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Low SNOT-22 Scores in Chronic Rhinosinusitis: Why do patients seek treatment?

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Abstract

Objective—Patients with chronic rhinosinusitis (CRS) who experience minimal reductions in quality-of-life (QoL) may present for treatment despite QoL scores comparable to controls without CRS. This study seeks to identify cofactors influencing patients with CRS and low 22-item Sinonasal Outcome Test (SNOT-22) scores to seek care.

Study Design—Prospective, multi-center, observational cohort.

Methods—Patients with CRS were enrolled between April 2011 and September 2015. Patients with sinonasal mucocele or unilateral sinus opacification were excluded. Control subjects without CRS were enrolled for comparison. Low-SNOT CRS was defined by a SNOT-22 score <20.

Results—774 subjects (“low-SNOT” CRS (n=38); “high-SNOT” CRS (n=641, SNOT-22 ≥20); controls without CRS (n=95)) were enrolled. Low-SNOT scores were identified in 6% of subjects with CRS. After adjustment, low-SNOT CRS and control groups without CRS report similar baseline average SNOT-22 total scores (p=0.879). Unexpectedly, compared to controls, low-SNOT CRS patients had significantly better average psychological (2.1[2.3] vs. 5.8[6.0]; p=0.030) and sleep dysfunction (2.7[3.4] vs. 6.0[5.2]; p=0.016) scores. 14/38 (37%) low-SNOT patients elected to undergo endoscopic sinus surgery (ESS) with a significantly lower likelihood of reporting a minimal clinically important difference (MCID) when compared to high-SNOT patients (43% vs. 82%; p<0.001) after a mean follow-up of ~15 months.

Conclusion—Low-SNOT CRS patients represent an outlier population for which measures of QoL fail to identify factors influencing the decision to seek treatment. Low-SNOT CRS patients

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electing ESS have a decreased likelihood of reporting MCIDs following ESS. Further study is required to identify novel factors associated with treatment seeking behavior in this population.

MeSH Key Words

Outcome Assessment (Health Care); Patient Outcome Assessment; Quality of Life; Therapeutics; Healthy volunteers

INTRODUCTION

Quality-of-life (QoL) has been identified as an important clinical metric with the potential to influence treatment planning among patients with chronic rhinosinusitis (CRS).^{1,2} Measured by the 22-item Sinonasal Outcome Test (SNOT-22), preoperative QoL impairment has been associated with postoperative outcomes among patients with CRS undergoing endoscopic sinus surgery (ESS).^{3,4} Low-SNOT CRS, defined by a total SNOT-22 score <20, has been identified as a threshold score in both North American and European populations, wherein patients demonstrate the lowest likelihood of achieving a minimal clinically important difference (MCID) following ESS.^{3,4} Subsequently, recent appropriateness criteria concluded that due to the low likelihood of achieving an MCID, it may be inappropriate to offer ESS to patients with uncomplicated CRS who have a baseline SNOT-22 of < 20, independent of polyp status.⁵ These findings create a challenge for clinicians to know how to best manage low-SNOT CRS patients seeking treatment.

Low-SNOT CRS remains an understudied population with comparable mean SNOT-22 scores to control patients without CRS.^{6–8} Despite symptom severity similar to control patients without CRS as well as a low likelihood of achieving a MCID following treatment, patients with low-SNOT CRS do present in clinical practice and elect to pursue treatment. Due to selection criteria associated with previous investigations, cofactors that may contribute to clinical presentation and treatment decision making among patients with low-SNOT CRS remain poorly described.^{4,9}

The objective of this study was to identify potential cofactors motivating patients with low-SNOT CRS to seek medical care. A secondary objective was to evaluate QoL outcomes, with comparison of low and high-SNOT CRS patients electing either appropriate, continued medical therapy (CMT) or ESS.

MATERIALS and METHODS

Study Participation and Inclusion Criteria – Case Subjects

Adult patients (> 18 years of age) were recruited into a prospective, multi-center, observational cohort study to evaluate treatment outcomes for CRS. The Institutional Review Board (IRB) at each enrollment center governed study protocols and annual safety monitoring. Previous outcome findings from this cohort have been recently reported.^{10–14} Enrollment centers consisted of sinus surgical centers located within academic hospitals in North America including: Oregon Health & Science University (OHSU; Portland, OR; IRB#7198), Stanford University (Palo Alto, CA; IRB#4947), the Medical University of

South Carolina (Charleston, SC; IRB#12409), and the University of Calgary (Calgary, Alberta, Canada; IRB #E-24208).

