



Objective and Subjective Analysis for Efficaciousness of Nasal Airway in Patients Undergoing Conventional and Endoscopic Septoplasty: A Comparative Study

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Abstract Deviated nasal septum is the most common cause of nasal obstruction and is one of the common problems encountered by otolaryngologists. Although there are different methods to surgically correct a deviated nasal septum which can give qualitative relief to the patient, less emphasis is put on the quantitative assessment of airway after a septal correction surgery. Institution based Case Control study was undertaken at Medical College and Hospital Kolkata between January 2019 to March 2020 to subjectively and objectively assess and compare the nasal airway status preoperatively and postoperatively in patients undergoing conventional and endoscopic septoplasty. A total of 250 patients were taken in this study and divided into two groups A and B. Group A consisted of patients undergoing Conventional Septoplasty (Control arm) and Group B consisted of patients undergoing Endoscopic Septoplasty (Case arm). Patients were followed up and the readings of NOSE score and PNIF value were recorded at the end of 6 weeks and 6 months (24 weeks). The Mean NOSE score post operatively at the end of 6 weeks was 36.32 in GROUP A (Control arm) and 33.08 in GROUP B (Case arm). t-Test revealed insignificant results with a *p*-value of 0.08. The mean NOSE score post operatively at the end of 6 months was 29.96 in GROUP A (Control arm) and 22.16 in GROUP B (Case arm). t-Test revealed significant results with a *p*-value of 0.00. Similarly, Mean PNIF value post operatively at the end of 6 weeks was 57.24 in GROUP A (Control arm) and 73.88 in GROUP B (Case arm). t-Test revealed significant results with *p*-value

of 0.00. The mean PNIF value post-operatively at the end of 6 months was 59.44 in GROUP A (Control arm) and 80.08 in GROUP B (Case arm). t-Test revealed significant results with *p*-value of 0.00. Endoscopic Septoplasty is a very effective way to treat septal deviations especially with deviations based on the posterior aspect of the septum. It provides a superior edge in terms of nasal airway improvement as compared to conventional method of septoplasty.

Keywords Septoplasty · Endoscopic septoplasty · Nasal airway · Pnif · Nose score · Mladina classification

Introduction

The nose, besides being important cosmetically is also the gateway to the airway. This is primarily divided by a bony-cartilaginous septum into two nasal passages. However, it may be deviated due to many reasons. Deviated Nasal septum accounts to 80% of the general population [1] although it may vary from population to population. Accepted reasons for deviated nasal septum include: congenital, moulding pressure at birth, unequal growth forces on the septum and trauma. Ruano-Gill et al. [2] looked at fifty embryos, and found that 4% of these foetuses had a deformity, leading them to state that there was a congenital component. Reports of septal dislocations of the new-born vary between 0.5 to 25%. Alpini et al. [3] examined 423 new-born infants, finding that 3.8% of natural birth babies and 4.62% of caesarean section delivered babies had septal deviations. Whereas Kawalski and Spiewak [4] looked at 273 new-born babies, and found that of those born by spontaneous delivery, 22.2% had a septal deformity, compared with only 3.9% of babies delivered by caesarean

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section. This led them to conclude that injury at birth was also responsible.

When considering surgery on a person, a conclusive diagnosis makes the decision to operate, the type of operation, and peri-operative care easier to plan for and manage. Conventional septoplasty and Sub mucosal resection have been a way, since long time, for management of septal deviations and with the recent advancements of endoscope aided septal surgeries, there are choices for the surgeons to choose according to septal deformity so that they can give the best functional result possible to their patients. There are two main types of nasal obstruction (excluding foreign body and tumour), physiological and anatomical. The nose studded with venous blood vessels which, when congested, result in a physiological reduction in nasal patency. When this becomes pathological, such as in allergy (producing rhinitis) or inferior turbinate hypertrophy, nasal obstruction can result. Decongestion of the nose with a topical nasal decongestant, or by exercise, eliminates the vascular component of nasal obstruction caused by swelling of the turbinates, allowing assessment of the anatomical or hard tissue component of the nasal obstruction. Nasal obstruction must be investigated before and after decongestion of the nose. In the hospital setting, this is usually accomplished with a nasal decongestant. Persistent nasal obstruction following decongestion points to anatomical cause.

