

Value of turbinoplasty in rhinosurgery - a controlled randomized study*

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Abstract

Background: Turbinoplasty is a common procedure in patients with nasal obstruction and hypertrophy of the nasal turbinates. A general recommendation regarding the necessity of turbinoplasty in functional rhinosurgery is still missing. For the first time, the value of turbinoplasty in septo- and septorhinoplasty regarding patient satisfaction as well as objective data in rhinomanometry and acoustic rhinometry was analyzed in a prospective randomized controlled trial.

Methodology: 73 patients with nasal obstruction due to septal deviation and / or a deviated nose were included in the study. After randomization, anterior turbinoplasty was or was not performed during septo- or septorhinoplasty. Pre- and postoperative rhinomanometry and acoustic rhinometry were accomplished. NOSE[®] and SNOT 20 questionnaires were completed by the patients before and 9 months after surgery. Additionally, the patients were asked about their subjective satisfaction.

Results: 81% of the patients were subjectively satisfied with the postoperative improvement of nasal breathing. There was a significant improvement in the values of NOSE[®] and SNOT 20 questionnaires with no relevant difference between the two study groups. Acoustic rhinometry and rhinomanometry showed values in MCA1 and 2, Vol 1 and Vol 2 as well as higher nasal flows with no statistically significant difference between the two study groups.

Conclusions: Patient satisfaction after functional septo- and septorhinoplasty is high and does not seem to be affected by turbinate surgery. There was no statistically significant difference in the postoperative results regarding objective rhinological measurements with or without turbinoplasty. As extensive resections of the turbinates can have a negative impact on nasal physiology, the indication for turbinoplasty must be considered carefully.

Key words: turbinoplasty, nasal breathing, rhinosurgery, septoplasty, septorhinoplasty

Introduction

The nasal turbinates enlarge the mucosal surface and ensure a close contact of inhaled air and the mucosa. This allows the most efficient heating and humidification possible. However, turbinoplasty is often used as an adjunct to septo- and septorhinoplasty. Hypertrophy of the nasal turbinates has many reasons. Allergic predisposition, recurrent infections, dry nasal mucosa due to long lasting exposure to conditioned air and an abuse of nasal decongestants are just a few or the manifold reasons. Frequently there is a compensatory hypertrophy of the turbinates as a result of septal deviation.

In 2016, 101.799 submucosal resections and plastic reconstructions of the nasal septum and 158.778 procedures regarding the inferior turbinate were registered just in Germany. There are many different ways to reduce the volume of the inferior turbinate described in the current literature⁽¹⁻¹⁰⁾. Laser application, radiofrequency ablation, bipolar coagulation, partial resection, pyriform turbinoplasty and the anterior inferior turbinoplasty are just a few procedures commonly used to supplement septoplasty or septorhinoplasty. Many patients report an initial improvement in nasal breathing after turbinoplasty. In the long term, however, a frequent recurrence of complaints is reported,

especially after laser application ⁽¹⁾.

The "anterior inferior turbinoplasty" is considered as one of the moderate procedures that reduces the volume of the inferior turbinate without over-resecting its mucosal surface. Here, the mucosa is dissected from the bone via a cut on the lower edge of the head of the inferior turbinate. Subsequently, the anterior-inferior part of the turbinate bone and the associated submucosal tissue as well as the lateral part of the mucosa are removed. Subsequently, the medial tissue and mucosa is lateralized and the shape of the head of the turbinate as well as and large parts of the mucosa are preserved.

Also, from a physiological point of view the nasal turbinates are able to significantly increase and reduce their volume during the nasal cycle due to the high density of venous vessels within the tissue. Within the nasal cycle activity and regeneration phases alternate allowing for greater exposure of one turbinate and concomitant regeneration of the other turbinate by reduced exposure to inhaled air ⁽¹¹⁻¹⁴⁾. Long-term observations suggest that the turbinate is able to adapt to the shape of the septum ⁽¹⁰⁾.

The hypothesis suggests that even after turbinoplasty, a long-term recurrent hypertrophy of the turbinate leads to an adaptation to the anatomical configuration of the septum in order to restore the physiological bottlenecks. This is often seen in strongly deviated septal configurations, where the inferior turbinate at the concave side of the septum hypertrophies and adapts its form to the septum. Of course, there are indications for a turbinoplasty as there are severe septal deviations with consecutive hypertrophy of the inferior turbinate that require a volume reduction in order to gain space for the corrected septum. Additionally, surgical resection of the turbinates increases the risk of postoperative bleeding and often requires nasal packing.