All case study participants were diagnosed with medically refractory CRS as defined by both the American Academy of Otolaryngology-Head and Neck Surgery and the European Position Paper on Rhinosinusitis and Nasal Polyps 2012.^{15–17} All patients must have reported “cardinal symptoms” associated with CRS.¹⁵ Participants completed initial trials of medical therapy including: at least one course of either topical corticosteroids (>21-days) or a 5-day course of oral corticosteroids, and at least one course (>14-days) of culture-directed or broad spectrum antibiotics. After counseling, study participants voluntarily selected either CMT or ESS as a subsequent treatment plan for mitigation of symptoms.

Study Participation and Inclusion Criteria – Control Subjects

The enrollment of control study participants involved recruitment of adult individuals (e.g. friends, family) who accompanied case subjects to clinical appointments and/or study initiation interviews. Control subjects were excluded from study participation if they had any history of CRS or reported any existing symptoms associated with diagnostic criteria for CRS.^{15,17} Study participants provided consent while study protocols followed guidelines established by the International Conference on Harmonisation.¹⁸

Exclusion Criteria

Case and control subjects were excluded from the final cohort if they failed to complete study-related baseline evaluations. Subjects were considered lost to follow-up if they did not complete postoperative evaluations at least 6 months after initial enrollment date. Subjects were also eliminated if they were current tobacco smokers due to potential variation in global health. Case subjects were excluded if they received a diagnosis of concurrent mucocele, presented with isolated unilateral sinus opacification on computed tomography (CT) imaging, or did not possess a CT image series upon enrollment.

Treatment Modality Selection-Case Subjects

Treatment modality for subjects with CRS was not randomized or assigned for investigational purposes. Study participants self-selected either: 1) non-standardized CMT in an effort to alleviate symptoms associated with CRS, or 2) ESS directed at the discretion of each enrolling physician and guided by both radiographic and endoscopic indications of disease. Primary or revision ESS procedures consisted of either unilateral or bilateral maxillary antrostomy, partial or total ethmoidectomy, sphenoidotomy, or frontal sinusotomy (*Draf*I, IIa/b, or III), with septoplasty and inferior turbinate reductions as adjunctive procedures. All ESS cases were followed with postoperative therapeutic regimens including daily nasal saline irrigations and appropriate CMT as needed for targeted symptom resolution.

Patient Reported Outcome Measures (PROMs)

All study participants were screened for social and medical history, as well as demographic information (Table 1). The primary PROM of interest to this investigation was the SNOT-22, a validated instrument developed to quantify sinonasal symptom severity (©2006,

Washington University, St. Louis, MO).^{7,19} Higher summarized scores on the SNOT-22 suggest worse functioning or symptom severity (total score range: 0–110). The 22 items of the SNOT-22 survey have previously been categorized and summarized into 5 distinct domains including: rhinologic, extra-nasal rhinologic, ear/facial, psychological dysfunction, and sleep dysfunction symptoms.²⁰ An MCID for SNOT-22 total scores has been described as a within-subjects improvement of at least 9.0 points.⁷

The secondary PROM of interest was the Rhinosinusitis Disability Index (RSDI), a 30-item survey developed to quantify CRS symptom severity. The RSDI consists of 3 domains which evaluate the impact of CRS on a respondent's physical, functional, and emotional domains. Higher summarized scores on the RSDI suggest worse functioning or symptom severity (total score range: 0–120).²¹ The MCID for RSDI total scores have previously been defined as a within-subjects improvement of at least 50% of the standard deviation (SD) of the preoperative mean score.^{1,22} The same definition was used when determining the MCIDs associated with the SNOT-22 domain scores. Enrolling surgeons were blinded to all survey responses. Case and control participants completed the SNOT-22 survey instrument during baseline enrollment meetings while only case participants completed both baseline surveys and follow-up outcome surveys following their treatment course.

