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Happiness and Smell: Overlooked Factors in Endoscopic Sinus Surgery?

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ABSTRACT

Objective: This study investigates the impact of functional endoscopic sinus surgery (FESS) on happiness levels in patients with chronic rhinosinusitis with nasal polyps (CRSwNP) and examines the factors influencing postoperative happiness.

Methods: This study included 55 patients (34 males, 21 females; mean age, 41.2 ± 14.7 years) who underwent FESS for CRSwNP. Preoperative and postoperative evaluations included the Sinonasal Outcome Test-22 (SNOT-22), Oxford Happiness Scale (OHS), Visual Analog Scale (VAS) for olfactory function, and saccharin clearance test for mucociliary clearance. Radiological and endoscopic disease severity was assessed preoperatively using the Lund–Mackay (LM) and Mackay–Lund Endoscopic Polyp Scores (MLEPS). A linear regression model was used to identify predictors of postoperative happiness.

Results: Postoperatively, SNOT-22 scores significantly decreased ($p=0.005$), while OHS and olfactory VAS scores significantly increased ($p<0.001$). Mucociliary clearance times were significantly shorter after surgery ($p=0.025$). Regression analysis revealed that both the improvement in olfactory VAS scores ($p=0.006$) and lower preoperative MLEPS values ($p=0.01$) were independent predictors of increased OHS scores.

Conclusion: FESS not only alleviates symptoms and enhances QoL in CRSwNP patients but also is associated with increased happiness at 1 month postoperatively. Improvement in olfactory function emerged as the strongest determinant of postoperative happiness, while patients with less extensive polyp disease experienced more favorable emotional recovery. Therefore, efforts aimed at optimizing olfactory outcomes, preserving existing olfactory function, and performing surgical intervention before widespread polyp formation may contribute to more favorable psychological outcomes after FESS.

1 | Introduction

Chronic rhinosinusitis (CRS) is symptomatic inflammation of the nasal cavity and paranasal sinuses lasting for more than 12 weeks. Its aetiology is multifactorial and involves infectious, allergic, and structural factors, including viral and bacterial pathogens, allergic rhinitis, biofilm formation, and nasal polyps. Chronic rhinosinusitis with nasal polyp (CRSwNP) affects 4% of the general population.

Functional endoscopic sinus surgery (FESS) remains the mainstay surgical treatment for patients with CRSwNP who fail to respond adequately to maximal medical therapy. The fundamental aim of FESS is to restore sinonasal ventilation and drainage, alleviate symptoms such as nasal obstruction, facial pain, and olfactory dysfunction, and ultimately enhance quality of life (QoL) [1]. Outcomes after FESS are typically assessed using clinical findings and, more commonly, QoL questionnaires [2]. While numerous studies have demonstrated significant postoperative

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Key Points

- FESS significantly improves short-term happiness levels in patients with CRSwNP.
- Improvement in olfactory function emerged as the strongest independent predictor of postoperative happiness.
- Patients with lower preoperative MLEPS (less extensive polyp disease) demonstrated greater gains in happiness after surgery.
- Traditional clinical measures, such as mucociliary clearance and SNOT-22 changes, were not significantly associated with postoperative happiness.
- Early surgical intervention and efforts to preserve or enhance olfactory function may optimize both functional and emotional recovery in CRSwNP patients.

improvements in symptom burden and QoL, the broader psychosocial and emotional consequences of FESS, particularly its impact on patient happiness, appear to be largely overlooked [2].

Happiness and QoL are related but distinct concepts. QoL reflects physical, psychological, and social functioning, whereas happiness reflects the subjective experience of positive affect, the absence of negative affect, and a high level of overall life satisfaction [3, 4]. In the present study, happiness was assessed using the Oxford Happiness Scale, which was chosen among others due to its validated version in the local language and common use ensuring reliable assessment of happiness in the study population. By specifically focusing on happiness as a distinct outcome, rather than a surrogate of quality of life, this approach allows a more nuanced evaluation of the psychological effects of FESS. While FESS may improve QoL by relieving symptoms and restoring function, its impact on happiness may not necessarily parallel QoL changes. Despite extensive evidence documenting the QoL benefits of FESS, a thorough review of the existing literature reveals an absence of studies examining its influence on happiness in patients with CRSwNP. Recognizing this critical gap, the present study primarily aimed to assess the change in the Oxford Happiness Score following FESS. Secondary aims were to identify potential predictors of postoperative happiness using linear regression analysis.

