The Empty Nose Syndrome 6-Item Questionnaire (ENS6Q): a validated 6-item questionnaire as a diagnostic aid for empty nose syndrome patients

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Background: **Empty nose syndrome (ENS) is considered an acquired condition that remains difficult to diagnose objectively. Defining specific symptoms that can be reliably associated with this disorder would be essential to identifying possible ENS patients. We sought to validate an ENS-specific, 6-item questionnaire as an adjunct to the standard Sino-Nasal Outcome Test 22 (SNOT-22) questionnaire to discriminate patients suspected of having ENS.**

Methods: **The Empty Nose Syndrome 6-item Questionnaire (ENS6Q) paired 6 common ENS symptoms (nasal suffocation, nasal burning, nasal openness, crusting, dryness, and impaired air sensation through nasal cavities) with testing on 75 patients divided in 3 patient cohorts: ENS; chronic rhinosinusitis without polyposis; and healthy controls. Participants answered 2 rounds of both the SNOT-22 questionnaire and ENS6Q within 48 hours of each other. No changes in treatments occurred in the test interval between questionnaires. Internal consistency, test-retest reliability, validity, and area under the curve were assessed to differentiate between patient cohorts using the 2 instruments.**

Results: **We found high internal consistency for ENS6Q and SNOT-22 questionnaire at 0.93 (95% CI, 0.90-0.95) and 0.94 (95% CI, 0.94-0.96), respectively. The test-retest reliability between timepoints for ENS6Q testing was 0.969. The ENS6Q statistically significantly discriminated between ENS and control patients and between ENS and chronic rhinosinusitis without polyposis (CRSsNP) patients, without significant differences between CRSsNP and controls. The area-under-the-curve (AUC) threshold score comparison further supported the ability of the ENS6Q to differentiate ENS from CRSsNP patients.**

Conclusion: **The ENS6Q is the first validated, specific, adjunct questionnaire to the SNOT-22 to more reliably identify patients suspected of developing ENS.** © 2016 ARS-AAOA, LLC.

Key Words:
empty nose syndrome; ENS; nasal airway; paradoxical nasal obstruction; questionnaire; SNOT-22; SNOT-25; survey; upper airway; validated

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The use of validated questionnaires in clinical management has helped physicians identify individuals with various conditions. Currently, in the field of rhinology, the Sino-Nasal Outcome Test 22 (SNOT-22) is arguably the most commonly used validated questionnaire.[1] Since its validation in 2009,[2] the SNOT-22 has provided clinicians with the ability to track the impact of sinonasal problems on the quality of life (QoL) of patients. The values provided by the questionnaire also allow the clinician to quantify the effect of intervention (medical, surgical, etc.). The SNOT-22 is best used in the setting of chronic rhinosinusitis (CRS); however, but, as with other conditions, such as

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TABLE 1. Participants' ratings of their perceived nasal symptoms considering the severity and frequency of each problem using the ENS6Q

Symptom	No problem/not applicable	Very mild	Mild	Moderate	Severe	Extremely severe
Dryness	0	1	2	3	4	5
Sense of diminished nasal airflow (cannot feel air flowing through your nose)	0	1	2	3	4	5
Suffocation	0	1	2	3	4	5
Nose feels too open	0	1	2	3	4	5
Nasal crusting	0	1	2	3	4	5
Nasal burning	0	1	2	3	4	5

ENS6Q = Empty Nose Syndrome 6-item Questionnaire.

nasal obstruction, rhinitis, or rhinoconjunctivitis,[3–5] separate, validated, disease-specific questionnaires have been constructed to help better quantify the effect of these specific sinonasal conditions on QoL.

Empty nose syndrome (ENS) is a term first coined by Kern and Stenkvist in 1994 to describe the acquired disorder.[6] ENS appears to most commonly arise as a postsurgical phenomenon secondary to loss of inferior turbinate tissue or volume. This diagnosis is most often associated with the presence of paradoxical nasal obstruction despite an objectively patent nasal airway,[7] although a wide constellation of prominent symptoms are also espoused by ENS patients, including dyspnea, nasal and pharyngeal dryness, facial or nasal pain, crusting, hyposmia, and depression.[8]

Currently, there is no validated questionnaire for ENS, which can cause profound QoL derangements in patients. The most commonly used outcome survey for ENS is probably the Sino-Nasal Outcome Test 25 (SNOT-25),[9] which has been used in several earlier studies.[7–10] The SNOT-25 aimed to assess ENS-specific symptoms,[9] leveraging the SNOT-20 scoring system, with the added parameters of "dryness," "difficulty with nasal breathing," "suffocation," "nose is too open," and "nasal crusting." However, the addition of the 5 subjective symptoms was never validated in this specific population for the SNOT-25. Moreover, the SNOT-20 system has largely fallen out of favor and into disuse due to the wider acceptance of the validated SNOT-22 scoring system. In addition, by incorporating 5 additional (nonvalidated) items into the original questionnaire, the SNOT-25 test final score cannot differentiate ENS from other sinonasal problems such as CRS. Given these disadvantages, a validated, disease-specific questionnaire to more reliably and accurately diagnose ENS was needed.

