Is the Sino-Nasal Outcome Test-22 a Suitable Evaluation for Septorhinoplasty?

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Objectives/Hypothesis: It is becoming increasingly important for clinicians to demonstrate the impact of their interventions. The Sino-Nasal Outcome Test-22 (SNOT-22) questionnaire is a disease-specific questionnaire involving 22 symptoms combining rhinologic issues with general health issues. We evaluated the SNOT-22 score as a quality-of-life outcome measure in septorhinoplasty surgery.

Study Design: Outcome research.

Methods: We carried out a prospective case series in 76 patients undergoing septorhinoplasty. Their SNOT-22 scores were compared pre- and postoperatively. We also recorded individual symptom scores to study the impact of surgery. To check its reliability, the SNOT-22 score was correlated to patient-reported symptoms on a visual analogue scale. Patients were screened for comorbid conditions. Interactions with the surgical technique and/or with the initial sinonasal disease were sought.

Results: The SNOT-22 is a reliable and responsive outcome measure in septorhinoplasty surgery. Septorhinoplasty was especially effective at addressing nasal obstruction, discharge, olfaction, related sleep disturbance, and emotional symptoms such as embarrassment or frustration. Comparison to the visual analogue scale instrument confirmed the outcome measured by the SNOT-22.

Conclusions: The SNOT-22 could be used in routine clinical practice to highlight the impact of nasal disease in each patient and to measure the outcome and the effectiveness of the surgical intervention.

Key Words: Nasal reconstruction, outcome, functional septorhinoplasty, nasal obstruction, quality of life, Sino-Nasal Outcome Test-22.

Level of Evidence: 2c

INTRODUCTION

The aim of functional septorhinoplasty is to restore adequate airway while preserving the harmony of the nose and the face. The most difficult aspect in evaluating nasal function is the subjectivity of the complaints. Functional, psychological, and aesthetic concerns should be considered.1,2 The surgeon has the responsibility to provide evidence of the quality of care and the effectiveness of the surgical treatment.

Scoring systems have been developed over the last two decades to assess nasal function and the impact of treatment on the nose.3 Of these, the 22-item Sino-Nasal Outcome Test (SNOT-22) has been widely adopted in clinical practice and has been proved to be the most suitable sinonasal outcome scoring system.4 The SNOT-22 is a disease-specific, quality-of-life-related measure of sinonasal function.3 The SNOT-20 was developed from the 31-item Rhinosinusitis Outcome Measure (RSOM-31) by removing 11 items thought to be redundant. The addition of two items of interest (nasal obstruction and olfaction) formed the SNOT-22, which has been demonstrated to be reliable, valid, and responsive.5,7 The SNOT-22 questionnaire is available in Fig. 1. Low score indicates good outcome.

Despite the validation of the SNOT-22 and the critical need for clinicians to demonstrate the effectiveness of their interventions, this score has been poorly studied in septorhinoplasty surgery.8 The need for quality-of-life measures in septorhinoplasty surgery has, however, been demonstrated.8,10

Our primary objective was to determine the responsiveness of the SNOT-22 score in septorhinoplasty. We correlated overall and individual SNOT-22 nasal symptom scores with specific visual analogue scores. We further identified whether it measures other benefits of septorhinoplasty surgery not necessarily measured by rhinoplasty tools. The impact of age, gender, comorbidities, previous surgical history, and surgical technique were also recorded. Our study aimed to look at ways of validating the SNOT-22 questionnaire in septorhinoplasty surgery and determine whether it truly reflects the 360° benefits of function, psychology, and aesthetics.
Fig. 1. Sino-Nasal Outcome Test-22 (SNOT-22). The SNOT-22 is a modification of a preexisting instrument, the SNOT-20. It involves 22 items including nasal obstruction and loss of sense of smell. Symptoms are rated from 0 (no problem) to 5 (problem as bad as it can be). The theoretical range of the new measure is 0 to 110, with a higher score indicating poorer nasal function or related symptoms.

