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Minimal cross-sectional areas, nasal peak flow and patients' satisfaction in septoplasty and inferior turbinectomy*†

J. Marais[1], J.A.M. Murray[1], I. Marshall[2], N. Douglas[3], S. Martin[3]

[1] Department of Otolaryngology, Royal Infirmary, Edinburgh, United Kingdom
[2] Department of Medical Physics, Western General Hospital, Edinburgh, United Kingdom
[3] Department of Respiratory Medicine, City Hospital, Edinburgh, United Kingdom

SUMMARY

Changes in minimal cross-sectional areas, measured by acoustic rhinometry as well as nasal peak flow fractions and linear analogue patients' satisfaction scores, were measured in two groups of eight patients each, undergoing septoplasty alone and septoplasty combined with trimming of the inferior turbinates, respectively. Patients who had both procedures performed showed the greatest increase in both minimal cross-sectional areas and peak flow fractions, and both of these parameters were closely correlated with patients' satisfaction, whether the patient was satisfied or not. Pre-operative nasal obstruction was worse in the dual-procedure group, but post-operative satisfaction was significantly greater in these patients. Both acoustic rhinometry and nasal peak flow fractions can be recommended as accurate and easy to perform pre-operative measurements in patients undergoing surgery for nasal obstruction.

Key words: septoplasty, inferior turbinectomy, acoustic rhinometry, nasal peak flow measurements

INTRODUCTION

Septoplasty and inferior turbinate trimming are often carried out either alone or in combination for patients complaining of nasal obstruction. At post-operative visits they express varying degrees of satisfaction dependent on the degree of pre operative obstruction (Larsen and Kristensen, 1990) and the success of the surgery undertaken to achieve relief. Objective measurements are seldom done in routine clinical practice, but would clearly be preferable to simple clinical impressions. We have used nasal peak flows and acoustic rhinometry to assess patients pre- and post-operatively and correlated this to post-operative patients' satisfaction scores.

PATIENTS AND METHODS

Sixteen consecutive patients who underwent either septoplasty alone or septoplasty and turbinectomy combined for nasal obstruction were studied. Nine of these patients were male, seven were female and their ages ranged from 14 to 70 years, with an average of 36.6 years. Eight patients had septoplasty (Group A) and 8 had septoplasty and bilateral inferior turbinate trimming combined (Group B).

All patients had the trial fully explained to them and written informed consent was obtained. The day prior to surgery, chest (oral) peak expiratory flow rates (PEFR) using a Wright's mini-peak flow meter were taken and averaged from three attempts. The same meter was converted to give nasal peak expiratory flow rates (NPEFR) by fitting a nasal mask and instructing the patient to blow through the nose as forcibly as possible. Once again, an average of three attempts was made. The pre-operative PEFR/NPEFR ratio or nasal peak flow fraction (NPFF) could thus be calculated (Table 1).

Acoustic rhinometry was performed pre-operatively using a custom-built reflectometer consisting of an IBM-compatible computer with a 34-kHz analogue-to-digital converter for data acquisition which is triggered from a custom-made respiration monitor able to sense nosepiece pressures. An in-line respiratory valve with a 50-ms closure-pulse delay and 16-mm internal diameter Tygon tubing was used and a Knowles BL1785 piezoelectric microphone with a 20-dB custom-made pre-amplifier and a 65-Hz to 12-kHz filter were fitted. Acoustic excitation pulses were produced and functioned as described by Marshall et al. (1992). Measurements were taken in the method outlined

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Table 1. Changes in minimal cross-sectional areas (MCSA), nasal peak flow fraction (NPFF) and patients satisfaction scores (PSS).

patient	group	total ΔMCA (cm^2)	PENF/PEFR (NPFF) pre	post	ΔNPFF	PSS
1	A	0.2	0.50	0.60	0.1	-1
2	B	0.5	0.44	0.70	0.26	+7
3	B	0.4	0.25	0.56	0.31	+9
4	A	0.0	0.55	0.55	0.0	0
5	A	0.1	0.46	0.52	0.06	-3
6	B	0.5	0.44	0.75	0.31	+9
7	B	0.5	0.45	0.70	0.25	+7
8	A	0.1	0.40	0.42	0.02	0
9	A	0.3	0.39	0.59	0.20	+5
10	A	0.3	0.40	0.55	0.15	+6
11	A	0.6	0.37	0.67	0.30	+8
12	B	0.6	0.18	0.46	0.28	+10
13	A	0.1	0.43	0.50	0.07	-8
14	B	0.4	0.21	0.46	0.25	+8
15	B	0.5	0.24	0.53	0.29	+7
16	B	0.6	0.19	0.56	0.37	+10

by Elbrond et al. (1991a, b). The minimal cross-sectional areas (MCSA) of both nasal cavities were noted from the readings, and the following day the patient underwent the operation as planned. This was done by one of two surgeons, and after uneventful recoveries all 16 patients were discharged home on the second post-operative day.

Each patient was seen two weeks post-operatively for nasal toilet and then reviewed again two months post-operatively. Repeated nasal assessment, PEFR, NPEFR, and acoustic rhinometry were performed.