In this study we share the results of this effort, a validated questionnaire that we have termed the *Empty Nose Syndrome 6-item Questionnaire* (ENS6Q). This tool can aid in making the diagnosis of ENS, and provides a quantifiable outcome measure for QoL in ENS patients.

Methods

This study was undertaken at the Sinus and Endoscopic Skull Base Center at Stanford University. After institutional review board approval, a prospective study was conducted at the Stanford Sinus Center, which manages individuals with ENS. We assembled the 6 questions in the ENS6Q diagnostic aid (Table 1) based on our growing clinical experience with evaluating ENS patients, some which were understandably carried over from the SNOT-25 test. We considered 4 of the questions from the SNOT-25 on "dryness," "suffocation," "nose feels too open," and "nasal crusting" to also be valid for use in the ENS6Q. We clarified past questions regarding the quality of nasal breathing and/or nasal congestion, to specify the "sense of diminished airflow (cannot feel air flowing through your nose)" in these complex patients. Finally, we added the question on "nasal burning," given that it is a common symptom expressed by patients in our practice.

We then administered the ENS6Q to 3 patient cohorts: 15 patients with ENS; 30 with chronic rhinosinusitis without polyposis (CRSsNP); and 30 healthy controls without past sinonasal surgery. These sample numbers were based on the available ENS patients in the practice at time of study initiation (n = 15), with double the number of tested non-ENS cohorts (30 patients each). As the exact prevalence of ENS patients is unknown, a formal power analysis to calculate the sample size could not be designed.

The diagnosis of ENS was made in patients presenting with nasal discomfort and/or paradoxical nasal obstruction despite wide open nasal passages who met the following criteria: (i) a positive history of inferior turbinate reduction with objective endoscopic and/or computed tomography (CT) evidence of inferior reduction; (ii) a positive "cotton test"; and (iii) candidacy for an inferior turbinate augmentation procedure. [7] The cotton test involves placement of dry cotton in the region of the deficient (or absent) inferior turbinate tissue in the un-anesthetized inferior meatus to simulate the bulk and tubular contour of a native turbinate in the lateral nasal wall. The patient's

TABLE 2. Demographic comparison of age, gender, race, and ethnicity between participants with ENS and CRSsNP, and controls

	ENS (n = 15)	CRSsNP (n = 30)	Controls (n = 30)	*p*-value
Age (years)	44.87 ± 12.35	48.10 ± 16.35	39.93 ± 13.66	0.100
Gender				0.431
Male	7 (46.7%)	12 (40.0%)	17 (56.7%)	
Female	8 (53.3%)	18 (60.0%)	13 (43.3%)	
Race or ethnicity				0.949
Caucasian	10 (66.7%)	18 (60.0%)	15 (50.0%)	
Hispanic	1 (6.7%)	2 (6.7%)	3 (10.0%)	
Black or African American	0	0	0	
Asian	3 (20.0%)	8 (26.7%)	8 (26.7%)	
Middle Eastern	1 (6.7%)	2 (6.7%)	10 (3.0%)	
Native Hawaiian/Other Pacific Islander	0	0	1 (3.3%)	
Previous sinonasal interventions	15 (100%)	21 (70%)	0	0.077
Septoplasty	8 (53.3%)	9 (30%)	0	0.083
IT reduction	15 (100%)	12 (40%)	0	0.003
ESS	2 (13.3%)	15 (50%)	0	0.026

CRSsNP = chronic rhinosinusitis without nasal polyposis; ENS = empty nose syndrome; ESS = endoscopic sinus surgery; IT = inferior turbinate.

symptoms are then reevaluated and an almost instantaneous, striking reduction in detrimental nasal symptoms, with a concomitant subjective improvement in the patient's sense of nasal airflow, supports the diagnosis of ENS.[8] To be included in the study, patients diagnosed with ENS based on the aforementioned criteria could not present active CRS symptoms at the time of diagnosis. CRSsNP patients were diagnosed based on the current guidelines of the American Rhinologic Society/International Consensus Statement of Allergy and Rhinology.[11] Healthy controls had no history of sinusitis or previous sinonasal surgery, and were recruited from the preoperative skull base surgery clinic. Participants completed 2 independent rounds of both the SNOT-22 questionnaire and ENS6Q 5 days apart (primary vs secondary). No changes in treatment plan, such as medication alteration or surgery, occurred between the primary and secondary administration of the questionnaires.

