The Impact of Septoplasty Operation on Odor Threshold Score and Symptom Severity According to the Nasal Septum Deviation Classifications

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Objective: The authors aimed to determine the changes in the odor threshold and sinonasal outcome test-22 scores of the patients after septoplasty surgery in terms of nasal septum deviation classifications.

Methods: Forty-nine patients with nasal septum deviation, aged between 17 and 65, were included in our study. The sinonasal outcome test-22 scores questionnaire and the N-Butanol Threshold test were administered to the patients, 2 days before and 2 months after the septoplasty.

Results: The authors' study had 4 major findings: Odor threshold scores improved after septoplasty operation both for the narrower and the wider side of the nasal airway passage. The Vidigal classification for nasal septum deviation was best for predicting the changes for odor threshold scores after septoplasty operation. The nasal septum deviation in which the nasal septum was pushing the inferior turbinate to lateral nasal wall caused the most smell dysfunction according to the Vidigal classification. Unilateral vertical crest affecting the nasal valv area or the posterior part of the septum had the most negative effect on olfactory functions according to the Mladina classification.

Conclusion: Septoplasty operation leads to improvement in odor threshold scores, and the Vidigal nasal septum deviation classification was best in predicting postoperative odor threshold changes.

Key Words: Nasal septum deviation, odor threshold score, septoplasty, sino-nasal outcome test

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Our sense of smell is not only essential for our quality of life, but also important for our protection from dangers. It is an important and life-saving sensation, alerting people about situations such as fire hazard or defective food. In addition, olfactory functions are important in social relations and taste perception. Studies have shown that 10% to 15% of the population is hyposmic and 1% to 5% of the population is anosmic.[1] Nasal septum deviation is one of the most common pathologies in otorhinolaryngology practice, which causes the insufficient air flow through the nose and decreases significantly the patient's quality of life.[2] Generally, 30% of patients who come to the otorhinolaryngology clinic complain that they can not breathe from the nose and the majority of these patients are diagnosed with nasal septal deviation.[3] The symptoms of the patients with nasal septal deviation may vary depending on the type and degree of deviation. About 40% of them undergo septoplasty procedure at last. It was found that 260,000 septoplasty operations were performed in 2006 at USA.[4,5]

Nasal septal deviation not only prevents comfortable air intake of human, but also affects odor intake. There are several studies in the literature on the effect of septoplasty surgery on odor functions and sino-nasal complaints. However, nasal septal deviation degree and type is not the same in every patient and the nasal airway varies according to the severity and place of the pathology. In the literature, there were 2 studies about nasal septum deviation classification and its effect on odor identification.[6,7] They found significant improvement in odor identification scores after septoplasty operation. However, the nasal septum deviation is an obstructive pathology of nasal airway, and the obstructive pathologies especially cause conduction type smell dysfunction, which may lead to decrease in odor threshold scores.[8] Best to our knowledge there was no other study investigating the odor threshold scores according to the nasal septum deviation classification and septoplasty operation results.

Therefore, we aimed to determine the changes in the odor threshold and sinonasal outcome test-22 (SNOT-22) test scores of the patients after septoplasty surgery in terms of nasal septum deviation classifications. Also, by using 3 different nasal septum deviation classifications, our secondary aim was to compare these different classifications in terms of impact on the olfactory function.

METHODS

Forty-nine patients with nasal septum deviation, aged between 17 and 65, were included in our study. Of these, 17 were female and 32 were male patients. All the patients were diagnosed as nasal septum deviation with endoscopic nasal examination and paranasal sinus computed tomography. None of our patients had previously suffered from head trauma, chronic sinusitis, allergic rhinitis, chronic drug use, chronic systemic, metabolic, and endocrinological disorder and none of them smoke regularly.

All investigations were performed in accordance with the Declaration of Helsinki on biomedical studies involving human subjects, and informed consent was obtained from all the study subjects. The study was conducted at Ankara Numune Training

and Research Hospital and approved by the local Institutional Review Board.

