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The impact of comorbid migraine on quality of life outcomes after endoscopic sinus surgery

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Abstract

Objectives—Chronic rhinosinusitis (CRS) and migraine are common entities with overlapping symptomatology yet little research exists which investigates the intersection of the two. This study seeks to investigate whether patients with CRS with and without a migraine history experience comparable quality-of-life (QOL) improvement after endoscopic sinus surgery (ESS).

Study Design—Retrospective analysis of a prospective cohort

Methods—An adult population (n=229) with medically refractory CRS was prospectively evaluated following ESS using disease-specific QOL surveys: the Rhinosinusitis Disability Index (RSDI), the Chronic Sinusitis Survey (CSS), and the Sinonasal Outcome Test-22 (SNOT-22). History of comorbid migraine was identified (n=46) and pre- and postoperative QOL was compared to patients without migraine (n=183).

Results—Patients migraine and CRS were more likely to be female (p=0.023), experience allergies (p=0.024), fibromyalgia (p=0.009), depression (p=0.010), and be less likely to have nasal polyposis (p=0.003). Objective measures of disease (endoscopy and computed tomography scores) were significantly lower in patients with migraine (p=0.027 and p=0.002, respectively), yet these patients scored lower on baseline RSDI and SNOT-22 scores (p=0.025 and p=0.019, respectively). QOL in both patients with and without migraine improved significantly after ESS (p<0.003) and by comparable magnitudes (p>0.062).

Conclusion—Patients with comorbid migraine and CRS are more likely to have less severe evidence of disease and worse preoperative baseline QOL scores. This may imply that comorbid migraine disorder, in the setting of CRS, compels these patients to seek surgical management earlier in the disease process. Regardless, ESS provides comparable improvement for both patients with and without comorbid migraine.

Keywords

Sinusitis; migraine disorders; outcome assessment; quality of life; comorbidity

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INTRODUCTION

Migraine and chronic rhinosinusitis (CRS) are prevalent diseases that share similar symptoms and patient demographics.^{1,2} Both can be associated with headache/facial pain, nasal symptoms and changes in the environment.^{3,4} These sometimes indistinguishable symptoms can make clinical diagnosis of the source of headache or facial pain challenging.⁵ To assist in diagnosis of CRS, practice guidelines state that patients must demonstrate twelve weeks of objective evidence of sinus inflammation coupled with two or more of the following symptoms: mucopurulent drainage, nasal obstruction, facial pain-pressure-fullness or decreased sense of smell must.⁴ Similarly, diagnostic criteria exist for migraine headache but they include the caveat that symptoms should not be better accounted for by another diagnosis.³ In addition to diagnostic ambiguity, rhinosinusitis and migraine diseases process can interact. Rhinosinusitis flares are an acknowledged trigger for migraine, and autonomic sinonasal symptoms can be associated with migraines.³ In patients with CRS, comorbid migraine can confound clinical decision making by obfuscating symptom etiology.

Medically refractory CRS is effectively treated with endoscopic sinus surgery (ESS). Multi-institutional data has demonstrated that approximately 75% of patients with medically refractory CRS experience a clinically significant improvement in validated quality-of-life (QOL) outcomes following ESS.² Patients with CRS rank headache as the most disabling symptom associated with CRS⁶ yet studies examining resolution of facial pain and headache post-ESS are mixed.^{6,7} Migraine comorbidity potentially confounds CRS quality-of-life outcomes via misdiagnosis or through a disease process interaction. Control of sinus disease theoretically may decrease migraine flares, presumably improving QOL and headaches post-operatively. Similarly, the challenge of discerning the underlying etiology of facial pain and headache may also mitigate post-ESS QOL gains typically seen in patients without migraine. The decision to recommend, or undergo, ESS is informed in part by clinical studies, but no study to date has examined the impact of concurrent history of migraine on CRS quality of life. The aim of the present study is to investigate the impact of comorbid migraine on CRS and post-ESS outcomes.

MATERIALS and METHODS

Adult (>18 years) study subjects were enrolled and followed at Oregon Health & Science University (OHSU) as part of a multi-institutional prospective, observational cohort study that has been previously reported.^{2,8} These subjects were enrolled prospectively between September, 2004 and November, 2012. All subjects had a diagnosis of CRS based on the Rhinosinusitis Task force criteria^{9,10} and were enrolled when the subjects elected to pursue ESS after failing either broad-spectrum or culture-directed antibiotics and a trial of oral and topical steroid therapy. All study protocols and informed consent were collected and approved by the institutional review board at OHSU.