Statistical Analysis

Participants included in the study cohort were summarized by count, absolute frequency, and 95% confidence interval (CI) for pertinent sociodemographic and clinical characteristics. This included age, gender, diagnosis, and ethnicity.

Internal consistency, defined as the intercorrelation between questionnaire items, was measured using Cronbach's α. Test-retest reliability was measured using the intraclass coefficient for total SNOT-22 and ENS6Q scores, as well as each individual question within the ENS6Q. The values were considered to be continuous in the analysis. A two-way mixed model was used to evaluate absolute agreement accounting for random reviewer effects and mixed measurement effects. Given this, the nonparametric Kruskal-Wallis test was used to assess the validity of the ENS6Q to distinguish clinical diagnostic groups. Receiver operating characteristic (ROC) curves were constructed to compare the ability of the ENS6Q to differentiate clinical diagnosis of ENS, CRSsNP, and controls, when compared with the SNOT-22. The area-under-the-curve (AUC) statistic and corresponding CIs were reported to compare ROC curves. The best cut-off score was reported that maximized the sensitivity and minimized the false-positive rate. Statistical analysis was performed with IBM® SPSS Statistics version 20.0 (IBM SPSS, Armonk, NY).

Results

The study cohort consisted of 75 individuals with mean age of 44.2 ± 1.7 years and included 36 (48.0%) males and 39 (52.0%) females. ENS was diagnosed in 15 (20.0%) participants, as noted previously, and CRSsNP was identified in 30 (40.0%) participants. A total of 30 (40.0%) healthy, non-CRS and non-ENS individuals were included for comparison. No significant differences were found for age, gender, race, or smoking status between individuals with ENS or CRSsNP and controls (Table 2).

TABLE 3. Comparison of participant responses on SNOT-22 and ENS6Q to assess validity for differentiation of individuals with ENS and CRSsNP, and controls

	ENS (n = 15)	CRSsNP (n = 30)	Controls (n = 30)	Kruskal-Wallis *p*-value
Primary evaluation				
Total SNOT-22	50.2 ± 26.6	33.4 ± 18.3	17.9 ± 16.2	<0.001[a]
Total ENS6Q	18.9 ± 7.5	4.7 ± 4.3	1.8 ± 2.8	<0.001[a]
ENS-specific questions				
Dryness	3.8 ± 1.1	1.4 ± 1.5	0.7 ± 1.1	<0.001[a]
Lack of air sensation going through your nasal cavities	3.8 ± 1.3	1.2 ± 1.5	0.3 ± 0.5	<0.001[a]
Suffocation	2.5 ± 2.2	0.4 ± 0.9	0.2 ± 0.6	<0.001[a]
Nose feels too open	3.3 ± 1.4	0.2 ± 0.6	0.1 ± 0.4	<0.001[a]
Nasal crusting	2.7 ± 1.8	1.0 ± 1.2	0.3 ± 1.0	<0.001[a]
Nasal burning	2.9 ± 1.8	0.7 ± 1.1	0.1 ± 0.4	<0.001[a]
Secondary evaluation				
Total SNOT-22	49.4 ± 28.2	31.4 ± 16.9	17.3 ± 17.9	0.002
Total ENS6Q	19.5 ± 7.5	3.6 ± 3.3	1.3 ± 2.4	<0.001[a]
ENS-specific questions				
Dryness	3.7 ± 1.4	1.2 ± 1.3	0.5 ± 0.9	<0.001[a]
Lack of air sensation going through your nasal cavities	4.0 ± 1.4	0.9 ± 1.2	0.4 ± 0.9	<0.001[a]
Suffocation	2.7 ± 2.1	0.3 ± 0.9	0.2 ± 0.6	<0.001[a]
Nose feels too open	3.5 ± 1.5	0.2 ± 0.5	0.03 ± 0.2	<0.001[a]
Nasal crusting	2.8 ± 1.9	0.6 ± 0.9	0.2 ± 0.7	<0.001[a]
Nasal burning	2.9 ± 1.6	0.6 ± 1.0	0.1 ± 0.3	<0.001[a]

[a]Statistically significant.
CRSsNP = chronic rhinosinusitis without nasal polyposis; ENS = empty nose syndrome; ENS6Q = Empty Nose Syndrome 6-item Questionnaire; SNOT-22 = Sino-Nasal Outcome Test 22.

