



# Functional and aesthetic results after septorhinoplasty and concomitant radiofrequency of the inferior turbinate: is there a role for patient reported outcome measures (PROMs)?

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## Abstract

**Purpose** Functional and aesthetic results after septorhinoplasty (SRP) are often not clearly demonstrated. There is still an open topic in the literature about analysis of aesthetic, functional results and patients' satisfaction after SRP. The aim of our study is to determine patients' satisfaction after SRP and concomitant radiofrequency of the inferior turbinate (RF) regarding nose appearance and improvement of symptoms, using patient reported outcome measures (PROMs).

**Methods** ROE questionnaire and the NOSE scale were used for a retrospective evaluation to assess patient's satisfaction in 369 patients undergoing SRP surgery from 2003 to 2016. Two additional questions were asked to confirm satisfaction following surgery.

**Results** 258 patients completed the questionnaires (71.7%). The global average ROE score was 18.14 (75.6%). The percentage of satisfaction of aesthetic result was 87.3%, in particular 10.5% were very happy, 57% very much satisfied and 19.8% moderately satisfied. The global post-operative average NOSE score was 13.1 with the resolution of nasal obstruction in 72.1% cases and a marked improvement in 9.3%. The results of the two additional questions showed that 81% of patients would undergo the procedure again if required and 72.1% of patients were globally satisfied.

**Conclusions** Our study demonstrates the utility of PROMs in evaluating aesthetic and functional results after SRP and simultaneous RF. In our series, the patients undergoing SRP and RF are generally satisfied by the functional and aesthetic results. This kind of assessments should be the most common post-operative evaluation methods in this surgery.

**Keywords** ROE questionnaire · NOSE scale · Septorhinoplasty · PROMs

## Introduction

Septorhinoplasty (SRP) is an elective procedure with a cosmetic purpose, thus surgeons and patients choose to undergo intervention based on subjective criteria. This makes the objective evaluation of surgical outcomes very difficult. Such analysis of quantitative parameters such as days of internment, morbidity and mortality may be applicable but are not relevant, thus the success rate is based above all on qualitative evaluations. Furthermore, patient satisfaction

depends on subjective factors such as perception of pre-operative appearance, expectations, social relationship capacities and temperament [1].

Concerning functional results of SRP, even though there are many diagnostic instruments that could be useful for the objective measurements of nasal patency such as rhinomanometry (RMM), acoustic rhinometry (AR), peak nasal inspiratory flow (PNIF), there is no consensus about their value, in fact in clinical practice, the perception of nasal airflow is a subjective sensation and therefore, by definition, difficult to quantify. Indeed many papers doubt about correlation between nasal obstruction symptoms and measured nasal resistances with limited value in quantifying the patients' perception of their improved nasal airway and quality of life (QoL) after SRP surgery [2–5].

We must also remember that SRP seeks to associate both functional and aesthetic improvement, making the

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objective quantification of the results very complicated. In fact, the aesthetic interventions aim to improve the QoL of patients, which is an improvement of the perception of their body and their social life.

For this reason, several papers [6–9] tried to identify objective factors related to surgical results that would otherwise only have a subjective feedback. In particular, these studies exploited patients' subjective experience and opinions after surgery, in an attempt to provide tools for a semi-quantitative analysis of results.

The aim of our study was to determine patients' satisfaction and QoL after SRP and simultaneous radiofrequency of the inferior turbinate (RF) in regard to nose appearance and psychological impact using Rhinoplasty Outcomes Evaluation (ROE) and to investigate on improvement of nasal symptoms with the Nasal Obstruction Symptom Evaluation (NOSE) scale. The final goal was to verify the utility of patient reported outcome measures (PROMs) in the evaluation of the benefits of surgery from the patient's perspective.

## Materials and methods

Retrospective evaluation was performed on 413 consecutive patients older than 18 years, undergoing functional SRP and bilateral RF from 2003 to 2016 at the Head and Neck Surgical Science Department (ENT Institute) of Agostino Gemelli University Hospital Foundation, Rome, Italy. We excluded from the study 44 patients: 27 underwent exclusive tip surgery, without any surgical procedure on septum and/or turbinate, 5 concomitant endoscopic sinus surgery for nasal polyposis or rhinosinusitis, 11 presented recent nasal fracture (< 1 year) and 1 had a coeval rhinopharynx obstruction. We submitted a follow-up phone interview (15–140 months) to all included patients (369) and 258 (71.7%) answered the two questionnaires of self-assessment (ROE questionnaire and NOSE scale).