Therefore, the purpose of this study is preoperatively assessing the type of septal deviation according to Mladina classification and also assess nasal airway by subjective and objective means in patients undergoing conventional and endoscopic septoplasty and comparing the results with following them post operatively and also to determine if there is any significant change or better gain of nasal airway in either of the above-mentioned procedures both subjectively and objectively.

Aims and Objectives

1. To Assess the Type of Septal Deviation According To Mladina Classification.
2. To Objectively Assess the Nasal Airway Status Pre and Post Operatively Using Peak Nasal Inspiratory Flow (PNIF) Meter.
3. To Subjectively Assess the Nasal Airway Status Pre and Post Operatively Using The Nose Questionnaire.

Methodology

An Institution based Case Control Study was done in the Department of Otorhinolaryngology, Medical College and hospital, Kolkata, West Bengal, India during the period from January 2019 to March 2020. A total of 250 patients were taken in this study and divided into two groups A and B. Group A consisted of patients undergoing Conventional Septoplasty (Control arm) and Group B consisted of patients undergoing Endoscopic Septoplasty (Case arm). The Inclusion & Exclusion criteria are as follows.

Inclusion Criteria

- (a) Age more than 12 years & less than 65 years.
- (b) Patients with Symptomatic Deviated Nasal Septum.

Exclusion Criteria

- (a) Age less than 12 years and more than 65 years.
 - (b) Patients with Anatomical deviated nasal septum without any symptoms.
 - (c) Patients with associated Rhinosinusitis.
 - (d) Patients with systemic co-morbidities such as Diabetes, Hypertension and Chronic Obstructive Pulmonary Disease.
- On the basis of computerized simple random sampling, the designated type of surgery (Conventional & Endoscopic Septoplasty) was attributed. The Conventional arm (Control) was named GROUP A and the Endoscopic (case) arm was named GROUP B.
 - Necessary Pre-operative Investigations were done along with CT scan in some cases to correctly identify the type of septal deviation. Also, Diagnostic Nasal endoscopy was performed to assess the same with decongesting the nasal mucosa prior the Endoscopy.
 - Printed form of NOSE scale was handed to fill up two days before the surgical procedure in patient's own language.

The Nasal Obstruction Symptom Evaluation (NOSE) scale is a subjective quality of life questionnaire for patients with nasal obstruction. It was developed by Stewart et al. in 2004, and has since been translated into many languages and clinically validated. The patient is provided this questionnaire in his/her native language and asked to tick the severity of each of the symptoms given below in the chart.

	Not a problem	Very mild problem	Moderate problem	Fairly bad problem	Severe problem
Nasal congestion/ stuffiness	0	1	2	3	4
Nasal blockage/ obstruction	0	1	2	3	4
Trouble breathing via nose	0	1	2	3	4
Trouble sleeping	0	1	2	3	4
Unable to get enough air via nose during exercise/ exertion	0	1	2	3	4

Nose Questionnaire

Final Nose Score is calculated by total Score from The Chart Above and Multiplying It By 5.

DEGREE = MILD (5–25), MODERATE (30–50), SEVERE (55–75), EXTREME (80–100).

Peak Nasal Inspiratory Flow metry was performed 2 days prior to surgery. The procedure is briefly described below:

The device is reset by returning the red cursor to its start position, and the patient is asked to exhale fully. The device is held horizontally. The face mask should form an air tight seal around the nose. The patient is instructed to close the mouth and inhale forcefully through his/her nose in one single go. 3 successive readings were obtained, and the highest was recorded.