This prospectively collected dataset did not originally include any information regarding migraine symptomatology; therefore, this cohort of subjects was retrospectively evaluated for history of migraine precluding use of diagnostic guidelines to define symptom complexes at the time of evaluation or migraine symptomatology at postoperative

evaluations. Review of the patient history at the time of presentation identified subjects reporting a history of migraine as well as use of medications indicated for only migraine. Both cases were considered positive for a history of migraine.

Inclusion Criteria

Study subjects with record of both of the following inclusion criteria were included for initial study evaluation:

1. A history of primary headache (specifically ICD-9 code #346 for migraine diagnosis, and ICD-9 code #339 for other sources of primary headache including both cluster headache and tension headache).
2. Use of medications indicated specifically for migraine including:
 - A. Triptans (almotriptan, eletriptan, frovatriptan, naratriptan, rizatriptan, sumatriptan, zolmitriptan)
 - B. Ergot alkaloids (ergotamine tartrate, dihydroergotamine mesylate)
 - C. Barbiturates (butalbital)
 - D. Herbals (feverfew, butterbur)

Exclusion Criteria

1. Subjects reporting a past medical history of secondary headache or facial pain attributed to a medical condition other than CRS.
2. All subjects with disorders of the cranium, neck, eyes, ears, teeth, mouth or cervical structure.

QOL Evaluation and Objective Testing

Previously consented subjects were administered the Rhinosinusitis Disability Index (RSDI) at a preoperative baseline assessment and again at 6, 12, and 18 month postoperative follow-up visits. Subjects were also administered a second disease-specific QOL measure, either the Sinonasal Outcome Test-22 (SNOT-22) or the Chronic Sinusitis Survey (CSS) at the same time points. Prior study has demonstrated no significant change in QOL beyond the six-month time point for this population.¹¹ Subjects enrolled between July, 2004 and December, 2008 were assessed using both the RSDI and CSS instruments,² while all subsequent subjects completed the RSDI and SNOT-22 at preoperative and follow-up evaluations. The RSDI measures rhinologic morbidity with a thirty questions subdivided into a physical, functional, and emotional scale. Possible scores range from 0 (the lowest level of disease impact) to 120 (the greatest level of disease impact).¹² The CSS is a sinusitis-specific outcome measure that consists of six questions in two subscales, symptom and medication use. This construct measures the time period 8-weeks prior to the evaluation, and ranges from 0 (lowest level of functioning) to 100 (highest level of functioning).¹³ The SNOT-22 evaluates physical, functional and emotional impact of chronic rhinosinusitis. It includes all four criteria set forth by the Rhinosinusitis Task Force. The scores range from 0 (no impact of disease) to 110 (most severe impact of disease).¹⁴

Objective measures of disease included computed tomography and endoscopic evaluation. Computed tomography scans in the coronal plane were obtained for preoperatively and evaluated by the enrolling surgeon (TLS) using the Lund-Mackay scoring system (0-24 point scale) at the time of original enrollment.¹⁵ Rigid sinonasal endoscopy was performed preoperatively and postoperatively at the six-month, twelve-month and eighteen-month visits when possible. The last available endoscopic exam was used for postoperative comparisons to baseline. Endoscopic exam was quantified using the scoring system described by Lund and Kennedy (0-20 point scale).¹⁶

Statistical Analysis

Data were collected on standardized clinical research forms and analyzed using SPSS version 22.0 statistical software (IBM Corporation, Armonk, NY). Descriptive statistics were compiled for all patient characteristics. Chi-square tests were used to compare differences between the prevalence of demographic factors and comorbid conditions between patients with and without a history of comorbid migraine. Two-sided independent t-tests or Mann-Whitney U tests were used to evaluate differences in all continuous variables and QOL responses and mean improvement between migraine subgroups where appropriate. Matched paired t-tests and Wilcoxon signed-rank tests were used to determine significant improvement in QOL between preoperative and postoperative time points. Whereas a history of migraine was identified as a significant, univariate predictor of either baseline QOL or mean improvement (last postoperative minus preoperative) in RSDI, CSS, or SNOT-22 scores, linear regression techniques were employed to further screen and adjust for potential independent cofactors or confounding variables. Preliminary models included history of migraine as the main exposure variable and all factors with univariate significance ($p < 0.250$). Without adjustment for baseline QOL scores, final models were elected using a stepwise, manual forward selection and backwards elimination procedure with $p = 0.050$ and $p = 0.010$ significance levels, respectively. Confounding was identified if covariates altered the effect estimate of the main exposure variable by at least $\pm 10\%$.

