Indian J Otolaryngol Head Neck Surg (2023) 75:S1062–S1068
https://doi.org/10.1007/s12070-023-03582-y

ORIGINAL ARTICLE

Snot-22 a Predictive and Assessment Tool for Subjective Improvement After Fess in Patients of Chronic Rhinosinusitis

Anshul Sharma[1] · Neha Raghuwanshi[1] · Yamini Gupta[1] · Aparaajita Upadhyay[1] · Rajkumar Mundra[1]

Received: 12 January 2022 / Accepted: 16 February 2023 / Published online: 2 March 2023

Abstract Chronic Rhinosinusitis (CRS) is a common health problem with an estimated prevalence of 6.8% in Asia. The treatment of CRS involves an initial course of maximal medical therapy followed by Functional Endoscopic Sinus Surgery (FESS). Here, we are assessing the outcomes of FESS on CRS using most recent Sino Nasal Outcome Test (SNOT-22) questionnaire, for quantifying changes in symptoms and predicting extent of postoperative improvement. 75 patients who reported in the tertiary health care centre in Department of ENT, MGM Medical College & M.Y. Hospital, Indore and were diagnosed with CRS that did not relieve on medication were selected on the basis of inclusion and exclusion criteria. The selected cases were asked to answer the SNOT-22 questionnaire before the surgery. FESS was done and after three months, the patients were again subjected to the SNOT-22 questionnaire. There was 83.67% overall improvement in postsurgical SNOT-22 evaluations, which was statistically significant (p value < 0.00001). Most common SNOT-22 symptom was the need to blow nose, which was seen in 28 (93.34%) cases, while ear pain was found in 10 (50%) patients and was the least common SNOT-22 symptom. FESS seems to be effective treatment of CRS patients. We observed SNOT-22 to be very effective and reliable in assessing the Quality of Life in CRS patients and to measure the improvement after FESS.

Keywords Chronic rhinosinusitis (CRS) · Sino-nasal outcome test (SNOT)-22 · Functional endoscopic sinus surgery (FESS)

✉ Aparaajita Upadhyay
draparaajita6@gmail.com

[1] Department of E.N.T., M.G.M. Medical College, 104 President Regency, 3/5 Manoramaganj, Indore 452001, India

Introduction

Chronic Rhinosinusitis (CRS) is a common health problem with an estimated prevalence of 6.8% in Asia [1]. The diagnosis of CRS is based on well-defined criteria which include a combination of specific symptoms and signs, confirmed with endoscopic and radiological findings [2]. The treatment of CRS involves an initial course of maximal medical therapy followed by Functional Endoscopic Sinus Surgery (FESS), because, it allows restoring ventilation and mucociliary clearance [3, 4]. With evolving trends, the management of patients of CRS has improved considerably following the introduction of FESS over the last few decades.

Here, we are assessing the outcomes of FESS on the CRS using most recent Sino Nasal Outcome Test (SNOT-22) questionnaire, for quantifying changes in symptoms and predicting extent of postoperative improvement as SinoNasal Outcomes Test (SNOT-22) is the most commonly utilized and highest quality sinus-specific quality of life (QOL) instrument available. The SNOT-22 containing 22 questions each scored 0–5 (total score range 0–110), with higher scores representing worse QOL [5]. Individual studies have consistently shown that SNOT-22 scores improve after FESS in adults with CRS.

Our main objective is to assess the improvement of QOL of the patient suffering from CRS who reported to the tertiary centre and got operated with FESS using SNOT-22 questionnaire pre and post-operatively and comparing the results.

Methodology

We selected 75 patients who reported in the tertiary health care centre in Department of ENT, MGM Medical College

& M.Y. Hospital, Indore and were diagnosed with CRS that did not relieve on medication. All were posted for FESS after all routine investigations, endoscopic assessment and CT-PNS. All cases were asked to answer the SNOT-22 questionnaire before the surgery. Three months after FESS, the patients were asked to answer the SNOT-22 questionnaire.

This was a prospective longitudinal study. The duration of the study was from October 2018 to March 2020.