Measures of Disease Severity

Measures of disease severity, collected as part of the standard of care, were used simultaneously as investigational cofactors. Sinonasal regions were evaluated using rigid, fiber-optic endoscopes (Karl Storz, Tuttlingen, Germany) both before and after ESS. Bilateral endoscopic examinations were staged by enrolling physicians using the Lund-Kennedy scoring system (total score range: 0–20) which estimates pathologic characteristics within the paranasal sinuses.²³

Preoperative, CT without contrast was utilized to assess sinonasal disease. Bilateral image staging was completed by enrolling physicians at each site in accordance with the Lund-Mackay scoring system (total score range: 0–24) which quantifies the severity of opacification in the sinus regions.²⁴ Postoperative CT images were not collected in case participants due to risk of elevated radiation exposure. Higher total scores on both staging systems reflect worse overall disease severity. Endoscopic examinations and CT measures were not collected for control participants.

Data Management and Statistical Analysis

Deidentified study data was securely transferred to OHSU from each enrollment site for entry into a password protected relational database (Access, Microsoft Corp, Redmond, WA). All analyses were completed using statistical software (SPSS v.22, IBM Corp., Armonk, NY). Regardless of treatment modality, participants with CRS were dichotomized into preoperative SNOT-22 score categories including: 1) Low-SNOT CRS, defined by a total SNOT-22 score < 20, and 2) High-SNOT CRS, defined by a total SNOT-22 score ≥ 20. These subgroups were both compared to control subjects across social and medical history covariates, demographics, and all PROM scores. The last available PROM score was used to define postoperative evaluations for participants with follow-up (≥ 6 months). Mann-Whitney

U, independent t-testing or one-way analysis of variance (ANOVA), with Bonferroni corrections for multiple comparisons, were used to evaluate mean differences of continuous data where appropriate. Chi-square (χ^2) testing was used to evaluate frequency data across independent groups. Two-tailed bivariate Pearson's correlation coefficients (R_p) were used to evaluate correlations between PROM scores in low-SNOT and high-SNOT cohorts. Means, [standard deviations], and median scores are reported and a type-I error probability (p-value) was considered significant at a 0.05 alpha level.

RESULTS

Final Cohort Selection

A total of 837 study participants were enrolled between April 2011 and December 2015, before the application of exclusion criteria, including both case participants with CRS (n=736) and control participants without CRS (n=101). A total of 63 participants were initially excluded due to incomplete baseline SNOT-22 surveys (n=6), patient-reported current tobacco use (n=40), radiographic evidence of mucocoele (n=11), unilateral sinus disease (n=5), or an unavailable CT imaging series (n=1). The final preliminary cohort (n=774) was comprised of baseline low-SNOT CRS (n=38, 5%), baseline high-SNOT CRS (n=641; 83%), and non-CRS controls (n=95; 12%). Low-SNOT represented 6% of all patients with CRS. Cohort characteristics and clinical measures of disease severity were compared among groups in Table 1, with Caucasians representing more than 76% of each group.

Bivariate comparisons between low-SNOT CRS and high-SNOT CRS groups were statistically similar for the majority of patient characteristics with the exception of higher average age (p=0.039) and a lower prevalence of comorbid depression (p=0.048) in the low-SNOT CRS group (Table 1). Further comparison of demographics and comorbid factors between low-SNOT and high-SNOT groups were not significant. Compared to non-CRS controls, low-SNOT CRS participants were found to have a significantly higher prevalence of males (p=0.005) and significantly higher proportions of sinonasal-related comorbidity measures including: asthma (p<0.001), nasal polyposis (p<0.001) and allergy (p=0.004) after adjusting for multiple comparisons.

Comparisons in Baseline PROMs

Overall comparisons for average baseline SNOT-22 and RSDI scores are described in Table 2 between CRS groups and non-CRS controls where available. Compared to non-CRS controls, high-SNOT CRS participants reported significantly worse mean QoL as measured by all SNOT-22 total and domain scores (p<0.001) after adjustment for multiple comparisons. Compared to non-CRS control participants, low-SNOT CRS subjects reported significantly better baseline symptom severity associated with psychological (p=0.030) and sleep dysfunction (p=0.016) domains, after multiple comparison adjustments. The severity of reported impairment associated with sinonasal symptoms was statistically similar between low-SNOT CRS subjects and non-CRS control subjects for the SNOT-22 rhinologic domain (p=0.355), the extra-nasal rhinologic domain (p=0.514), the ear/facial domain (p>0.999) and SNOT-22 total scores (p=0.879). Interestingly, baseline SNOT-22 and RSDI

total scores were found to correlate more strongly in high-SNOT CRS participants ($R_p=0.714$; $p<0.001$) than in low-SNOT CRS participants ($R_p=0.312$; $p=0.056$).

