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SHORT COMMUNICATION

Effects of septorhinoplasty on smell perception

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Abstract

Purpose To assess whether significant changes in smell perception occur after septorhinoplasty, and evaluate whether septum deviation, allergic rhinitis, and surgical technique affect postoperative smell perception.

Methods Thirty-four patients (> 18 years old) awaiting septorhinoplasty were included, while those with previous severe hyposmia or anosmia were excluded. The participants self-assessed their smell perception using a 100-mm visual analogue scale (VAS), where 0 mm indicated the inability to smell and 100 mm indicated normal smell perception. The University of Pennsylvania Smell Identification Test (UPSIT) was applied before the procedure, and 4 and 12 weeks after surgery.

Results The UPSIT score showed no significant changes at 4 ($p = 0.59$; 95% CI − 0.35 to + 2) or 12 weeks ($p = 0.16$; 95% CI − 1.13 to + 0.66). A comparison of the VAS scores before and 4 weeks after surgery ($p = 0.62$; 95% CI − 0.63 to + 0.39) yielded similar results. However, the average VAS scores improved 12 weeks after surgery ($p = 0.007$; 95% CI + 0.22 to + 1.30). Olfactory function, measured using the UPSIT, was not influenced by open or closed surgical techniques ($p \geq 0.10$), the presence or absence of rhinitis ($p \geq 0.15$), or obstructive septum deviation ($p \geq 0.38$). Twelve weeks after surgery, self-evaluated smell perception was better in patients who underwent a closed procedure rather than an open procedure ($p = 0.006$; 95% CI: −1.39 to −0.37).

Conclusion A validated test demonstrates that septorhinoplasty does not compromise smell perception 4 and 12 weeks after surgery. However, it might improve smell perception by the self-report observation.

Keywords Septorhinoplasty · Smell perception · Olfaction · Rhinoplasty · Septal deviation · Septoplasty · VAS · UPSIT

Introduction

Previous studies have estimated that between 7 and 16% of the US population reports smell-related complaints [1, 2]. These are often underestimated, even though they are common and have a major impact on the quality of life [2]. Frequently, patients do not seek medical care, or seek care too late, because they believe the perception will recover with time. Olfactory disorders have numerous causes, and the most common are those related to upper respiratory infections, rhinosinusitis, and trauma [3].

Most patients seeking to undergo cosmetic surgery of the nose do not report functional complaints, and inform normal smell perception before surgery. However, even a temporary decrease in smell perception can reduce the patient's satisfaction with the procedure. The impact of septorhinoplasty on smell perception is controversial and varies from an improvement in smell perception to its complete loss. However, in most patients, the loss is temporary [4–8].

Septorhinoplasty might compromise the olfactory capacity because of the direct trauma caused to the olfactory plaque region by laser, cautery, abrasion, or upper nasal septum traction; high osteotomies; edema of the nasal mucosa; narrowing of the nostrils and nasal valves, which prevent air from reaching the olfactory nerve; ischemia resulting from local anesthesia with a vasoconstrictor; direct injury of the

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olfactory nerve branches; and psychological disturbances [4].

Rarely, anosmia after septorhinoplasty can be permanent, causing a deleterious outcome in patients who were previously healthy [4]. Few studies have evaluated the effects of septorhinoplasty on olfactory function. The main objective of this study was to assess whether septorhinoplasty causes significant changes in smell perception. Moreover, this study aimed to evaluate whether variables such as septum deviation, allergic rhinitis, and surgical technique might change smell perception in the postoperative period.

Materials and methods

A prospective observational study was conducted between January and December 2017. A cohort of 34 consecutive patients, aged more than 18 years, was selected by convenience. They were on a waiting list for septorhinoplasty, seeking mainly to improve the esthetics of their nose. Patients with systemic diseases or important nasal disorders related to smell perception changes, such as pre-existing anosmia or severe hyposmia or chronic rhinosinusitis, previous traumatic brain injury, systemic diseases needing a continued use of hyposmia-related medications such as benzodiazepines, neurological diseases associated with decreased smell perception, and acute upper respiratory infection or rhinitis's crisis on testing days, were excluded from the study. The study was reviewed and approved by the local research ethics committee. Patients were included after they read and signed the informed consent form.