Within the ENS patient cohort, 53% underwent septoplasty, 100% had turbinoplasty (with a wide variety of reduction procedures), and 13.3% had endoscopic sinus surgery (ESS). The CRSsNP cohort had fewer inferior turbinate reduction procedures (40%, $p = 0.003$), but had more ESS procedures (50%, $p = 0.026$), compared with the ENS cohort (Table 2).

With respect to the 5 questions in the SNOT-25 referring to ENS, we made 2 major alterations to the ENS-specific symptoms tested. First, based on our experience, the term "difficulty with nasal breathing" was not clear to our participants. Therefore, we modified this item to "lack of air sensation going through your nasal cavity." Second, we added "nasal burning" to the ENS6Q, based on this common complaint from patients in our practice. Consequently, our adjunct survey to the SNOT-22 for identifying ENS patients was constructed (Table 1).

At primary and secondary evaluations, total SNOT-22 scores differed significantly between the ENS, CRSsNP and control participants (Table 3). With regard to the ENS6Q, individuals with ENS reported significantly higher symptom scores in their responses at both the primary and secondary evaluations ($p < 0.001$; Table 3). The overall Cronbach α coefficient value for ENS6Q and SNOT-22 was 0.93 (95% CI, 0.90-0.95) and 0.94 (95% CI, 0.94-0.96), respectively, suggesting strong internal consistency between the questionnaires. Intraclass correlation coefficients (ICCs) evaluating test-retest reliability showed significant absolute agreement between the primary and secondary responses on ENS-specific items among all participants, with the ENS6Q ICC for all groups being 0.969 (95% CI, 0.950-0.980) (Table 4).

Specifically, among participants with ENS, the strongest absolute agreements between test and retest measurements

TABLE 4. Intraclass correlation coefficients (ICC) evaluating test-retest reliability between participant responses on ENS-specific items at primary and secondary timepoints

	ENS (n = 15)	CRSsNP (n = 30)	Controls (n = 30)
ENS6Q	ICC (95% CI)	ICC (95% CI)	ICC (95% CI)
Dryness	0.919 (0.874–0.948)	0.875 (0.756–0.938)	0.847 (0.701–0.924)
Lack of air sensation going through your nasal cavities	0.928 (0.888–0.954)	0.920 (0.919–0.964)	0.425 (0.081–0.678)
Suffocation	0.926 (0.885–0.952)	0.851 (0.711–0.926)	0.667 (0.405–0.827)
Nose feels too open	0.963 (0.941–0.976)	0.940 (0.879–0.971)	0.800 (0.624–0.899)
Nasal crusting	0.951 (0.862–0.983)	0.584 (0.291–0.777)	0.839 (0.692–0.920)
Nasal burning	0.954 (0.869–0.984)	0.842 (0.697–0.921)	0.642 (0.371–0.812)

Empty Nose Syndrome 6-item Questionnaire (ENS6Q) for all groups 0.96 (0.950-0.980), CI = confidence interval; CRSsNP = chronic rhinosinusitis without nasal polyposis; ENS = empty nose syndrome.