Inclusion Criteria

i. Patient of age from 20 to 60 years of age
ii. Patient having DNS with CRS with nasal polyposis, fungal sinusitis, patients with mucocele and pansinusitis were included
iii. Patients with safe Chronic Suppurative Otitis Media (CSOM) with nasal focus of etiology
iv. Patient with history of allergy (indoor as well as outdoor allergen like smoke, dust)

Exclusion Criteria

i. Patients < 20 years and > 60 years
ii. Patients with co-morbidities like Tuberculosis (T.B), diabetes, hypertension etc.
iii. Patients with unsafe CSOM
iv. Patients of Benign/malignant tumors of nasal cavity
v. Patients not giving consents for FESS
vi. Patients of Atrophic rhinitis and acute rhinitis and sinusitis
vii. Patient having history of trauma to nose and face
viii. Patient having any diagnosed Psychiatric illness.
ix. Patients not giving consent for participation in this study

All patients in the study underwent a complete history and ENT examination. All routine blood investigations were done. Rigid nasal endoscopy with 0 degree and 30 degree endoscopes was performed as a part of examination. The SNOT-22 questionnaire was used to measure QOL, and scores for each domain calculated for each patient. Axial and coronal view of non-contrast enhanced CT scans of patients were studied to note the extent of disease.

The involvement of structures and extent of disease as observed on the CT PNS Scan were the predominant factors in deciding whether limited or complete FESS was to be planned in each patient. Surgery was planned after written and informed consent. Endoscopic septoplasty was done first in most cases to remove the deviated part of the septum. In initial stages of surgery Middle turbinate was medialized using an elevator. If in case of concha bullosa, the lateral aspect of concha bullosa was surgically removed (Fig. 1a). Uncinectomy was done using through sickle knife (Fig. 1b) and ball probe or microdebrider to reveal the lateral limit of the infundibulum and the maxillary sinus ostium. Maxillary sinus natural ostium is inspected with 30 degree endoscope and probed. The ostium was dilated to permit ventilation and drainage using ballpoint probe, through cutting instrument or debrider (Fig. 1c, d). Bulla ethmoidalis was opened with freer's elevator and anterior ethmoidal cells inspected with 45° endoscope. The nasal packing was done with merocel and was removed after 48 h of surgery. Patients were discharged at 5th day of surgery after suction cleaning of operated nasal cavity.

Patients were followed postoperatively for 3 months. After 3 months follow up, the postoperative SNOT-22 questionnaire was completed.

Data was compiled in excel sheet and paired t test and chi-square test, whichever applicable were used to find the statistical significance of the observations. The p value below 0.05 is considered to be statistically significant.

There are no conflicts of interest associated with this study. This research involved only human participants. We obtained written and informed consent from each participant and the patients who refused to consent for surgery and/or participation in this study were excluded from the study.

Results

The study was performed on 75 patients who were candidates for FESS. The mean age of the patients was 31.1 years and 27 (36%) of the patients were males and 48 (64%) were females. Overall SNOT-22 score improvement, showing the combined assessment of all the parameters, in the male cases showed 87.46% while in the female cases it showed 81.15%.

Among the 75 patients who underwent FESS, 48 (64%) were 20 to 30 years, 22 (29.3%) were 31 to 40 years while 5 (6.66%) patients were 51 to 60 years.

The overall improvement for age groups was 82.2%, 88.24% and 81.68% respectively (Table 1).

In all patients the severity of sinusitis symptoms were measured by SNOT-22 questionnaire before and after the FESS; so for each symptom, the distribution of symptom grades was assessed before and after the procedure.

Most common presenting symptom was nasal discharge, seen in 58 (77.33%) patients followed by Nasal obstruction and reduced smell, which were found in 50 (66.66%) patients each. Least common presenting symptom was facial pain, found in 26 (34.66%) patients (CHART 1).

The mean preoperativeSNOT-22 score was 41.83, and mean post-operative SNOT-22 score after 3 months following FESS was 6.83, showing an 83.67% improvement (Table 2). Paired-t test was applied and p value is < 0.00001, which is statistically significant.