All septorhinoplasties were performed under general anesthesia, using a combination of local infiltration of 2% lidocaine and 1:80,000 epinephrine, carried out by a single otorhinolaryngologist assisted by a fellow training facial plastic surgery. Septorhinoplasties were performed using an open or closed technique, as evaluated by the physician as the more adequate procedure to obtain the best esthetic and functional results in each case. Generally, patients with alterations in the shape of the nasal tip were submitted to an open technique, which allowed better access to and restoration of these deformities. Lateral osteotomies and septoplasty were performed in all patients. Even in patients without septal deviation, septoplasty was performed to obtain cartilage for the grafts, following the technique of structured rhinoplasty. The quadrangular cartilage of the septum was removed, leaving a 10-mm portion from the upper and anterior parts, and an L-shaped strut provided nasal support. No postoperative tampons or corticosteroids were used. Nasal splints were introduced at the end of surgery and removed after 7 days.

The participants filled an identification form, answering questions about age, sex, education, smoking, nasal obstruction sensation, and frequent rhinitis symptoms, such as nasal pruritus, sneezing, and runny nose. Preoperative images were acquired with the patient in the frontal, lateral, nasal base, and oblique positions.

Patients were divided into subgroups: presence or absence of obstructive septum, presence or absence of rhinitis and open or closed surgical technique. The presence or absence of obstructive septum deviation was evaluated using nasal videoendoscopy and considered obstructive when the septum touched the lateral nasal wall. Rhinitis was considered present on the basis of the Allergic Rhinitis and its Impact on Asthma guideline [9]. All patients in the rhinitis subgroup were considered as having "mild" rhinitis according to this protocol. However, these patients were evaluated in the period with no symptoms of rhinitis.

Patients self-evaluated their smell perception using a 100-mm visual analogue scale (VAS), where 0 mm indicated the inability to smell and 100 mm indicated normal smell perception. They also completed the University of Pennsylvania Smell Identification Test [10] (UPSIT; Sensonics International, NJ, USA) before surgery, and 4 and 12 weeks after surgery. The questions in the test were presented at random, and a time interval of at least 30 s was given between each question. The patients knew their results only after the twelfth week of surgery.

The Shapiro–Wilk test was used to assess the normal distribution of continuous variables. Student's *t* test was used to compare the UPSIT scores between the three periods. The non-parametric Wilcoxon–Mann–Whitney test was used to compare olfactory function between the septal deviation subgroups, presence of rhinitis, type of surgical technique, and self-evaluation test. A 95% confidence interval (CI) was applied.

Results

Of the 34 participants enrolled in the study, 29 (85%) were women and 5 (15%) men, with an average age of 31 years (minimum, 20; maximum, 57 years; SD, 9.96). As for the level of education, 80% had complete or incomplete higher education. Ten patients (29.4%) reported symptoms compatible with rhinitis and 17 (50%) had obstructive septum deviation. Open septorhinoplasty was performed in 25 patients (73.5%) and closed septorhinoplasty in 9 (26.5%). None of the patients smoked.

The average UPSIT scores before the procedure were not statistically different from those 4 weeks after surgery ($p = 0.59$; 95% CI − 0.35 to + 2) or 12 weeks after surgery ($p = 0.16$; 95% CI − 1.13 to + 0.66) (Fig. 1).

Similar results were obtained when the average VAS score before and 4 weeks after surgery was compared ($p = 0.62$; 95% CI − 0.63 to + 0.39). However, the average

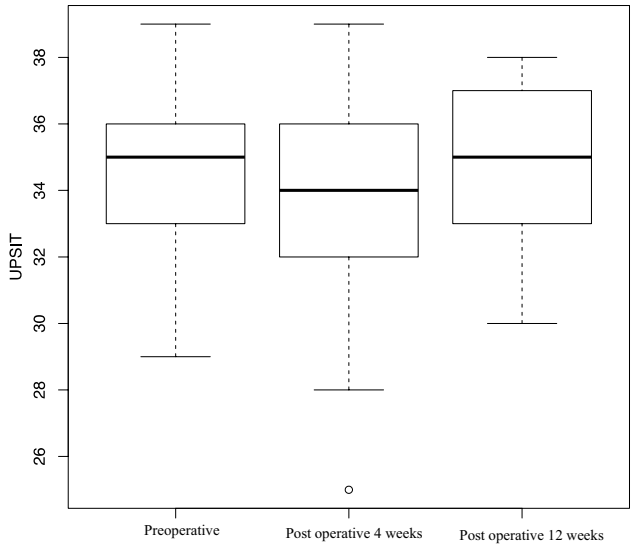

Fig. 1 Boxplot: comparison of UPSIT average: preoperative, postoperative 4 weeks and postoperative 12 weeks

