



Does Septoplasty Affect Middle Ear Pressure and Eustachian Tube Function?

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ORIGINAL
INVESTIGATION

ABSTRACT

Objective: To investigate the effects of septoplasty on middle ear pressure and Eustachian tube function.

Materials and Methods: Patients who were suffering from nasal obstruction and underwent septoplasty due to nasal septal deviation and healthy volunteers not suffering from nasal obstruction were involved in the study. Nasal patency was evaluated by rhinomanometry, and middle ear pressure and Eustachian tube function were evaluated by tympanometry. Total nasal resistance (TNR) and tympanometric peak pressure (TPP) values were used for this purpose. If TPP changed more than ± 10 daPa with Valsalva and Toynbee maneuvers, the Eustachian tube function of that ear was accepted as good. Rhinomanometry and tympanometry measurements were performed for patients in the preoperative period and in the 1st and 3rd postoperative months. To determine the normative levels of TNR, rhinomanometry was performed in the control group.

Results: Twenty-three patients and 30 volunteers were involved in the study. The preoperative TNR values of the patients were remarkably higher than the control group ($p < 0.001$), but they decreased significantly in the 1st and 3rd postoperative months ($p < 0.001$), and they were similar to those of the control group in the 3rd postoperative month ($p > 0.05$). Middle ear pressures and Eustachian tube function did not differ significantly in the 1st and 3rd postoperative months compared to the preoperative period ($p > 0.05$).

Conclusion: It was found that septoplasty did not affect middle ear pressure and Eustachian tube function.

Key words: Septoplasty, eustachian tube, middle ear pressure, tympanometry, rhinomanometry

INTRODUCTION

The primary physiological functions of the Eustachian tube (ET) are the ventilation of the middle ear and the balancing of the pressure of the external environment with that of the middle ear (1). In addition, protecting the middle ear from nasopharyngeal secretions and emptying the middle ear secretions into the nasopharynx are also among its functions. Eustachian tube dysfunction causes effusion, infection, and chronic inflammation in the middle ear.

Nose, paranasal sinuses, and nasopharyngeal diseases can disrupt the functions of the ET (1-3). The function of the ET can be disrupted either by masses in the nasopharynx, such as hypertrophic adenoid or neoplasia, that mechanically block the tubal orifice or by the effects of the infections, allergies or neighboring structures (4-7). It has also been shown that nasal obstruction can disrupt the functions of the ET and change the middle ear pressure (8, 9). The effects of nasal septum deviation (SD), one of the most important causes of nasal obstruction, and of its surgical treatment on ET functions have long been discussed. In studies about this topic, especially on whether or not septoplasty recovers the functions of ET, contradictory results have been reported (1, 10, 11). But, no study of rhinomanometry that shows objective nasal patency has been conducted in patients who have undergone septoplasty.

In this study, we aimed to demonstrate whether or not septoplasty has any effects on middle ear pressure and the functions of the ET in patients who, by rhinomanometry, we have objectively shown that nasal patency is established by septoplasty.

MATERIALS and METHODS

The study was designed as a controlled and prospective study; approval for the study was received from the Clinical Research Ethics Committee of Erciyes University. Patients that applied due to nasal obstruction and were indicated for septoplasty with a diagnosis of septum deviation were admitted to the study. Patients that suffered from diseases other than septum deviation that caused nasal obstruction or that disrupted the functions of the Eustachian tube and ones with ear pathology were excluded from the study. Furthermore, a control group was formed with

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healthy volunteers that did not suffer from nasal obstruction and that had a similar age and gender distribution as the patients. A signed volunteer form was collected from all participants.

Nasal patency was measured by rhinomanometry (Rhino 4000, Homoth Medizinelektronik GmbH & CoKG, Hamburg, Germany). Total nasal resistance (TNR) was used in its evaluation. TNR was calculated with the equation $R=\Delta P/V$ (R: resistance, Pa/cm³/s; ΔP : 150 Pa pressure; V: total nasal airflow of the left and right nasal passages during inspiration, liter/s). Rhinomanometry measurements were taken from the patients preoperatively and in the 1st and 3rd months after septoplasty, which was done under general anesthesia. Furthermore, normative values of TNR were determined by making rhinomanometry measurements in the control group.

Middle ear pressure measurements which were done passively, and evaluation of ET functions which were done by using the Valsalva and Toynbee maneuvers were all performed by tympanometry (Interacoustics AZ T, Impedance Auidometer, Denmark), measured by performing the Valsalva and Toynbee maneuvers. As a result of the tympanometric measurement, tympanometric peak pressure (TPP) was recorded. ET functions of the ears in which TPP changed by more than ± 10 daPa with the Valsalva and Toynbee maneuvers were accepted as good [ETF (+)], and ones in which TPP changed by less than ± 10 daPa were accepted as bad [ETF (-)]. These measurements were taken from the patient group preoperatively and postoperatively in the 1st and 3rd months.

