

## Lateralized olfactory difference in patients with a nasal septal deviation before and after septoplasty\*

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### Abstract

**Background:** patients with a smell disorder and less often, healthy people, exhibit an olfactory difference between the two sides of the nose. Higher olfactory thresholds are correlated with the obstructed side of a nasal septal deviation (NSD). With this prospective study we sought to investigate if a NSD compromises the olfactory identification. **Materials and methods:** thirty patients with nasal obstruction due to a NSD were recruited. The patients were listed for primary septoplasty with or without radiofrequency reduction of the inferior turbinates. Pre- and postoperatively, patients were assessed by visual analogue scales for symptoms and by the bilateral nasal spirometry (nasal partitioning ratio-NPR) for the side/degree of obstruction. Olfactory identification was tested separately for each nasal cavity by means of the 12 item Sniffin Sticks test (12-SS test) and a 3-point difference between the nasal sides was considered significant. **Results:** the mean age of patients (25 males/5 females) was 33 years (range 17-52). No complications or anosmia were reported postoperatively. Subjective hyposmia, nasal obstruction and the NPR were reduced ( $p < 0.001$ ). Significant lateralized differences were present in 20% and 13% of patients before and after septoplasty respectively; the change was not significant ( $p = 0.754$ ). Patients with a significant lateralized olfactory difference had a greater NPR pre- ( $p = 0.031$ ) but not postoperatively ( $p = 0.783$ ). The sides of obstruction and worst olfactory performance did not differ in these patients before surgery. **Conclusions:** olfactory identification may be compromised on the convex side of a large NSD. Post-operatively, patients exhibit a lateralised smell identification difference as often as healthy people. The effect of a clinically significant NSD on the different aspects of olfactory performance warrants further study. Hippokratia. 2012; 16 (2): 166-169

**Key words:** septoplasty, nasal septal deviation, olfaction, sniffin sticks test, olfactory identification test

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A lateralised difference in olfactory function is present in 15% of healthy people<sup>1</sup> and 23.4% of patients presenting with a smell dysfunction<sup>2</sup>. Patients with neurological diseases such as schizophrenia<sup>3</sup> or Parkinson's disease<sup>4</sup> exhibit a significant difference in olfactory perception between the two nasal sides. It seems rational to test olfactory perception for each nasal cavity separately.

A clinically significant nasal septal deviation (NSD) may be associated with lateralised functional differences in nasal resistance<sup>5</sup>, nasal cycle<sup>6</sup> and mucociliary clearance<sup>7</sup>. With regard to olfaction there are only scarce reports on the olfactory difference between the two sides of a NSD<sup>8</sup>. Septal surgery may affect positively olfactory thresholds possibly due to the improvement in transport of volatile molecules to the olfactory slit<sup>9,10</sup>. Rarely the olfactory ability is compromised post-septoplasty as a result of direct trauma, traction or vascular compromise to the olfactory epithelium. Complete postoperative functional anosmia, however, is very rare<sup>11</sup>.

The aim of this study was to investigate the relationship between a NSD and a significant lateralized difference in odor identification before and after septoplasty. For this purpose the 12-item Sniffin Sticks test (12-SS test) was applied separately to each nasal cavity.

### Materials and methods

#### Patients and treatment

The study received approval by the Ethical Committee of Aristotle University of Thessaloniki. Adult patients with nasal obstruction due to a NSD who were listed for primary septoplasty in our tertiary referral center were invited to participate. A detailed history with special focus on factors affecting olfaction (upper respiratory infection, exposure to chemicals, smoking habits, medication and rhinitis) was taken. Anterior rhinoscopy, nasal endoscopy, allergy testing and sinus imaging when necessary, completed the preoperative workup. Patients were excluded if they suffered from a recent upper airway infec-

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**Table 1:** Lateralized olfactory difference and degree of nasal septal deviation.

<b>Before septoplasty</b>			
	Group A	Group B	p
N of patients	6	24	
Hyposmia	67[19.7-76]	22.5[1-49]	0.077
Nasal obstruction	65[46.5-83.7]	50[43.5-66.7]	0.253
NPR	0.56[0.36-0.91]	0.34[0.17-0.41]	0.031
<b>After septoplasty</b>			
N of patients	4	26	
Hyposmia	0[0-24]	3[0-12]	0.373
Nasal obstruction	9[0.28.5]	14[0-35.2]	0.439
NPR	0.18[0.07-0.27]	0.15[0.06-0.28]	0.783

NPR: nasal partitioning ratio

**Table 2:** Factors with potential effect on lateralised olfactory difference.

	Group A (%)	Group B (%)	p
Number of patients	6	24	
Nasal Allergy	2 (33.3)	11 (45.8)	0.469
Smoking	2 (33.3)	13 (54.2)	0.326
IT reduction	4 (66.7)	18 (75)	0.520

IT: inferior turbinate

tion, chronic rhinosinusitis, polyps, known post traumatic or post viral hyposmia or any systematic or neurological diseases. The surgical procedure was a typical Cottle's septoplasty with or without inferior turbinate reduction by radiofrequency ablation. Patients received a short course of antibiotics and they were instructed to irrigate their nose with normal saline regularly until the follow up examination two months after the operation.

