Use of peak nasal inspiratory flowmetry and nasal decongestant to evaluate outcome of septoplasty with radiofrequency coblation of the inferior turbinate*

H. Huseyin Balikci[1] and M. Mustafa Gurdal[2]

[1] Department of ORL, Susehri State Hospital, Sivas, Turkey

[2] Department of ORL, Uskudar State Hospital, Istanbul, Turkey

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Abstract

Background: To investigate the role of peak nasal inspiratory flowmetry (PNIF) in evaluating inspiratory improvements in patients who underwent both septoplasty and inferior turbinate coblation by radiofrequency (ITC-RF).

Methods: One hundred and eight patients underwent both Cottle's septoplasty and ITC-RF. PNIF measurements were performed in all patients in the preoperative period and 6 months postoperatively. All measurements were made both before and after decongestion of the nasal cavity with oxymetazoline spray.

Results: Mean preoperative PNIF measurements differed significantly: 104.3 ± 33.6 L/min vs 136.1 ± 27.7 L/min before and after oxymetazoline decongestion, respectively. Mean postoperative PNIF measurements were 139.2 ± 30.8 L/min and 151.2 ± 32.3 L/min before and after decongestion, respectively. Preoperatively the mean difference between before and after decongestion was 32.1 ± 16.3 L/min. Postoperatively the mean difference was 11.8 ± 11.1 L/min.

Conclusion: PNIF can be used in the assessment of ITC-RF outcomes with the aid of nasal decongestants, even in patients who also underwent septoplasty.

Key words: peak nasal inspiratory flowmetry, radiofrequency, decongestant, septoplasty, inferior turbinate, coblation

Introduction

Inferior turbinate hypertrophy is one of the most common causes of nasal obstruction. It may be observed in allergic rhinitis, vasomotor rhinitis and chronic hypertrophic rhinitis or as a compensatory response to nasal septal deviation. Although medical treatment may achieve a slight improvement, most patients require surgical treatment [(1)]. Various surgical techniques such as turbinoplasty, total/partial turbinectomy, chemical cauterization, electrocauterization, laser turbinate reduction, submucosal tissue reduction by microdebrider, cryotherapy and inferior turbinate coblation by radiofrequency (ITC-RF) are available for the treatment of hypertrophic inferior concha [(1-3)]. These procedures are often performed together with septoplasty.

Nasal obstruction can be evaluated by objective and subjective methods. Objectively, tools such as acoustic rhinometry (AR) and rhinomanometry (RM) are used. Peak nasal inspiratory flowmetry (PNIF) is another objective method that is easy, cheap and non-invasive, but is not commonly used [(4)]. PNIF and RM have similar power to discriminate pathology from healthy subjects and recent papers have highlighted the increasing interest in PNIF [(5,6)]. We aimed to investigate the role of PNIF in evaluating inspiratory improvements in patients who underwent both septoplasty and ITC-RF.

Materials and methods

The study was conducted with 108 patients who underwent

both Cottle's septoplasty and ITC-RF (Gyrus® ENT, Bartlett, IL, USA) in the Otorhinolaryngology Department of Susehri State Hospital. RF energy was delivered as 400 J separately to the anterior, middle and posterior portions of the inferior turbinate in coagulation mode and auto-stop mode. We took great care not to injure the overlying mucosa of the turbinate.
PNIF (Clement Clarke International, Harlow, UK) measurements were made in all patients in the preoperative period and 6 months postoperatively. All measurements were made both before and after decongestion of the nasal cavity with oxymetazoline spray. PNIF values during forced inspiration were expressed as L/min. The use of the device was explained in detail and illustrated to all patients. The patients were asked to expire forcefully while sitting. Thereafter, with an anesthesia mask placed over the mouth and nose in an airtight manner and connected to the device, they were asked to inspire forcefully through the nose with the lips closed. Of three consecutive measurements with a maximal 10% difference, the highest measurement was recorded as the final value.

Exclusion criteria

Patients with lower respiratory tract pathology, nasal valve insufficiency, a history of sinonasal surgery or chronic disease, those taking medications (such as oral contraceptives, beta-blockers), smokers and those with physical or mental problems were excluded from the study.

