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Original Research Article

Correlation between subjective and objective outcomes of septoplasty in septal deviation

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ABSTRACT

Background: Septal deviation is one of the leading causes of chronic nasal obstruction. Septoplasty is the procedure of choice for treating these patients. Depending on the patient's perception and satisfaction the benefits of the surgery vary.
Methods: A prospective study was conducted at command hospital air force Bangalore in the department of ENT for a period of 2 years from 2018 to 2020 in 60 patients who underwent septoplasty. Preoperative and postoperative data were documented and analysed to get the results.
Results: On postoperative objective evaluation by diagnostic nasal endoscopy 47% of patient's anatomical deviation was completely corrected while it was partially corrected in 53% of patients overall. Post-op subjective evaluation by evaluating mean modified nose obstruction symptom evaluation (NOSE) score also depicted a significant improvement ($p<0.5$). There was also a significant positive correlation between the subjective and objective outcomes of septoplasty in our study. On correlating the postoperative subjective and objective outcome individually in all the types of septal deviation, there was an improvement in mean modified NOSE score in all types of patients.
Conclusions: There was improvement in both subjective and objective outcomes postoperatively. Study concluded that modified NOSE scale addresses wider range of symptomatology and is a good tool for subjective assessment of septoplasty. Improvement in anatomical septal deviation was noted by diagnostic nasal endoscopy postoperatively in all types of septal deviation of patients in our study.

Keywords: Nasal obstruction, Nasal septum, Quality of life

INTRODUCTION

Nasal obstruction is one of the most common presenting complaints reported in otolaryngology OPD. One of the most common causes of nasal obstruction is septal deviation. Surgical correction of the deviated nasal septum that is by septoplasty is the definitive treatment.[1,2] Perception of nasal obstruction by patient is complex and it depends on many psychological and physiological factors.

Just as there are many causes of nasal obstruction, there are also many methods of measuring it. Outcomes after nasal surgery can be assessed subjectively or objectively. Subjective evaluation is performed based on symptom scores like quality of life as assessed by using the NOSE scale and visual analogue scale (VAS).[3,4] Anatomic

outcome measure like imaging studies such as CT and MRI can be used to measure directly the volume and area of the nasal airway. Very significant limitation of imaging is that they are prone to changes in area and volume depending on the level of nasal congestion since imaging is a static measurement.[5-7] For objective assessment of nasal obstruction still there is no agreement on any tool. Patient-reported outcome measures (PROM) evaluate subjective experiences of the patient. It also evaluates the patient's self-reported assessment of the efficacy of the treatment without any interpretation of the physician or any other observer.[8] It provides a quantitative assessment of the otherwise subjective results. Those used for nasal obstruction are disease specific as nasal surgery outcomes may be too subtle for global quality of life measures.[9]

Global quality of life and health status instruments play an important role in the assessment of health status. Most widely used validated PROM for evaluation currently is NOSE scale. It is a disease specific quality of life instrument for the assessment of nasal obstruction and is valid, reliable and sensitive in evaluation of nasal obstruction.[10] It includes set of 5 questionnaire based on a 4-point scale, with scores reported on scale of 0 to 100 by multiplying the raw score by 5. A severity classification of the NOSE scale was developed (mild: 5-25, moderate: 30-50, severe: 55-75, extreme: >80) which had almost 90% sensitivity and specificity in evaluation of patients with nasal airway obstruction.[11] It has been validated for use in groups of patients and not an individual patient. Hence it can be used to compare the effects of different treatments like medical vs surgical. It can be used to compare health status before and after treatment and can also be used to assess differences in outcome when different surgical techniques are used.

Philip et al in his study used modification in NOSE scale to address all these symptoms and to address a wider range of symptomology which included snoring, poor sense of smell, feeling panicky enough that air is not entering the nose, irritation in the throat, nocturnal cough, daytime sleepiness, frequent common cold, general health condition, blocked sensation in ear, headache and epistaxis.[12]

Eren et al studied objective evaluation of septal deviation post septoplasty by classifying septal deviation into six groups using classification defined by Baumann et al.[13,14] Mladina et al in his study classified the anatomical septal deviation of nasal cavity into seven types and named it as Mladina's classification of septal deviation.[15]

Objective

The objective of this study was to assess the disease specific quality of life outcomes of patients undergoing septoplasty by means of a questionnaire using modified nose scale and to correlate it with diagnostic nasal endoscopic findings.