## ROE questionnaire

The ROE questionnaire is a validated six-point questionnaire assessing the main factors influencing the grade of satisfaction after surgery:

- (1) Physical factor: evaluation of nasal form and function;
- (2) Psychological factor: evaluation of the grade of surgeon's confidence and the desire of modify their nose;
- (3) Social factor: evaluation of the feeling of acceptance in the family and professional sphere.

There are two questions for every factor with five options of answer [6] (Table 1).

Patients rank individual responses on a scale of 0–4 with a maximum score of 24. To make understanding easier, the result can be converted into a percentage: A score of  $\geq 12/24$  ( $\geq 50\%$ ) shows satisfactory aesthetic results, instead a score of  $< 12/24$  ( $< 50\%$ ) reflects patient dissatisfaction [10]. Moreover, two additional questions were asked to confirm satisfaction following surgery: 'Knowing the final result of the operation, would you choose to undergo the same procedure again?' and 'Overall, are you satisfied with the results of the operation?' [11].

## NOSE scale

NOSE scale investigates subjective sensation of nasal obstruction and the impact on QoL. In the beginning, the test was composed by ten questions (alpha version) subsequently reduced to five. It is based on a scale of 0–4 for each question with a maximum score of 20 multiplied by five to give a final score out of 100 [8] (Table 2). A NOSE score  $< 25$  is considered normal, between 25 and 50 indicates low nasal obstruction,  $> 50$  denotes severe nasal obstruction, and a score of 100 represents a condition of total nasal obstruction.

Data were collected and analyzed using Excel<sup>®</sup> 2016 (Microsoft, Redmond, WA, USA). The statistical analysis was performed in SPSS<sup>®</sup> version 24 (IBM, New York, US)

**Table 1** Rhinoplasty outcome evaluation (ROE) questionnaire

ROE questionnaire	0	1	2	3	4
1 How well do you like the appearance of your nose?	Absolutely no	A little	Moderately	Very much	Completely
2 How well are you able to breathe through your nose?	Absolutely no	A little	Moderately	Very much	Completely
3 How much do you feel your friends or loved ones like your nose?	Absolutely no	A little	Moderately	Very much	Completely
4 Do you think your current nasal appearance limits your social and/or professional activities?	Always	Frequently	Sometimes	Rarely	Never
5 How confident are you that your nasal appearance is the best that it can be?	Absolutely no	A little	Moderately	Very much	Completely
6 Would you like to surgically alter the appearance or function of your nose?	Definitely	Very likely	Possibly	Probably not	No

**Table 2** Nasal symptom obstruction evaluation (NOSE) scale

	NOSE scale	No complaints	Mild	Moderate	Bad	Severe
1	Nasal congestion or stuffiness	0	1	2	3	4
2	Nasal blockage or obstruction	0	1	2	3	4
3	Trouble breathing through my nose	0	1	2	3	4
4	Trouble sleeping	0	1	2	3	4
5	Unable to get enough air through my nose during exercise or exertion	0	1	2	3	4

using the Mann–Whitney *U* test. Statistical significance was obtained with *p* value < 0.05.

## Results

A total of 258 patients (52.3% male – 135 patients, 47.7% female – 123 patients) completed the questionnaires with a response rate of 71.7%. The age range was 18–74 years (mean age 36 years). The most common cause for non-response was inability to establish contact owing to a change in phone numbers or address. 243 patients underwent primary surgery instead there were 15 cases of revision surgery. The mean duration of follow-up was 48 months (range 15–140 months).

### Results of ROE questionnaire

The average post-operative ROE score was 18.14 corresponding to 75.6% (standard deviation 2.93, range 8–21) and a 95% confidence interval of 17.77–18.48. The results after partition of individual question scores for the ROE are summarized in Table 3.

The percentage of satisfaction of aesthetic results (“very much” at the first question of ROE) was 57% (147 patients) and the percentage of high satisfaction (“completely”) was 10.5% (27 patients). 19.8% patients reported a limited but acceptable improvement of the nose aesthetic (“moderately”). The answers (“moderately”, “very much”,

“completely”) to the first question of ROE confirmed a satisfactory aesthetic result in 87.3% (225/258 patients). On the other hand, 10.4% (27 patients) were little satisfied with the surgery, and 2.3% (6 patients) told about a worsening of aesthetics (Table 4).

Examining the two additional questions to the standard ROE questionnaire, 72.1% of patients answered to be globally satisfied with the end result of the operation and 81% would repeat the same procedure again based on the final result of the surgery.

### Results of NOSE scale

The average post-operative NOSE score was 13.1 (standard deviation 25.39, range 0–100) and a 95% confidence interval of 10.20–16.18. Results and breakdown of individual question scores for the NOSE scale are summarized in Table 5.