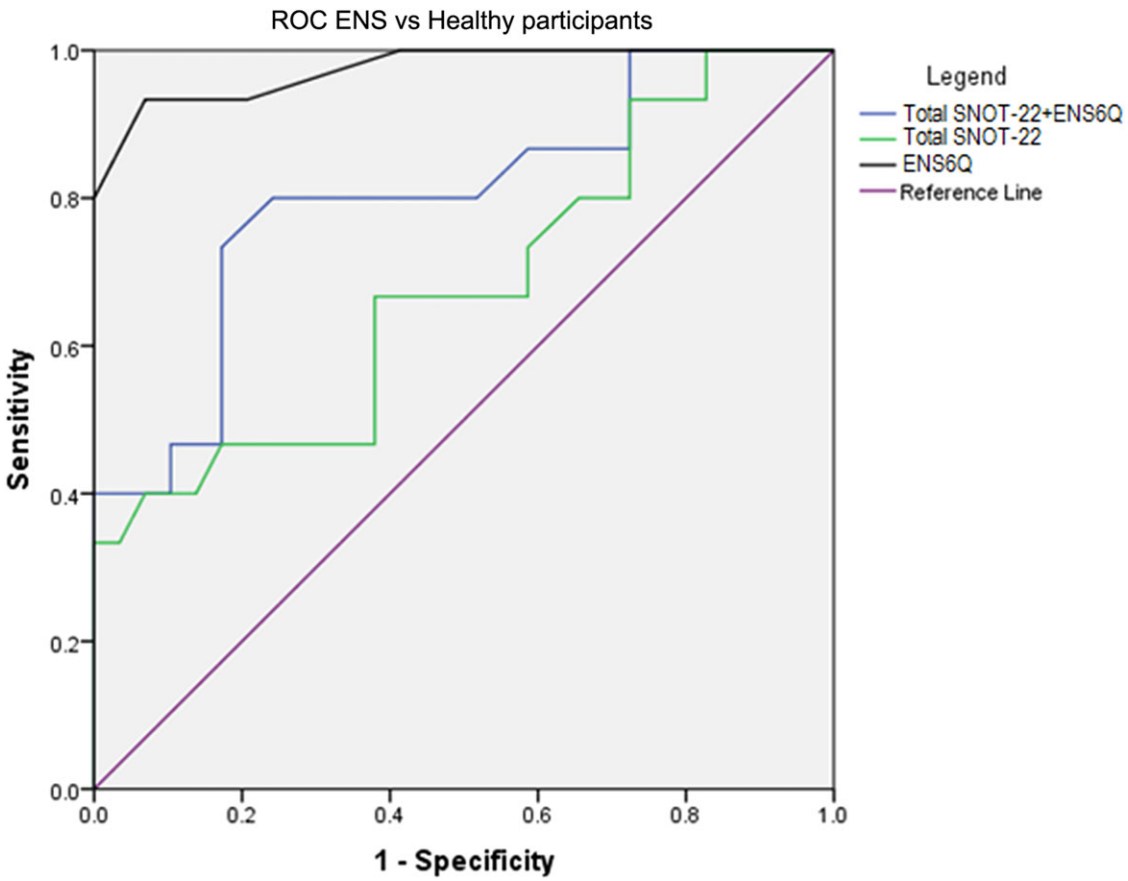

FIGURE 1. Receiver operating characteristics curve analysis comparing ENS6Q, SNOT-22, and SNOT-22+ENS6Q scores between patients with ENS vs healthy participants. ENS = empty nose syndrome; ENS6Q = Empty Nose Syndrome 6-item Questionnaire; SNOT-22 = Sino-Nasal Outcome Test 22.

were found for the 3 questions regarding "nasal burning" (ICC, 0.954), "nasal crusting" (ICC, 0.951), and "suffocation" (ICC, 0.920, Table 4).

The ROC curve was used to quantify the diagnostic value of SNOT-22 and ENS6Q in ENS patients. As seen in Figures 1 and 2, ENS6Q surpassed both SNOT-22 and SNOT-22+ENS6Q in its ability to discriminate ENS from CRSsNP and healthy patients, with AUCs of 0.97 (95% CI, 0.93-1.00), 0.67 (95% CI, 0.50-0.85), and 0.80 (95% CI, 0.65-0.94), respectively. The ENS6Q cut-off score to reliably associate/predict ENS was determined to be 10.5 out of a total possible score of 30 (Table 5). When analyzing each of the ENS6Q items individually, "nose feels too open" and "lack of air sensation going through nasal cavities" were found to be the most predictive symptoms of ENS with AUCs of 0.95 (95% CI, 0.87-1.00) and 0.93 (95% CI, 0.83-1.00), respectively (Table 5).