However, in many cases a turbinoplasty is routinely performed in the context of a septo- and septorhinoplasty. The usefulness of a routinely performed turbinoplasty in septo- and septorhinoplasty can be questioned considering the adaptability of the nasal turbinates. So far, there are no studies in the current literature analyzing the long-term effects of turbinoplasty as a supplement in septoplasty and septorhinoplasty in a randomized controlled setting. Therefore, the aim of the present study was the analysis of the value of turbinoplasty in this context in a prospective, controlled, randomized trial.

Materials and methods

A prospective, controlled randomized study was performed monocentrically at the Department of Otorhinolaryngology, Head and Neck Surgery of the University Hospital Ulm. The study was approved by the local ethics committee in 2015 (No 326/15). Patients with septal deviation or a functionally relevant deviated nose undergoing septo- or septorhinoplasty for functional reasons were included in the study.

The first study group received a regular septoplasty / functional septorhinoplasty without any manipulation regarding the turbinates (study group "NO TPL").

In patients of the second group, in addition to the septoplasty / functional septorhinoplasty, bilateral anterior inferior turbino-plasty was performed (study group "TPL"). In order to receive comparable results, an anterior inferior turbinoplasty was performed in all patients belonging to the TPL group. Here, an incision is made on the caudal edge of the head of the lower turbinate and a medial mucosal flap is formed. The caudal parts of the turbinate bone including the lateral submucosal swelling parts are resected and then the medial mucosal flap is replaced. The advantage of this method is the only minor reduction of the mucosal surface and the sparing of the head of the lower turbinate as part of the nasal valve.

The procedures were performed by four different senior physicians. To ensure comparable results, the turbinoplasty was performed by all surgeons in the exact same technique. The patients were randomized to one of the two groups. Patients were not told which of the two groups they belonged to until the last examination and questioning nine months postoperatively. There were 3 examinations for each patient. Preoperatively, the SNOT20 (GAV) and the NOSE[®] questionnaires were completed by all participants. Nasal endoscopy with a digital photo documentation of the septum and the inferior turbinates, rhinometry and rhinomanometry were performed using Rhino-Sys (Happersberger, otopront GmbH, Germany) according to the consensus report on acoustic rhinometry and rhinomanometry ⁽¹⁵⁾. At the end of their inpatient stay, the study participants received a modified "Postoperative Questionnaire" in order to measure acute postoperative complaints. This questionnaire covered complaints of nasal breathing, pressure in the nose, problems sleeping and crusting in the nose on a scale from 1 (minor complaints) to 4 (severe complaints).

The third and final examination was performed nine months postoperatively. Each of the study participants completed in the SNOT20 (GAV) and NOSE[®] for the second time. Additionally, a postoperative feedback was captured by questionnaire. Rhinomanometry and acoustic rhinometry were repeated as well as the endoscopy and the intranasal photo documentation of both nasal cavities.

Exclusion criteria were any kind of previous surgeries regarding the nose, turbinates and the paranasal sinuses, patients with obstructive sleep apnoea, patients with regular cigarette consumption and patients of more than 60 or less than 18 years of age. Patients eligible for study enrollment were specifically asked for allergic complaints. In all patients a prick test was performed to exclude cutaneous sensitization to inhaled allergens. Patients with an allergic anamnesis or with a positive prick test were excluded from the study.

The collected data was anonymized using a unique identifica-

Table 1. Pre- and postoperative results of rhinomanometry.

Rhinomanometry (bilateral mean inspiratory flow)		
		Average [ml/s]
NO TPL	preoperative	499.37
	postoperative	515.33
TPL	preoperative	502.25
	postoperative	594.38

tion number (ID). All data was recorded with Microsoft Excel. Statistical analysis was performed by IBM SPSS Statistics data editor.

Results

73 patients were included in the study. The questionnaires from 58 patients could be included in the analysis. 51 patients returned to the final examination after 9 months. 15 patients did not return the questionnaires and did not return to hospital for the final examination. The reasons were moving the apartment, schedule difficulties or contact problems. 19 of the included patients received a septoplasty. 9 of them were additionally treated with an anterior inferior turbinoplasty. 54 patients received a septorhinoplasty due to a deviated nose. 28 of them received an anterior inferior turbinoplasty. The age and gender distribution of the two study groups was comparable.

47 of 58 patients (81 %) were satisfied with the general results of surgery regarding improved nasal breathing and would opt for surgery again.