The resolution of the main symptom (nasal obstruction) was reached in 72.1% cases (186 patients), and in 9.3% cases (24 patients) there was a marked improvement in symptomatology compared to the pre-operative situation. On the other hand, the percentage of failure was low, because there was no improvement in obstructive symptoms only in 4.7% cases (12 patients), and there was not a satisfactory improvement than pre-operative status in 5.8% cases (15 patients). The second question of NOSE scale highlighted an improvement of nasal breathing (“No complaints”, “Mild”, “Moderate”) in 89.5% cases (231/258 patients) (Table 6).

**Table 3** Total results and breakdown of individual question scores for the ROE

	ROE questionnaire	Mean	SD	95% CI
1	How well do you like the appearance of your nose?	2.63	0.89	2.52–2.73
2	How well are you able to breathe through your nose?	2.78	0.81	2.68–2.88
3	How much do you feel your friends or loved ones like your nose?	2.63	0.89	2.53–2.74
4	Do you think your current nasal appearance limits your social and/or professional activities?	3.85	0.43	3.79–3.9
5	How confident are you that your nasal appearance is the best that it can be?	2.6	0.9	2.49–2.71
6	Would you like to surgically alter the appearance or function of your nose?	3.64	1.02	3.51–3.76
TOT		18.14	2.93	17.77–18.48

**Table 4** Number and percentage of answers per question of ROE

ROE questionnaire	0	1	2	3	4
1 How well do you like the appearance of your nose?	6 (2.3)	27 (10.4)	51 (19.8)	147 (57.0)	27 (10.5)
2 How well are you able to breathe through your nose?	8 (3.1)	10 (3.9)	42 (16.3)	168 (65.1)	30 (11.6)
3 How much do you feel your friends or loved ones like your nose?	6 (2.3)	26 (10.1)	53 (20.5)	144 (55.8)	29 (11.2)
4 Do you think your current nasal appearance limits your social and/or professional activities?	0 (0)	1 (0.4)	5 (1.9)	25 (9.7)	227 (88)
5 How confident are you that your nasal appearance is the best that it can be?	6 (2.3)	29 (11.2)	52 (20.2)	145 (56.2)	26 (10.1)
6 Would you like to surgically alter the appearance or function of your nose?	12 (4.7)	8 (3.1)	8 (3.1)	6 (2.3)	224 (86.8)

*n* (%)

**Table 5** Total results and breakdown of individual question scores for the NOSE

NOSE scale	Mean	SD	95% CI
1 Nasal congestion or stuffiness	0.6	1.13	0.47–0.74
2 Nasal blockage or obstruction	0.61	1.14	0.48–0.76
3 Trouble breathing through my nose	0.55	1.07	0.48–0.76
4 Trouble sleeping	0.35	0.82	0.26–0.45
5 Unable to get enough air through my nose during exercise or exertion	0.5	0.99	0.38–0.61
TOT	13.1	25.39	10.20–16.18

## Discussion

Objective evaluation of aesthetic and functional results of SRP is object of discussion in the literature, so a standardized and universally recognized method has never been identified [12–15]. In fact, many studies were realized on the functional outcomes of surgical treatments of nasal obstructive diseases, such as nasal septum deviation [13] and turbinate hypertrophy [14], and they were finalized to identify a method that could make an objective evaluation of the outcome of surgery, using instruments such as RMM, AR and PNIF. However, the analysis of the literature shows that there is no universally recognized method

capable of an objective evaluation of the functional results of surgery [13, 15, 16].

Alsarraf et al. [6, 7] were the first to create a questionnaire with reliability, internal consistency and validity for several plastic surgeries, including rhinoplasty. The ROE questionnaire allowed measurement of qualitative factors such as physical, social and psychological variables.

Stewart et al. [8] validated the NOSE scale that is a disease-specific health status instrument for outcomes studies in adult patients with nasal obstruction.

Recently Barone et al. [9] tried to identify existing questionnaires in the literature and they divided surgery-specific questionnaires about rhinoplasty into three categories: functional self-assessment (nasal surgical questionnaire, NOSE scale, and nasal obstruction septoplasty effectiveness), aesthetic self-assessment (Utrecht Questionnaire, FACE-Q rhinoplasty module, Glasgow Benefit Inventory) and aesthetic and functional self-assessment (ROE, Functional Rhinoplasty Outcome Inventory 17, RHINO Scale, and Evaluation of Aesthetic Rhinoplasty Scale).