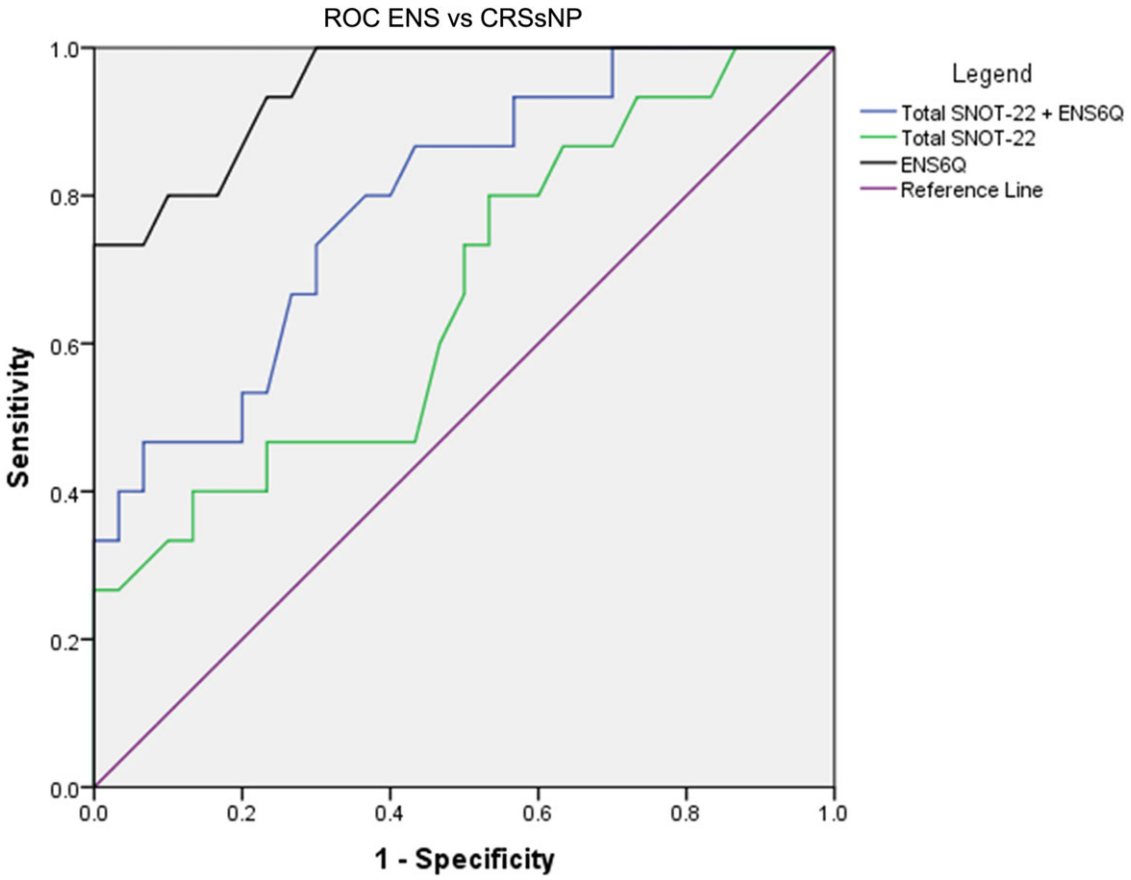

FIGURE 2. Receiver operating characteristics curve analysis comparing ENS6Q, SNOT-22, and SNOT-22+ENS6Q scores between patients with ENS vs CRSsNP participants. CRSsNP = chronic rhinosinusitis without polyposis; ENS = empty nose syndrome; ENS6Q = Empty Nose Syndrome 6-item Questionnaire; SNOT-22 = Sino-Nasal Outcome Test 22.

TABLE 5. AUCs for predicting threshold score for ENS diagnosis*

	AUC	95% CI	Cut-off score	Sensitivity	Specificity	LR+
Total SNOT-22	0.678	0.503-0.853	32.5	66.7%	62.1%	1.76
Total ENS6Q score	0.975	0.930-1.000	10.5	86.7%	96.6%	25.50
Dryness	0.894	0.781-1.000	2.5	86.7%	83.3%	5.19
Lack of air sensation going through your nasal cavities	0.930	0.831-1.000	2.5	93.3%	86.7%	7.02
Suffocation	0.818	0.668-0.967	1.5	60.0%	90.0%	6.00
Nose feels too open	0.959	0.878-1.000	1.5	93.3%	96.7%	28.27
Nasal crusting	0.819	0.668-0.970	2.5	60.0%	93.3%	8.95
Nasal burning	0.864	0.736-0.993	2.5	73.3%	93.3%	10.94

*Proposed threshold score comparison between SNOT-22 and ENS6Q scores between healthy participants and individuals with ENS.
AUC = area under the curve; CI = confidence interval; ENS, empty nose syndrome; ENS6Q = Empty Nose Syndrome 6-item Questionnaire; LR+ = likelihood ratio; SNOT-22 = Sino-Nasal Outcome Test 22.

Discussion

In this report we have evaluated the validity, reliability, and interpretability of the ENS6Q in the context of ENS patients. ENS is a challenging condition to diagnose and can be overlooked by otolaryngologists and other specialists because some of the cardinal symptoms, such as nasal obstruction or shortness of breath, rarely correspond to the examination and/or endoscopic findings of a widely patent nasal passage.[8,12] A high index of suspicion is required to make the diagnosis. Prior to this study, our "gold standard" for the putative diagnosis of ENS

required a history of inferior turbinoplasty and a positive cotton test. Subsequently, we felt that understanding and validating symptoms experienced by ENS patients, and not by those who are healthy or who have CRS, would help otolaryngologists identify these often neglected patients.