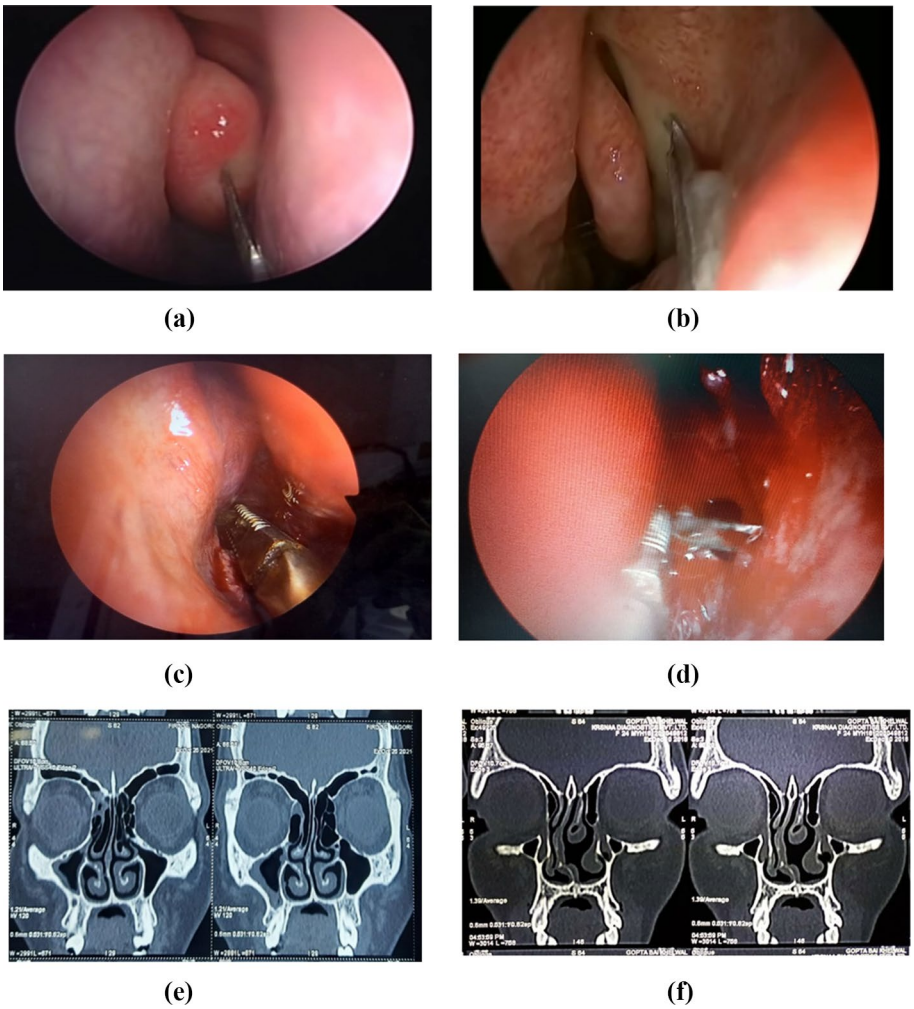

Fig. 1 **a** Concha bullish resection. **b** Uncinectomy using a sickle knife. **c**, **d** Antrostomy. **e** Concha Bullosa seen on CT-PNS. **f** DNS and Inferior Turbinate hypertrophy seen on CTPNS

Table 1 Showing basic demographic characteristics of subjects

Demographic characteristic	Number	Percentage
Total number of cases	75	
Sex-distribution		
Males	27	36
Females	48	64
Age distribution		
20–30	48	64
31–40	22	29.3
41–50	0	–
51–60	5	6.66

Out of 75 cases, 70 (93.33%) cases reported to have the need to blow nose. This was found to be the most common SNOT-22 symptom. Ear pain was found in 25 (33.33%) patients and was the least common SNOT-22 symptom. Maximum improvement amongst all symptoms was seen in reduced concentration (decrease in ability to focus) with preoperative mean SNOT-22 score 1.43 and postoperative was 0.1 resulting in 93.01% improvement. Minimum improvement was seen in ear pain with preoperative mean SNOT-22 score 0.8 and postoperative was 0.1 resulting in only 41.25% improvement (CHART 2).