In addition, the patient was asked to rate his/her overall satisfaction or dissatisfaction with the post-operative nasal patency compared to the pre-operative situation. This was done using a linear analogue scale of -10 cm to +10 cm (total 20 cm), where "-10" represents total dissatisfaction, "zero" represents no change, and "+10" represents complete satisfaction. The change in pre- and post-operative NPFF could thus be compared to actual changes in total minimal cross-sectional areas and with the patients' satisfaction scores (PSS).

RESULTS

Group A had a pre-operative mean combined MCSA of 2.05 cm^2 compared to group B with a mean of 1.75 cm^2 (Table 1). The former group also had a mean NPFF of 0.438, whilst that of the latter was 0.30. Patients' satisfaction with their post-operative outcomes ranged from -8 to +10 on the 20-point scale. Five of the 16 patients would not have chosen to have their operation if given the choice again after knowing what benefit was to be gained and at what discomfort. All five of these patients were in group A (septoplasty alone) and all gave a negative PSS, but the average for the group was 0.88, whilst that for group B was 8.6. All five of those in Group A who responded negatively had an improvement in NPFF of less than 0.1, compared to the rest of the patients in both groups who responded positively and had an average improvement of 0.33.

Table 2. Pre- and post-operative nasal peak flow fractions (NPFF) and minimal cross-sectional areas (MCSA).

group	pre-op NPFF	Pre-op MCSA (cm^2)	scores <0	mean post-op NPFF	mean MCSA (cm^2)	mean PSS
A	0.438	2.05	5	0.11	0.21	+0.88
B	0.30	1.75	0	0.29	0.50	+8.6

Those in group B (septoplasty and inferior turbinate trimming) showed an NPFF improvement of at least 0.25 (mean value of 0.29), a highly significant difference ($p<0.01$).

The average increase in combined MCSA in group B was 0.5 cm^2 whilst that in group A was only 0.21 cm^2 (Table 2). The Spearman correlation coefficient between the change in combined MCSA as measured by acoustic rhinometry and the improvement in NPFF for all patients was 0.880 ($p<0.01$), whilst that between the PSS and the NPFF was 0.884 at $p<0.01$. The MCSA change also correlated closely with the patients' satisfaction score, giving a Spearman correlation of 0.860 ($p<0.01$)

DISCUSSION

The most important index of outcome in nasal sugery is patients' satisfaction, but the basis of any science is objective measurement. Nasal peak flows have been shown to be an easy and valid measurement for the assessment of nasal obstruction (Larsen and Kristensen, 1990). This group has shown that there is a stronger correlation of subjective assessment with the NPFF post-operatively than with the NPFF pre-operatively. The current study has confirmed the close correlation between the former and, in addition, has shown that a similar relationship exists between PSS and the change in NPFF. Gleeson et al. (1986) found that patients' subjective assessment of nasal patency was poor and that the best measurements in their study were apparent nasal volume and peak inspiratory flow, although this study was carried out on healthy volunteers with no apparent nasal pathology. The most accurate test of patency was apparent nasal volume, which was measured by recovery of saline instilled into the nasal cavity. Apart from being "the least comfortable method" this cannot account for collection of saline in the sinuses which is then not recovered. It is possible, however, to obtain a volume reading for the entire nasal cavity (excluding the sinuses) on most acoustic rhinometers with suitable software which can integrate area and distance functions. Peak inspiratory nasal flow ranked as the next most accurate measurement, but no attempt was made to correlate this to pulmonary capacity.

The current study demonstrates a close relationship between patient satisfaction scores and the actual change in cross-sectional areas as measured by acoustic rhinometry. Hilberg et al. (1989) and others (Elbrond et al., 1991a, b; Lenders and Pirsig, 1990) have shown that nasal and nasopharyngeal cross-sectional areas may be reliably measured by acoustic reflections. Since this is an easy to use and patient-friendly technique which requires no subjective co-ordination (unlike nasal peak

flow fractions, rhinomanometry, et cetera), its use in the outpatient clinic can be recommended. The computer facilities on most AR units allow for storage and instant recall of all patient traces and plots, and printouts are instantly available for patient case-files. Superimposition of pre- and post-operative or treatment AR traces allows easy visualization of airway improvement and these can be shown to patients where appropriate.

Of interest is the apparently greater success achieved in patients on whom inferior turbinate trimming was performed. All indices in this study showed significantly greater improvement in these patients, although the degree of obstruction pre-operatively seemed to be greater in this group. The poor margins of improvement in the septoplasty-alone group as evidenced by lower NPFF changes and poorer improvements in MCSA is reflected in striking patients dissatisfaction with regard to obstruction. Larsen and Kristensen (1990) have also noted a lower degree of satisfaction in cases which have lesser degrees of pre-operative obstruction. Therefore, it is suggested that unless gross septal distortion exists, septoplasty should not be carried out alone, but combined with a turbinate-debulking procedure.

CONCLUSIONS

Acoustic rhinometry is recommended as part of the pre-operative work-up of any patient complaining of nasal obstruction. Despite being a non-invasive procedure, it can show organic obstruction and demonstrate improvements due to surgery or medical therapy (Elbrond et al., 1991a, b; Lenders and Pirsig, 1990). On the basis of these results, turbinate reduction is to be recommended as an adjunct to septoplasty for nasal obstruction, except in cases of gross septal deformity when the latter procedure alone will suffice.

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J. Marais, FRCS
Department of Otolaryngology
The Royal Infirmary
Lauriston Place
Edinburgh EH3 9EN
United Kingdom