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The Impact of Septal Deviation on Intranasal Schirmer Test Values

Original Investigation

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Abstract

Objective: Intranasal Schirmer test serves as an objective measurement for evaluation of nasal secretion and humidity. This study aimed to evaluate the effect of septal deviation on nasal secretion and humidity by measuring the intranasal Schirmer test values in patients who had septal deviation and compare it to the values of our healthy volunteers.

Methods: The study included 52 patients with nasal septum deviation and 52 volunteers without any rhinologic complaints or deviated nasal septum. Intranasal Schirmer test was performed to all patients and volunteers for both nasal cavities.

Results: The intranasal Schirmer test values of the convex (deviated) side were lower than that of the concave (non-deviated) side (20.71 and 23.35 respectively); although this difference was not statistically significant (p=0.054,). After excluding the four patients with equal Schirmer test results on both sides, 70% (34/48) of our patients had lower intranasal Schirmer test values on the deviated side. There was no statistically significant difference between the Schirmer test values of the patients with septal deviation and the volunteers without septal deviation (p>0.05).

Conclusion: The Schirmer test values of the deviated sides were less than the values of the contralateral side in majority of our patients. This finding supports the negative effect of nasal septum deviation on nasal humidification, although the difference did not reach statistical significance.

Keywords: Intranasal Schirmer test, nasal septum, nasal secretion, measurement

Introduction

Nasal blockage is a commonly encountered symptom in otorhinolaryngology and can have several etiologies, one of which is nasal septal deviation. Nasal septal deviation is the most common anatomical cause of nasal obstruction (1, 2). Deviation of the nasal septum may alter the nasal airflow, resulting in an alteration from the normal laminar airflow to a more turbulent one. This leads to a drier mucosa, leading to recurrent epistaxis (3). However, there are only few objective ways of measuring nasal humidity and these tests require special equipment, and might occasionally cause some discomfort to the patients (4, 5).

The Schirmer test is routinely used by ophtalmologists for the evaluation of the tear production using strips of paper (6, 7). Recently, otolaryngologists have also started using Schirmer test in head and neck area. This test is useful in diagnosis of dry mouth by placement of the test strip on the floor of the mouth and quantify the distance of wetting (8). Other than salivary gland hypofunction, Lindemann et al. (7) evaluated the Schirmer test as an objective measurement tool for assessment of nasal secretion and humidity, and reported that intranasal Schirmer test can provide objective data regarding nasal humidification. They used the intranasal Schirmer test in healthy volunteers, but they did not include subjects with nasal pathologies. The aim of this study was thus to evaluate the nasal Schirmer test values in patients who had nasal septal deviation and compare it to the intranasal Schirmer test values of healthy volunteers.

Methods

The study was performed with the approval of the local ethics committee and was conducted in İstanbul Training and Research Hospital between May-August 2015. Informed consent was obtained from all individual participants included in the study.

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The study included 52 patients who had nasal septal deviation. The control group comprised of 52 volunteers who had no rhinologic symptoms and no septal deviation on physical examination. Only patients over 18 years of age who had nasal obstruction due to deviated nasal septum were included. Septal deviation was defined as the deviation of the nasal septum that was symptomatic and required septoplasty. All our subjects were patients who were scheduled for septoplasty. Patients who had a deviated nasal septum without any symptoms were excluded. Patients with a history of nasal surgery, allergy, infectious and inflammatory sinonasal disease, recent upper respiratory tract infection, systemic diseases, tobacco use, recent use of topical decongestants and/or steroids were also excluded. Detailed history was obtained and complete otorhinolaryngological examination, including nasal endoscopy after decongestion, was performed. Anterior rhinoscopy and nasal endoscopy were used to evaluate the anatomy of the nasal septum. The deviated side of the nasal septum was noted. The deviated side was referred to as "convex" side and the non-deviated side was referred to as the "concave" side. The rhinologic symptoms of the patients were also recorded.