RESULTS

Preoperative Patient Characteristics and Disease Severity

A total of 229 patients enrolled in the study met inclusion criteria. Forty-six patients (20.0%) reported a diagnosis of migraine at initial evaluation. **Table I** demonstrates preoperative characteristics of patients with and without a history of migraine and CRS. Patients reporting a history of migraine were more likely to be female (63.0% versus 44.3%; $p = 0.023$), report a history of allergy (19.6% versus 8.2%; $p = 0.024$), fibromyalgia (10.9% versus 1.6%; $p = 0.009$) and have comorbid depression (30.4% versus 14.2%; $p = 0.010$). Patients reporting a history of migraine were less likely to have nasal polyposis (30.4% versus 54.6%; $p = 0.003$), lower average endoscopy scores (6.5(4.1) versus 8.0(4.1); $p = 0.027$) and lower average computed tomography scores (11.3(5.6) versus 14.5(6.1); $p = 0.002$).

QOL Findings at Baseline

Subjects reporting a history of migraine also reported higher impact of disease as measured by the average preoperative RSDI total score (54.6(21.0) versus 46.7(21.2); $p=0.025$) and average SNOT-22 scores (68.9(18.3) versus 54.6(19.1); $p=0.019$; **Table 2**) when compared to patients with no history of migraine. Average scores on the RSDI physical and functional subscale were both worse at baseline in patients with a history of comorbid migraine (22.2(8.2) versus 18.7(8.0); $p=0.011$ and 17.6(7.6) versus 14.7(7.5); $p=0.020$, respectively).

QOL and Endoscopic Outcomes

Subjects were followed for an average duration of 15.3(6.3) months. Both subjects with and without a history of migraine showed improvement in all QOL measures between preoperative and last postoperative assessments (**Table 3**). Both subjects with and without a history of migraine were found to have a significant improvement in endoscopy scores (-3.0(4.2) and -4.3(4.4), respectively; both $p<0.001$). Both subgroups experienced a statistically similar degree of improvement over time across all QOL constructs (**Table 4**).

DISCUSSION

Patients with a history of migraine and objective evidence of CRS can pose a challenging situation to the sinus surgeon. There is no way to discern preoperatively whether headache, facial pain and pressure or nasal congestion is manifestation of a migraine or if it is the direct result of sinonasal inflammation. Pain and headache are strong motivating forces for patients to elect ESS,⁶ yet little evidence exists regarding the impact of comorbid migraine on QOL gains after ESS. Understanding and recognizing the unique profile of patients with CRS and comorbid migraine can facilitate appropriate diagnosis and management of these two common disease processes.

Patients with comorbid migraine and chronic rhinosinusitis are a distinct patient group with a unique comorbidity profile and lower measures of objective sinus disease. In this study, patients with a history of comorbid migraine were significantly more likely to be female and present with comorbid diagnoses of fibromyalgia, depression and allergy. Migraine was a significant predictor of baseline QOL (RSDI, SNOT-22), yet patients reporting a history of migraine were also found to have significantly lower objective measures of sinonasal inflammation (CT and endoscopic scores), but worse baseline QOL; however, subjects with comorbid migraine achieved comparable benefit from ESS as patients without comorbid migraine with the exception of the CSS medication subscale, which inquires about use of antibiotics, nasal sprays, antihistamines, and decongestants over the last prior 8 weeks.