In the patient group, the changes in total nasal resistance, middle ear pressure, and Eustachian tube functions from the preoperative period to the postoperative period were analyzed. Furthermore, total nasal resistance values of the patient group and the control group were compared.

Statistical analysis

The normality of the data was analyzed using the Shapiro-Wilk test. TNR and TPP variables that were not normally distributed within the patient group were summarized with median and maximum/minimum values. The temporal changes in TNR and TPP variables within the patient group were analyzed using the Friedman test, and the temporal changes in Eustachian tube functions were analyzed using the Cochran Q test. Mann-Whitney U-test was used in comparing the TNR values of the two groups. The level of significance was accepted as $p<0.05$. The SPSS 15.0 program was used for the statistical analysis.

RESULTS

A total of 23 patients, consisting of 11 men and 12 women with a mean age of 22.78 ± 7.29 (16-43), and a total of 30 healthy individuals, consisting of 17 men and 13 women with a mean age of 25.13 ± 7.04 (18-50), were involved in the study.

The preoperative TNR values of the patients with clear nasal obstruction were, appropriately, significantly high compared to the control group ($p<0.001$). After establishing their nasal patency with septoplasty, TNR values of the patients in the 1st and 3rd postoperative months declined significantly ($p<0.001$), and their differences from the 3rd postoperative month control group were determined as insignificant ($p>0.05$) (Table 1 and 2) (Figure 1).

Prior to the septoplasty, the mean TPPs of patients in both ears were within the normal range and did not change significantly after the septoplasty ($p>0.05$) (Table 2) (Figure 2). Likewise, in the 1st and 3rd postoperative months, the Eustachian tube function ratios in both the left and right ears did not change significantly compared to the preoperative period ($p>0.05$) (Table 2) (Figure 3).

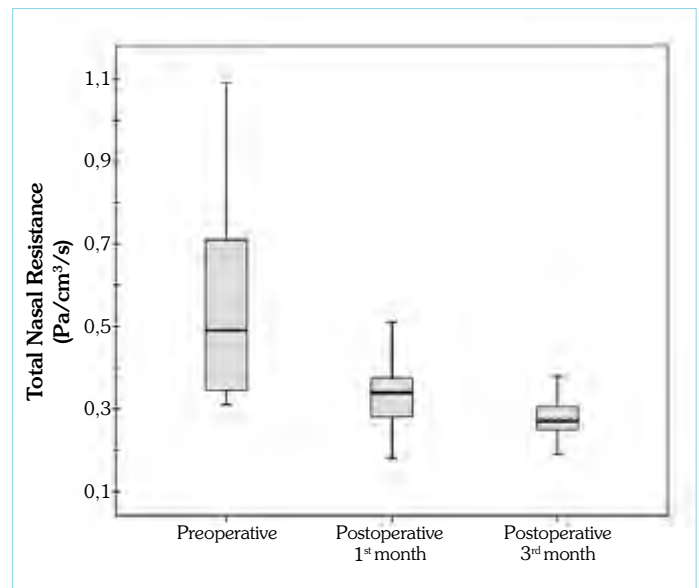


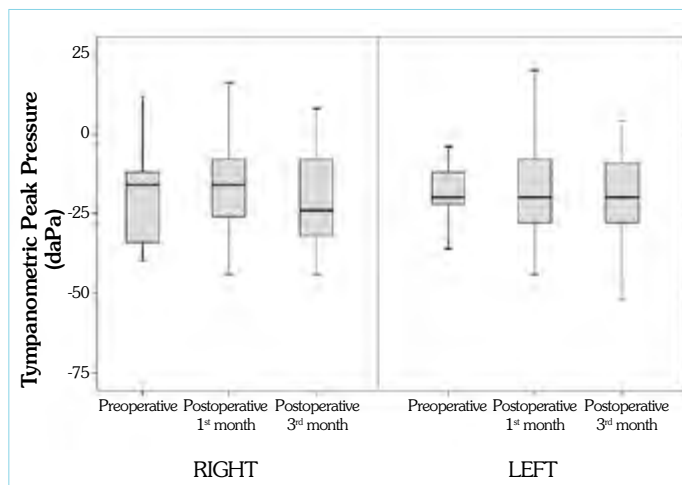
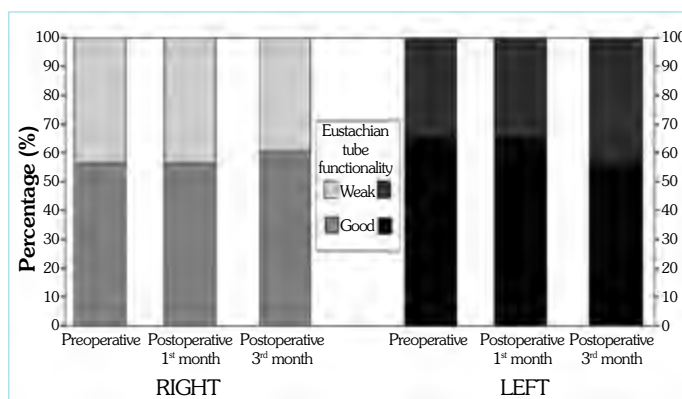
Figure 1. Temporal change in the total nasal resistance values of patients