On the other hand, a relatively small number of studies investigated the correlation between diagnostic exams and subjective sensation of nasal patency with controversial results [2–4]. In a recent study, Radulesco et al. highlighted the poor correlation between post-operative NOSE score and nasal resistance objectively calculated with RMM, with only a 50% of patients affected by severe objective nasal obstruction that complained of post-operative nasal blockage [17].

**Table 6** Number and percentage of answers per question of NOSE

NOSE scale	No complaints	Mild	Moderate	Bad	Severe
1 Nasal congestion or stuffiness	187 (72.5)	25 (9.7)	20 (7.8)	14 (5.4)	12 (4.7)
2 Nasal blockage or obstruction	186 (72.1)	24 (9.3)	21 (8.1)	15 (5.8)	12 (4.7)
3 Trouble breathing through my nose	189 (73.3)	26 (10.1)	22 (8.5)	11 (4.3)	10 (3.9)
4 Trouble sleeping	206 (79.8)	26 (10.1)	17 (6.6)	5 (1.9)	4 (1.6)
5 Unable to get enough air through my nose during exercise or exertion	191 (74.0)	30 (11.6)	21 (8.1)	8 (3.1)	8 (3.1)

*n* (%)

Other papers confirmed the poor correlation between nasal resistance to airflow and patient symptom scores doubting on diagnostic value of RMM and AR in estimating the severity of nasal obstruction symptoms [3, 4].

Sipila et al. [18] suggested that this discrepancy could be related to the role of that specific nasal sensory function by the major palatine nerve that could be responsible for the subjective perception of nasal patency independently from any objective measurable change in nasal resistance.

Moreover, other factors could contribute to this inaccuracy of results. These exams are operator-dependent and directly linked to compliance of patients such as RMM and PNIF incorrect measurements could depend on loose face masks, incompletely closed mouth, the way of application of the nozzles, stabilization of nasal soft tissue by face masks similar to Cottle-maneuver [19]. In addition, the air turbulence or overcharge of jet exposed areas into the nasal cavity could be perceived as nasal obstruction and may not be detected by RMM and PNIF [20].

Moreover, PNIF is effort-dependent reflecting not only nasal patency, but also lung activity because of the correlation with ventilation parameters (FVC and FEV1) [21].

Instead AR requires a quiet room with controlled air temperature and air humidity, a well-sealed system and an expert operator, thus many factors can influence the success of the exam [22].

Another problem is linked to the dual objectives of SRP researching both the functional than the aesthetic improvement. In fact, the aesthetic interventions aim to improve the QoL of patients, that is an improvement of the perception of their body and their social life. In aesthetic surgery, it is even more difficult to establish standardized parameters to evaluate the outcome of the operation, because the choice of undergoing the surgical intervention is based mainly not on objective but on subjective criteria, or on the surgeon's assessment according to patient's requirements.

In recent years, general trend of the literature concerns the evaluation of the impact on the QoL of patients undergoing SRP.

Until now in otolaryngology, outcomes research has been used primarily in the assessment of QoL in head and neck cancers and when evaluating specific treatments for disorders such as otitis media, sinusitis and obstructive sleep apnoea [23–25].

Surprisingly, there is less evidence in the literature about outcomes for facial plastic and reconstructive surgery, where the degree of satisfaction should be the main target. PROMs are crucial in estimating surgical results quantifying patients' satisfaction by means of questionnaires; thus these instruments are becoming more and more important in documenting the effectiveness of such procedures, above all those that try to improve patients' QoL. A recent review by Wahmann et al. [26] pointed out that ROE questionnaire

is a reliable and specific measure instrument for physical function and aesthetic satisfaction, due to its characteristics.

Nowadays, few studies based on the ROE questionnaire after SRP have been published in the literature. Our results (mean score was 18.14, 75.6%) confirm the range of post-operative scores of other published papers (69.75% – 85.4%) [11].

Regarding functional outcomes analyzed by NOSE, our results demonstrate the resolution of nasal obstruction in 72.1% of cases (186 patients), and an improvement in symptomatology in 9.3% of cases (24 patients) compared to the pre-operative situation. Instead, there was a low rate of failure: only 4.7% (12 patients) had no improvement in obstructive symptoms or even worse, and in 5.8% of cases (15 patients) there was not satisfactory improvement.