Migraine is a neuroinflammatory pain syndrome of the meninges fueled by neuronal excitability in the cerebral cortex with subsequent central dysregulation. In the case of migraines preceded by aura, the aura prodrome is the result of a spreading cortical depression of neuronal activity.^{17,18} At the periphery of the spreading depression is a region of cortical excitability believed to activate the trigeminal pain fibers that innervate the meninges. The activated C-fibers release neuropeptides that are vasoactive resulting in vasodilation, protein exudation, activation of mast cells—in short, neurogenic inflammation

—that is experienced clinically as a throbbing headache. Afferent axons sensitized by the inflammation activate a centrally mediated reflex arc that travels through the trigeminal ganglia, the trigeminal caudalis, and out via parasympathetic innervation of cranial ganglia and sphenopalatine ganglia before reaching end targets (meninges or nasal cavity) exacerbating symptoms.¹⁷ Neurons in the trigeminal caudalis in response to the neurogenic inflammation also are sensitized to other stimuli that may typically be better tolerate such as cough, movement¹⁹ and conceivably management of CRS symptoms.

Although migraine environmental triggers are not completely understood, a variety of triggers have been identified including alcohol ingestion, specific odorants, food allergy and stress, and are all postulated to end in the final common pathway of neuroinflammation within the meninges.²⁰ Alcohol lowers trigeminal nociceptor thresholds in the meninges. Certain scents, such as that of the ‘headache tree,’ *Umbellularia californica*, which is endemic to parts of California and Oregon and potentially encountered by the study population, are thought to activate trigeminal nerve endings in the nasal cavity. These examples directly stimulate trigeminal nociceptors triggering the neurogenic inflammatory cascade.^{20,21} Conceivably, CRS flares could trigger similar trigeminal nociceptors. Furthermore, pro-inflammatory states may increase the risk of migraine. Randomized control trial data support that patients exposed to food allergens identified through IgG testing have significantly more migraine attacks compared to patients on an elimination diet.² The authors postulate that this is the result of a pro-inflammatory state that predisposes to these subjects to the neuroinflammatory cascade of migraine. CRS theoretically could provide an environment primed for migraine.

The mechanisms underlying migraine may explain some of the idiosyncracies of the CRS and comorbid population. We found patients with comorbid migraine were more likely to also have a history of allergy. The increased incidence of allergy may be the result of both an increased inflammatory milieu (as seen with food allergy),²¹ and it also may be an example of the influence of the direct triggering of a nasal trigeminal nociceptor response as seen with *U. californica*.²⁰ Additionally, the lesser objective measures of disease in the comorbid migraine subjects may be the result of central brainstem changes sensitizing the subjects to pain leading to earlier presentation in the disease process.

We have found that subjects in this cohort with comorbid migraine were more likely to be of female gender and suffer from fibromyalgia and depression. The association of female gender and migraine is well documented with women experiencing migraine 2-3 times as frequently as men.²² Similarly, fibromyalgia is a disease that predominately impacts women, and when men do have fibromyalgia they are significantly less symptomatic.²³ The observation that women are disproportionately impacted by pain-related disorders (including temporomandibular disorder and irritable bowel syndrome) has led to the hypothesis that sex hormones may be responsible for modulating pain.²⁴ Additionally, perimenstrual migraines are associated with fluxes in estrogen.²⁵ Animal studies also support the role of estrogen modulation of sensory neurons to nociceptive mediators.²⁶ Prior report on gender differences in this cohort found that women have worse pre-operative and postoperative QOL measures. This difference in part may be secondary to comorbid depression, which is

more common in women,²⁷ but may also reflect gender differences in central modulation of trigeminal nociception.

Future studies investigating the intersection or overlap of migraine and chronic rhinosinusitis would benefit from collecting disease-specific QOL constructs for both migraine or headache and CRS. Validated migraine QOL measures exist²⁸ and could help elucidate how the symptoms of CRS correlate with the symptoms of migraine. Other potential confounders to the present study are inherent to the retrospective nature of identification of the migraine subset. Patients with episodic migraines may underreport on medical history questionnaires infrequent use of abortive drugs or conditions, such as episodic migraine, that do not occur on a daily basis. Underreporting of migraine may represent non-differential misclassification bias, which predisposes the present study to failing to find a significant difference. In fact, subjects reporting comorbid migraine and CRS in a study by Aaseth et al.²⁹ found that almost 25% of patients reporting a migraine history did not have an episode within the last year. Furthermore, patients that did report migraine may not have reached an ideal medical management of the migraine, or failed 'maximal' medical management of migraine prior to being enrolled in the cohort. Effective medical migraine management may impact CRS-specific QOL measures, and may have impacted the decision to elect surgical intervention.