Total Cohort Patient Reported Outcome Measures – CMT

A total of 132/537 subjects (25%) with at least 6-month follow-up PROM evaluations elected appropriate CMT for subsequent treatment of symptoms associated with CRS. Average follow-up months were not statistically different ($p=0.816$) between baseline low-SNOT CRS (15.2[6.0] mo.) and high-SNOT CRS (15.6[4.4] mo.) participants. Comparisons in the average improvement in PROM scores, between baseline low-SNOT CRS and high-SNOT CRS subgroups electing CMT, are described in Table 3. Additionally, between-group comparisons of the prevalence of post-treatment improvement (≥ 1 MCID value) are described for the CMT treatment group in Table 4. Participants with high-SNOT CRS at baseline reported significantly better mean improvement in both SNOT-22 total scores, as well as the extra-nasal rhinologic and ear/facial symptom domains compared to the low-SNOT group ($p=0.016$). Low-SNOT participants reported symptom worsening on average on some PROM scores. Likewise, high-SNOT participants reported significantly greater frequencies of improvement on both PROM instrument scores.

Improvement in Patient Reported Outcome Measures – ESS

A total of 405/537 subjects (75%) with at least 6-month follow-up PROM evaluations elected ESS for subsequent treatment of symptoms associated with CRS. Average follow-up months were not statistically different ($p=0.877$) between baseline low-SNOT CRS (15.0[5.2] mo.) and high-SNOT CRS (15.2[5.2] mo.) participants. Comparisons in the mean improvement in PROM scores, between baseline low-SNOT CRS and high-SNOT CRS subgroups electing ESS, are described in Table 5. Additionally, between-group comparisons of the prevalence of post-treatment improvement (≥ 1 MCID value) are described for the ESS treatment group in Table 6. Across all measures of improvement, high-SNOT CRS participants at baseline reported significantly greater magnitudes of post-treatment improvement compared to low-SNOT CRS subjects electing endoscopic sinus surgery.

DISCUSSION

Patients with low-SNOT CRS represent an outlier population and comprised 6% of patients with CRS in this multi-institutional cohort. While these patients met diagnostic criteria for CRS based on presence of cardinal symptoms and objective measures of sinonasal inflammation, PROM scores were more comparable to control subjects without CRS. Low-SNOT CRS patients have a significantly higher prevalence of comorbid asthma and atopy than control patients without CRS, and a lower prevalence of comorbid depression. While comparison of baseline QoL impairment between low-SNOT CRS and non-CRS controls found no statistical difference in total SNOT-22 score or the rhinologic, extra-nasal rhinologic and ear/facial symptoms domains, low-SNOT CRS patients reported significantly better scores in the psychological dysfunction and sleep dysfunction domains. Interestingly, previous study has found SNOT-22 psychological and sleep dysfunction domain scores associate with treatment modality selection among these patients, with significantly worse scores among those electing ESS.²

When compared to high-SNOT CRS, patients with low-SNOT CRS are less likely to have multiple comorbid conditions associated with increased sinonasal inflammation, with a lower prevalence of previous sinus surgery, comorbid asthma, nasal polyposis, allergies, ASA intolerance, and septal deviation; however these differences were not statistically significant. Consistent with current diagnostic criteria, objective evidence of sinonasal inflammation was present in both low and high-SNOT CRS groups, with significantly higher radiographic and endoscopic scores among patients with high-SNOT CRS. While total and domain SNOT-22 measures were significantly increased among high-SNOT CRS patients, the magnitude of correlation between SNOT-22 and RSDI scores was significantly lower among patients with low-SNOT CRS, further reflecting the decreased utility of conventional PROMs for this population.

In order to further define the predisposing factors associated with treatment seeking among patients with low-SNOT CRS, this evidence suggests we look beyond PROMs and medical comorbidities. The influence of patient referral bias is unknown and could be explored with further evaluation of primary patient symptoms and treatment expectations. Additionally, individual factors such as insurance provision, patient personality, risk aversion, and physician-patient relationship have been proposed to influence treatment decision making. While these factors are not associated with surgical decision making among a broad group of CRS patients²⁵, they may play a larger role among patients with low-SNOT CRS.