2 | Material and Methods

This retrospective study was conducted at a tertiary care center in accordance with the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Balikesir University, Faculty of Health Sciences (decision no: 2025/18, dated January 7, 2025). Demographic and clinical data were obtained from patients' electronic medical records and follow-up charts.

2.1 | Study Population

All the patients aged between 18 and 65 years who underwent FESS for CRSwNP refractory to maximal medical therapy

between January 2020 and January 2024 were included. The diagnosis of CRSwNP was established according to the criteria outlined in the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS 2012) [5]. All surgical procedures were performed by the same senior otolaryngologist with extensive experience in endoscopic sinus surgery to minimize inter-surgeon variability.

2.2 | Exclusion Criteria

Patients were excluded if they had a history of previous sinonasal surgery, congenital or acquired immunodeficiency, Covid-19, autoimmune disease, primary ciliary dyskinesia, cystic fibrosis, systemic vasculitis, granulomatous disease, fungal sinusitis, sinonasal neoplasia, or Samter's triad. These conditions were assessed based on detailed clinical history, physical examination, and review of medical records, and although no additional diagnostic investigations were performed, patients with known or suspected conditions were excluded from the study to minimize potential confounding. Additionally, patients whose pre- and postoperative records were incomplete or who reported non-compliance with the prescribed postoperative saline irrigation regimen during follow-up visits were excluded from the analysis.

2.3 | Medical and Surgical Management

Prior to surgery, all patients received standardized medical therapy with systemic and topical corticosteroids. Systemic methylprednisolone was initiated peroral at 1 mg/kg/day and tapered over 14 days, while topical fluticasone furoate (110 µg/day) was administered concurrently.

All FESS procedures were performed under general anaesthesia. Total fronto-maxillo-spheno-ethmoidectomy was routinely performed without nasal packing. Postoperative care included isotonic saline irrigation four times daily for 4 weeks using a 240-mL squeeze bottle.

All patients undergoing FESS for CRSwNP were evaluated using a standardized preoperative and one-month postoperative assessment protocol that included the Sino-Nasal Outcome Test-22 (SNOT-22), mucociliary transit time measurement, olfactory visual analog scale (VAS), and a happiness questionnaire as part of routine clinical follow-up. All patients provided written informed consent prior to surgery, which included consent for the use of data obtained during routine clinical examinations, questionnaires, as well as anonymized clinical data for scientific research purposes.

2.4 | Radiological and Endoscopic Evaluation

Radiological disease severity was assessed using the preoperative Lund-Mackay (LM) computed tomography (CT) score [6]. In this system, six bilateral regions (maxillary, anterior and posterior ethmoid, sphenoid, frontal sinuses, and the ostiomeatal complex) are scored according to the degree of opacification: 0 (no opacification), 1 (partial opacification), or 2 (total opacification) [7]. The extent of nasal polyps was evaluated preoperatively

using the Lund–Mackay Endoscopic Polyp Score (MLEPS), which classifies polyps as Grade I (confined to the middle meatus), Grade II (extending beyond the middle turbinate but not reaching the nasal floor), and Grade III (occupying the entire nasal cavity) [8].

2.5 | Quality of Life and Happiness Assessment

Quality of life (QoL) was assessed using the SNOT-22 questionnaire, a validated instrument evaluating both disease-specific and general effects of CRS on QoL [1, 9, 10]. The questionnaire consists of 22 items scored from 0 (“no problem”) to 5 (“problem as bad as it can be”), with total scores ranging from 0 to 110; higher scores indicate worse QoL [11]. SNOT-22 was administered preoperatively and 1 month postoperatively.