The study population comprised of patients with nasal septal deviation and the control group comprised of 52 volunteers who had no rhinologic complaints and no pathological findings on anterior rhinoscopic and endoscopic nasal examination. These volunteers were the relatives of our patients. They were not previously informed about the study. They were not in the hospital for a health problem of their own, but they only came to the hospital to accompany their relatives who came to the hospital for an otolaryngologic problem. During the examination of the patient, the accompanying relatives without otorhinolaryngologic complaints were informed about the study and the ones who aggreed to participate and had normal otorhinolaryngologic examination findings were included in the study. Sample size was calculated via online calculator (www.surveysystem.com/sscalc.htm) with 95% confidence level and 10% margin of error, which represents a population size of 10,000.

Intranasal Schirmer test was performed to all patients and volunteers as described previously by Lindemann et al. (7). Briefly, the patients and the volunteers were requested to blow their nose 15 minutes before the nasal endoscopic examination and waited for 15 minutes where the average temperature was 22.5°C and relative humidity was 33.8%. A Whatman no 41 strip of filter paper known as Schirmer test paper (Schirmer test paper; Dr. Gerhard Mann Chem.- Pharm Fabrik GmBH, Berlin, Germany) with 1-mm intervals from 1 to 35 mm was used to perform the intranasal Schirmer test. An angle of 45° was formed by folding the strips at 5 mm distance. The folded strips were placed on the mucosa of the anterior nasal septum bilaterally during anterior rhinoscopic examination. The paper strips were placed such that the 5 mm long part was completely in contact with the anterior septal mucosa and the remaining part of the strip was extended out of the nostril (Figure 1). After 10 minutes, the wetted area was measured in millimeters. The study was conducted at the same time of the day and at the same place for all patients and volunteers to achieve standardized conditions.

Statistical Analysis

Statistical tests were performed using Statistical Package for the Social Sciences (SPSS) 22.0 statistical software (IBM Corp.; Armonk, NY, USA). Descriptive statistics were used to define the characterics of each group. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test the normality of the study population. Mann-Whitney-U test and independent samples T-test were used for comparison of the Schirmer test values between the mean Schirmer score between right and left nostril. Independent Samples T-test was used to compare the intranasal Schirmer test values between the convex and the concave sides and also to compare the values of the patients and healthy volunteers. The statistical significance was set to $p<0.05$.

Results

The study included 52 patients who had nasal septal deviation, of which 17 (32%) were women and 35 (68%) were men. The mean age of patients was 30.77±10.03 ranging from 18 to 56. There was no statistically significant difference between patients and volunteers in terms of age ($p>0.05$). Thirty-three (63%) out of 52 patients had right sided septal deviation and 19 (37%) out of 52 patients had left sided septal deviation. The mean Schirmer test values for the right and left sides were 20.85±7.21 and 23.40±6.61 respectively. Due to the non-normalized distribution of the values of the group with right sided deviation, Mann Whitney U test was used for statistical analysis. However, the values of the group with left sided deviation showed normal distribution and independent samples T-test was used as the test of choice for statistical analysis. For patients with right sided septal deviation, the mean Schirmer test

Figure 1. Intranasal Schirmer test, placement of the Schirmer test paper on the anterior septal mucosa bilaterally, side view

Table 1. Intranasal Schirmer test values of the patients and the healthy volunteers

	INS* value on the convex (deviated) side	INS* value on the concave (non- deviated) side	p
Patients with septal deviation	20.71±7.29	23.35±6.47	0.054**
	Right INS value	**Left INS value**	**p**
Control Group (no deviation)	21.38±6.05	20.96±6.03	0.722**

*INS: Intra Nasal Schirmer **Independent Samples t-test

values measured from the right and the left sides were 19±6.97 and 23.73±6.11 respectively. The difference between these values was not statistically significant (p=0.07). For patients with left sided septal deviation, the mean Schirmer test values measured from the right and the left side were 23.21±7.20 and 22.84±7.54, respectively. The difference between these values was not statistically significant (p=0.27). We then combined all 52 patients and compared the values between the convex (deviated) and the concave (non-deviated) sides. The mean Schirmer test values measured from the convex and the concave sides were 20.71±7.29 and 23.35±6.47 respectively, but this difference was not statistically significant (p=0.054). There was no statistically significant difference between the intranasal Schirmer test values of the control group and patients with septal deviation either in the concave or the convex side (p=0.101 and p=0.584 respectively).