Nasal septum deviations of the patients were typed according to 3 different classifications with preoperative anterior rhinoscopy and nasal endoscopy. These classifications are defined by Mladina, Vidigal, and Baumann.[9–11] Supplemental Digital Content, Table 1, http://links.lww.com/SCS/A807, shows the nasal septum deviation types and patient numbers according to those types.

All the patients were treated with a closed technique septoplasty procedure under general anesthesia, which were described by Cottle. None of the patients had a procedure for their nasal conchas, for nasal dorsum, upper or lower lateral cartilages.[12]

The SNOT-22 questionnaire and the N-Butanol Threshold test were administered to the patients, 2 days before and 2 months after the surgery.

APPLICATION OF N-BUTANOL THRESHOLD TEST

The N-Butanol Threshold Test was applied to each nostril while the other hole was clogged with cotton. The room where the test was done was cared for to be fresh airy and at room temperature. The odor threshold test is a part of the validated ''Sniffin' Sticks'' test. Odorants were presented in commercially available felt-tip pens (Burghart GmbH, Wedel, Germany).[13–15] Patients are introduced to the target pen smell (N-Butanol). For this purpose, the pen including the highest concentration of the odor was shown to the patient (pen no: 1). For the actual test, the eyes of the patients were connected with a "sleeping mask." Each of the 3 pens (triplets) is administered to the patient at intervals of about 5 seconds, of which only 1 pen (the red cap pen) contains the odorant, the other 2 (blue and green cap pens) containing the diluent. The task of the patient is to find the pen with target odor from the other two. The time between the first pen in the first triangle and the first pen in the second triangle must be 30 seconds. Each item is shown only once, but it is not acceptable to repeat the trio at the request of the patient. Even if they are not sure, patients have to make a choice (forced choice). The first accurate determination dilution step is the starting point for the following test procedure. Thresholds were determined using a single ladder technique. Correct identification of the pen containing the fragrance twice in succession from 1 of the 3 alternative pens provided the transition to the next higher dilution step, while a misidentification caused a transition to the previous lower dilution step. The test continued until 7 turns were detected in this way. Odor thresholds were determined as the average of the last 4 turns.[13–15]

SINONASAL OUTCOME TEST-22

Twenty-two questions included in the test are individually asked by the doctor and each is scored separately according to the patient's complaint. At the end of the test, the patient's response points are collected and the result is obtained.[16,17]

Statistical Analysis

The research data were evaluated by SPSS 21.0 (Statistical Package for Social Sciences; SPSS Inc, Chicago, IL). Descriptive statistics were presented as frequency distribution and percentage for categorical variables and as mean ± standard deviation for the variables specified by measurement. Paired T test, ANOVA test, and Pearson correlation analysis were used as statistical methods. Statistical significance was accepted as $P < 0.05$.

RESULTS

Forty-nine nasal septum deviation patients aged between 17 and 65 were included in our study. Of these, 17 were female and 32 were male patients.

As a result of our study, we found statistically significant change in SNOT-22 test scores after septoplasty surgery ($P < 0.001$). We found statistically significant improvement in septoplasty (independently by deviation side) in the odor threshold test scores made separately from the right and left nostrils ($P < 0.001$). In addition, we found a statistically significant improvement in the olfactory threshold between the narrow and wide sides of the nasal passages after septoplasty surgery ($P < 0.001$) (Supplemental Digital Content, Table 2, http://links.lww.com/SCS/A807). Moreover, gender differences were investigated in terms of odor threshold. However, we did not find any significant difference between males and females in terms of preoperative and postoperative odor threshold scores ($P = 0.45$ and $P = 0.22$, respectively).

In our study, we differentiated the deviations according to 3 different classifications before surgery and evaluated how the odor threshold test score is affected by the deviation type after the operation.

According to the Vidigal classification; 11 patients with type 1, 24 patients with type 2, and 14 patients with type 3 were included in the study ($P = 0.03$). There was a significant correlation between the odor threshold score and Vidigal classification ($r = -0.4$, $P = 0.01$). When an ANOVA test was performed, we found that patients with type 3 nasal septum deviation had significantly lower odor threshold score when compared to patients with type 1 ($P = 0.001$), whereas such a significant difference was not found between patients with type 2 nasal septum deviation and type 3 ($P = 0.09$)

When the patients were classified according to the Bauman classification, we found that 6 of our patients were type 1, 15 patients were type 2, 13 patients type 3, 4 patients type 4, 8 patients type 5, and 3 patients type 6. We did not find significant difference between the Baumann nasal septum deviation types in terms of preoperative odor threshold scores ($P = 0.1$).