In this study, we have developed and validated a disease-specific questionnaire for ENS (ENS6Q) referencing the previously reported SNOT-25,[6,9] which, in our experience, also incorporated many of the most common complaints described in this cohort of patients. We added the question on "nasal burning" as 1 of our 6 diagnostic questions given the frequency of this reported symptom to our ENS patient population, and also clarified somewhat vague questions regarding nasal congestion with the wording "sense of diminished airflow (cannot feel air flowing through your nose)." We believed that successful validation would provide a quantifiable outcome measure to strengthen a clinician's suspected diagnosis of ENS, and also assess QoL. In this study, we found ENS6Q to be a valid disease-specific questionnaire in the evaluation and diagnosis of ENS, with consistent test-retest internal reliability and consistency. Furthermore, we have established a diagnostic score cut-off within the ENS6Q of 10.5, to assist with the rapid translation of the scoring significance in the clinical setting.

The reliability of any instrument can be assessed by its internal consistency—in our case, maintenance of the score over time when the individual patient's condition does not change. In this study, internal consistency of the ENS6Q was thoroughly evaluated. The Cronbach α value of 0.93 for the ENS6Q demonstrates high internal consistency to a level necessary for clinical application, much like the SNOT-22, which has an internal consistency value of 0.93.[13] However, it is important to note that patients in this study responded to the second questionnaire after 5 days as compared with 10 to 14 days in the validation of the SNOT-22, which may deviate the internal consistency to a higher level; however, based on our experience, patients have little recollection of their previous answers within 2 days after the original questionnaire. Moreover, 5 days was chosen between test dates to minimize the delay in care as no patients were allowed to start any form of medical management until the second test was complete. Furthermore, our findings are supported by the high ICC found in our results (0.96) when the ENS6Q was applied at different timepoints, showing satisfactory test-retest reliability.

The ROC curve plays a central role in evaluating the diagnostic ability of the ENS6Q to discriminate between different disease states and provide the optimal cut-off values for diagnosis.[14] The AUC provides a measure of accuracy by showing the capacity of this diagnostic test to discriminate between the presence or absence of a determined condition and its associated sensitivity and specificity values.[14,15] When AUC = 0.5, the ROC curve corresponds to random chance, whereas ROC = 1.0 indicates perfect accuracy.[15] In this study, the AUC for the total ENS6Q score was 0.975, demonstrating the high accuracy of the cut-off score of 10.5 to discriminate patients with and without ENS, with a sensitivity and specificity of 86.7% and 96.6%, respectively. Although there are no universal criteria to define the ideal value for a valid method, some investigators have defined a method as accurate when the sum of the sensitivity and specificity values is >120%.[15] In the present study, this sum was 183.3%, demonstrating the reliable accuracy of the ENS6Q in diagnosing ENS patients.

In this study, "lack of air sensation going through the nasal cavities" and "nose feels too open" were found to be the symptoms with the highest predictive value for association with ENS, with AUCs of 0.930 (sensitivity 93.3%, specificity 86.7%) and 0.959 (sensitivity 93.3%, specificity 96.7%), respectively. By extrapolation, these symptoms correlate well with our endoscopic findings in that the loss of turbinate tissue ultimately alters the meatal structure and airflow patterns, contributing to actual and/or perceived reduction in airflow efficiency.[16,17] The meatus is contoured by the inferior turbinate, septum, nasal floor walls, and nasal vestibular bodies,[18] providing both aerodynamics and resistance to nasal upper airway airflow. In patients with ENS, who partially or completely lack turbinate tissue and associated structure, airflow resistance appears to be substantially compromised. Therefore, in our clinical experience, in substituting vague phrasing, such as "nasal congestion," for "lack of air sensation," patients were better able to understand this terminology. However, numerically, patients also found it to be a statistically significant question, as it is one of the most predictive items in the ENS6Q.

On the other hand, although the question regarding "nose feels too open" may have slightly "outperformed" the ENS6Q as a whole, it may be reasonable to query whether this question alone would be sufficient to ask of ENS patients. However, every candidate ENS patient is fairly varied in their experience through this enigmatic disease process, and patients have a wide constellation of other symptoms, including those in the questionnaire as well as others. Given the wide variety of reported symptoms in the disease presentation, evaluation of a single symptom would be insufficient for a correct diagnosis, in favor of the easily completed, slightly more broad, 6-item questionnaire presented herein.