The scores were categorized to mild, moderate and severe according to SNOT-22 preoperative symptom score. Mild (0–20) category had 5 cases, moderate (21–50) category had 46 cases and severe (> 50) category had 24 cases. The moderate category showed the maximum improvement, with 41 out of the 45cases (89.13%) showing postoperative SNOT-22 score ≤ 9; while both mild and severe categories showed improvement in 50% cases (Table 3). The *p* value is 0.3543 which is statistically not significant.

Discussion

Chronic rhinosinusitis is a problem resulting in significant patient morbidity and large health care costs. At present, SNOT-22 data scores are used before and after surgery for outcome analysis [6].

Table 2 Comparison of PRE-OP and POST-OP SNOT 22 score in 75 cases

CASE SR. NO	PRE OP	POST OP	Percentage improvement
1	36	2	94.44
2	57	35	38.60
3	32	3	90.63
4	53	7	86.79
5	53	11	79.25
6	69	6	91.30
7	61	13	78.69
8	70	11	84.29
9	42	5	88.10
10	8	8	0.00
11	54	8	85.19
12	49	5	89.80
13	44	8	81.82
14	59	0	100.00
15	40	10	75.00
16	22	6	72.73
17	26	4	84.62
18	40	5	87.50
19	13	2	84.62
20	55	18	67.27
21	39	2	94.87
22	36	5	86.11
23	28	1	96.43
24	49	5	89.80
25	52	6	88.46
26	25	0	100.00
27	23	3	86.96
28	21	0	100.00
29	50	3	94.00
30	49	16	67.35
31	55	9	83.64
32	40	8	80.00
33	45	0	100.00
34	35	6	82.86
35	24	4	83.33
36	60	10	83.33
37	31	6	80.65
38	47	8	82.98
39	60	10	83.33
40	18	10	44.44
41	49	2	95.92
42	52	8	84.62
43	43	5	88.37
44	65	11	83.08
45	38	4	89.47
46	25	12	52.00
47	57	10	82.46
48	52	0	100.00
49	45	3	93.33
50	42	9	78.57
51	39	5	87.18
52	46	7	84.78
53	61	11	81.97
54	29	7	75.86
55	52	6	88.46
56	26	9	65.38
57	44	7	84.09
58	40	4	90.00
59	51	0	100.00
60	58	12	79.31
61	50	13	74.00
62	25	4	84.00
63	15	2	86.67
64	33	7	78.79
65	40	0	100.00
66	54	15	72.22
67	55	2	96.36
68	27	9	66.67
69	35	4	88.57
70	49	9	81.63
71	41	8	80.49
72	23	13	43.48
73	51	0	100.00
74	10	10	0.00
75	45	5	88.89
Total	3137	512	83.67
Mean	41.83	6.83	83.67

T value—21.890413

The value of p is < 0.00001

Mean age of study participant in this study was found to be 31.1 years. In the study of Marambia et al. mean age was 40.7 ± 13.5 years [7] and 38.3 years in the study of Begh et al. [8].

We observed that most of our cases were in third decade of life with slight female predominance, in the given socio-demographic population. This is in contrast to Rudmik et al. and Abdalla et al. where they found it to be male predominance [9, 10].

In our study the nasal discharge was found to be the most common presenting symptom whereas nasal obstruction was the second most common symptom. In the study of Balaji et al. [11] nasal obstruction was the most common symptom.

In this study, 66.66% (n = 50) of the had allergy. In the study of Shah et al. [12], 63–89% of the patients showed co-existence of CRS and allergy.

Table 3 Category of postoperative improvement after 3 months of FESS according to SNOT-22 score

Category of SNOT-22 preoperative	No. of cases	Percentage	No of cases improved (post-operative score ≤ 9)	Percentage
Mild (0–20)	5	6.66	3	60
Moderate (21–50)	46	61.33	41	89.13
Severe (> 50)	24	32	12	50

The chi-square statistic is 2.0753

The p value is 0.3543

Endoscopic sinus surgery is an effective treatment modality for CRS with good symptomatic outcomes in long term follow-up [13]. There was significant relief of symptoms in all the patients included in the study after the FESS in the CRS symptoms which was reflected as decrease in pre-op SNOT 22 score individually as shown in chart 2. As it was also shown in a study done by Regi Kurian et al. which showed that FESS is effective in improving the overall QOL of patients. Postoperative follow-up by SNOT-22 scoring, along with endoscopy helps in monitoring the subjective and objective improvement in patients with CRS [14]. There is improved mucosal healing and sinus ventilation in all cases which leads to improved outcomes.