METHODS

A prospective study was conducted at command hospital air force Bangalore in the department of ENT for a period of 2 years from 2018 to 2020 in 60 patients who underwent septoplasty. Analysis of symptoms of all these patients undergoing septoplasty was done preoperatively and postoperatively. NOSE scale assesses the presence of nasal congestion, nasal obstruction, and trouble breathing through the nose, trouble sleeping and inability to get enough air through nose during exercise or exertion. In our study modified NOSE scale was used for analysis with additional questions which included presence of snoring, poor sense of smell, feeling panicky that enough air is not entering the nose, irritation in throat, nocturnal cough, frequency of common cold, daytime sleepiness, blocked sensation in ear, general health condition, headache and epistaxis. A score of 0 to 4 was given for each symptom, 4 being the most severe.

Mladina's classification of septal deviation was taken as standard guideline to assess pre and post op septal deviation on diagnostic nasal endoscopy and was classified from type 1 to VII. type 1 as mild deviation in vertical plane, type 2 as Moderate anterior vertical deviation of cartilaginous septum in full length, type 3 as posterior vertical deviation at level of osteomeatal complex and middle turbinate, type 4 as 'S'-shaped, posterior to one side and anterior to other, type 5 as horizontal septal crest touching or not touching the lateral nasal wall, type 6 as pcominent maxillary crest contralateral to the deviation with a septal crest on the deviated side, type 7 as combination of previously described septal deformity types.

Scoring was done on basis of symptoms present in patients for at least three months before surgery and was evaluated again post operatively at one month. Post-operatively diagnostic nasal endoscopy was done for all the patients and depending on the amount of correction achieved they were classified in four groups as: completely corrected (septum central), partially corrected (mild septal deviation persisted), no correction (finding similar to preoperative diagnostic nasal endoscopy) and aggravated with complications (septal deviation more than the preoperative assessment).

Inclusion criteria

Patients with age at least 14 years, septal deviation causing chronic nasal obstruction and symptoms lasting at least 3 months were included in the study.

Exclusion criteria

Patients with age below 14 years, septoplasty performed with concurrent sinus surgery, sleep apnea surgery and rhinoplasty and nasal fracture, adenoid hypertrophy, history of chronic sinusitis, allergic rhinitis, prior nasal

surgery and uncontrolled asthma were excluded from the study.

Ethics committee approval

The study was approved by the institutional ethics committee.

Statistical methods

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Non-normally distributed quantitative variables were summarized by median and interquartile range (IQR). Data was also represented using appropriate diagrams like bar diagram, pie diagram and box plots. The association between pre-operative and post-operative outcomes was assessed by cross tabulation.

P<0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

The sample size was calculated assuming the expected mean value of bleeding from nose pre operatively as 0.14, and in post-operatively the mean of trouble in sleeping considered as 0.03 as per a study by Philip et al.[7,9] Other parameters considered for sample size calculation were 95% power and 5% two-sided alpha error. The sample size was calculated using the following formula, to detect difference between two paired means.

$$n \geq \frac{2\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2}{\left[\delta_{Difference}/\sigma_{Difference}\right]^2} + \frac{Z^2_{1-\alpha/2}}{2}$$

N=Required sample size, $\delta diff$=Expected mean difference of the outcome (Before and after)=0.11, $\sigma diff$= Expected standard deviation of difference of the outcome= 0.1, $Z_{1-\frac{\alpha}{2}}$ =Z value for the given alpha error=0.96, $Z_{1-\beta}$= Z value for the given power of study.

The required sample size would be 24 subjects. To account for a loss to follow up of about 30%, another 8 subjects will be recruited. Hence the final required sample size is not less than 32 subjects.

RESULTS

Preoperative assessment of all the patients were done objectively with help of diagnostic nasal endoscopy and were classified in seven different types on basis of Mladina's classification of septal deviation. Most common type of patients seen in our study were type II (36%) followed by type IV (27%) and type VII (12%). There was no patient which fell into type V of this classification. Postoperative correction in all the patients were documented with help of diagnostic nasal endoscopy and the patients were categorized in four groups as completely corrected, partially corrected, not corrected and aggravated with complications. Postoperative mean modified NOSE score was compared in all these groups of patients with preoperative mean modified NOSE score in each and every type of patients from type I to type VII as classified by Mladina's classification preoperatively.

Subjective outcomes

The mean age group of patients in our study was 26.48 (SD±7.35) years. Minimum age of 17 years and maximum age of 48 years.

Figure 1 shows improvement in symptoms in percentages post operatively in study population using a staked bar chart.