<table>
<thead>
<tr>
<th>Item Description</th>
<th>No problem</th>
<th>Very mild problem</th>
<th>Mild or slight problem</th>
<th>Moderate problem</th>
<th>Severe problem</th>
<th>Problem as bad as it can be</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need to blow nose</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sneezing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Runny nose</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Cough</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Post nasal discharge (draining at the back of your nose)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Thick nasal discharge</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Ear fullness</td>
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<td>Dizziness</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Ear pain/pressure</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Facial pain/pressure</td>
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<tr>
<td>Difficulty falling asleep</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Waking up at night</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Lack of a good night’s sleep</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Waking up tired</td>
<td>0</td>
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<td>2</td>
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<tr>
<td>Fatigue during the day</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Reduced productivity</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Reduced concentration</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Frustrated/restless/irritable</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Sad</td>
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<td>1</td>
<td>2</td>
<td>3</td>
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<td>5</td>
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<tr>
<td>Embarrassed</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Sense of taste/smell</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Blockage/congestion of nose</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**TOTAL:**

For Medical Use Only

<table>
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<tr>
<th>Patient No.:</th>
<th>d.o.b.:</th>
<th>Date:</th>
<th>M</th>
<th>F</th>
<th>Diagnosis:</th>
<th>Aims of Treatment:</th>
<th>Today’s treatment:</th>
<th>L-M score:</th>
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</thead>
</table>
MATERIALS AND METHODS

A prospective study of 76 consecutive patients undergoing functional and reconstructive septorhinoplasty surgery was conducted over a 24-month period at the Royal National Throat, Nose and Ear Hospital, London. The procedures were performed under general anesthesia by the same team of surgeons. The exclusion criteria were contraindication to surgery, age under 16, inability to understand the questionnaire, concomitant functional endoscopic sinus surgery, or other nasal airway procedure. Patients completed the SNOT-22 questionnaire at the time of decision to treat and at the routine postoperative follow-up scheduled 3 months later. The SNOT-22 questionnaire (Fig. 1) rated 22 different symptoms from 0 (no problem) to 5 (problem as bad as it can be). Patients were not allowed to see their preoperative scores at the postoperative visit. Patients reported symptoms on a visual analogue scale from 0 to 10 recorded at the same time in a subgroup of 20 patients. Patients who failed to attend follow-up were contacted and completed the questionnaire by telephone. Information was also collected for the following: age, sex, comorbid conditions, sinonasal disease, surgeon, and surgical technique.

Because the test of normality (Shapiro-Wilk) did not show normally distributed results, we used the Wilcoxon test to compare pre- and postoperative overall scores. The influences of sex, surgeon, and surgical technique on the SNOT-22 scores were analyzed by two-way analysis of variance. We questioned the correlation between age and SNOT-22 scores by the Spearman regression. Each item of the SNOT-22 questionnaire was examined using the Wilcoxon matched pairs test, and adjustments were made for multiple comparisons with the Bonferroni method. To test its reliability, the SNOT-22 score was compared to another quality-of-life instrument. We correlated SNOT-22 results to patient-reported symptoms on a visual analogue scale using Spearman regression.

RESULTS

Population

Seventy-six subjects (42 males, 34 females) were included in this study. The mean age was 35.53 years (± 11.41 years). The majority of patients (76.31%) required an external approach, and 18 patients (23.68%) underwent an endonasal septorhinoplasty. Twenty-four patients (31.57%) were secondary cases, including 21 external and three endonasal septorhinoplasties. The interventions were carried out by consultant (68.42%) and ear, nose, and throat residents (31.58%) under supervision. The mean time to follow-up score was 105.14 days (± 11.86 days) (i.e., 15 weeks). The demographic and medical data are summarized in Table I. The proportion of missing data was low, ranging from 0% to 1.6% across items. Responses to all items were well distributed across response categories.

