance secondary to increased pulmonary vascular pressure. Similar pathophysiologic changes and vascular impairment were shown in OSAS (9,19). The impaired blood supply is considered as a risk factor for optic nerve functions (11). Furthermore, studies showed that the increased vascular resistance secondary to triggered renine-angiotensine arch in patients with upper airway resistance syndrome (20,21). This mechanism is also another independent pathophysiologic pathway that may play role in impaired ocular systems in patients with NSD. Bayhan et al. (22) and Xin et al. (23) reported decreased macular thickness in patients with OSAS. In contrast, Ozge et al. (24) reported increased sub-macular choroid thickness in patients with OSAS. They linked the increased macular thickness contrary to the other studies, to the younger population of their study. Microvascular change after a chronic disease is a process and takes time. Continuing vascular adaptation may change choroid blood supply and choroid structure.

The reported variable results for macular thickness might be associated with different stages of microvascular change in patients with OSAS. The mean age of our study population was 33.22±13.51 which is significantly lower than in similar studies. The mean duration of complaints of the patients was 3.92 years. The increased macular and choroid thickness in the present study may be associated with the short duration of the complaint in the younger study population and the early stage of microvascular change. We believe that our results indicate macular changes in the early stage of tissue hypoxia and hypercapnia owing to the microvascular changes. Although the mean age of the study group was low in the report by Şahin et al. (11), they found the choroid thickness decreased in the study group, but they did not give any information about the duration of the patients' complaints.

The main limitation of the current study is the lack of objective data about chronic hypoxia, hypercapnia, and systemic inflammation. We excluded participants if they have any diagnosed OSAS or potential comorbid diseased but we did not perform polysomnography tests for included patients.

CONCLUSION

This is one of the pioneer studies evaluating ocular examination findings in patients with NSD. Our results showed that macular and choroid thickness increases in patients with NSD, but the duration of symptoms may be effective on these findings. It is obvious that other studies with large numbers of patients are needed to obtain more information on this subject.

Ethics Committee Approval: The study was approved by the Ethics Committee of Düzce University Faculty of Medicine (18.06.2018, 77).

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