We must underline that nasal obstruction with oral breathing in resting conditions (solved in 73.3% of patients, unchanged in 3.9%) are factors that have a greater impact on the QoL of patients and, therefore, they are more readily recognized than the other symptoms associated with nasal respiratory obstruction such as difficulty in sleeping (solved in 79.8% of cases and remained unchanged only in 1.6% of cases) and the difficulty of doing sports (solved in 74.% of cases and unchanged in 3.1%). We think that volumetric reduction of inferior turbinate by means radiofrequencies could condition the good performance of our study, though Sinno et al. [27] in a recent review of the literature about inferior turbinate surgery in rhinoplasty, assessed that only 5/21 studies on RF described improvement in nasal patency symptoms and 12 of these studies reported changes in visual analog scale score. Thus, the role of turbinate surgery in SRP is still object of debate, however, in our cases, there was a systematic use of this technique that is a fast, mini-invasive and almost without side effects technique, characterized by excellent long-term results [28]. These characteristics make this technique compatible with SRP, respect to other mucotomy techniques, characterized by higher risks of bleeding.

It is important to emphasize that most of the patients aimed to solve the respiratory problem first, showing a secondary interest in the aesthetic result while aesthetic results were much more stressed in younger ones.

We found a satisfaction rate of 87.3% for aesthetic results in particular 10.5% of patients were very happy, 57% very much satisfied and 19.8% reported a limited improvement in the shape of their nose, though they considered it acceptable. On the other hand, 10.4% of cases (27 patients) were unfortunately satisfied with surgery, and 2.3% of cases (6 patients) complained of post-operative aesthetic worsening.

About the aesthetic liking of friends and relatives, patients' opinions are largely overlapping with their personal satisfaction level, but probably this is influenced by the psychological factors of individual patients and also by the objective outcome of the intervention.

It is interesting that the outcome of surgery had a minimal impact on the social and work life of patients; in fact, 88% of patients (227 cases) did not refer feelings of discomfort in both social and work life, regardless of the positive or negative outcome of the intervention. Similarly, 66.3% of patients claimed an aesthetic result absolutely similar with what they desired with only 8.5% of cases in doubt, and 4.7% of patients (12/258 patients) sure to undergo a revision surgery.

Very few articles have been designed to describe both functional and aesthetic results after SRP. In fact, most of the authors compared pre- and post-operative aesthetic outcomes only with ROE questionnaire or objective and subjective functional results following the use of various surgical techniques. Others preferred different PROMs than the ROE and the NOSE scale to assess surgical outcomes. Our study shows results in line to those: Saleh et al. [29] evaluated satisfaction grade of 113 patients undergoing SRP using ROE and NOSE with post-operative values of 76.95 (18.5/24) and 24.5 respectively. Similar results were obtained by Radulesco et al. [17] studying a group of 35 patients: post-operative ROE and NOSE were 18/24 and 22/100 with a statistically significant difference between the pre-operative and post-operative values. In addition, Başer et al. [30] compared pre- and post-operative results revealing the benefits from SRP surgery in terms of aesthetic and functional aspects. In this paper, post-operative ROE and NOSE score were  $81.39 \pm 19.37$  ( $19.5 \pm 4.65$ ) and  $15.78 \pm 15.58$ , respectively, underlying surgical outcomes also with VAS measurements.

The main limits of this study were the lack of pre-operative scores because of its retrospective nature, thus limiting our ability to quantify the exact level of improvement or deterioration of clinical conditions after surgery and, furthermore, the impossibility to analyze separately the impact of SRP and RF due to our standard medical practice: in fact, in our institution we always perform turbinate surgery in association with SRP. However, the overall response rate of 71.7% achieved with a long follow-up suggests the general satisfaction with the aesthetic and functional result after SRP. These results become particularly relevant in spending-review times, where surgical procedures associated with any aesthetic element risk the exclusion from the National Health Service (NHS) if patients' real benefits can't be demonstrated. For these reasons, the role of PROMs will become increasingly important in the near future.

## Conclusions

The correct assessment of the effectiveness and quality of the benefits provided by the NHS has recently gained great importance to ensure good functionality and optimize financial resources. SRP has an aesthetic and functional value,

and certainly it must take into account both of them in the evaluation, by comparing their respective success rates.

Our study demonstrates, by means of a process of patient-centered assessment by examining their opinions, their symptoms and the QoL after surgery, that patients undergoing SRP with RF are generally satisfied by the functional and aesthetic results of treatment. This does not imply that rhinoplasty alone (without septal surgery and turbinate surgery) can have the same impact. Further studies could analyze if rhinoplasty alone or SRP alone can be as effective as the associated procedures.

Our results showed that PROMs could be used to evaluate surgical intervention on patients' point of view, thus evaluating the overall effectiveness of the financial resources employed, as well as underlining the benefits of new surgical techniques.

PROMs seem to be useful instruments to evaluate the benefits of surgery from the patients' perspective. For sure this kind of evaluation will become more commonplace and could assume more importance in the NHS, above all during a period of austerity and limited resources.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** For this type of study, formal consent is not required.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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