

RHINOLOGY

# The effects of inferior turbinoplasty on nasal airflow during cosmetic rhinoplasty

## *Gli effetti sul flusso aereo nasale della turbinoplastica inferiore in corso di rinoseptoplastica*

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### SUMMARY

Rhinoplasty is one of the most common and challenging cosmetic procedures. One of the complications of rhinoplasty associated with dissatisfaction is nasal obstruction, which is often due to narrowing of the nasal valve area. Application of certain procedures such as turbinoplasty can prevent and correct this problem. This study aim was to investigate the effect of inferior turbinoplasty in reduction of airflow resistance and nasal obstruction. Using active anterior rhinomanometry, nasal airflow was measured in 50 patients who underwent cosmetic rhinoplasty and bilateral turbinoplasty before and 6 months after surgery. None of the patients subjectively complained of nasal obstruction before or after surgery. According to rhinomanometry results, improvement in nasal airflow was seen both in inspiration and expiration, although only expiration was significant ( $p = 0.034$ ). Airflow changes in males and females and in different age groups was not significant ( $p > 0.05$ ). It appears that rhinoplasty does not adversely affect nasal airflow when it is accompanied by simple adjuvant procedure inferior turbinoplasty.

KEY WORDS: Rhinoplasty • Rhinomanometry • Turbinoplasty

### RIASSUNTO

*La rinoplastica è una procedura chirurgica molto comune e al tempo stesso di elevata complessità. Uno degli aspetti più discussi di tale chirurgia sono gli insoddisfacenti esiti funzionali dovuti spesso ad un eccessivo restringimento dell'area della valvola nasale. Alcune procedure, come la turbinoplastica inferiore, possono favorire la prevenzione di tali problematiche ostruttive. L'intento del presente studio è quello di indagare gli effetti della turbinoplastica inferiore sulla resistenza nasale e sull'ostruzione respiratoria. In 50 pazienti è stata effettuata un'analisi preoperatoria e sei mesi dopo rinoplastica con turbinoplastica inferiore mediante rinomanometria anteriore attiva. Nessuno dei pazienti ha lamentato sintomatologia ostruttiva nasale nel preoperatorio o nel corso del postoperatorio. In accordo con i dati rinomanometrici sia le resistenze inspiratorie che quelle espiratorie hanno presentato valori migliori nel postoperatorio, ma solo le resistenze espiratorie hanno presentato una significatività statistica ( $p = 0,034$ ). Le differenze in termini di flusso nasale fra maschi, femmine e differenti gruppi di età non sono state significative ( $p > 0,05$ ). In conclusione dai dati del nostro studio emerge che la rinoseptoplastica, associate a turbinoplastica parziale non ha un impatto negativo sulla funzionalità nasale ed in particolare sul flusso aereo attraverso le cavità nasali.*

PAROLE CHIAVE: Rinoplastica • Rinomanometria • Turbinoplastica

Acta Otorhinolaryngol Ital 2016;36:97-100

### Introduction

Respiratory problems following rhinoplasty are a major concern, and despite a favourable cosmetic outcome, can cause dissatisfaction for the patient. Some researchers have reported such breathing disturbances are as high as 70% following rhinoplasty, although scars and loss of mucosal sensation can also give the feeling of a “blocked” nose<sup>1</sup>. The aetiology of nasal obstruction after rhinoplasty includes various factors that result from a combination of

both undiagnosed nasal disorders such as septal deviation, turbinate hypertrophy and mucosal diseases in addition to reduced nasal valve area following this type of surgery<sup>2,3</sup>. On the other hand, the inferior nasal turbinate is an independent bone<sup>4</sup>; forming a part of the nasal lateral wall, it is a major structure in the nose<sup>5</sup>. The inferior turbinate causes resistance against the nasal airflow that is essential for normal respiration. Moreover, as part of the valvular area it changes the lamellar and laminar flow into the turbinate state<sup>6</sup>.

Rhinoplasty may cause reduction of nasal valve area and result in severe airflow obstruction and respiratory problems. Accordingly, as for any type of surgery in this region it should be performed with utmost care and precision. The use of techniques such as inferior turbinate fracture or turbinoplasty and inferior turbinate size reduction by improving nasal airflow<sup>7</sup> can be beneficial in improving the post-operative results and increase patient satisfaction. We hypothesised that removing part of the inferior turbinates (turbinoplasty) during rhinoplasty by increasing the internal nasal space might reduce airflow resistance and nasal obstruction and consequently improve patient breathing. Inferior turbinoplasty is a procedure that reduces the size of the inferior turbinates.

Considering above hypothesis, this study aimed at investigating the effect of inferior turbinoplasty in reducing the airflow resistance and nasal obstruction following rhinoplasty.