Also, we classified our patients according to the Mladina classification, and we found that there were 8 patients with type 1, 20 patients with type 2, 7 patients with type 3, 5 patients with type 4, 2 patients with type 5, and 7 patients with type 6. There was a significant difference between Mladina nasal septum deviation types in terms of preoperative odor threshold scores ($P = 0.007$). When an ANOVA with posthoc Dunnett test was performed, we found that Mladina type 2 and 3 had significantly lower preoperative odor threshold scores when compared the other types of Mladina classification.

After the septoplasty operation we evaluated the changes (the difference before and after surgery) in the odor threshold scores according to the nasal septum classifications and their subtypes. We found that the changes in odor threshold scores after septoplasty operation were statistically significant according to the Vidigal classification. There was a significant difference between the Vidigal type 1 and type 3 in terms of the improvement of odor threshold score ($P = 0.004$). There was no such a significant difference between type 2 and Vidigal type 1 ($P = 0.96$), a significant difference was found between type 2 and 3 ($P < 0.001$).

However, according to the Baumann and Mladina classifications, no significant difference was found between the types in terms of changes in the postoperative odor threshold scores.

In addition, there was no statistically significant difference between the nasal septal deviation types in terms of SNOT-22 scores in pre- and postoperative scores for all nasal septum classifications.

DISCUSSION

There were 2 studies investigating the nasal septum deviation classification and olfactory function. In those studies the

researchers used odor identification tests for evaluating olfactory functions in terms of nasal septum deviation classification purposed by Mladina and Baumann.[6,7] In our study we used odor threshold score for evaluating olfactory functions, which was especially affected at obstructive pathologies of nasal cavity. Also, we used 3 different nasal septum classifications in our study. Our study had 4 major findings: Odor threshold scores improved after septoplasty operation both for the narrower and the wider side of the nasal airway passage. The Vidigal classification for nasal septum deviation was best for predicting the changes for odor threshold scores after septoplasty operation. The nasal septum deviations in which the nasal septum was pushing the inferior turbinate to lateral nasal wall caused the most smell dysfunction according to the Vidigal. Unilateral vertical crest affecting the nasal valv area or the posterior part of the septum had the most negative effect on olfactory functions according to the Mladina classification. Although the SNOT 22 scores were significantly improved after septoplasty operation, we did not find significant correlation between investigated nasal septum deviation types and SNOT 22.

There were studies about nasal surgical procedures and their impact on olfaction and quality of life in the literature. In a study conducted in 2016, 30 patients with nasal septal deviation underwent external septoplasty procedure. Before and 6 weeks after the operation, the Sniffin Sticks test battery was used for evaluating the olfactory functions, and they found that odor threshold, discrimination, and identification scores improved.[18]

In a recent review about sinus surgery and olfaction including 1956 patients, the researcher determined that the 50% of the patients with chronic rhinosinusitis had an improved olfactory function after sinus surgery, whereas up to 10% of the patients had a decreased olfactory function after the sinus surgery.[19]

Also, in another recent literature about nasal septum deviation, the researchers investigated the effect of septoplasty operation on patients in terms of symptom severity, stress test, depression scale, olfactory function, and sleep quality. They claimed that the preoperative evaluation of the symptom severity and stress levels were the most useful predictive factors for patients' satisfaction after septoplasty operation.[20]

Our results were resembled with relevant literature that olfactory functions had an improvement after the septoplasty operation. However, the number of patients for the deviation subtypes defined by Baumann and Mladini is small, and this might be the major limitation of our study. Also, we did not find a significant difference between males and females in terms of odor threshold scores. This might be due to low number of female patients.

CONCLUSION

Septoplasty operation leads to improvement in odor threshold scores, and the Vidigal nasal septum deviation classification was best in predicting postoperative odor threshold changes.

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