Comparisons were also made for each subject. For four patients, the intranasal Schirmer test values for the right and the left nostrils were equal. When these four subjects were excluded, of the remaining 48 subjects, 70% (34/48) had higher intranasal Schirmer test values on the non-deviated side compared to the side with nasal septal deviation.

The mean Schirmer test values of the 52 volunteers were 21,38±6.05 and 20,96±6,03 for the right and left nasal septum respectively. The difference between the two sides was not statistically significant (p=0.722). All findings were summarized in Table 1.

Discussion

In the present study we aimed to evaluate the nasal Schirmer test values in patients who had nasal septal deviation. We also compared the results to those of the normal population. The intranasal Schirmer test values of the deviated (ipsilateral) sides are less than the values of the contralateral side, although not statistically significant.

The laminar airflow gains turbulence (high-frequency velocity that fluctuates) while crossing the nasal valve region, resulting in more intensive contact with the nasal mucosa (9-13). Deviation of the nasal septum can lead to formation of local turbulent vortices and high flow velocity anterior to the septal deviation, which results in an increase in airway resistance, mechanical damage to the septal mucosa on the deviated side and dryness (12, 14-16). All these factors contribute to a drier nose with less humidity. The less humid the nose, the lower the intranasal Schirmer test values are, and these might explain our decreased intranasal Schirmer test values on the deviated side, although not statistically significant.

Compensatory mucosal hypertrophy of the contralateral turbinate usually accompanies a deviated nasal septum, and is presumed to protect the more patent nasal cavity from the excess airflow, like drying and crusting (17, 18). Of our 48 patients, 34 had higher intranasal Schirmer values on the non-deviated side (70%), showing the humidification effect of the inferior turbinate on the non-deviated side.

The elder people are known to be more prone to nasal dryness, and it was reported that the geriatric patients had significantly lower temperature and humidity values when compared to younger individuals (19). We thus excluded patients and volunteers over 60 years of age to avoid any conflicts. Also, to eliminate the effects of seasonal changes on nasal secretion and humidity, we conducted the test in the same season for all patients and volunteers. Lastly, as cigarette smoking also influences the nasal humidification (7), we also excluded subjects and volunteers with a history of smoking.

This study has a few drawbacks. First of all, we did not perform rhinomanometry or acoustic rhinometry to our patients. However, in a previous study, no statistical correlation was found between the results of rhinomanometry, acoustic rhinometry and the nasal wetting distances of the nasal Schirmer test (7). We thus doubt that performing these tests and doing an extra test on patients would add much to the study. Other than that, we did not perform allergy testing to our patients. However, as we mentioned previously, patients and volunteers with history of allergy were excluded from the study, and we did not want to perform allergy tests to patients without history of allergy and allergic symptoms. We did not correlate the test results with Quality of Life Questionnaires like Nasal Obstruction Symptom Evaluation (NOSE), Sinonasal Outcome Test (SNOT) Questionnaires. However, the aim of this study was not to correlate the symptoms with the Schirmer test results, as all our patients were symptomatic and were scheduled for surgery. Besides, none of our volunteers were symptomatic. We aimed to show the objective effect of septal deviation on nasal Schirmer test values and do not think that these questionnaires would add any extra benefit to our study. Lastly, further studies including larger number of cohort would be beneficial as there are currently no established normal values of intranasal Schirmer test.

To the best of our knowledge, this is the first study to investigate the effects of nasal septal deviation on nasal Schirmer test values and compare it to normal population. The intranasal Schirmer values of the deviated (ipsilateral) sides are less than the values of the contralateral side, supporting the negative effects of nasal septal deviation on nasal humidification. Further studies including large numbers of cohort are necessary to show the effects of septal deviation and other nasal pathologies on intranasal Schirmer test values.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of İstanbul Training and Research Hospital (717/2015).

Informed Consent: Informed consent was obtained from patients who participated in this study.

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