- Standard procedure of Conventional and Endoscopic septoplasty with 4 mm 0° Endoscope were done. All the surgeries were performed by the same surgeon.
- The patients were discharged in a post-operative period of minimum 48 h after removing the nasal pack and the time of post-operative stay was recorded individually.
- The patients were subsequently followed-up & Post-operative Nose Scale and PNIF values were taken at the end of 6 and 24 weeks.

Statistical Analysis

The qualitative data was presented as proportion & percentage, and the quantitative data was presented as mean & standard deviation. Student's t test was used to find out the significance of study parameters on continuous scale and the difference in proportion were analyzed by using chi square test. *P* value < 0.05 was consider significant. The

statistical software SPSS 25 and primer were used for the data analysis and Microsoft word & MS excel 2019 have been used to generate graphs and tables.

Results

Out of 250 patients, 126 (50.4%) patients were Male and 124 (49.6%) were Females (Fig. 2). The mean Age of presentation in the entire study was 32.76 with lowest being 13 years and maximum being 62 years. The maximum number of patients were in the age group 21–30 years (Fig. 1). The nature of septal deviation was identified & recorded according to Mladina classification. To ensure the correct type of deviation, a combination of clinical and investigative method viz. Anterior Rhinoscopy, Posterior Rhinoscopy, Diagnostic Nasal Endoscopy and CT scan in some cases. It was observed that Mladina type V was the most common type of septal deviation and the least common was Mladina type I (Fig. 3). Presenting symptoms were noted and the Primary symptom was recorded. The presenting symptoms were namely Nasal Obstruction, Nasal Discharge, Epistaxis, Headache and Hyposmia. Around 121(48%) patients in this study presented with Nasal Obstruction which was the most common symptom followed by Nasal discharge (23%) with least being Hyposmia comprising of only 2% (Fig. 4).

Pre-operative NOSE scores and PNIF values were recorded 2 days prior to surgery. The Mean Nose Score pre-operatively in Group A (Control arm) was 45.68 and in Group B (Case arm) was 45.36 (Figs. 5 and 6) and the Mean PNIF value pre-operatively in Group A (Control arm) was 47.06 and in Group B (Case arm) was 52.52 (Figs. 7 and 8). Patients were followed up and the readings of NOSE score and PNIF value were recorded at the end of 6 weeks and 6 months (24 weeks). The Mean NOSE score post operatively at the end of 6 weeks was 36.32 in GROUP A (Control arm) and 33.08 in GROUP B (Case arm). t-Test revealed insignificant results with a p-value of 0.08 (Fig. 9).