The present study design is limited by a lack of a medical control group of patients undergoing both continued medical management of migraine and CRS. Although, prior study of treatment modalities for CRS have favored ESS over medical management,³⁰ patients with CRS and comorbid migraine are a unique sub-population that may reap a greater benefit from medical therapy than patients without comorbid migraine. Future clinical study, ideally would also investigate the impact of the frequency of migraine on CRS and whether ESS has therapeutic value in reducing the frequency of migraine occurrence to help tailor the ideal medical and surgical interventions. Further investigations into the neurophysiology of trigeminal pain could also potentially offer novel effective medical treatments for both migraine and CRS.

CONCLUSION

Migraine and CRS are common diseases with similar patient demographics and symptom profiles. Patients with CRS reporting a history of migraine tend to have lower objective evidence of sinusitis at baseline than patients with no history of migraine and CRS yet comorbid migraine is associated with lower baseline QOL. This differential may imply that comorbid migraine disorder in the setting of CRS compels these patients to seek surgical management earlier in the disease process. Further research employing disease-specific migraine QOL constructs in addition to CRS disease-specific measures with a comparison continued medical management cohort would help elucidate the interplay between these common diseases and identify the ideal treatment modalities. Regardless, patients with CRS and a history of migraine can be expected to experience mean improvements after ESS comparable to patients with no history of migraine.

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Table 1

Comparison of baseline demographic and clinical characteristics for CRS patients with and without migraine.

Characteristics:	History of Migraine (n=46)		No Migraine History (n=183)		
	Mean (SD)	N(%)	Mean (SD)	N(%)	p-value
Age (years)	46.7 (14.2)		50.3 (14.1)		0.124
Male		17 (37.0)		102 (55.7)	
Female		29 (63.0)		81 (44.3)	0.023
Previous sinus surgery		25 (54.3)		111 (60.7)	0.436
Nasal polyposis		14 (30.4)		100 (54.6)	0.003
Septal deviation		18 (39.1)		63 (34.4)	0.551
Asthma		16 (34.8)		69 (37.7)	0.714
Aspirin intolerance		2 (4.3)		21 (11.5)	0.180
Allergies (history)		9 (19.6)		15 (8.2)	0.024
Allergies (testing)		13 (28.3)		46 (25.1)	0.665
Fibromyalgia		5 (10.9)		3 (1.6)	0.009
Depression		14 (30.4)		26 (14.2)	0.010
Current smoker		4 (8.7)		8 (4.4)	0.266
L-K Endoscopy score	6.5 (4.1)		8.0 (4.1)		0.027
L-M CT score	11.3 (5.6)		14.5 (6.1)		0.002

CRS, chronic rhinosinusitis; SD, standard deviation; L-K, Lund-Kennedy; L-M, Lund-Mackay; CT, computed tomography.

Table 2

Comparison of baseline QOL scores for CRS patients with and without migraine

Baseline QOL measures:	History of Migraine		No Migraine History		p-value
	Mean (SD)	Range	Mean (SD)	Range	
	(n=46)		(n=183)		
RSDI physical	22.2 (8.2)	[6 – 44]	18.7 (8.0)	[2 – 39]	0.011
RSDI functional	17.6 (7.6)	[2 – 36]	14.7 (7.5)	[0 – 35]	0.020
RSDI emotional	14.8 (8.4)	[0 – 40]	13.2 (8.1)	[0 – 39]	0.245
RSDI total	54.6 (21.0)	[9 – 116]	46.7 (21.2)	[3 – 107]	0.025
	(n=33)		(n=116)		
CSS symptom	20.0 (22.1)	[0 – 75]	29.7 (26.8)	[0 – 92]	0.065
CSS medication	44.4 (23.0)	[0 – 100]	48.2 (25.2)	[0 – 100]	0.445
CSS total	32.2 (16.2)	[0 – 67]	39.0 (19.1)	[0 – 84]	0.061
	(n=13)		(n=67)		
SNOT-22	68.9 (18.3)	[40 – 99]	54.6 (19.1)	[15 – 106]	0.019

QOL, quality of life; CRS, chronic rhinosinusitis; SD, standard deviation; RSDI, Rhinosinusitis Disability Index; CSS, Chronic Sinusitis Survey; SNOT-22, 22-Item Sinonasal Outcome Test.

Table 3

Comparison in change of QOL scores post-ESS in CRS patients with and without migraine over time.