Rhinomanometry

The mean inspiratory flow was 499 ml/s preoperatively vs. 515 ml/s postoperatively in the NO TPL group and 502 ml/s preoperatively vs. 594 ml/s in the TPL group. Table 1 shows the results of inspiratory flow (ml/s, 150 Pa) in rhinomanometry, Figure 1 depicts the changes in a box plot. There was no statistically significant difference between the two groups (TPL vs. NO TPL) preoperatively ($p = 0.724$) and postoperatively ($p = 0.122$). Comparing the pre- and postoperative results of the patients, there was a statistically significant difference ($p = 0.004$).

Acoustic rhinometry

The difference in MCA2 averaged 0.30 cm^2 preoperatively vs. 0.83 cm^2 postoperatively in the NO TPL group and 0.25 cm^2 preoperatively vs. 0.91 cm^2 postoperatively in the TPL-group. A statistically significant difference was detected between the pre- and postoperative result within the groups (NO TPL: $p = 0.002$, TPL: $p = 0.0001$) with regard to MCA2, but no significant difference between the groups TPL and NO TPL, preoperatively ($p = 0.064$) and postoperatively ($p = 0.828$). Table 2 depicts

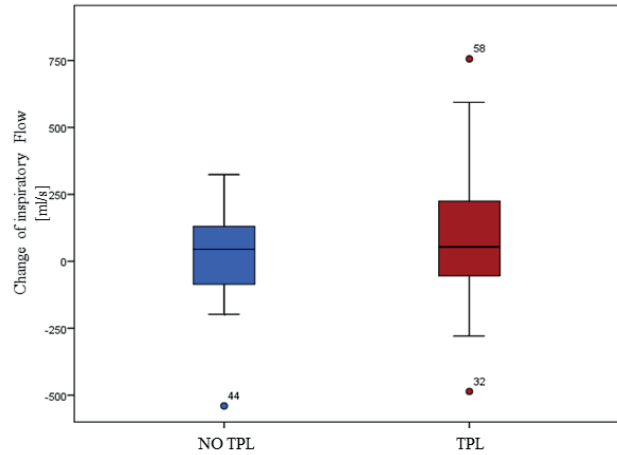


Figure 1. Box Plot of the flow-change in rhinomanometry (comparing the turbinoplasty group and the no turbinoplasty group) in ml.

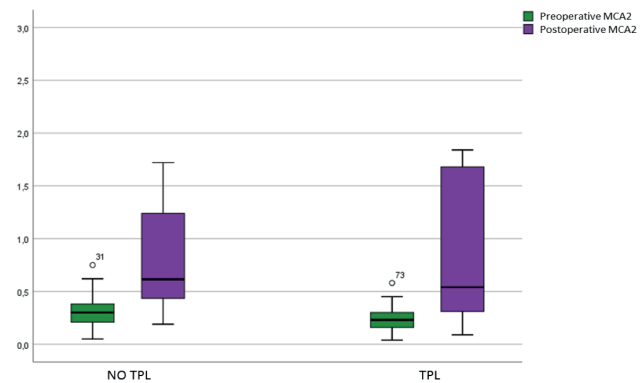


Figure 2. Box Plot of the pre- and postoperative acoustic rhinometry (MCA2, comparing the TPL and the NO TPL group).

the change in acoustic rhinometry regarding MCA2. Figure 2 displays the results of the pre- and postoperative acoustic rhinometry (MCA2) in a box blot.

Questionnaires

The SNOT 20 (GAV) showed an average total score of 26 points preoperatively vs. 16 points postoperatively in the NO TPL-group. The average score decreased from 30 points to 16 points on average in the TPL-group. The pre- and postoperative difference was statistically significant ($p < 0.05$) for both groups regardless of whether a turbinoplasty was performed or not. The same result was detected for the NOSE® questionnaire ($p < 0.05$). Here the average score decreased from 64 to 28 for the NO TPL-group whereas the TPL-group decreased from 62 to 28. Analyzing the differences between the two groups, there was no significant difference between the patients of the two groups, with and without turbinoplasty ($p > 0.05$) (Tables 3 and 4).

Table 2. Changes in MCA2.

Acoustic Rhinometry: Changes in MCA2 (deviated side of the septum)		
		Average
NO TPL	preoperative	0.30 cm ²
	postoperative	0.83 cm ²
TPL	preoperative	0.25 cm ²
	postoperative	0.91 cm ²

Table 3. Pre- and postoperative values of the SNOT 20 GAV questionnaire within the groups (TPL vs. No TPL).