Statistics

Statistical analysis of the results was performed using SPSS for Windows 19.0 (Chicago, IL, USA). Comparisons of data between groups were made using the paired-samples t-test and $p < 0.05$ was considered significant.

Results

The mean age of the patients was 30.2 ± 10.4 years (range, 16–56 years); 45.4% of the patients were female and 54.6% were male.

Mean preoperative PNIF measurements were 104.3 ± 33.6 L/min and 136.1 ± 27.7 L/min before and after oxymetazoline decongestion, respectively ($p < 0.001$). Mean postoperative PNIF measurements were 139.2 ± 30.8 L/min and 151.2 ± 32.3 L/min before and after decongestion, respectively ($p < 0.001$). When we compared the non-decongested preoperative (104.3 ± 33.6 L/min) and postoperative (139.2 ± 30.8 L/min) mean values, the postoperative value was significantly higher ($p < 0.001$). On comparison of the decongested preoperative (136.1 ± 27.7 L/min) and postoperative (151.2 ± 32.3 L/min) mean values, the postoperative value was significantly higer ($p < 0.001$). However, the mean decongested preoperative value (136.1 ± 27.7 L/min) and non-decongested postoperative value (139.2 ± 30.8 L/min) were not significantly different ($p = 0.57$) (Figure 1 and Table 1). Preoperatively, the mean difference between before and after decongestion was 32.1 ± 16.3 L/min (range, 0–70 L/min). Postoperatively, the mean difference was 11.8 ± 11.1 L/min (range, 0–55 L/min). When we compared the preoperative and postoperative mean differences resulting from decongestion, we observed a significantly higher value in the preoperative mean difference ($p < 0.001$) (Figure 1 and Table 1).

Discussion

PNIF is an objective method for the assessment of nasal airflow [(7)]. The efficacy of PNIF has been disputed in several studies. Many have compared PNIF with RM, AR or a Visual Analog Scale (VAS) in evaluating nasal obstruction [(8-11)]. When RM and PNIF were used to evaluate patients with obstructive pathology of the nose, no difference was found between the two methods [(8,9)]. Hellgren et al. compared PNIF, AR, RM and a VAS in healthy subjects and patients with allergic rhinitis due to histamine loading and concluded that PNIF was the most sensitive method among these [(12)]. PNIF was also reported as more sensitive than AR and RM in demonstrating the positive effect of nasal topical corticosteroid after nasal histamine loading [(13)]. Ozkul et al. reported that PNIF is an inexpensive, noninvasive, reproducible, portable and highly effective method that does not require technical knowledge or complicated equipment to assess nasal obstruction. In the same study, the normal value for PNIF in the Turkish population was determined to be 137 L/min [(7)]. In the present study, we investigated the success of ITC-RF accompanied by septoplasty using PNIF.

In another study, microdebrider-assisted partial turbinoplasty was evaluated by PNIF in 22 patients; the reported values of 65 L/min preoperatively, 98 L/min at 1 month, 123 L/min at 3 months and 126 L/min at 6 months showed a significant improvement between the preoperative period and 1, 3 and 6 months postoperatively [(14)]. Norlander et al. assessed powered-assisted partial turbinectomy and mometasone furoate nasal spray in patients with rhinosinusitis using PNIF and concluded that PNIF values improved for all patients, though significantly only for patients using mometasone spray [(15)]. Ozkul et al. evaluated septoplasty outcomes by PNIF and reported significantly increased values postoperatively. They found the mean pre- and postoperative PNIF values to be 102 L/min and 139 L/min, respectively, and observed an average increase of 37 L/min. In another study of 22 patients undergoing nasal septal surgery, postoperative PNIF measurements were found to be significantly higher than those made before the procedure [(16)]. In the present study, we recorded mean pre- and postoperative PNIF values of 104.3 L/min and 139.2 L/min, respectively.