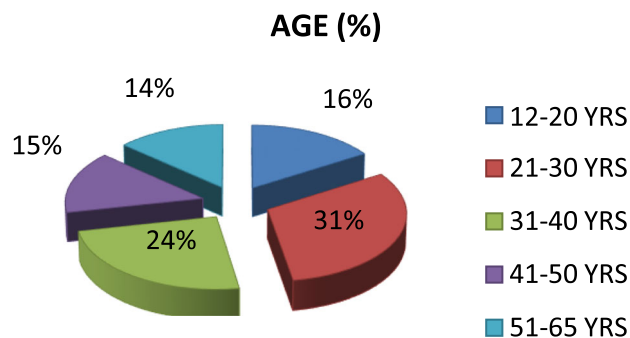


Fig. 1 Age distribution

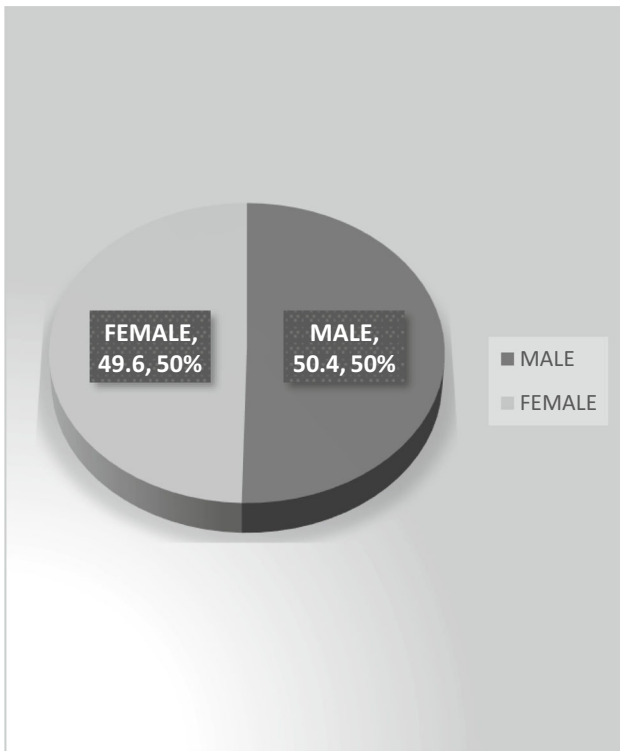


Fig. 2 Sex distribution

The mean NOSE score post operatively at the end of 6 months was 29.96 in GROUP A (Control arm) and 22.16 in GROUP B (Case arm). t-Test revealed significant results with a *p*-value of 0.00 (Fig. 10). Similarly, Mean PNIF value post operatively at the end of 6 weeks was 57.24 in GROUP A (Control arm) and 73.88 in GROUP B (Case

arm). t-Test revealed significant results with *p*-value of 0.00 (Fig. 11). The mean PNIF value post-operatively at the end of 6 months was 59.44 in GROUP A (Control arm) and 80.08 in GROUP B (Case arm). t-Test revealed significant results with *p*-value of 0.00 (Fig. 12).

Discussion

Demographical Data

As per the inclusion criteria, out of 250 patients in this study, 126 were males and 124 were females. The Mean age of presentation in the study was 32.76 years. The mean ages of the conventional and endoscopic arms were 33.18 & 32.34 respectively. This is in concordance with studies done by Basavaraj et al. [5] who did a study on 151 patients to compare the result of septoplasty with or without nasal packing, in their study 126 (83.4%) patients were in the age group of 10–30 years and only 26.6% of patients were above 30 years & Jain et al.[6] who did a comparative study on 100 patients and found that most commonly affected subjects belonged to 2nd and 3rd decade of life in both the sexes with 37% and 36% respectively in both the age group. In most studies, the number males have exceeded females. Such as study by Mohammad IA, Nabliur Rahman [7] who conducted a descriptive study on 200 patients to assess the complications of septoplasty and sub mucous resection of septum in which 162 (81%) patients were male and 38 (19%) patients were females with a ratio of 4.26:1. However, in our study the ratio of male: female was roughly 1:1.

