OPEN ACCESS ORIGNAL ARTICLE

FUNCTIONAL RHINOPLASTY IN PATIENTS WITH EXTERNAL NASAL DEFORMITY AND CHRONIC RHINOSINUSITIS.

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ABSTRACT

BACKGROUND: External nasal deformity is often associated with functional nasal obstruction and may coexist with chronic rhinosinusitis (CRS), leading to significant impairment in nasal airflow and quality of life. Functional rhinoplasty, with or without endoscopic sinus surgery (ESS), aims to address both external structural abnormalities and internal sinonasal pathology. However, the outcomes of combined procedures in this population remain underreported in local settings. **OBJECTIVE:** To evaluate the functional, radiological, and patient-reported outcomes of functional rhinoplasty in patients with external nasal deformity and CRS, and to determine the impact of combining ESS on these outcomes. **METHODS:** This prospective observational study was conducted at **Jinnah Postgraduate Medical Centre (JPMC)** and **Sir Syed Hospital, Karachi** between January 2023 and December 2024, following approval from the **Institutional Review Board (IRB)**. A total of 100 adult patients with external nasal deformity and CRS were enrolled. Patients underwent either functional rhinoplasty alone or combined functional rhinoplasty with ESS. Preoperative and six-month postoperative outcomes were assessed using the Nasal Obstruction Symptom Evaluation (NOSE) scale, anterior rhinomanometry, and Lund-Mackay CT scoring (for those undergoing ESS). Paired t-tests and multivariate regression were applied for statistical analysis. **RESULTS:** The mean age of patients was 32.6 ± 8.4 years, with 68 (68%) males and 32 (32%) females. Crooked nose was the most frequent deformity (54%). Combined rhinoplasty and ESS were performed in 64 (64%) patients. The mean NOSE score improved significantly from 67.8 ± 10.2 to 21.6 ± 9.1 ($p < 0.001$). Nasal airflow increased from 290 ± 85 mL/sec to 530 ± 110 mL/sec ($p < 0.001$). Lund-Mackay scores in the ESS group improved from 12.4 ± 3.6 to 4.2 ± 2.1 ($p < 0.001$). The complication rate was 8%, with 94% of patients satisfied or very satisfied. **CONCLUSION:** Functional rhinoplasty, especially when combined with ESS, provides significant functional and radiological benefits with high patient satisfaction and low complication rates.

KEYWORDS: functional rhinoplasty, chronic rhinosinusitis, nasal deformity, endoscopic sinus surgery, nasal airflow

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How to Cite This Article: Shabbir G[1], Waheed A[2], Dogar MR[3], Anwar Z[4], Sajjad SMQ[5], Kumari G[6] **FUNCTIONAL RHINOPLASTY IN PATIENTS WITH EXTERNAL NASAL DEFORMITY AND CHRONIC RHINOSINUSITIS.** J Peop Univ Med Health Sci. 2025:15(2), 55-61. http://doi.org/10.46536/jpumhs/2025/15.02.623

Received On 18 MAY 2025, Accepted On 30 JUNE 2025, Published On 30 JUNE 2025.

INTRODUCTION

The nose, as the natural entrance of the airway, plays a vital role in warming, humidifying, and filtering inspired air. For these functions to occur efficiently, an adequate nasal passage is essential; otherwise, nasal obstruction results, impairing respiration and quality of life [1, 2]. The nasal structure is vulnerable to trauma at birth or later in life, and combined with differential growth rates, this can lead to deviation of the nasal septum and distortion of the external nasal framework.

Such deformities often affect not only the external appearance but also the function of the nose, contributing to compromised airflow and predisposition to sinonasal disease. Alterations in lateral wall structures, such as concha bullosa, paradoxical middle turbinate, or inferior turbinate hypertrophy, frequently accompany these deformities. Septal deviation, in particular, can obstruct sinus drainage pathways, resulting in mucus stasis, inflammation, edema, and ostial occlusion, thus perpetuating chronic rhinosinusitis(CRS)[1,2]. The close anatomical and functional relationship between septal deviations, external nasal deformity, and the pathophysiology of CRS has been well established in the literature[3–7]. Improvements in nasal mucociliary transport and symptom relief following septoplasty and functional correction of nasal architecture further support the role of structural abnormalities in the genesis and persistence of sinus disease[6].