SNOT 20 GAV questionnaire		
		Total score (average)
NO TPL	preoperative	26 / 100
	postoperative	16 / 100
TPL	preoperative	30 / 100
	postoperative	16 / 100

Table 4. Pre- and postoperative values of the NOSE[®] questionnaire within the groups (TPL vs. NO TPL).

NOSE [®] questionnaire		
		Average points
NO TPL	preoperative	64 / 100
	postoperative	28 / 100
TPL	preoperative	62 / 100
	postoperative	28 / 100

Discussion

Turbinoplasty is an important surgical method in the treatment of certain nasal pathologies. In many cases a turbinoplasty is still a standard step in septo- and septorhinoplasty. Mlynski et al. demonstrated the remarkable adaptability of the turbinates to the given spatial conditions. They demonstrated, that turbinates physiologically adapt to septal deviations by hypertrophying on the concave side of the septum until the physiological cleft space between the turbinate and the septum is restored. This long-term effect is also seen after turbinoplasty. On the other hand, the turbinate is able to adapt to tight spatial conditions, just to restore this gap^(14,16–21).

In this respect, a turbinoplasty does not seem to be fundamentally necessary in all patients, as the turbinate is able to produce physiological conditions on its own. These observations led us to carry out the present study.

Hypertrophy of the inferior turbinate is a common problem in nasal obstruction. There are reasons to perform an anterior

inferior turbinoplasty, especially in not on conservative therapy-responsive hypertrophy^(22,23). There are a variety of operational techniques that are described in the current literature to reduce the volume of turbinates^(1,3,7,8,24–26). Under certain conditions, these techniques offer good chances of success to significantly improve the nasal breathing of affected patients. Based on the above-mentioned studies on the adaptability of the turbinates, it seems reasonable that a turbinoplasty should not be performed as standard step in functional rhinosurgery. Patients with allergic hypertrophy of the inferior turbinate were excluded in the present study although it is a quite common pathology. However, the treatment of choice in this case is initially medicinal and only with persistence of hypertrophy surgical. Apart from impairing nasal physiology, a turbinoplasty significantly increases the risk of bleeding⁽²⁷⁾. In addition, a recent retrospective study found that patients receiving septum and turbinoplasty had significantly more problems than those in the control group where patients received septoplasty only⁽²⁸⁾. Extensive resections of the inferior turbinate may lead to an empty nose syndrome, which is associated with severe reduction of the quality of life⁽²⁹⁾.

Septoplasty and septorhinoplasty are effective methods for improving subjectively nasal breathing. 81% of the patients enrolled in the study would have the operation re-performed independently of the turbinoplasty. Although the effectiveness of septoplasty in the literature is discussed quite controversially⁽³⁰⁾, our results underline its positive impact on functional nasal breathing. The direct comparison between the TPL and NO TPL groups revealed no significant difference neither in nasal air flow volumes of rhinomanometry nor in minimal cross-sectional areas and volumes of acoustic rhinometry. In both groups nasal airflow volumes were improved postoperatively. Even though active anterior rhinomanometry offers valuable information (nasal air flow volume), there are limitations of this method⁽³¹⁾. According to the technique of active anterior rhinomanometry, results are values of volume depending on the active cooperation of the patient. Additionally, the results do not necessarily correlate with the patient's complaints and/or clinical findings. Therefore, as much subjective (SNOT-20 and NOSE questionnaires and a self-designed questionnaire) and objective data (rhinomanometry, acoustic rhinometry) as possible were collected in the present study in order to obtain a valid statement. As patient enrollment started in 2015 and data collection was completed in 2017, the updated agreement on nasal airway function tests of 2018 could not be fully taken into consideration⁽³²⁾.

In selected cases, nasal breathing can be additionally enhanced by a turbinoplasty. However, this can impair the physiological functions of humidification, warming and cleaning the inhaled air. In this respect, any surgical intervention should have as little as possible impact on the physiological conditions or attempt to restore them.

Conclusion

Nasal turbinate surgery remains an important procedure in rhinosurgery. However, it should not be performed by default in septo- or septorhinoplasty. The present results showed no benefit for patients that received a turbinoplasty during septo- or septorhinoplasty in subjective (SNOT 20 GAV, NOSE[®] questionnaire) and objective (rhinomanometry, acoustic rhinometry) values.

In this respect turbinoplasty should be avoided in the context of septoplasty and septorhinoplasty, if there is no urgent reason justifying this additional procedure. The aim of rhinosurgery must be the restoration of as physiological conditions as possible and not the maximum possible nasal breathing.

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Author contribution

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Conflict of interest

None of the above-mentioned authors has a conflict of interest regarding this publication.

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