The SNOT-22 is a validated tool to evaluate the quality of life in patients with CRS and measure outcomes following medical or surgical treatment [5, 15].

In this study, the SNOT-22 scores before surgery were in the range of 40–60, which is similar to studies of Abdalla et al. [10] and Lind et al. [16]. Postoperatively FESS had a positive impact on the reduction of the overall SNOT-22 scores of patients as shown in our study. More than 60% of the patients had a postoperative score of less than seven indicating that their scores became normal after surgery. Significant improvements in SNOT-22 scores in CRS patients have been demonstrated in the literature [16].The median SNOT 22 score thought to be free of sinonasal disease to be 7. A score of 7 is used as indicative of ''normal'', and when score is reported to be below 7, one must be cautious while suggesting treatment [17].

As our follow up period was only for 3 months none of the patient reported for revision surgery or with any FESS complications.

The most significant improvement was observed in cases which had highest SNOT 22 scores prior to surgery. This corresponds with previous studies, which have cited the relatively greater improvement amongst more severely affected patients [18].The cases with lowest preoperative scores also showed improvement; however the magnitude of improvement was restricted, due to the flooring effect.

In our study the mean preoperative SNOT-22 score was 41.83 which reduced to a mean of 6.83 postoperative that means 83.7% decrease in the score was seen after 3 months of follow-up, which was statistically significant. Similarly in a study carried out in 2020 by Payal et al. where mean preoperative SNOT-22 score was 46.25 ± 20.44 and mean postoperative SNOT-22 scores decreased at postoperative follow up visits at 3 months to 14.58 ± 4.90 which conclude for 68.5% decrease, which was statistically significant [19]. Similarly in the study of Gendy et al. there was 70% improvement among 40 cases with mean preoperative SNOT-22 score 46.2 and postoperative score 9.2 [20], with the highest preoperative SNOT-22 score of 70 and the lowest was 13, while the range of post operative score was 0–18. We observed maximum improvement from a preoperative score 69 to 6 (91.3%).Out of the 75 patients, 8 patients showed 100% improvement in SNOT-22 scoring.

In our study there is improvement in the overall symptom score in patients, whom identified "need to blow nose and sneezing" as a significant symptom. Out of 75 cases 68 (90.66%) cases report to have need to blow nose symptom while sneezing was present in 65 (86.66%) cases. The preoperative mean for the 2 symptoms was 3.8 and 2.87 respectively which in postoperative reduces to a mean of 0.3 and 0.53, which shows 92.1% and 81.5% improvement respectively. Also in a study done by Chowdhury et al. [21] shows rhinologic SNOT-22 preoperative score to be 3.8. Krishnaswami et al. [22] shows sneezing as predominant symptom. Nasal obstruction was seen in 55 (73.33%) cases with preoperative score of 2.6 which reduced to 0.1 postoperatively, showing 96.2% improvement. Intriguing point to make out is on the sleep disturbance, 68 patients (90.6%) showed it in the form of difficulty in falling sleep, waking up at night and lack of good sleep at night with preoperative mean SNOT-22 value 2, 2.73 and 2.8 respectively which improved with a postoperative mean SNOT-22 value 0.36, 0.36, 0.33 respectively which results in 82%, 86.9% and 88.2% respectively. Postoperatively out of 68patients, only 28 (41.1%) patient persist with the sleep disturbance but with less severity as compared to preoperative values. Similar outcome was also shown by Mahdavinia et al. [23] having high prevalence of sleep disruption in CRS, and its detrimental effects on QOL.