The Oxford Happiness Scale (OHS) was used to assess patients’ happiness before and after surgery. The OHS, developed by Argyle and Hills, is a 29-item psychometric instrument with a 6-point Likert-type response format (1 = strongly disagree, 6 = strongly agree) [12]. Higher scores indicate greater happiness. The validity and reliability of the OHS in the study population were established by Doğan T and Sapmaz F in 2012 [13]. The OHS was administered preoperatively and 1 month postoperatively.

2.6 | Olfactory and Mucociliary Function Testing

Olfactory function was evaluated using a 10-point Visual Analog Scale (VAS), where 0 indicated complete anosmia and 10 normal olfactory perception. Measurements were obtained preoperatively and 1 month postoperatively.

Mucociliary clearance (MCC) was evaluated using the saccharin test by placing a 0.8-mm saccharin particle on the inferior turbinate; the time to the first perception of sweetness was recorded [14, 15]. MCC assessment of the patients was performed preoperatively and 1 month postoperatively.

To investigate whether FESS has an impact on happiness, patient’s OHS scores were compared preoperatively and postoperatively.

A linear regression model was then constructed to identify independent predictors of postoperative increases in happiness

(OHS score). Variables included age, gender, preoperative LM and MLEPS scores, and changes in SNOT-22, MCC, and olfactory VAS scores before and after surgery.

3 | Statistical Analysis

Results of the study were presented as mean \pm SD for normally distributed data, and median (min-max) for non-normally distributed data. The distribution pattern of the data was investigated employing the Kolmogorov Smirnov test. Comparisons of normally distributed data were performed employing paired samples *T*-test, and comparisons of non-normally distributed data were performed employing the Wilcoxon test. To predict the factors that increase the Oxford happiness score, age, gender, and the differences in SNOT, MKS, and smell scores before and after surgery were included in a linear regression model. Spearman correlation analyses were performed to evaluate the relationship between polyp extent, disease burden, and olfactory outcomes. All statistical analyses were performed under SPSS 30.0 software for MacOs (SPSS Inc., Chicago, IL). A *P* value less than 0.05 was considered statistically significant.

4 | Results

In this study, 55 patients (34 males and 21 females, mean age: 41.2 ± 14.7 years) who previously underwent FESS were included. The mean preoperative Lund Mackay score was 12 ± 7.1 and the mean preoperative MLEPS was 1.76 ± 0.84 .

According to the paired samples *T*-test, the mean postoperative SNOT score was significantly lower compared with the preoperative SNOT score ($p = 0.005$), indicating a marked improvement in QoL and the mean OHS score was significantly higher compared with the preoperative score ($p < 0.001$). According to the Wilcoxon test, the median postoperative smelling test score was significantly higher compared with the preoperative score ($p < 0.001$), and the median postoperative mucociliary clearance time was significantly lower compared with the preoperative mucociliary clearance time ($p = 0.025$) (Table 1).

To predict the factors that increase the OHS score, age, gender, preoperative MLEPS and LM scores, and the differences in SNOT, MKS, and smell scores before and after surgery were included in a linear regression model. The mean standard residual of the linear regression model was 0.000437 ± 0.927 .

TABLE 1 | Comparison of preoperative and postoperative scores.

	Preoperative	Postoperative	<i>p</i>
SNOT score (mean \pm SD)	48.15 \pm 21.41	26.55 \pm 17.94	0.005*
Smelling score [median (min-max)]	3 (0–10)	9 (0–10)	< 0.001**
Oxford happiness score (mean \pm SD)	92.02 \pm 18.84	102.04 \pm 18.78	< 0.001*
Mucociliary clearance time (Sc) [median (min-max)]	720 (138–1810)	549 (60–1875)	0.025**

Abbreviation: Sc, second.

*of paired sample *T*-test.

**of wilcoxon signed-rank test.

TABLE 2 | Linear regression analysis results.