Fig. 3 Variations of deviation in this study

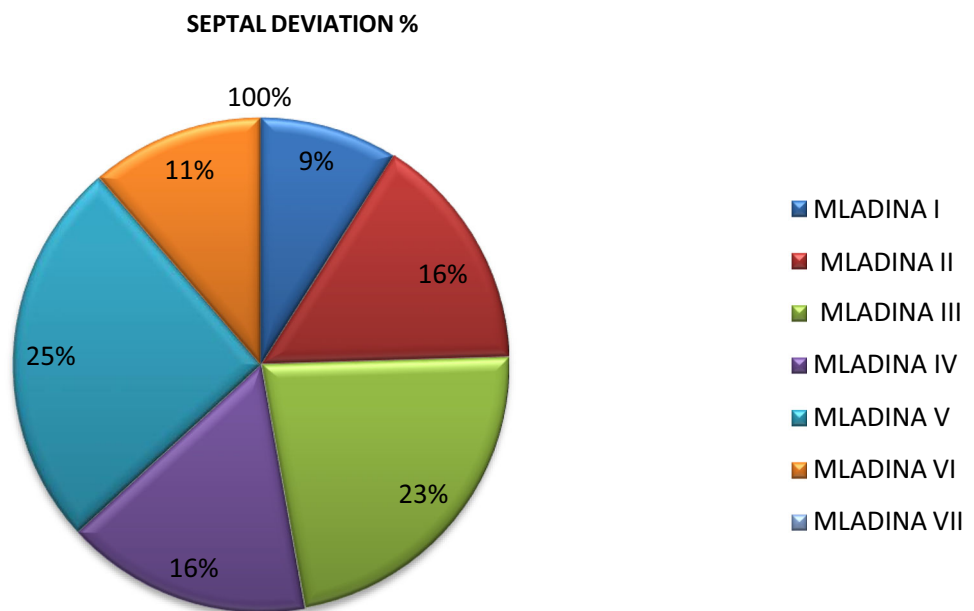
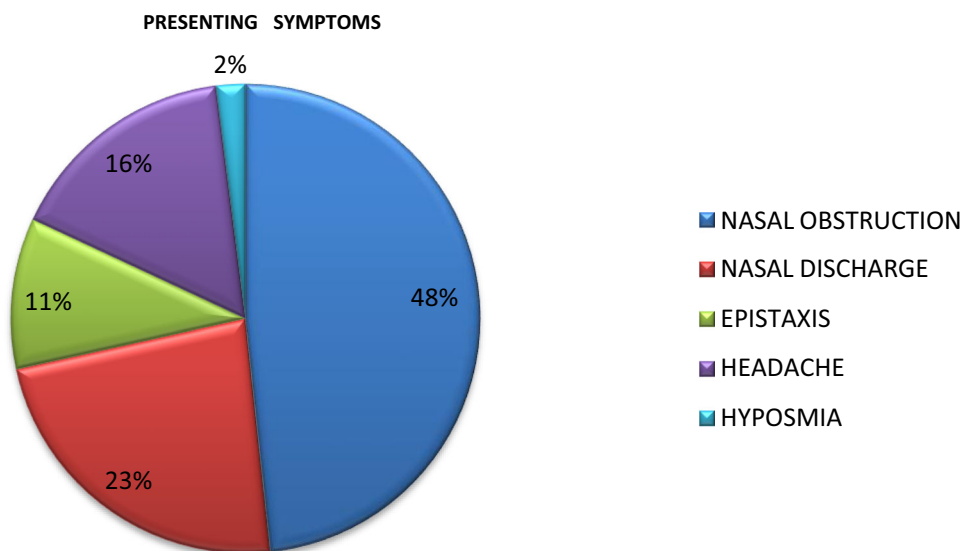


Fig. 4 Presenting Symptoms



CONVENTIONAL SEPTOPLASTY NOSE SCORE			
	Mea n	Std. Deviation	N
NOSE PREOP	45.6	10.594	125
NOSE POST OP 6WKS	36.3	10.909	125
NOSE OST OP 6 MONTHS	29.9	11.386	125

Fig. 5 Conventional septoplasty nose scores mean

ENDOSCOPIC SEPTOPLASTY NOSE SCORE			
	Mea n	Std. Deviation	N
NOSE PREOP	45.3	18.493	125
NOSE POST OP 6 WKS	33.0	17.572	125
NOSE POST OP 6 MONTHS	22.1	15.244	125

Fig. 6 Endoscopic septoplasty nose scores mean

Pre-operative Data

All the patients were examined clinically with thorough history taking and proper evaluation. All patients underwent Anterior Rhinoscopy, Posterior Rhinoscopy, and Diagnostic Nasal endoscopy to assess the type of septal deviation with help of CT scan in some cases, and data for NOSE score and PNIF value was taken to assess the status of nasal air flow. The type of surgery was designated on the basis of computer generated simple random sampling.

In assessment of type of septal deviation according to MLADINA’s classification, we found type V to be the most common followed by type III with least being type I.