## Materials and methods

This prospective study was performed on patients referred to a private clinic for rhinoplasty between 2010 and 2012. Among patients referred for rhinoplasty, those with wide nose and large inferior turbinates and without symptomatic septal deviation, turbinate hypertrophy, and without history of chronic sinusitis or allergy were selected because the chance of developing airflow resistance and nasal obstruction is higher in this group of patients after reduction of nose size. In other words, selected patients were candidates for elective rhinoplasty without septoplasty.

Informed consent was obtained from each patient. The study protocol was approved by the local institutional review board (IRB).

A total of 50 patients were randomly selected among eligible patients using a table of random numbers who underwent rhinomanometry and subsequent rhinoplasty. Active anterior rhinomanometry was performed by placing the nozzle into both nasal cavities. Patients were evaluated under similar circumstances (during certain periods of the day, no smoking and no exercise before the test). Rhinomanometry was performed for all female patients

during the first week after menstruation. For all patients, closed rhinoplasty was performed by the same surgeon without any intervention or reconstruction of nasal valve. Bilateral high-low-high internal lateral osteotomy and inferior turbinate outfracture with preservation of Webster's triangle was performed for all patients.

Nasal airflow was measured by active anterior rhinomanometry before and 6 months after the operation. Rhinomanometry was performed with a Rino 4000 device (Homoth Medizinelektronik GmbH & Co. KG, Hamburg, Germany). The airflow during inspiration and expiration was measured at 75, 150 and 300 Pascal, whereas in data analysis 150 Pascal was considered as the standard level of pressure. The results were reported as numbers and diagrams for each patient and were then analysed by a statistician.

The patients were also evaluated for post-operative complications such as respiratory problems after the operation.

Based on rhinomanometry results, patients were divided into three groups. Group 1: nasal airflow changes after surgery between -50 and 50 ml/sec that was considered as the default change in the airflow due to device error, moderator error or error in the patient's respiration (unchanged condition); Group 2: those with airflow changes less than -50 ml/sec were considered as patients with a worsened condition; Group 3: patients with more than 50 ml/sec changes in the nasal airflow during the same time regarded as improved condition.

### Statistical analysis

Statistical analysis was performed using SPSS ver. 11.5 for Windows. Normally distributed quantitative variables were demonstrated as mean  $\pm$  standard deviation. The normality condition of the quantitative variables was investigated using the Kolmogorov-Smirnov test. Mann-Whitney U test was used to compare equality distribution of age in two gender and changes in nasal airflow following rhinoplasty in two groups. Chi-square and maximum likelihood ratio tests were used to assess relation between Changes in nasal airflow following rhinoplasty and ratio variant. A p value < 0.05 was considered as significant.

**Table I.** Changes in nasal airflow following rhinoplasty (Classification A).

Variable	Group 1	Group 2	Group 3	Test	
	(Between -50 to 50 ml/sec) n (%)	(Less than -50 ml/sec) n (%)	(More than 50 ml/sec) n (%)	Test statistic	P value
Right nasal cavity inspiratory airflow	26 (52)	9 (18)	15 (30)	8.92	0.012*
Right nasal cavity expiratory airflow	25 (50)	8 (16)	17 (34)	8.68	0.013*
Left nasal cavity inspiratory airflow	26 (52)	11 (22)	13 (26)	7.96	0.019*
Left nasal cavity expiratory airflow	28 (56)	9 (18)	13 (26)	12.04	0.002*
Both nasal cavities inspiratory airflow	17 (34)	13 (26)	20(40)	1.48	0.477
Both nasal cavities expiratory airflow	21 (42)	8 (16)	21(42)	6.76	0.034*

\*p < 0.05 significant

**Table II.** Changes in nasal airflow following rhinoplasty (Classification B).

Variable	Comparing the unchanged with worsened condition (Group 1 & 2)		Comparing the unchanged with improved condition (Group 1 & 3)	
	Test statistic	P value	Test statistic	P value
Right nasal cavity inspiratory airflow	26.000	0.007*	26.000	0.118
Right nasal cavity expiratory airflow	25.000	0.005*	17.000	0.280
Left nasal cavity inspiratory airflow	11.000	0.021*	26.000	0.055
Left nasal cavity expiratory airflow	9.000	0.003*	28.000	0.029*
Both nasal cavities inspiratory airflow	13.000	0.584	17.000	0.742
Both nasal cavities expiratory airflow	21.000	0.026*	21.000	0.999

\*  $p < 0.05$ .

## Results

Among the 50 cases, 8 (16%) were male and 42 (84%) female. Their age ranged from 15 up to 59 years with mean age of  $26.84 \pm 8.81$ . The mean age of men and women was not significantly different ( $p = 0.055$ ,  $Z = 1.921$ ). Considering symptoms, none of the patients complained of nasal obstruction, either before or after surgery.

Mean inspiratory airflow before and after rhinoplasty was  $670.32 \pm 697.5$  and  $694.62 \pm 715.5$  ml/sec, respectively. In addition, mean expiratory airflow before and after rhinoplasty were  $676.38 \pm 703$  and  $716.26 \pm 718$  ml/sec, respectively. Based on rhinomanometry results, the inspiratory and expiratory airflows changed significantly at 6 months after rhinoplasty with turbinoplasty (Table I). The number of patients without airflow changes (Group 1) was higher than those with a worsened condition (Group 2); no significant difference was found in the number of patients without airflow change (Group 1) and those with improved condition (Group 3) (Table II).