Several studies have reported treatment outcomes among patients with low-SNOT CRS. Rudmik et al.⁴ evaluated change in SNOT-22 score following ESS among a multi-institutional North American population, finding that patients with pre-treatment SNOT-22 scores between 10–19 reported a worsening of their QoL fourteen months after ESS. In contrast, patients with pre-treatment SNOT-22 scores greater than 30 reported a 45% reduction in total SNOT-22 scores following ESS, with an associated 75% chance of reporting a MCID. Hopkins et al.³ published similar findings among an English cohort undergoing ESS, while patients with preoperative SNOT-22 scores ≥ 20 demonstrating the smallest change in self-reported QoL at both 3 months and 12 months after ESS. Steele et al.⁹ evaluated treatment outcomes among CRS patients electing to undergo CMT, finding that patients with pre-treatment SNOT-22 scores between 10–19 reported no relative mean improvement in SNOT-22 scores after ~15 months follow-up. These findings are consistent with treatment outcomes reported in the current study, with significantly lower improvement in total SNOT-22 scores among low-SNOT CRS patients undergoing either CMT or ESS.

There are several limitations to the current study. While the low prevalence of low-SNOT CRS with follow-up if of limited size (n=38), this did not preclude the ability to detect statistically significant observations even across subgroups. Additionally, this multi-institutional cohort is limited to academic, tertiary care centers, with the potential for treatment selection bias and the undefined influence of referral bias on subsequent decision making. This analysis also did not evaluate the potential for response threshold shifts following each treatment. While the magnitude of response shifts has been described as clinically insignificant following ESS overall²⁰, QoL recalibration may account for a large proportion of patients failing to reach a MCID, such as those with low-SNOT CRS. Finally, the SNOT-22 is not universally utilized in the clinical evaluation of CRS patients, thus

limiting the interpretability of findings to those clinical practices using the SNOT-22 as a screening tool. While the authors do not advocate the use of PROMs as a singular surgical screening instrument to be utilized in place of clinical observation and physician judgment, we do believe it represents an important tool for patient counseling and risk stratification. Given currently available evidence, it may be inappropriate to offer ESS to patients with low-SNOT CRS without mucocoele or acute complication. Future study seeking to identify the relative importance of specific, self-identified primary symptoms on patient outcomes will further refine to utility of this clinical instrument.

CONCLUSIONS

Patients with low-SNOT CRS represent an outlier population for which conventional QoL metrics may fail to identify factors driving the decision to seek treatment. Accounting for ~6% of CRS patients in academic, tertiary-care practices, these patients report comparable baseline SNOT-22 scores to a control population without CRS. Since patients with low-SNOT CRS demonstrate decreased likelihood of reporting MCIDs following ESS, they should be identified in order to assist patient counseling prior to surgery. Further study is required to identify and potentially target novel factors associated with treatment seeking and decision making among this unique population.

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Table 1

Preliminary cohort characteristics and baseline clinical measures of disease severity

Demographics:	Low-SNOT CRS (n=38)		High-SNOT CRS (n=641)		Low vs High- SNOT CRS p-value&	Non-CRS controls (n=95)		Omnibus test p-value*
	Mean [SD]	N (%)	Mean [SD]	N (%)		Mean [SD]	N (%)	
Age (years)	55.1 [15.6]		49.8 [15.3]		0.039	53.2 [17.4]		0.024
Males		24 (63%)		301 (47%)	0.052		34 (36%)	0.016
White/Caucasian		29 (76%)		542 (85%)	0.177		68 (72%)	0.005
Hispanic/Latino		2 (5%)		28 (4%)	0.682		2 (2%)	0.550
Asthma		12 (32%)		254 (40%)	0.323		6 (6%)	<0.001
Nasal polypsis		10 (26%)		257 (40%)	0.091		----	----
Septal deviation		9 (24%)		221 (35%)	0.172		----	----
Allergies (RAST/skin prick)		13 (34%)		293 (46%)	0.166		12 (13%)	<0.001
ASA intolerance		1 (3%)		57 (9%)	0.240		0 (0%)	0.005
Depression		1 (3%)		92 (14%)	0.048		7 (7%)	0.027
Corticosteroid dependency		1 (3%)		60 (9%)	0.241		0 (0%)	<0.001
Ciliary dyskinesia		1 (3%)		26 (4%)	>0.999		0 (0%)	0.127
Diabetes mellitus (Type I/II)		5 (13%)		48 (8%)	0.206		7 (7%)	0.442
Previous sinus surgery		19 (50%)		373 (58%)	0.321		----	----
Endoscopy scores	4.5 [3.4]		6.4 [3.9]		0.004	----		----
CT scores	10.0 [4.4]		12.5 [6.0]		0.013	----		----

& p-values reflect an overall significance between low-SNOT CRS and high-SNOT CRS cohorts using independent t-testing of mean values or χ^2 testing for percentage comparisons.