Olfactory and nasal airway testing

Olfaction was assessed by a 100 mm visual analogue scale (degree of hyposmia) and the lateralized 12-SS test (odor identification). The 12-SS test is a forced choice olfactory test of odor identification with maximal score

of 12. Patients are considered normosmic if they identify correctly 11-12 odorants. Seven to 10 correct answers are indicative of hyposmia and a score of 6 or less raises the possibility of anosmia. The adopted version of the 12-SS test for the greek population<sup>12</sup> was performed separately for each nostril while the other was occluded by adhesive tape. The patient should have abstained from drinking, eating, chewing a gum and smoking for at least 20 minutes. The pen with the odorant was presented for about 4 seconds in a blinded fashion. The time interval between each odorant presentation was at least 30 seconds in an attempt to minimize olfactory desensitization. A difference in score of at least 3 points between the two sides

of a NSD signified a clinically meaningful difference in olfactory performance<sup>13</sup>.

Subjective nasal obstruction was assessed by a 100 mm visual analogue scale and the degree of NSD was assessed by the bilateral nasal spirometry<sup>14</sup> by means of a rhin spirometer (GM Instruments). The post-decongestion nasal partitioning ratio (NPR) reflected the nasal airflow asymmetry. Since NPR can assume values from -1 (indicates complete left sided nasal obstruction) to +1 (indicates complete right sided nasal obstruction), the absolute values were taken into account.

#### Statistical analysis

Data were analyzed with SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics for continuous variables (degree of subjective hyposmia, nasal obstruction and NPR) were presented as medians with interquartile ranges (IQR) because most data did not follow the normal distribution. For before-after analysis of the aforementioned continuous variables, the Wilcoxon Signed ranks test was chosen. The change of frequency of lateralized olfactory difference after septoplasty was handled as dichotomous data (difference >3 points present, difference >3 points absent) and so the Mc Nemar's test for related binary data was used. To test for correlation between the degree of NSD, as expressed by the NPR, and the presence of a significant lateralized olfactory difference, patients were divided into two groups. Group A: patients with a significant difference, Group B: patients without a significant difference. The NPR between the two groups was compared by the Mann-Whitney test. For differences of qualitative parameters (allergy, smoking frequency, inferior turbinate intervention) between group A and B, the Fischer's exact test was applied. The level of statistical significance was set at 0.05.

#### Results

Thirty patients, 25 males and 5 females, with a median age of 33 years (range 17-52) participated in the study. There were 15 smokers (50%) and 13 patients with symptoms of allergic rhinitis (43.3%). Twenty two patients (73.3%) had reduction of the inferior turbinates of whom 18 had bilateral and 4 had unilateral intervention. No postoperative complications or functional anosmia was reported.

The degree of subjective hyposmia decreased significantly from 23[5-66] to 3[0-11] ( $p < 0.001$ ) and the degree of nasal obstruction also decreased from 52 [41.5-70.5] to 14[0-32.5] ( $p < 0.001$ ). The preoperative absolute NPR decreased significantly from 0.36[0.23-0.52] to 0.15[0.06-0.30] ( $p < 0.001$ ).

#### I. Lateralized olfactory difference before and after surgery

A lateralized difference >3 points was present at 6 patients preoperatively (20%) and 4 patients postoperatively (13%). The entire group change was not significant ( $p = 0.754$ ). In all 6 patients, the side of obstruction, according to spirometry, coincided with the side of worst performance of the smell identification (4 patients with a right-sided obstruction and 2

patients with a left-sided obstruction). The preoperative lateralized difference was abolished after surgery. The subjective sense of hyposmia was significantly reduced from 67[20-70] to 23.5[7-30] ( $p = 0.028$ ); the NPR was also significantly reduced from 0.56[0.40-0.88] to 0.34[0.22-0.36] ( $p = 0.046$ ).