When it comes to presenting symptoms, we found out that 48% of the study population has nasal obstruction followed by nasal discharge (23%), Headache (16%), Epistaxis (11%) and least being Hyposmia (2%). This is similar to the results found out by Jain et al. [6] who in their comparative study on conventional and endoscopic septoplasty done on 50 cases found that the most prevalent complaint in the patients of deviated nasal septum among the study subjects was nasal obstruction (74%), Sneezing (15%), post nasal drip (8%), epiphora (7%), hyposmia (3%), bleeding (3%) and snoring (3%). In another study conducted by Arunachalam PS, Kitcher E, Gray J [8] showed that nasal obstruction was complained by 74% patients, facial pain by

PNIF VALUE IN CONVENTIONAL SEPTOPLASTY			
	Mea n	Std. Deviation	N
PNIF PREOP (L/MIN)	47.08	14.116	125
PNIF POST OP 6 WKS (L/MIN)	57.24	12.548	125
PNIF POST OP 6 MONTHS (L/MIN)	59.44	12.135	125

Fig. 7 Conventional septoplasty pnif mean values

PNIF VALUE IN ENDOSCOPIC SEPTOPLASTY			
	Mean	Std. Deviation	N
PNIF PRE OP(L/MIN)	52.52	19.702	125
PNIF POST OP 6 WKS(L/MIN)	73.88	25.478	125
PNIF POST OP 6 MONTHS(L/MIN)	80.08	25.185	125

Fig. 8 Endoscopic Septoplasty Pnif Mean Values

72% patients. In some studies, Headache was the most common complaint like a study conducted by Dipak Ranjan Nayak, R Balakrishnan, K Deepak Murthy [9] on 60 patients. 47 patients (78.3%) had complaints of nasal obstruction. Headache was present in 46 (76.66%),

rhinorrhoea in 27(45%), post nasal discharge was present in 35(58.33%) and hyposmia in 5(8.33%) patients.

The mean NOSE scores pre operatively in the patients who underwent conventional septoplasty later was 45.68 with Std. Deviation of 10.594 and the mean NOSE scores pre operatively in the patients who underwent endoscopic septoplasty later was 45.36 with Std. deviation of 18.493.

Similarly, mean PNIF value pre operatively in the patients who underwent conventional septoplasty later was 47.08 with Std. Deviation of 14.116 and the mean PNIF value pre operatively in the patients who underwent endoscopic septoplasty later was 52.52 with Std. Deviation of 19.702.

Post-operative Data

Although the patients were followed up at weekly in the order of 2nd, 4th, 6th, 8th, 12th, 24th weeks, the data was recorded at the end of 6 weeks and 6 months (24 weeks). The mean NOSE scores post operatively in the patients who underwent conventional septoplasty was 36.32 with Std. Deviation of 10.909 at the end of 6 weeks and 29.96 and 11.386 respectively at the end of 6 months whereas, the mean NOSE scores post operatively in the patients who underwent endoscopic septoplasty was 33.08 with Std. deviation of 17.572 at the end of 6 weeks and 22.16 and 15.244 respectively at the end of 6 months. In a study by Michael G Stewart et al. [10], fifty-nine patients underwent surgery; there was a significant improvement in mean NOSE score at 3 months after septoplasty (67.5 versus 23.1, $P < 0.0001$), and this improvement was unchanged at 6 months. Patient satisfaction was very high, and patients used significantly fewer nasal medications.

In another similar study by Behroz Gandomi [11], 86 patients with septal deviation were asked using an outcomes instrument (the Nasal Obstruction Symptom Evaluation scale) before 3 and 6 months after septoplasty. Seventy-seven patients (89.5%) reported a subjective improvement in their nasal obstruction, which is more than the experience of most authors. There was a significant improvement in mean Nasal Obstruction Symptom Evaluation score at 3 months after septoplasty, and some symptom improvement continued to 6 months. Similarly, mean PNIF value post operatively in the patients who underwent conventional septoplasty was 57.24 with Std.