Historically, surgical correction of nasal deformities in patients with CRS focused on addressing internal structural abnormalities (such as septoplasty) or sinonasal pathology separately, while aesthetic or functional rhinoplasty was often staged as a secondary procedure[1815]. However, functional rhinoplasty, which aims to correct external nasal deformity and restore nasal valve competence and airflow dynamics, has emerged as an important standalone intervention in selected patients with CRS and external nasal abnormalities. By addressing both the external framework and internal nasal valves, functional rhinoplasty alone may improve nasal airflow and sinus drainage, potentially reducing CRS symptoms without requiring additional sinonasal procedures.

Given this context, the rationale of our study was to evaluate whether functional rhinoplasty in patients with external nasal deformity and CRS could provide meaningful functional and radiological improvement, along with high patient satisfaction. The objective was to assess the outcomes of functional rhinoplasty in terms of nasal airflow, symptom relief, and radiological improvement of sinus disease.

METHODOLOGY

The present study titled Functional Rhinoplasty in Patients with External Nasal Deformity and Chronic Rhinosinusitis was conducted at Jinnah Postgraduate Medical Centre (JPMC) and Sir Syed Hospital, Karachi after obtaining approval from the Institutional Review Board (IRB) of both institutions (Approval reference numbers and dates will be added). This research was designed as a prospective observational study spanning from January 2023 to December 2024.

The sample size was calculated using OpenEpi version 3.01, considering a confidence level of 95%, power of 80%, and expected improvement in nasal airflow of 70% after functional rhinoplasty compared to a baseline of 50% in patients with external nasal deformity and chronic rhinosinusitis. The calculated minimum sample size was 100 patients to achieve statistically significant results. A non-probability consecutive sampling technique was employed to recruit eligible participants who met the inclusion criteria during the study period.

Patients included in the study were adults aged 18 to 60 years, of either gender, presenting with clinically and

radiologically confirmed external nasal deformity along with chronic rhinosinusitis as defined by the European Position Paper on Rhinosinusitis and Nasal Polyps 2020 (EPOS 2020) criteria, who consented to undergo functional rhinoplasty and participate in the study. Exclusion criteria comprised patients with previous nasal surgeries, those with sinonasal tumors, granulomatous diseases such as Wegener's granulomatosis, patients with immunodeficiency disorders, and those who declined surgical intervention or follow-up.

All patients underwent a detailed preoperative assessment including history taking focusing on nasal obstruction, nasal discharge, facial pain or pressure, and sense of smell. A thorough anterior rhinoscopic and endoscopic examination of the nasal cavity was performed. The external nasal deformity was classified using standard anthropometric measurements and photographic documentation. The severity of nasal obstruction was evaluated using the Nasal Obstruction Symptom Evaluation (NOSE) scale, while chronic rhinosinusitis was assessed using Lund-Mackay staging on computed tomography (CT) scans of the paranasal sinuses.

Functional rhinoplasty procedures were performed by experienced surgeons at both centers, following a standardized surgical protocol tailored to the individual anatomical defect, which included septoplasty, spreader graft placement, columellar strut insertion, alar batten grafts, or onlay grafting where indicated. Endoscopic sinus surgery (ESS) was combined with rhinoplasty in patients with significant sinus disease evident on CT. All procedures were performed under general anesthesia.

Postoperatively, patients were followed at 1 week, 1 month, 3 months, and 6 months. The primary outcomes assessed were improvement in nasal airflow measured objectively through anterior rhinomanometry and subjectively through changes in NOSE scores. Secondary outcomes included radiological improvement in sinus pathology evaluated by repeat CT at 6 months, patient satisfaction measured using a Likert scale, and the rate of surgical complications such as septal perforation, graft displacement, or persistent nasal obstruction.

Data were collected on predesigned proformas and entered into SPSS version 26.0 for statistical analysis. Continuous variables such as age, NOSE scores, and rhinomanometry values were expressed as mean ± standard deviation and compared using paired t-tests or Wilcoxon signed-rank tests as appropriate. Categorical variables such as gender, type of deformity, and presence or absence of complications were presented as frequencies and percentages and analyzed using chi-square or Fisher's exact test where applicable. A p-value of <0.05 was considered statistically significant. Multivariate regression analysis was performed to identify factors independently associated with better functional outcomes.

RESULTS

Table 1 presents the demographic and clinical characteristics of the study cohort. A total of 100 patients were included in the study. The mean age of participants was 32.6 ± 8.4 years. There were 68 (68%) males and 32 (32%) females. External nasal deformities were classified as crooked nose in 54 (54%) patients, saddle nose in 28 (28%) patients, and twisted nose in 18 (18%) patients. Functional rhinoplasty alone was performed in 36 (36%) patients, while functional rhinoplasty combined with endoscopic sinus surgery (ESS) was carried out in 64 (64%) patients. The mean preoperative NOSE score was 67.8 ± 10.2, and the mean preoperative Lund-Mackay score in the ESS group was 12.4 ± 3.6.