* p-values reflect an overall significance using omnibus ANOVA or omnibus χ^2 testing for percentage comparisons across all 3 groups.

CRS, chronic rhinosinusitis; SNOT, SinoNasal Outcome Test; RAST, radioallergosorbent testing; ASA, acetylsalicylic acid; CT, computed tomography.

Table 2

Comparisons of mean baseline SNOT-22 and RSDI scores

Patient Reported Outcome Measures:	Low-SNOT CRS (n=38) Mean [SD]	High-SNOT CRS (n=641) Mean [SD]	Low vs High-SNOT CRS p-value&	Non-CRS controls (n=95) Mean [SD]	F-statistic (df)	Low CRS vs Non-CRS Controls p-value*
SNOT-22 Total Scores	12.5 [5.3]	53.9 [18.1]	<0.001	16.0 [14.6]	278.7 ₍₂₎	0.879
Rhinologic domain	5.1 [3.8]	16.9 [5.8]	<0.001	3.5 [4.3]	301.7 ₍₂₎	0.355
Extra-nasal rhinologic domain	2.6 [2.5]	8.6 [3.3]	<0.001	1.7 [2.5]	238.6 ₍₂₎	0.514
Ear/facial domain	2.4 [2.3]	9.4 [5.1]	<0.001	2.3 [3.0]	121.5 ₍₂₎	>0.999
Psychological dysfunction domain	2.1 [2.3]	16.0 [7.9]	<0.001	5.8 [6.0]	126.5 ₍₂₎	0.030
Sleep dysfunction domain	2.7 [3.4]	14.0 [6.4]	<0.001	6.0 [5.2]	120.1 ₍₂₎	0.016
RSDI Total Scores	11.6 [12.4]	46.9 [23.2]		----	85.9 ₍₁₎	----
Physical domain	5.6 [5.5]	19.3 [8.7]	<0.001	----	91.4 ₍₁₎	----
Functional domain	3.3 [4.2]	15.0 [8.4]	<0.001	----	71.7 ₍₁₎	----
Emotional domain	2.7 [4.5]	12.6 [8.6]	<0.001	----	49.0 ₍₁₎	----

& p-values reflect an overall significance between low-SNOT CRS and high-SNOT CRS groups using independent t-testing of mean values.

* multiple comparison adjusted p-values reflect an overall significance between low-SNOT CRS and non-CRS controls using Bonferroni corrections.

df, degrees of freedom; CRS, chronic rhinosinusitis; PROMs, Patient Reported Outcome Measures; SNOT-22, 22-item SinoNasal Outcome Test; RSDI, Rhinosinusitis Disability Index.

Table 3

Comparison in mean and median change in patient-reported outcome measure scores between low-SNOT and high-SNOT CRS for participants electing continued medical therapy (n=132)

	Low-SNOT CRS (n=13)	High-SNOT CRS (n=119)	
Patient Reported Outcome Measures:	Mean [SD]/ Median	Mean [SD]/ Median	p-value
SNOT-22 Total Scores	3.6 [16.0]/0.0	-9.9 [22.0]/-10.0	0.013
Rhinologic domain	0.8 [6.2]/0.0	-3.9 [7.7]/-3.0	0.058
Extra-nasal rhinologic domain	1.2 [2.9]/1.0	-1.6 [4.0]/-1.0	0.016
Ear/facial symptoms domain	1.5 [1.9]/1.0	-1.5 [5.2]/-1.0	0.012
Psychological dysfunction domain	0.3 [5.6]/0.0	-2.7 [7.8]/-2.0	0.199
Sleep dysfunction domain	-0.4 [4.1]/0.0	-2.6 [7.4]/-3.0	0.194
RSDI Total Scores	-0.9 [15.3]/-2.0	-8.9 [19.4]/-8.0	0.071
Physical domain	-0.5 [6.0]/-1.0	-4.0 [8.6]/-4.0	0.105
Functional domain	0.0 [4.6]/0.0	-3.2 [7.1]/-3.0	0.053
Emotional domain	-0.4 [5.5]/0.0	-1.7 [6.4]/-1.0	0.280

Negative mean change scores represent patient-reported improvement for both SNOT-22 and RSDI survey scores over time.