Sadness was found in 40 cases (53.33%) with preoperative mean SNOT-22 value 1.47 which showed improvement in all cases, with postoperative SNOT score 0.47 showing 68% improvement. Sinus surgery is not effective in alleviating the effect of depression, and it is likely that comorbid

depression and CRS are operating on independent disease pathways, stated in a study by Mace et al. [24].

In our study maximum improvement was seen in reduced concentration with preoperative mean SNOT-22 score 1.43 and postoperative was 0.1 result in 93.01% improvement while ear pain was least incident symptom as only present in 25 (33.33%) patient with variable grades. Ear pain was present with minimum grade in postoperative 9 patients out of 10, also least improved as mean preoperative SNOT-22 score was 0.8 which on postoperative become 0.47 that is only 41.25% improvement. This can be explained by underlying CSOM, and, therefore, not amenable to improvement through FESS. In the study of Kennedy et al. the symptom with least post-treatment relief was "cough". This was attributed to the co-existence of asthma in such cases, hence it could not be relieved by FESS [25].

Shamim Toma et al. [26] gave a stratification on SNOT-22 score and formed 3 categories on basis of score and classified them into mild (0–20), moderate (21–50) and severe (> 50) in preoperative cases. Based on this in our study there are 5 (6.66%) cases in mild, 46 (61.33%) cases in moderate while 24 (32%) were in severe category in preoperative evaluation. The SNOT-22 total scores was set at 9.0 or less than 9 for postoperative improvement assessment [21]. The maximum improvement was seen in moderate category in which 41 out of 46 cases (89.13%) were improved with FESS, while in mild and severe categories the improvement was observed in 60% and 50% of the cases respectively. This emphasizes that patient having the preoperative score in moderate category have maximum improvement by FESS according to SNOT-22 scoring system [27].

Conclusion

We observed SNOT-22 to be very effective and reliable in assessing the Quality of Life of the patients of CRS and to measure the improvement after FESS.