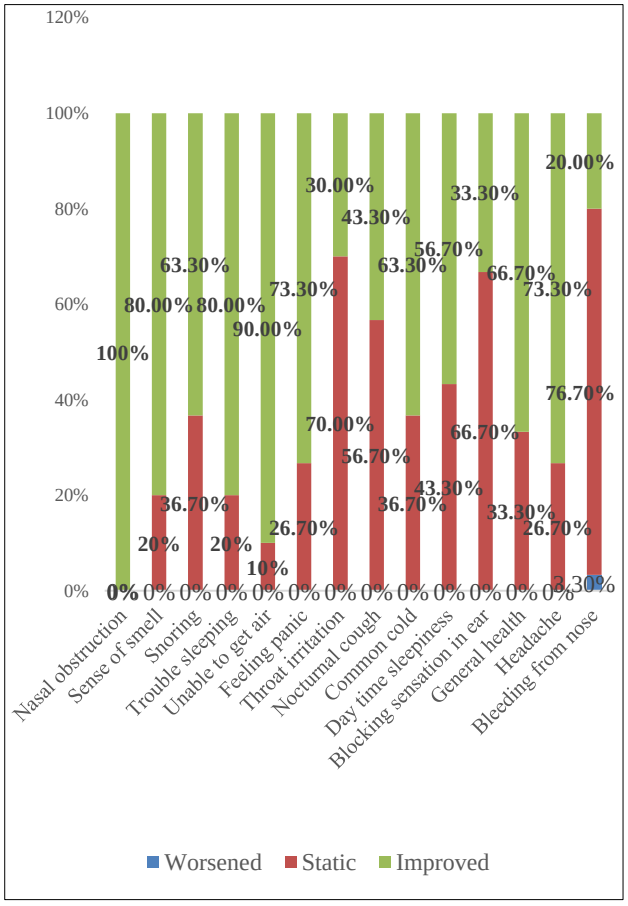

Figure 1: Improvement of symptoms in the study population in percentages, (n=60).

Among the study population, Nasal obstruction median was 3 (IQR 3,3) of pre-operative and nasal obstruction median was 0 (IQR 0 to 1) of post-operative. The difference in between pre and post-operative and nasal obstruction was statistically significant (p<0.001). The mean Nasal obstruction pre and post-operative was 2.83±0.59 and 0.4±0.49. Among the study population, sense of smell median was 1 (IQR 1,2) of pre-operative and Sense of smell median was 0 (IQR 0 to 0) of post-

operative. The difference in between pre and post-operative and Sense of smell was statistically significant (p<0.001). The mean sense of smell pre and post-operative was 1.33±0.99 and 0.13±0.34 (Table 1).

Similarly, the improvement in modified NOSE score was significant for all the symptoms post operatively (p<0.5) (Table 1).

Table 1: Comparison between pre-op and post-op symptom by modified NOSE score.

Symptoms		N	Mean±SD	Min	Max	Median (IQR)	Z score	P value
Nasal obstruction	Pre	60	2.83±0.59	1.00	4.00	3 (3,3)	-6.884	<0.001
	Post	60	0.4±0.49	0.00	1.00	0 (0,1)		
Sense of smell	Pre	60	1.33±0.99	0.00	4.00	1 (1,2)	-6.237	<0.001
	Post	60	0.13±0.34	0.00	1.00	0 (0,0)		
Snoring	Pre	60	1.27±0.9	0.00	3.00	1.5 (0,2)	-5.665	<0.001
	Post	60	0.47±0.62	0.00	2.00	0 (0,1)		
Trouble sleeping	Pre	60	2.1±1.12	0.00	4.00	2 (2,3)	-6.117	<0.001
	Post	60	0.3±0.59	0.00	2.00	0 (0,0)		
Unable to get air	Pre	60	2.27±0.9	0.00	4.00	2 (2,3)	-6.490	<0.001
	Post	60	0.53±0.72	0.00	2.00	0 (0,1)		
Feeling panic	Pre	60	1.3±1.23	0.00	4.00	1 (0,2)	-5.972	<0.001
	Post	60	0.1±0.3	0.00	1.00	0 (0,0)		
Throat irritation	Pre	60	0.6±0.92	0.00	3.00	0 (0,1)	-3.874	<0.001
	Post	60	0.2±0.4	0.00	1.00	0 (0,0)		
Nocturnal cough	Pre	60	0.93±1.01	0.00	3.00	1 (0,2)	-4.602	<0.001
	Post	60	0.3±0.46	0.00	1.00	0 (0,1)		
Common cold	Pre	60	1.8±1.26	0.00	4.00	2 (1,3)	-5.505	<0.001
	Post	60	0.63±0.55	0.00	2.00	1 (0,1)		
Day time sleepiness	Pre	60	1.53±1.32	0.00	4.00	2 (0,2)	-5.165	<0.001
	Post	60	0.5±0.62	0.00	2.00	0 (0,1)		
Blocking sensation in ear	Pre	60	0.53±0.89	0.00	4.00	0 (0,1)	-4.179	<0.001
	Post	60	0.13±0.43	0.00	2.00	0 (0,0)		
General health	Pre	60	1.3±0.91	0.00	3.00	2 (0,2)	-5.670	<0.001
	Post	60	0.3±0.46	0.00	1.00	0 (0,1)		
Headache	Pre	60	1.3±0.94	0.00	3.00	1.5 (0,2)	-6.289	<0.001
	Post	60	0.47±0.5	0.00	1.00	0 (0,1)		
Bleeding from nose	Pre	60	0.37±0.88	0.00	4.00	0 (0,0)	-2.797	<0.005
	Post	60	0.03±0.18	0.00	1.00	0 (0,0)		