SNOT, SinoNasal Outcome Test; CRS, chronic rhinosinusitis; RSDI, RhinoSinusitis Disability Index.

Table 4

Comparison in the prevalence of a minimal clinically important difference in patient-reported outcome measure scores between low-SNOT and high-SNOT CRS for participants electing continued medical therapy (n=132)

	Low-SNOT CRS (n=13)	High-SNOT CRS (n=119)	
Patient Reported Outcome Measures:	N (%)	N (%)	p-value
SNOT-22 Total Score	2 (15%)	63 (53%)	0.016
Rhinologic domain	4 (31%)	56 (48%)	0.380
Extra-nasal rhinologic domain	1 (8%)	42 (36%)	0.059
Ear/facial symptoms domain	0 (0%)	46 (39%)	0.004
Psychological dysfunction domain	1 (8%)	44 (37%)	0.034
Sleep dysfunction domain	3 (18%)	54 (46%)	0.147
RSDI Total Scores	1 (8%)	46 (39%)	0.032
Physical domain	1 (8%)	52 (44%)	0.015
Functional domain	1 (8%)	48 (40%)	0.031
Emotional domain	1 (8%)	43 (36%)	0.059

SNOT, SinoNasal Outcome Test; CRS, chronic rhinosinusitis; RSDI, RhinoSinusitis Disability Index.

Table 5

Comparison in mean and median change in patient-reported outcome measure scores between low-SNOT and high-SNOT CRS for participants electing ESS (n=405)

	Low-SNOT CRS (n=14)	High-SNOT CRS (n=391)	
Patient Reported Outcome Measures:	Mean [SD]/Median	Mean [SD]/Median	p-value
SNOT-22 Total Scores	-0.7 [14.1]/-7.0	-26.0 [22.4]/-26.0	<0.001
Rhinologic domain	1.0 [5.2]/0.0	-8.3 [7.9]/-8.0	<0.001
Extra-nasal rhinologic domain	-0.1 [2.6]/0.0	-4.0 [3.9]/-4.0	<0.001
Ear/facial symptoms domain	-1.2 [3.2]/-1.0	-5.0 [5.2]/-5.0	0.003
Psychological dysfunction domain	-0.1 [3.8]/-0.5	-7.7 [8.7]/-7.0	<0.001
Sleep dysfunction domain	-0.1 [5.6]/-0.5	-6.1 [7.0]/-6.0	0.002
RSDI Total Scores	-2.6 [14.5]/-3.5	-23.6 [23.4]/-22.0	<0.001
Physical domain	-1.6 [5.8]/-2.5	-9.9 [9.4]/-9.0	0.001
Functional domain	-0.4 [5.0]/-1.0	-8.0 [8.7]/-8.0	<0.001
Emotional domain	-0.5 [5.2]/0.0	-5.8 [7.9]/-5.0	0.002

Negative mean change scores represent patient-reported improvement for both SNOT-22 and RSDI survey scores over time.

SNOT, SinoNasal Outcome Test; CRS, chronic rhinosinusitis; RSDI, RhinoSinusitis Disability Index.

Table 6

Comparison in the prevalence of a minimal clinically important difference in patient-reported outcome measure scores between low-SNOT and high-SNOT CRS for participants electing ESS (n=405)

	Low-SNOT CRS (n=14)	High-SNOT CRS (n=391)	
	N (%)	N (%)	p-value
SNOT-22 Total Score	6 (43%)	321 (82%)	<0.001
Rhinologic domain	3 (21%)	281 (72%)	<0.001
Extra-nasal rhinologic domain	1 (7%)	254 (65%)	<0.001
Ear/facial symptoms domain	4 (29%)	270 (69%)	0.003
Psychological dysfunction domain	1 (7%)	251 (64%)	<0.001
Sleep dysfunction domain	2 (14%)	253 (65%)	<0.001
RSDI Total Scores	1 (7%)	266 (69%)	<0.001
Physical domain	4 (29%)	273 (70%)	0.002
Functional domain	1 (7%)	250 (64%)	<0.001
Emotional domain	2 (14%)	206 (53%)	0.005

SNOT, SinoNasal Outcome Test; CRS, chronic rhinosinusitis; RSDI, RhinoSinusitis Disability Index.