The ENS6Q has the ability to aid in the clinical diagnosis of ENS in patients who present with difficulty breathing and/or nasal discomfort. The questionnaire can be completed in approximately 2 minutes and may be administered as an adjunct to, or independent of, the SNOT-22. The established score cut-off point of 10.5 for the ENS6Q provides a marker for the clinician to consider the performance of either the cotton test and/or assess the patient's sinus CT scan through a more discriminating lens, assessing for objective findings of ENS, as recently described by Thamboo and colleagues.[19] Future studies in larger populations utilizing this questionnaire will strengthen its validation results. Additional layers of utility, such as responsiveness and clinical interpretability (minimal clinically important difference), of the ENS6Q are now being assessed in view of our encouraging validation results.

However, because of its simplicity, this diagnostic aid can be readily integrated into clinical activities and patient-based research.

A potential limitation of our study design is that the ENS6Q, by design, was not administered to all patients complaining of nasal obstruction of varied etiologies. Our initial study design explored patients with postoperative CRSsNP as the primary comparison group, because both the ENS and CRSsNP groups underwent previous sinus surgery. As a major premise in our experience, ENS is an iatrogenic condition in the vast majority of cases, and therefore the ENS6Q should only be administered to patients who have undergone previous sinonasal surgery and are without primary nasal obstruction. On the other hand, patients may present with persistent septal deviation and/or inferior turbinate hypertrophy after previous sinonasal surgery, which this study does not isolate as a separate comparative group. However, ENS would only be considered as a diagnosis of exclusion in patients when other obvious causes of nasal obstruction have been ruled out. For example, deviated septum with internal nasal valve compromise or reversible turbinate hypertrophy after inferior turbinate decongestion would be expected to produce standard nasal obstruction, and therefore the diagnosis of ENS and/or administration of the ENS6Q, would not typically be considered. Thus, an additional study may be useful to illustrate the capacity of the ENS6Q to differentiate between these latter 2 groups. This would also help to show that patients with ENS have a constellation of symptoms, beyond paradoxical nasal obstruction, that are nearly exclusive to this complex patient cohort, and would readily differentiate them from patients with primary nasal obstruction and nasal obstruction despite previous sinonasal surgery.

Conclusion

The ENS6Q is the first validated, specific, adjunct questionnaire to the SNOT-22 to more reliably identify patients suspected of having empty nose syndrome.

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Sino-Nasal Outcome Test (SNOT-22) Questionnaire

Name: _____ **DOB**: _____
Date: _____

Below you will find a list of symptoms and social/emotional consequences of your nasal disorder. We would like to know more about these problems and would appreciate your answering the following questions to the best of your ability. There are no right or wrong answers, and only you can provide us with this information. Please rate your problems as they have been over the past two weeks. Thank you for your participation.

A. Considering how severe the problem is when you experience it and how frequently it happens, please rate each item below on how "bad" it is by circling the number that corresponds with how you feel using this scale:

	No Problem	Very Mild Problem	Mild or Slight Problem	Moderate Problem	Severe Problem	Problem as bad as it can be	Most important items
1. Need to blow nose	0	1	2	3	4	5	[ ]
2. Sneezing	0	1	2	3	4	5	[ ]
3. Runny nose	0	1	2	3	4	5	[ ]
4. Nasal obstruction	0	1	2	3	4	5	[ ]
5. Loss of smell or taste	0	1	2	3	4	5	[ ]
6. Cough	0	1	2	3	4	5	[ ]
7. Post-nasal discharge	0	1	2	3	4	5	[ ]
8. Thick nasal discharge	0	1	2	3	4	5	[ ]
9. Ear fullness	0	1	2	3	4	5	[ ]
10. Dizziness	0	1	2	3	4	5	[ ]
11. Ear pain	0	1	2	3	4	5	[ ]
12. Facial pain/pressure	0	1	2	3	4	5	[ ]
13. Difficulty falling asleep	0	1	2	3	4	5	[ ]
14. Waking up at night	0	1	2	3	4	5	[ ]
15. Lack of a good night's sleep	0	1	2	3	4	5	[ ]
16. Waking up tired	0	1	2	3	4	5	[ ]
17. Fatigue	0	1	2	3	4	5	[ ]
18. Reduced productivity	0	1	2	3	4	5	[ ]
19. Reduced concentration	0	1	2	3	4	5	[ ]
20. Frustrated/restless/irritable	0	1	2	3	4	5	[ ]
21. Sad	0	1	2	3	4	5	[ ]
22. Embarrassed	0	1	2	3	4	5	[ ]
TOTALS (each column):							

GRAND TOTAL SCORE (all columns together):

B. Please check off the most important items affecting your health in the last column (max of five items)