Intervention	n	Mean	SD	t	P value
Conventional	125	36.32	10.909	1.751	0.08
Endoscopic	125	33.08	17.572		

Fig. 9 t-Test results comparing post-operative nose score between conventional and endoscopic surgery after 6 weeks

Intervention	n	Mean	SD	t	P value
Conventional	125	29.96	11.386	4.583	0.00
Endoscopic	125	22.16	15.244		

Fig. 10 t-Test results comparing post-operative nose score between conventional and endoscopic surgery after 6 months

Intervention	n	Mean	SD	t	P value
Conventional	125	57.24	12.548	-6.551	0.00
Endoscopic	125	73.88	25.478		

Fig. 11 t-Test results comparing post-operative pnif score between conventional and endoscopic surgery after 6 weeks

Intervention	n	Mean	SD	t	P value
Conventional	125	59.44	12.135	-8.255	0.00
Endoscopic	125	80.08	25.185		

Fig. 12 t-Test results comparing post-operative pnif score between conventional and endoscopic surgery after 6 months

Deviation of 12.548 at the end of 6 weeks and 59.44 and 12.135 at the end of 6 months respectively, whereas the mean PNIF value post operatively in the patients who underwent endoscopic septoplasty was 73.88 with Std. Deviation of 25.478 at the end of 6 weeks and 80.08 and 25.185 at the end of 6 months respectively.

In a study done by Marais et al. [12] they showed increase in PNIF after septoplasty.

In a similar study done by Sahin C [13], sixty patients diagnosed with nasal septum deviation was included. Nasal Obstruction Symptom Score scales of patients, PNIF and was measured preoperatively and 14 days after surgery. Preoperative NOSE scores were 14.9 ± 2.7 and PNIF scores were 129.6 ± 15.5 L/min in study group. Postoperatively NOSE scores were 7.9 ± 1.8 and PNIF scores were 154.2 ± 9.2 L/min in study group. Nasal Obstruction Symptom Score scores were 3.3 ± 2.3 and PNIF scores were 169.3 ± 13.5 L/min in control group. They concluded that Anterior and anteroposterior located nasal septum deviation (NSD) had statistically higher degrees of NOSE scores and lower levels of PNIF scores. Posterior located NSD PNIF scores changed postoperatively but NOSE scores do not change statistically. There was a statistically significant correlation in Pearson correlation analysis between NOSE and PNIF scores. The authors recommend using PNIF and NOSE scores in NSD patients. Our study partially corroborated with this study in terms of PNIF score. However, the mean PNIF and NOSE were different from ours possibly owing to race of the study population.

Conclusion

Ever since the advent of Endoscopes, the dexterity of performing endoscopic surgeries has been challenging. Not only in performing septoplasty but also as an adjunct to Functional Endoscopic Sinus Surgery. There have been various published articles singing praises about the utility and advantages of Endoscope assisted Septal correction surgeries and this study is no exception to it.

Endoscopic Septoplasty not only has an excellent visualization to the pathology of the Nasal septum but also allows limited manipulation in areas surrounding the septum which causes minimal wear and tear of the nasal mucosa. Although there have been some limitations which have been proposed initially like single handed manoeuvrability, tendency to have the tip smeared with blood, difficulty in securing haemostasis while using it, chance of heat dissipation etc. but these limitations can be overcome with proper training. The posterior end of the nasal septum has never been seen better with a Nasal endoscope and hence posterior based deviations are best corrected by this method. In this study, Diagnostic Nasal endoscopy was done to ensure the type of septal deviation. This statement itself signifies the advantage of endoscope in a surgery.

We often fail to assess the main motive behind septal correction surgery. The main motive is to provide a sufficient nasal air pathway and to assess it, we must routinely take the help of methods which assess nasal airway patency. In our study, we used Nasal peak Inspiratory Flow (NPIF) meter as an objective method to assess the nasal

airway status. In spite of its few shortcomings, NPIF is preferred since it is easy to use and inexpensive method and can be performed in outdoor basis. This can be correlated with the NOSE scale to ensure better patient compliance and also can be kept as record for Medico-legal purposes. Though, we do not intend to demean the conventional method of septoplasty, but through this study, we certainly can say that Endoscopic method of septoplasty is a better method of septoplasty. Although, it has to be mastered to achieve its peak benefits and lesser complications.

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Declarations

Conflict of interest The author's declare that they have no conflict of interest.

Ethical approval Approved by the institutional ethics committee.

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