	B	Beta	t	p	95% CI		Collinearity Tolerance	VIF
					Lower bond	Upper bond		
Age	-0.165	-0.306	-0.128	0.378	-0.537	0.208	0.836	1.196
Gender	6.140	-0.026	0.162	0.282	-5.224	17.504	0.774	1.291
Difference in SNOT-22	0.147	-0.026	0.172	0.297	-0.134	0.429	0.651	1.535
Difference in MCS	-0.100	0.020	-0.041	0.783	-0.827	0.627	0.785	1.275
Difference in smelling score	2.414	0.438	0.453	0.006	0.720	4.108	0.693	1.443
Preoperative LM	0.951		0.349	0.083	-0.128	2.030	0.447	2.236
Preoperative MLEPS	-12.920		-0.572	0.010	-22.583	-3.258	0.383	2.614

Abbreviations: MCS, mucociliary clearance VIF, Variance Inflation Factor—an indicator used to detect multicollinearity between independent variables. LM, Lund-Mackay MLEPS, Mackay-Lund Endoscopic Polyp Scores, CI, confidence interval SNOT-22: Sinonasal Outcome Test-22.

TABLE 3 | Spearman correlation analysis between Mackay and Lund endoscopic polyp staging system (MLEPS), preoperative disease burden, and olfactory outcomes.

	Spearman rho	p
MLEPS—Preoperative Lund-Mackay (LM)	0.665	<0.001
MLEPS – Preoperative SNOT-22	0.377	0.005
MLEPS – Preoperative mucociliary clearance	0.520	<0.001
MLEPS – Preoperative olfactory VAS	-0.272	0.044
MLEPS – Postoperative olfactory improvement (Δ VAS)	-0.350	0.009

Abbreviations: MLEPS, Mackay and Lund endoscopic polyp staging system; LM, Lund-Mackay; VAS, Visual Analog Scale. Postoperative olfactory improvement was calculated as the change in olfactory VAS score (Δ VAS=postoperative–preoperative). Rho: spearman correlation coefficient. p=statistical significance (2-tailed).

According to the regression analysis, both the improvement in olfactory VAS scores and the MLEPS were identified as independent predictors of increased OHS scores ($p=0.006$ and $p=0.01$, respectively) (Table 2). Improvement in olfactory VAS scores and lower MLEPS values were associated with a significant increase in OHS scores.

To further explore the relationship between polyp extent, disease burden, and olfactory outcomes, correlation analyses were performed between preoperative MLEPS and radiological, clinical, and olfactory parameters.

Spearman correlation analysis showed a positive correlation between preoperative MLEPS and LM scores ($\rho=0.665$, $p<0.001$). MLEPS was also positively correlated with preoperative SNOT-22 scores ($\rho=0.377$, $p=0.005$) and mucociliary clearance time

($\rho=0.520$, $p<0.001$). Higher MLEPS values were associated with worse preoperative olfactory VAS scores ($\rho=-0.272$, $p=0.044$) and negatively correlated with postoperative olfactory improvement ($\rho=-0.350$, $p=0.009$) (Table 3).

5 | Discussion

FESS is the most commonly preferred treatment approach for patients with CRSwNP resistant to medical therapy [16, 17]. Its primary aim is to restore sinonasal ventilation, create a polyp-free nasal cavity that allows optimal delivery of topical medications, and improve quality of life (QoL) and patient satisfaction. Previous studies using various QoL instruments, including the RSDI, RAND-36, SNOT-20, and SNOT-22, have consistently demonstrated significant QoL improvement after FESS, in line with our findings [2, 18, 19]. However, despite extensive research on postoperative outcomes, the relationship between FESS and happiness has not been directly investigated in the current literature. While QoL encompasses physical, psychological, and social functioning, happiness reflects subjective well-being and emotional state; therefore, these constructs are not always parallel but rather represent complementary aspects of patient recovery. In the present study, OHS scores significantly increased 1 month after surgery, suggesting that FESS may also enhance patients' psychological well-being. In correlation analyses performed to understand the factors associated with the increase in postoperative happiness levels, mucociliary clearance, preoperative LM scores, SNOT-22 values, age, and gender did not have a significant association with happiness. However, improvement in the sense of smell was significantly associated with increased happiness of the patients.

The prevalence of olfactory dysfunction can be as high as 80% in CRSwNP patients. The sense of smell is a basic sense that plays an important role in human life, influencing our interaction with the environment, memory, and emotions. It also contributes to the enjoyment of food by enhancing taste perception and supports social interactions. Research shows that the sense

of smell is closely related to psychological well-being and happiness [20]. People experiencing loss of smell also experience a decrease in their enjoyment of life and a decrease in their overall happiness level [20, 21]. In the present study, improvement in olfactory function after FESS was associated with increased happiness levels. These findings are consistent with previous studies showing that restoration of olfactory function contributes to overall well-being and may reduce symptoms of depression [21, 22].