References

1. Kim YS, Kim NH, Seong SY et al (2011) Prevalence and risk factors of chronic rhinosinusitis in Korea. Am J Rhinol Allergy 25(3):117–121
2. Fokkens WJ, Lund VJ, Mullol J et al (2012) European position paper on rhinosinusitis and nasal polyps 2012. Rhinol Suppl 5:1–12
3. Smith LF, Brindley PC (1993) Indications, evaluation, complications, and results of functional endoscopic sinus surgery in 200 patients. Otolaryngol Head Neck Surg 108:688–696
4. Kennedy DW (1992) Prognostic factors, outcomes and staging in ethmoid sinus surgery. Laryngoscope 102:1–18
5. Hopkins C, Gillett S, Slack R et al (2009) Psychometric validity of the 22-item sinonasal outcome test. Clin Otolaryngol 34:447–454
6. Soler ZM, Jones R, Le P, Rudmik L, Mattos JL, Nguyen SA et al (2018) SNOT-22 outcomes after sinus surgery: a systematic review and meta-analysis. Laryngoscope 128(3):581–592
7. Marambaia PP, Lima MG, Santos KP, Gomes AD, Sousa MM, Marques ME (2013) Evaluation of the quality of life of patients with chronic rhinosinusitis by means of the SNOT-22 questionnaire. Braz J Otorhinolaryngol 79:54–58
8. Begh RA, Saraf A, Kishore K, Kalsotra P (2020) Quality of life after functional endoscopic sinus surgery. Int J Otorhinolaryngol Head Neck Surg 6(6):1049–1053
9. Rudmik L, Mace J, Soler ZM et al (2014) Long-term utility outcomes in patients undergoing endoscopic sinus surgery. Laryngoscope 124(1):19–23
10. Abdalla S, Alreefy H, Hopkins C (2012) Prevalence of sinonasal outcome test (SNOT-22) symptoms in patients undergoing surgery for chronic rhinosinusitis in the England and Wales National prospective audit. Clin Otolaryngol 37(4):276–282
11. Balaji NK, Ravi D, Prasad MH (2019) Assessment of symptom severity in chronic rhinosinusitis with and without polyps—a prospective study in tertiary care centre at Mandya. Trop J Ophthalmol Otolaryngol. 4(4):270–276
12. Shah A (2014) Allergic rhinitis, chronic rhinosinusitis and nasal polyposis in Asia Pacific: impact on quality of life and sleep. Asia Pac Allergy 4(3):131–133
13. Senior BA, Kennedy DW, Tanabodee J, Kroger H, Hassab M, Lanza D (1998) Long-term results of functional endoscopic sinus surgery. Laryngoscope 108:151–157
14. Vedantam R, Kurien R, Sunny E (2018) Impact of functional endoscopic sinus surgery on patients with chronic rhinosinusitis: a prospective, cohort study among Indian patients. Int J Clin Rhinol 1(11):1–6
15. Anne J, Sreedharan S, Dosemane D, Shenoy V, Kamath PM, Zubair SM (2020) Predictors of surgical outcomes after functional endoscopic sinus surgery in chronic rhinosinusitis. Indian J Otolaryngol Head Neck Surg. https://doi.org/10.1007/s12070-020-01855-4
16. Lind H, Joergensen G, Lange B et al (2016) Efficacy of ESS in chronic rhinosinusitis with and without nasal polyposis: a Danish cohort study. Eur Arch Oto-Rhino-Laryngol 273:911–919
17. Yeolekar A, Dasgupta K, Khode S, Joshi D, Gosrani N, Prof A (2013) A study of SNOT 22 scores in adults with no sinonasal disease. J Rhinolaryngo Oto 8:1
18. Smith TL, Litvack JR, Hwang PH, Loehrl TA, Mace JC, Fong KJ et al (2010) Determinants of outcomes of sinus surgery: a multi-institutional prospective cohort study. J Am Acad Otolaryngol-Head Neck Surg 142:55–63
19. Verma P, Rawat D, Aseri Y, Verma P, Singh B (2020) A prospective longitudinal study of clinical outcome and quality of life assessment in patients with chronic rhinosinusitis after functional endoscopic sinus surgery using sino nasal outcome test-22. Indian J Otolaryngol Head Neck Surg
20. Gendy S (2019) An audit of the predictive value of SNOT-22 Tests in Evaluating Nasal Surgeries Emerson's Green/Devizes NHS treatment centres. J Otolaryngol Rhinol 2(5):2
21. Chowdhury NI, Mace JC, Bodner TE, Alt JA, Deconde AS, Levy JM et al (2017) Investigating the minimal clinically important difference for SNOT-22 symptom domains in surgically managed chronic rhinosinusitis. Int Forum Allergy Rhinol 7(12):1149–1155
22. Krishnaswami B, Velayutham P, Pruthivirajan N, Murugesan S, Vellikkannu R (2019) Evaluation of pre-operative sino-nasal outcome test-22 scores as a predictor of outcome in patients undergoing functional endoscopic sinus surgery for chronic rhinosinusitis. Int J Otorhinolaryngol Head Neck Surg 5:876–882
23. Mahdavinia M, Schleimer RP, Keshavarzian A (2017) Sleep disruption in chronic rhinosinusitis. Expert Rev Anti Infect Ther. https://doi.org/10.1080/14787210.2017.1294063

24. Mace J, Michael Y, Carlson N, Litvack J, Smith T (2008) Effects of depression on quality of life improvement after endoscopic sinus surgery. Laryngoscope 1(118):528–534
25. Kennedy JL, Hubbard MA, Huyett P, Patrie JT, Borish L, Payne SC (2013) Sino-nasal Outcome Test (SNOT-22): a predictor of post-surgical improvement in patients with chronic sinusitis. Ann Allergy Asthma Immunol Off Publ Am Coll Allergy Asthma Immunol 111(4):246–251
26. Toma S, Hopkins C (2016) Stratification of SNOT-22 scores into mild, moderate or severe and relationship with other subjective instruments. Rhinol J 54(2):123–129
27. Singla G, Singh M, Singh A, Kaur I, Harsh K, Jasmeen K (2018) Is sino-nasal outcome test-22 reliable for guiding chronic rhinosinusitis patients for endoscopic sinus surgery? Niger J Clin Pract 21(9):1228