ITC-RF is a common procedure for the surgical treatment of hy-

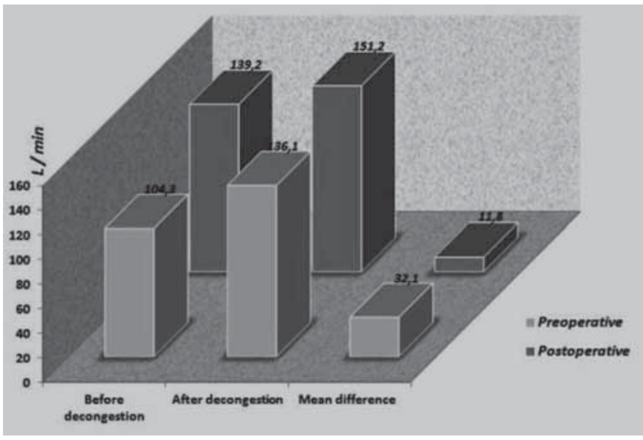

Figure 1. PNIF measurements before and after decongestion preoperatively and postoperatively.

Table 1. Results and comparisons of PNIF measurements.

	Preoperative measurement	Postoperative measurement	p value (paired-samples t-test)
Before decongestion	104.3 ± 33.6 L/min	139.2 ± 30.8 L/min	$p < 0.001$
After decongestion	136.1 ± 27.7 L/min	151.2 ± 32.3 L/min	$p < 0.001$
Mean difference	32.1 ± 16.3 L/min	11.8 ± 11.1 L/min	$p < 0.001$

pertrophic inferior turbinate. Several studies have been published regarding the evaluation of the efficacy of this technique; most have reported ITC-RF to be effective even on long-term follow-up. However, all of these studies evaluated the technique using objective or subjective methods such as AR, RM or a VAS [17-21]. In the present study, we evaluated the nasal airflow of patients who underwent both septoplasty and ITC-RF. This is not the first study to have focused on this topic, but to our knowledge there is no identical study in the literature [7,8,22]. In this regard, our study is unique. We also aimed to determine the role of PNIF in the assessment of ITC-RF in patients who underwent septoplasty in the same session, making measurements both before and after administration of a nasal decongestant both preoperatively and postoperatively. Differences in PNIF values before and after decongestion derive from reduction of the soft tissue volume of the inferior turbinate. Thus, we can assert that a smaller difference between pre- and post-decongestion reflects greater success of ITC-RF. We found the statistically significant differences resulting from decongestion to be 32.1 L/min and 11.8 L/min in the preoperatively and postoperatively period, respectively.

Nasal decongestants are used in various nasal pathologies such as rhinitis and sinusitis. They increase nasal airflow by reducing the soft tissue volume, especially of the inferior turbinate [23], but their effects are temporary and last only hours. Alternatively, the soft tissue volume of the inferior turbinate can be reduced by the RF coblation technique, aiming for a permanent effect. It is thus reasonable to use decongestants in the assessment of the efficacy of inferior turbinate coblation or any other type of inferior turbinate surgery that alters the soft tissue volume. It might be thought that the nasal cycle (in which the dominance in nasal airflow alternates between the nasal passages over a period of several hours [24]) could affect PNIF measurements. However, PNIF measurements of total nasal airflow are not affected by this alternation in airflow; the total nasal resistance remains relatively constant because of the reciprocal relationship between the two sides of the nose [25]. Therefore, the mean differences between pre- and post-decongestion PNIF values in the present study would not have been affected by the nasal cycle pre- or postoperatively.

Conclusion

In conclusion, PNIF is an option for the objective evaluation of nasal airflow in septoplasty. It can also be used to assess the outcomes of ITC-RF with the aid of nasal decongestants, even in patients who also underwent septoplasty.

Authorship contribution

HHB: contributed to data collection and analysis and to the writing of the paper. MG contributed to the writing of the paper.

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None

Conflicts of Interest

We have no financial relationship with the organization that sponsored the research.

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H. Huseyin Balikci
Suşehri Devlet Hastanesi
Kulak Burun Bogaz Klinigi
58600, Suşehri
Sivas
Turkey

Tel.: +90-346-311 4008
Fax: +90-346-311 4803
E-mail: balikcient@gmail.com