Table 1. Comparison of the total nasal resistance values of the patients and control group

	Control Group (n=30)	Patient Group (n=23)	P
Total Nasal Resistance (Pa/cm ³ /s)	0.27	Preoperative 0.49	0.000
[median (min-max)]	(0.16-0.42)	(0.31-1.37)	
		Postoperative 1 st month 0.34	0.012
		(0.18-0.74)	
		Postoperative 3 rd month 0.27	0.418
		(0.19-0.88)	

Table 2. Comparison of the total nasal resistance, tympanometric peak pressure, and Eustachian tube function values of the patients (n=23) preoperatively and in the 1st and 3rd postoperative months (ETF +): Eustachian tube function is good)

		Preoperative	Postoperative 1 st month	Postoperative 3 rd month	P
Total Nasal Resistance (Pa/cm ³ /s) [median (min-max)]		0.49 (0.31-1.37)	0.34 (0.18-0.74)	0.27 (0.19-0.88)	0.000
Tympanometric Peak Pressure (daPa) [median (min-max)]	right (-100-12)	-16 (-44-46)	-16 (-44-48)	-24 0.308	0.490
	left (-36-35)	-20 (-44-20)	-20 (-52-20)	-20	
Eustachian Tube Function Ratio (%) [ETF (+)]	right	57	57	61	0.926
	left	65	65	57	0.751

**Figure 2.** Temporal change in the tympanometric peak pressure values of patients**Figure 3.** The change in Eustachian tube function ratios in the patients' right and left ears with respect to time

DISCUSSION

The findings of this study demonstrate that in patients for whom it was objectively shown that nasal patency is effectively established, there were no changes in middle ear pressure or Eustachian tube functions.

Ears in which the tympanic membrane is intact, besides the modifications of tympanometry, sonotubometry, manometry, inflation-deflation tests, and the Valsalva and Toynbee maneuvers are used in evaluating Eustachian tube functions (12-14). In case TPP changes by more than 10 daPa in the positive direction with the Valsalva maneuver, a method that is easy to perform in the clinic, and changes by more than 10 daPa in the negative direction with the Toynbee maneuver, ET functions can be said to be good (1, 15). In our study, we used this method to evaluate ET functions as well.

Nose, paranasal sinuses, and nasopharyngeal diseases can disrupt the functions of the ET (1-3). Among the studies that have investigated the effects of nasal obstruction on ET functions, the clinical study by Bonding et al. (8) and the experimental study by Buchman et al. (9) show that middle ear pressure changes when double-sided total nasal obstruction occurs. Looking at the literature, in septum deviation, which causes partial obstruction, middle ear pressure was shown to be within the normal range, and contradictory results have been reported regarding ET functions (1, 10). In this study, we showed that the middle ear pressure of nasally obstructed patients with septum deviation was within the normal range prior to the operation, that it did not fall outside of the normal range in the 1st and 3rd months after the operation, and that ET functions did not change by establishing nasal patency.

In addition to septum deviation, the existence of paranasal and pharyngeal diseases, such as allergic rhinitis, concha hypertrophy, and adenoid hypertrophy, should be taken into consideration in studies that evaluate the effects of septoplasty on ET functions. When these diseases are present, septoplasty can further disrupt the functions of ET, and in these patients, septoplasty can contribute to the recovery of ET functions (11). In our study, we aimed to see the effects of only septum deviation and septoplasty on ET by excluding patients with additional pathologies other than septum deviation.

In studies about nasal obstruction and its change, using objective rather than subjective data will increase the reliability of the study (16-18). In this study, we objectively showed, using rhinomanometry, that SD patients who were admitted to the study were nasally obstructed and showed, using septoplasty, that nasal patency was established. This study is novel in that it objectively demonstrates,

by rhinomanometry, the effectiveness of surgery while investigating the effects of septoplasty on the middle ear and Eustachian tube functions, because it is not possible to say that every septoplasty performed is effective-that is, it establishes nasal patency.

CONCLUSION

Septoplasty, which was objectively shown to establish nasal patency, does not cause any changes in middle ear pressure or Eustachian tube functions.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Erciyes University Clinical Research Ethics Committee.

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

Peer-review: Externally peer-reviewed.

Authors' Contributions: Conceived and designed the experiments or case: MİŞ. Performed the experiments or case: ŞG, ÜP. Analyzed the data: ŞG, ÜP. Wrote the paper: MİŞ, İK. All authors have read and approved the final manuscript.

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