Postoperative Outcome

The mean preoperative SNOT-22 score was 39.95 (± 2.47). The mean postoperative score was 21.22 (± 2.24). The surgical improvement measured by the SNOT-22 was highly significant (***P < .0001). Overall scores pre- and postoperatively are shown in Figure 2 and Table II. The overall postoperative score was improved in 90.79% of subjects.

Fig. 2. Preoperative (Pre-op) and postoperative (Post-op) Sino-Nasal Outcome Test-22 (SNOT-22) scores. The overall SNOT-22 score improved significantly after septorhinoplasty (**P < .0001). The mean preoperative SNOT-22 score is shown in black (39.97 ± 2.746). The mean postoperative score is shown in white (22.82 ± 2.690). Data are presented as mean ± standard error of mean.

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patients. No correlation between the SNOT-22 score and sex and age (Spearman $r^2 = 0.21$) was found, suggesting that responses to the SNOT-22 are not biased in terms of sociodemographic factors. No interaction was found between the SNOT-22 score and the surgeon, the comorbidities, or the surgical technique. The overall SNOT-22 score improved in all subgroups (Table II). Secondary septorhinoplasties showed significantly higher SNOT-22 scores pre- and postoperatively, but no statistical interaction was found in the surgery-related improvement of the SNOT-22 score. Data are presented as mean ± standard error of mean (SEM).

Analysis of Disease-Specific Subgroups

The average scores for each item of the questionnaire are shown in Figure 3. Analysis of the questionnaire showed an improvement in disease-specific subgroups. Nasal blockage (item 22) was the main preoperative complaint and had a significant improvement of 37.4%, from a mean score of 3.45 to 1.58 ($P = .0022$). We observed that 84.9% of subjects reported an improvement of nasal blockage, 13.7% no change, and 1.4% worsening of this issue. Septorhinoplasty was also especially effective ($P < .01$) at addressing postnasal and thick discharge (items 5 and 6), related sleep disturbances such as lack of a good night’s sleep (item 13) and waking up tired (item 14), emotional symptoms such as frustration (item 18) or embarrassment (item 20), and olfaction (item 21). The benefit of the surgery was particularly high in symptoms badly scored preoperatively (Fig. 3). In addition, septrhinoplasty significantly improved ($P < .05$) nighttime awakenings (item 12) and daytime fatigue (item 15).

Correlation to Another Quality-of-Life Instrument

Correlation between the overall SNOT-22 score and the scoring of the global nose symptoms on a visual analogue scale (range, 1–10) was high (Spearman $r^2 = 0.82$) (Fig. 4A). Moreover, correlation was high between the 22nd item of the SNOT-22 questionnaire addressing nose blockage and the specific question regarding nose blockage on the visual analogue scale (Spearman $r^2 = 0.80$) (Fig. 4B).

DISCUSSION

This study involved 76 septorhinoplasty patients and demonstrated the feasibility of the SNOT-22 questionnaire in routine clinical practice. The preoperative SNOT-22 score showed reduced quality of life relating to both disease-specific and general health domains. Nasal
blockage was the main preoperative complaint and showed also the most significant improvement after surgery. Moreover, septorhinoplasty surgery was effective at addressing related sleep disturbance, nasal discharge, olfaction, and emotional symptoms. Answers to the SNOT-22 questionnaire were consistent with the symptoms scored on a visual analogue scale.

Patients were screened for comorbid conditions. Our series included a high rate of post-traumatic (55.77%) and revision cases (31.58%), which is consistent with data from similar studies.\(^9\) The rate of allergic rhinitis in our series was 28.84%, reflecting a higher rate compared to the general population,\(^11\) whereas the rate of smokers was lower.\(^12\)

All but seven patients demonstrated an improvement in their total SNOT-22 scores postoperatively. Among these seven patients, two had a preoperative score below 12/110, reflecting good nasal function and leaving little room for improvement. The surgical indication was a post-traumatic nose deformity. The five other patients were secondary septorhinoplasties, emphasizing the complexity of these cases. Out of these five patients, only one was scheduled for revision septorhinoplasty. The other four reported acceptable outcome despite the poor SNOT-22 score. Among them, one presented with long-standing cocaine abuse and another with acute sinusitis at the follow-up assessment.