All 4 patients without a significant preoperative lateralized difference developed a difference postoperatively. In 2 out of 4 patients, the side of obstruction, according to spirometry, was also the side of worst identification performance. No significant reduction of hyposmia (from 25[0-70] to 0[0-16],  $p = 0.068$ ) and NPR (from 0,35[0,26-0,49] to 0,18[0,05-0,45],  $p = 0.068$ ) was noted postoperatively but results should be viewed with caution due to the small sample size.

- #### II. Correlation between the degree of NSD and presence of a significant lateralized olfactory difference
- Patients in group A had a greater NPR and a marginally greater degree of hyposmia preoperatively than patients in group B. This positive correlation between NPR and lateralized olfactory difference became insignificant postoperatively (Table 1). There were no differences between groups A and B in terms of other factors that could influence olfactory identification (Table 2).

#### Discussion

The 12-SS test is a brief version of the full Sniffin Sticks test which is divided in three subtests: threshold, discrimination and identification (suprathreshold functions). The 12-SS tests olfactory identification and differentiates between anosmics, hyposmics and normosmics with good reliability and reproducibility<sup>15</sup>. By using this test we found that 20% of patients with a NSD have a lateralized difference, equal to or more than 3 points, in olfactory identification. With increasing degree of NSD more patients are likely to perceive a difference in olfactory identification between the two sides of the nose. Gudziol et al<sup>1</sup>, tested 479 healthy people with the 12 SS test and found a lateralized difference in 15% of them. In this study patients with nasal pathology appeared to have a lateralized difference more often: 32% with nasal tumors and 26% with chronic rhinosinusitis. Based on these results, the authors advocate further testing to exclude a nasal tumor when a side difference of more than 25% is present. Welge-Lussen et al<sup>2</sup>, studied 518 patients with various nasal pathologies adopting the full version of Sniffin Sticks test and concluded that an olfactory side difference is present in almost one quarter of patients with smell disorders. It is not known yet if a lateralized olfactory difference in patients with a NSD implies that the deviation is clinically significant.

The effect of intranasal anatomical factors before septoplasty on olfactory aspects of the Sniffin Sticks test is not fully understood. A computational fluid dynamics experiment has shown that a small decrease in the surface of the nasal valve area (1.45%) can result in a

large decrease (18.7%) in airflow directed to the olfactory cleft<sup>16</sup>. In terms of the specific aspects of smell tests, Pfaar et al<sup>8</sup>, studied 30 patients with the complete version of Sniffin Sticks test. They found that only olfactory thresholds correlate with the NSD preoperatively but not postoperatively. Our study showed that olfactory identification was reduced at the obstructed nasal side prior to operation and this could not be attributed to other factors which may affect olfaction (rhinitis, smoking). This apparent discrepancy may be explained by the fact that a clinically significant stenosis at the nasal valve area alters both threshold and suprathreshold functions. Damm et al<sup>10</sup>, have shown that the anterior part of the lower meatus influences olfactory thresholds and to a lesser degree olfactory discrimination. On the other hand, Leopold et al<sup>17</sup>, have identified a space up to 15 mm below the cribriform plate, not including the nasal valve area, that correlates with olfaction. Jun et al<sup>18</sup>, tested 16 patients awaiting septal surgery with the Butanol Threshold Test and Cross-Cultural Smell Identification Test and found no correlation between the volume around the inferior turbinate and the olfactory function. All studies underpin the important influence of the middle and superior meatus area on olfactory perception<sup>10, 17, 18</sup>.

Corrective surgery at the nasal valve area improves the scores of threshold and suprathreshold olfactory tests. The effect of septoplasty with partial turbinectomy was investigated by Damm et al<sup>19</sup>, who concluded that suprathreshold functions improve more than thresholds. Pfaar et al<sup>8</sup>, found also an improvement in olfactory discrimination post-septoplasty. Possibly, the improved sensation of nasal airflow results in increased olfactory sensitivity at a higher level than the olfactory mucosa where cognitive factors play a major role in olfactory perception<sup>20</sup>. Experimentally, a nasal dilator at the area of the nasal valve has been shown to improve odorant transport and enhance both thresholds and odor identification<sup>21</sup>. In our study, correction of the NSD resulted in a) fewer patients reporting a significant lateralized difference in odor identification and b) a lack of association between the degree of NSD and the presence of such a difference. This suggests that a significant NSD impairs the ability of an individual to identify a smell from the obstructed nostril.

### Conclusions

There is a paucity of data regarding the olfactory difference between the two sides of a NSD. This study shows that a large NSD may be associated with a lateralised difference of olfactory identification. Post-septoplasty, patients exhibit such a difference as often as healthy people. More research is necessary to elucidate the effect of a clinically significant NSD on the different aspects of olfactory performance.

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