	History of Migraine				p-value
	Preoperative		Postoperative		
QOL Improvement:	Mean (SD)	Range	Mean (SD)	Range	
	(n=46)				
RSDI physical	22.2 (8.2)	[6 – 44]	12.4 (9.4)	[0 – 35]	<0.001
RSDI functional	17.6 (7.6)	[2 – 36]	10.9 (9.4)	[0 – 35]	<0.001
RSDI emotional	14.8 (8.4)	[0 – 40]	9.7 (9.0)	[0 – 40]	<0.001
RSDI total	54.6 (21.0)	[9 – 116]	32.9 (25.0)	[0 – 105]	<0.001
	(n=33)				
CSS symptom	20.0 (22.1)	[0 – 75]	55.3 (35.0)	[0 – 100]	<0.001
CSS medication	44.4 (23.0)	[0 – 100]	63.4 (24.0)	[16 – 100]	0.001
CSS total	32.2 (16.2)	[0 – 67]	59.3 (20.1)	[12 – 100]	<0.001
	(n=13)				
SNOT-22	68.9 (18.3)	[40 – 99]	44.2 (20.6)	[10 – 84]	0.003

	No Migraine History				p-value
	Preoperative		Postoperative		
QOL Improvement:	Mean (SD)	Range	Mean (SD)	Range	
	(n=183)				
RSDI physical	18.7 (8.0)	[2 – 39]	9.7 (7.7)	[0 – 37]	<0.001
RSDI functional	14.7 (7.5)	[0 – 35]	7.1 (7.0)	[0 – 32]	<0.001
RSDI emotional	13.2 (8.1)	[0 – 39]	7.3 (7.5)	[0 – 39]	<0.001
RSDI total	46.7 (21.2)	[3 – 107]	24.1 (20.2)	[0 – 101]	<0.001
	(n=116)				
CSS symptom	29.7 (26.8)	[0 – 92]	62.5 (26.9)	[0 – 100]	<0.001
CSS medication	48.2 (25.2)	[0 – 100]	57.1 (25.2)	[0 – 100]	0.001
CSS total	39.0 (19.1)	[0 – 84]	59.8 (21.3)	[12 – 100]	<0.001
	(n=67)				
SNOT-22	54.6 (19.1)	[15 – 106]	28.9 (20.4)	[2 – 104]	<0.001

QOL, quality of life; ESS, endoscopic sinus surgery; CRS, chronic rhinosinusitis; SD, standard deviation; RSDI, Rhinosinusitis Disability Index; CSS, Chronic Sinusitis Survey; SNOT-22, 22-Item Sinonasal Outcome Test.

Table 4

Comparison of mean improvement in outcome measures between CRS patients with and without migraine.

	History of Migraine		No Migraine History		
QOL Improvement:	Mean (SD)	Range	Mean (SD)	Range	p-value
	(n=46)		(n=183)		
RSDI physical	-9.8 (9.8)	[-44 – 10]	-9.1 (9.0)	[-35 – 27]	0.655
RSDI functional	-6.8 (8.7)	[-27 – 11]	-7.6 (7.5)	[-32 – 13]	0.521
RSDI emotional	-5.1 (8.2)	[-28 – 14]	-5.9 (7.4)	[-31 – 16]	0.527
RSDI total	-21.7 (22.6)	[-92 – 28]	-22.6 (21.4)	[-92 – 50]	0.794
	(n=33)		(n=116)		
CSS symptom	35.4 (36.7)	[-67 – 100]	32.8 (30.8)	[-59 – 100]	0.606
CSS medication	18.9 (30.0)	[-59 – 100]	8.9 (26.1)	[-50 – 84]	0.062
CSS total	27.1 (25.2)	[-17 – 88]	20.1 (22.0)	[-46 – 75]	0.305
	(n=13)		(n=67)		
SNOT-22	-24.7 (19.8)	[-60 – 10]	-25.7 (24.8)	[-100 – 65]	0.932

All mean improvement scores listed are unadjusted for other independent risk factors or potential confounding variables. CRS, chronic rhinosinusitis; QOL, quality of life; SD, standard deviation; RSDI, Rhinosinusitis Disability Index; CSS, Chronic Sinusitis Survey; SNOT-22, 22-Item Sinonasal Outcome Test.