We acknowledge the lack of objective monitoring of nasal patency to provide a conclusive validation of the SNOT-22 for septorhinoplasty specifically. However, interesting observations and trends have been made from using this tool in a real-life clinic. Objective measures of nasal patency (nasal peak flow, rhinomanometry, acoustic rhinometry) have limitations for their use in the clinical setting.\(^13\) Although they provide objective outcome measures, they reflect only one aspect of the disease and may thus not encompass all the other aspects.\(^14\) Questionnaires are simpler and cheaper methods to assist the surgeon in selecting patients for surgery and in providing a reliable follow-up. They include a cluster of interconnected symptoms. Beyond the nasal airflow, they reflect the patient's perception, suffering, and hope. They could help the surgeon to meet the patient's expectations.\(^2\)

In recent years, there has been a great expansion in the number and use of instruments to measure quality of life and other patient-based outcomes in health care. The Nasal Obstruction Symptom Effectiveness score and the Rhinoplasty Outcomes Evaluation score have been applied to objectify outcomes in functional rhinoplasty.\(^9\) However, they do not evaluate general health issues and emotional aspects. The SNOT-22 has been widely adopted in rhinosinusitis and sinus surgery.\(^5\) It has proven to be the most suitable sinonasal outcome scoring system.\(^3\) Its validity has been demonstrated in septal surgery,\(^19\) and has been used for evaluating nasal tip surgery.\(^8\) Regardless of these publications and the increasing need for a reliable outcome measure, surgeons have not adopted until now any systematic instrument to help them select and follow-up on patients for septorhinoplasty surgery.\(^3\) Our study illustrated the practical application of the SNOT-22 and may suggest its valuable role in septorhinoplasty surgery. We acknowledge that the postoperative outcome may be attributable to nonsurgical factors such as the natural course of the disease or psychological issues.\(^21\)

Some of the symptoms evaluated by the questionnaire appeared to be of little relevance to our patient group. For example, questions regarding cough, ear fullness, dizzy, and ear and facial pain/pressure were virtually absent both pre- and postoperatively. On the other hand, the items embarrassed or irritable were scored severely on the preoperative questionnaire, and were dramatically improved by the surgery. We could hypothesize that these items may cover a large range of feelings from discomfort with nasal breathing to bitterness over the aspect of the nose. One more specific question could be added, such as “Are you concerned by the shape of your nose?” However, in keeping with the natural evolution of the SNOT scoring system, it would be easier just to add the additional question of aesthetics so as to encompass all aspects of rhinological surgery and allow it to be used universally.

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**Fig. 4.** Correlation to the visual analogue scale (VAS) instrument. We found a high correlation between the Sino-Nasal Outcome Test-22 (SNOT-22) score and another quality-of-life instrument, the VAS. (A) Correlation between the overall SNOT-22 score (x-axis) and the scoring of the global nose symptoms on a VAS instrument (y-axis) was high (Spearman \(r^2 = 0.82\)) (B) Correlation between the last item of the SNOT-22 questionnaire addressing nose blockage (x-axis) and the specific question regarding nose blockage on the VAS instrument (y-axis) showed also a good correlation (Spearman \(r^2 = 0.80\)) (B). Pre-op = preoperative; Post-op = postoperative.
CONCLUSION

Overall, the SNOT-22 score significantly improved in patients undergoing septorhinoplasty surgery. Further evaluation is required to determine what exactly confers that outcome. Parts of this scoring tool appear particularly relevant to septorhinoplasty patients (obstruction, emotional symptoms, sleep disorders), whereas others components are less appropriate (ear-related complaints, cough, pain). The concern of the shape of the nose should be addressed. Changes in a few key items of the SNOT-22 may increase its relevance for patients undergoing septorhinoplasty surgery. This score is easy to implement in the routine clinical setting.

BIBLIOGRAPHY