Both inspiratory and expiratory nasal airflows improved at 6 months after rhinoplasty and inferior turbinoplasty, but the improvement was significant only for expiratory airflow ( $p = 0.034$ ). In addition, the level of airflow changes in males and females and in different age groups was not significant ( $p > 0.05$ ).

## Discussion

Nasal obstruction is a major complication of rhinoplasty that results in true problems and discomfort for the patient<sup>8</sup>. Since the airflow in each nasal cavity changes based on the prominence and lack of space caused by the inferior turbinate, changes in the turbinate structure can

thus affect nasal function, which is important in rhinoplasty surgeries and post-operative nasal obstruction.

The importance and necessity of the present research is that if the efficacy of turbinoplasty during rhinoplasty is improved, common post-operative complications such as nasal obstruction are resolved, and further costs for revision surgeries can be avoided.

Due to the increase in the demand for rhinoplasty, the results of this study can have a major impact on its costs and patient satisfaction. Herein, the role of fracture of the inferior turbinate or turbinoplasty was investigated in the prevention of post-operative nasal obstruction in those cases that had been referred for cosmetic rhinoplasty without respiratory complaints. In addition to qualitative and subjective studies by clinical history, quantitative and objective studies by anterior rhinomanometry were also performed which adds further value to our results.

In a study by Grymer, which was performed 6 months after rhinoplasty surgery using acoustic rhinometry, it was observed that the internal diameters of the nasal cavity, especially in the anterior section, decreased after rhinoplasty surgery<sup>9</sup>; this factor plays a major role in post-operative nasal obstruction.

Kosh et al., in 2004, reported that rhinoplasty is the most important cause of nasal obstruction followed by nasal trauma (15%) and congenital anomaly (6%)<sup>10</sup>. However, in the study by Courtiss, the findings suggested that rhinoplasty had no impact on nasal airflow<sup>11</sup>. In another study regarding the complications of nasal obstruction following rhinoplasty surgery, revision osteotomy with turbinoplasty was proposed for overcoming this problem<sup>3</sup>, a finding which is consistent with our results. In a similar study, the role of turbinectomy in cases of hypertrophic inferior and middle turbinates was highlighted as a solution for post-operative nasal breathing problems<sup>12</sup>.

Mlynski et al. concluded that anterior turbinoplasty and turbinectomy reduce nasal airflow resistance, but due to disruption of the natural shape of the lateral nasal wall, worsen its respiratory function<sup>13</sup>. In another study on cases with nasal airway obstruction, significant reduction in obstruction was seen following inferior turbinectomy by carbon dioxide laser in comparison with those receiving cryotherapy, turbinate submucosal resection and partial turbinectomy<sup>14</sup>. This is also in agreement with our findings.

Moreover, the studies by Ophir et al. on patients complaining from nasal obstruction due to inferior turbinate hypertrophy showed that total turbinectomy reduces nasal obstruction in 84% of cases and also improves nasal-conditioning<sup>15</sup>.

Buyuklu et al., in a study on patients with mild and moderate inferior turbinate hypertrophies, showed that outfracture of the inferior turbinate (turbinoplasty) is an effective technique that can increase the nasal airway in these patients<sup>16</sup>. Moreover, in a recent study by Zhang et al. on 50 patients with chronic hypertrophic rhinitis and inferior

turbinate hypertrophy, it was found that inferior turbinate outfracture surgery is a proper method that can expand the nasal cavity and improve nasal ventilatory function<sup>17</sup>. The findings of the two latest studies are consistent with our results, although with different patient cohorts (inferior turbinate hypertrophies vs rhinoplasty).

The findings of our study are very similar to most previous reports on this issue, demonstrating that fracture of the inferior turbinate can be of major importance in improving nasal function, preventing post-operative obstructive symptoms and increase patient satisfaction following rhinoplasty surgeries. It also shows that turbinoplasty improves nasal airflow during both inspiration and more prominently expiration, with no association with age or sex. It also highlights that the number of patients with no significant change in nasal airflow is greater than those who experience significant worsening in airflow, meaning that due to the decreased nasal space following rhinoplasty, no change can also be interpreted as improvement. The main limitation of this study is lack of a matched control arm that may limit the conclusions. Therefore, our findings should be interpreted with caution.

As nasal obstruction following rhinoplasty is very common, further studies using the unilateral turbinoplasty technique and larger case-control studies and in different countries are recommended.

## Conclusions

Based on the evidence herein, turbinoplasty during cosmetic rhinoplasty in patients with large nose and large inferior turbinates may prevent nasal obstruction and adverse effects of surgery on nasal airflow.

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Received: April 22, 2015 - Received: June 18, 2015