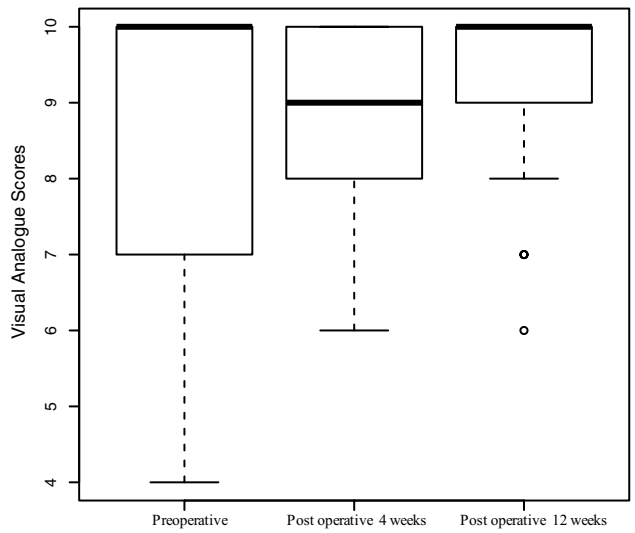

Fig. 2 Boxplot: comparison of average smell perception using VAS—preoperative, postoperative 4 weeks and postoperative 12 weeks

VAS score improved 12 weeks after surgery than before ($p = 0.007$; 95% CI + 0.22 to + 1.30) (Fig. 2).

Olfactory function was unaffected by different surgical techniques (all $p \geq 0.10$), the presence or absence of rhinitis (all $p \geq 0.15$), or obstructive septum deviation (all $p \geq 0.38$). Twelve weeks after surgery, smell perception was rated as worse on the VAS by patients submitted to the open technique than by those submitted to the closed technique ($p = 0.006$; 95% CI − 1.39 to − 0.37).

A descriptive analysis of the classification of the individual participants' smell perception before surgery showed that 79.4% of them presented normal smell perception. This decreased to 58.8% 4 weeks after surgery, and returned to levels close to the preoperative period (76.5%) 12 weeks after surgery (Table 1).

Discussion

In this study, using a test validated for the local culture [11] (UPSIT), we demonstrated that septorhinoplasty does not change sense of smell 4 and 12 weeks after surgery and using VAS the procedure can even improve olfactory perception 12 weeks after surgery. Previous studies evaluating smell perception before and after rhinoplasty presented controversial results, some showing an improved smell perception and others showing different degrees of hyposmia after surgery. However, the symptom was temporary in most patients.

Dürr et al. found no changes in smell perception after an average time of 5.4 months of rhinoplasty using the "Sniffin'Sticks" test [12]. Using the same test, Randhawa et al. [7] found a significant score improvement 12 weeks after functional septorhinoplasty. In our study, smell perception also improved 12 weeks after surgery, but the improvement was observed only in the VAS test results, and it remained unchanged in the UPSIT test results. The difference can be justified, because only patients who needed functional septorhinoplasty were included in the abovementioned series.

Data from earlier postoperative periods, such as 4 weeks after surgery, and the evaluation of two different times after surgery had not yet been reported using validated tests.

Some studies using unvalidated tests [5, 6] found a significant decrease in smell perception 1–6 weeks after rhinoplasty, with complete recovery 6 months after surgery. Shemshadi et al. [5] found that 6 weeks after surgery, more than 80% of the patients still presented some degree of hyposmia. In our study, 58.8% of the patients already presented normosmia in

Table 1 Frequency of smell ratings over time

No. (%)	Normosmia	Mild hyposmia	Moderate hyposmia	Severe hyposmia
Preoperative no. (%)	27 (79.4)	5 (14.7)	2 (5.9)	0
Four weeks after surgery no. (%)	20 (58.8)	10 (29.5)	3 (8.8)	1 (2.9)
Twelve weeks after surgery no. (%)	26 (76.5)	7 (20.6)	1 (2.9)	0

the fourth postoperative week and the UPSIT scores before the procedure were not statistically different from those 4 or 12 weeks after surgery. The impaired olfactory function in these previous series may be related to the use of unreliable olfactory tests, traumatic approaches that risk damaging the olfactory fibers and worsen edema of the nasal cavity, idiosyncratic factors associated with each surgeon's technique, or population differences. It is worth mentioning that olfactory function was only temporarily affected in these patients, who totally recovered after 6 months.