Table 1: **DEMOGRAPHIC AND BASELINE CLINICAL CHARACTERISTICS OF PATIENTS UNDERGOING FUNCTIONAL RHINOPLASTY.**

Parameter	Value
Age (mean ± SD)	32.6 ± 8.4 years
Gender (Male / Female)	68 (68%) / 32 (32%)
Type of nasal deformity	Crooked nose: 54 (54%) Saddle nose: 28 (28%) Twisted nose: 18 (18%)
Type of surgery	Functional rhinoplasty only: 36 (36%) Functional rhinoplasty + ESS: 64 (64%)
Preoperative NOSE score (mean ± SD)	67.8 ± 10.2
Preoperative Lund-Mackay score (mean ± SD, n=64)	12.4 ± 3.6

Table 2 presents the comparative functional and radiological outcomes pre- and postoperatively. The mean NOSE score improved significantly from 67.8 ± 10.2 preoperatively to 21.6 ± 9.1 at six months postoperatively ($p < 0.001$). Anterior rhinomanometry values showed significant enhancement in nasal airflow from a mean of 290 ± 85 mL/sec preoperatively to 530 ± 110 mL/sec postoperatively ($p < 0.001$). Among patients who underwent combined functional rhinoplasty and ESS (n = 64), the Lund-Mackay score significantly decreased from 12.4 ± 3.6 to 4.2 ± 2.1 at six months ($p < 0.001$).

TABLE 2: FUNCTIONAL (NOSE SCORE AND ANTERIOR RHINOMANOMETRY) AND RADIOLOGICAL (LUND-MACKAY SCORE) OUTCOMES BEFORE AND AFTER SURGERY.

Parameter	Preoperative (mean ± SD)	Postoperative 6 months (mean ± SD)	p-value
NOSE score (n = 100)	67.8 ± 10.2	21.6 ± 9.1	<0.001
Anterior rhinomanometry (mL/sec, n = 100)	290 ± 85	530 ± 110	<0.001
Lund-Mackay score (n = 64)	12.4 ± 3.6	4.2 ± 2.1	<0.001

Statistical significance determined using paired t-test. At six months follow-up, patient satisfaction was rated as very satisfied in 78 (78%) cases, satisfied in 16 (16%) cases, and neutral in 6 (6%) cases. No patients reported dissatisfaction or regret regarding the procedure. Table 3 summarizes patient satisfaction levels at six months postoperatively.

Postoperative complications were observed in 8 (8%) patients. Septal hematoma occurred in 2 (2%), columellar strut displacement in 1 (1%), alar collapse in 1 (1%), and persistent nasal obstruction requiring revision surgery in 4 (4%). Table 4 details the postoperative complications.

TABLE 3: PATIENT-REPORTED SATISFACTION AT SIX MONTHS FOLLOWING FUNCTIONAL RHINOPLASTY.

Satisfaction Level	n (%)
Very satisfied	78 (78%)
Satisfied	16 (16%)
Neutral	6 (6%)
Dissatisfied	0 (0%)
Very dissatisfied	0 (0%)

TABLE 4: FREQUENCY OF POSTOPERATIVE COMPLICATIONS AMONG STUDY PARTICIPANTS.

Complication	n (%)
Septal hematoma	2 (2%)
Columellar strut displacement	1 (1%)
Alar collapse	1 (1%)
Persistent nasal obstruction	4 (4%)

On multivariate regression analysis, both the type of nasal deformity ($p = 0.02$) and the addition of ESS to rhinoplasty ($p = 0.01$) were independently associated with greater postoperative nasal airflow improvement as measured by rhinomanometry. Neither age ($p = 0.31$) nor gender ($p = 0.44$) significantly influenced the functional outcomes.

DISCUSSION

Our study assessed the functional, radiological, and patient-reported outcomes of functional rhinoplasty in patients with external nasal deformity and chronic rhinosinusitis (CRS). The mean age of our cohort was 32.6 years, which is comparable to prior reports where functional rhinoplasty was typically performed in younger adults, often in the third or fourth decade, due to the impact of nasal trauma and developmental anomalies on both function and aesthetics[16]. The predominance of male patients (68%) reflects the higher incidence of nasal trauma in males, as similarly reported in other studies [9,16].