From a clinical perspective, this situation emphasizes the importance of considering the factors that may affect patient happiness in the treatment, in addition to the aim of FESS surgery being to improve the anatomical condition of the disease and increase the quality of life. In order to maintain favourable postoperative outcomes, future studies may explore approaches aimed at supporting olfactory function and preserving existing olfactory capacity.

Our regression analysis demonstrated that lower preoperative MLEPS values were significantly associated with higher postoperative happiness levels. Additional correlation analyses showed that higher MLEPS values were associated with greater preoperative disease burden, reflected by higher LM and SNOT-22 scores and prolonged mucociliary clearance times, as well as worse olfactory VAS scores preoperatively. Moreover, MLEPS was negatively correlated with postoperative olfactory improvement, indicating that patients with less extensive polyp disease achieved greater olfactory recovery, which may explain their more favorable emotional recovery. These findings suggest that milder polyp involvement may preserve olfactory capacity preoperatively and allow greater restoration of smell after surgery. Consequently, earlier surgical intervention before extensive polyp formation may help maximize both functional recovery and psychological well-being in patients with CRSwNP.

Among studies reporting quality-of-life outcomes in patients with CRSwNP, biologic therapies have gained increasing attention and have been shown to improve disease-specific measures; however, their impact on happiness has not been prominently addressed [23, 24]. In a previous cost–utility analysis, Scangas et al. reported that both primary and revision endoscopic sinus surgery were more cost-effective treatment options than dupilumab for patients with CRSwNP, with dupilumab costing approximately ten times more [25]. In this context, when patient happiness is considered an important outcome alongside quality of life, ESS may be considered a cost-effective option for upfront management of CRSwNP.

A central consideration in interpreting the present findings may be the absence of a control group and the relatively short postoperative follow-up period. In a chronic, remitting–relapsing condition such as CRSwNP, improvements in happiness observed at 1 month after surgery may reflect early postoperative changes and may also be influenced by nonspecific factors, such as postoperative optimism or the psychological impact of receiving care. Although multivariable regression analysis was used to account for several clinical variables, the potential influence of unmeasured psychological and socioeconomic factors, including subjective social status, should be considered when interpreting these results and further explored in future prospective studies.

Although our findings provide valuable preliminary evidence of a strong association between postoperative happiness and olfactory improvement, this study has several limitations. The small sample size and retrospective design limit causal interpretation. Moreover, postoperative assessments were performed only 1 month after FESS; therefore, the findings reflect short-term effects on patient happiness. Future prospective studies incorporating appropriate control groups and longer follow-up are needed to better clarify the effects of FESS on happiness.

6 | Conclusion

This study provides novel evidence that, beyond improving symptom management, FESS also contributes significantly to enhancing short-term happiness. It was observed that there was a significant increase in the happiness levels of the patients 1 month after FESS and the strongest determinant of this increase was the improvement in the sense of smell. Additionally, lower preoperative MLEPS were associated with higher postoperative happiness, suggesting that patients with less extensive disease experience more favorable emotional recovery after surgery. These findings highlight that the sense of smell in patients with nasal polyps is not only a physiological function but also a significant factor influencing emotional and psychological health. Therefore, efforts aimed at optimizing olfactory outcomes, preserving existing olfactory function, and performing surgical intervention before widespread polyp formation may contribute to more favorable psychological outcomes after FESS.

Author Contributions

Protocol/project development: O.H., K.G.T. Data collection or management: T.T., M.U.A., H.Ç. Data analysis: T.T., M.U.A., K.G.T. Project administration: O.H., K.G.T. Manuscript writing/editing: T.T., K.G.T., H.Ç., O.H.

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The authors have nothing to report.

Ethics Statement

This study was conducted following approval from the Institutional Ethics Committee of Balıkesir University (IEC Number: 2025/118) and adhered to the principles of the Declaration of Helsinki.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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