Septorhinoplasty was performed in all patients, that is, septoplasty was associated with rhinoplasty, even if the patient had no septum deviation. Septal cartilage was used as grafts in all surgeries, according to the rhinoplasty structural technique, thus ensuring more consistent and long-lasting outcomes. Hence, we avoided biases when referring to results influenced by the functional correction of the nasal septum in patients from the septal deviation subgroup.

Some studies showed that smell perception improved upon the correction of septal deviation [13, 14]. In this study, the presence of rhinitis or septal deviation did not influence the postoperative alteration in smell perception. This might have occurred because patients did not have other major associated nasal pathologies, such as chronic rhinosinusitis. Moreover, none of the included patients presented severe degree of rhinitis. All patients in the subgroup "rhinitis" had mild seasonal rhinitis and were not in crisis on testing days. In addition, the "rhinitis" group was small (ten patients).

No patient had persistent anosmia or significant hyposmia after postoperative 12 weeks. Persistent anosmia has already been reported in the literature and could be a rare complication of rhinoplasty [4].

According to the technique employed, we observed a better self-assessment of smell perception among patients submitted to a closed procedure rather than an open procedure 12 weeks after surgery. This finding was also verified by Razmpa et al. [6] and probably occurs because of the greater surgical trauma in the open procedure. However, the result was not the same when applying the UPSIT test.

A series involving weekly smell perception testing after surgery could better predict a reduction in olfactory function up to 4 weeks after the procedure. In addition, studies with a larger cohort would have a greater chance of considering patients with complications, such as persistent postoperative hyposmia.

Conclusion

In the 4th week after septorhinoplasty, smell perception does not change significantly; moreover, it may even improve in the 12th week. The presence of rhinitis and obstructive septal deviation had no influence on olfactory function after surgery. According to the technique employed, we observed a better self-assessment of smell perception in patients undergoing surgery via a closed approach than via an open approach.

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to report.

Research involving human participants A prospective observational study was made involving humans. The study was reviewed and approved by the local research ethics committee.

Informed consent Patients were included after they read and signed the informed consent form.

References

1. Wysocki CJ, Gilbert AN (1989) National Geographic Smell Survey. Effects of age are heterogenous. Ann N Y Acad Sci 561:12–28
2. Van Toller S (1999) Assessing the impact of anosmia: review of a questionnaire's finding. Chem Senses 24:705–712
3. Seiden AM (2004) Postviral olfactory loss. Otolaryngol Clin North Am 37:1159–1166
4. Champion R (1966) Anosmia associated with corrective rhinoplasty. Br J Plast Surg 19(2):182–185
5. Shemshadi H, Azimian M, Onsori MA, Azizabadi Farahani M (2008) Olfactory function following open rhinoplasty: a 6-month follow-up study. BMC Ear Nose Throat Disord 8:6
6. Razmpa E, Saedi B, Safavi A, Mohammadi S (2013) Olfactory function after nasal plastic surgery. B-ENT 9:269–275
7. Randhawa PS, Watson N, Lechner M, Ritchie L, Choudhury N, Andrews PJ (2016) The outcome of septorhinoplasty surgery on olfactory function. Clin Otolaryngol 41:15–20
8. Fiser A (1990) Changes of olfaction due to aesthetic and functional nose surgery. Acta Otorhinolaryngol Belg 44(4):457–460
9. Bousquet J, Van Cauwenberge P, Khaltaev N, Aria Workshop Group; World Health Organization (2001) Allergic rhinitis and its impact on asthma. J Allergy Clin Immunol 108(5 Suppl):S147–S334
10. Doty RL, Shaman P, Kimmelman CP, Dann MS (1984) University of Pennsylvania Smell Identification Test: a rapid quantitative olfactory function test for the clinic. Laryngoscope 94(2 Pt 1):176–178
11. Fornazieri MA, Santos CA, Bezerra TFP, Pinna FR, Voegels RL, Doty RL (2015) Development of normative data for the Brazilian adaptation of the University of Pennsylvania Smell Identification Test. Chem Senses 40:141–149
12. Dürr J, Lindemann J, Keck T (2002) Untersuchungen zur Riechfunktion vor und nach funktionell-ästhetischer Nasenoperation. HNO 50:626–629
13. Damm M, Eckel HE, Julgehulsing M, Hummel T (2003) Olfactory changes at threshold and suprathreshold levels following septoplasty with partial inferior turbinectomy. Ann Otol Rhinol Laryngol 112:91–97
14. Philpott CM, Rimal D, Tassone P, Prinsley PR, Premachandra DJ (2008) A study of olfactory testing in patients with rhinological pathology in the ENT clinic. Rhinology 46:34–39