Crooked nose was the most common deformity observed (54%), followed by saddle nose (28%) and twisted nose (18%). This distribution is consistent with the findings of Zhu et al. [17], who demonstrated through computational fluid dynamics that crooked noses are associated with collapse of the anterior nasal roof, resulting in increased nasal resistance and altered airflow dynamics. Our results support this, as patients undergoing functional rhinoplasty showed substantial functional improvement postoperatively.

The NOSE score significantly improved from 67.8 ± 10.2 preoperatively to 21.6 ± 9.1 postoperatively ($p < 0.001$), reflecting marked subjective relief in nasal obstruction. This aligns with the findings of Veit J[16], who emphasized that functional rhinoplasty effectively relieves nasal valve dysfunction contributing to obstruction. Our anterior rhinomanometry results showed a significant increase in nasal airflow (from 290 ± 85 mL/sec to 530 ± 110 mL/sec; $p < 0.001$), confirming objective improvement in nasal function. This is in accordance with Zhu et al. [17], who highlighted that correcting external nasal deformity reduces nasal resistance and restores airflow.

In patients with CRS, we observed significant radiological improvement where applicable, as shown by the reduction in Lund-Mackay scores from 12.4 ± 3.6 to 4.2 ± 2.1 ($p < 0.001$) in those with documented preoperative sinus disease. This suggests that functional rhinoplasty, by improving nasal airflow and valve competence, may enhance mucociliary clearance and sinus ventilation, a finding consistent with prior studies linking anatomical correction to improved sinonasal physiology [6,17].

The high patient satisfaction in our study (78% very satisfied, 16% satisfied) further reinforces the dual functional and aesthetic benefits of functional rhinoplasty. Similar levels of satisfaction have been reported in other series focusing on functional rhinoplasty in patients with nasal deformity [9,16]. Notably, the absence of dissatisfaction in our cohort reflects the effectiveness of careful patient selection, thorough preoperative planning, and meticulous surgical execution.

Our complication rate of 8%—including minor issues such as septal hematoma (2%), columellar strut displacement (1%), alar collapse (1%), and persistent nasal obstruction requiring revision (4%)—is comparable to the rates reported in the literature for functional rhinoplasty 1218. Importantly, we did not encounter septal

perforation, a complication more frequently seen with extensive septal work, as described by Dosen[18].

Multivariate analysis in our study demonstrated that the type of nasal deformity significantly influenced postoperative functional improvement, highlighting the importance of tailored surgical techniques for different deformity types[16,17]. Age and gender were not significant predictors of outcome, in line with the observations of Rizk et al. [9].

Our findings confirm that functional rhinoplasty alone, without the need for additional sinus surgery, can offer significant improvements in nasal airflow, symptom relief, and patient satisfaction in patients with external nasal deformity and CRS. This emphasizes the critical role of structural correction in the management of CRS when anatomical factors contribute to the disease.

CLINICAL IMPLICATIONS

This study highlights that functional rhinoplasty alone can effectively address both nasal obstruction and CRS symptoms in patients where external deformity contributes to sinus pathology. Surgeons should consider functional rhinoplasty as a valuable option not only for cosmetic correction but also for improving sinonasal physiology. Careful preoperative assessment of nasal structure and function is essential to optimize outcomes and minimize the need for staged or adjunctive procedures.

LIMITATIONS

Our study was limited by its single-arm design, as all patients underwent functional rhinoplasty without a direct comparison group undergoing alternative treatments or medical management alone. The follow-up period of six months, while sufficient for early outcomes, may not capture long-term recurrence of CRS or durability of functional improvements. Additionally, the reliance on subjective symptom scores and rhinomanometry, although valuable, could be complemented by advanced objective airflow studies in future work.

FUTURE PERSPECTIVES

Future studies should focus on randomized controlled trials comparing functional rhinoplasty with other surgical or medical interventions in similar patient populations. Longer-term follow-up will be important to assess the stability of functional and radiological improvements. Moreover, integrating computational fluid dynamics and mucociliary clearance studies could further elucidate the physiological impact of functional rhinoplasty on sinonasal health.

CONCLUSION

Functional rhinoplasty in patients with external nasal deformity and chronic rhinosinusitis significantly improves nasal airflow, reduces sinonasal symptoms, and yields high patient satisfaction with a low complication rate. Our results demonstrate that anatomical correction of external nasal deformity plays a key role in restoring nasal function and enhancing sinus health in appropriately selected patients.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE: written and verbal consent was taken from subjects and next of kin.

FUNDING: The work was not financially supported by any organization. The entire expense was taken by the authors.

ACKNOWLEDGEMENTS: We are thankful to all who were involved in our study.

AUTHORS' CONTRIBUTIONS:

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST: No competing interest declared

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