Wilcoxon signed t=rank test p<0.05 statistically significant: p>0.05 not significant.

Table 2: Descriptive analysis of levels of improvement of symptoms, (n=60).

Symptoms	Worsened 1 level	Static	Improved 1 level	Improved 2 level	Improved 3 level	Improved 4 level
Nasal obstruction	0 (0)	0 (0)	4 (6.7)	30 (50)	22 (36.7)	4 (6.7)
Sense of smell	0 (0)	12 (20)	30 (50)	14 (23.3)	2 (3.3)	2 (3.3)
Snoring	0 (0)	22 (36.7)	28 (46.7)	10 (16.7)	0 (0)	0 (0)
Trouble sleeping	0 (0)	12 (20)	10 (16.7)	22 (36.7)	10 (16.7)	6 (10)
Unable to get air	0 (0)	6 (10)	20 (33.3)	22 (36.7)	8 (13.3)	4 (6.7)
Feeling panic	0 (0)	16 (26.7)	28 (46.7)	6 (10)	8 (13.3)	2 (3.3)
Throat irritation	0 (0)	42 (70)	12 (20)	6 (10)	0 (0)	0 (0)
Nocturnal cough	0 (0)	34 (56.7)	16 (26.7)	8 (13.3)	2 (3.3)	0 (0)
Common cold	0 (0)	22 (3.7)	14 (23.3)	20 (33.3)	0 (0)	4 (6.7)

Continued.

Symptoms	Worsened 1 level	Static	Improved 1 level	Improved 2 level	Improved 3 level	Improved 4 level
Day time sleepiness	0 (0)	26 (43.3)	14 (23.3)	12 (20)	8 (13.3)	0 (0)
Blocking sensation in ear	0 (0)	40 (66.7)	16 (26.7)	4 (6.7)	0 (0)	0 (0)
General health	0 (0)	20 (13.3)	22 (36.7)	16 (26.7)	2 (3.3)	0 (0)
Headache	0 (0)	16 (26.7)	38 (63.3)	6 (10)	0 (0)	0 (0)
Bleeding from nose	2 (3.3)	46 (76.7)	6 (10)	4 (6.7)	0 (0)	2 (3.3)

Table 3: Descriptive analysis of improvement of symptoms, (n=60).

Symptoms	Worsened (%)	Static (%)	Improved (%)
Nasal obstruction	0 (0)	0 (0)	60 (100)
Sense of smell	0 (0)	12 (20)	48 (80)
Snoring	0 (0)	22 (36.7)	38 (63.3)
Trouble sleeping	0 (0)	12 (20)	48 (80)
Unable to get air	0 (0)	6 (10)	54 (90)
Feeling panic	0 (0)	16 (26.7)	44 (73.3)
Throat irritation	0 (0)	42(70)	18 (30)
Nocturnal cough	0 (0)	34 (56.7)	26 (43.3)
Common cold	0 (0)	22 (33.70)	38 (63.3)
Day time sleepiness	0 (0)	26 (43.3)	34 (56.7)
Blocking sensation in ear	0 (0)	40 (66.7)	20 (33.3)
General health	0 (0)	20 (36.30)	40 (66.7)
Headache	0 (0)	16 (26.7)	44 (73.3)
Bleeding from nose	2 (3.3)	46 (76.7)	12 (20)

Level of improvement for each symptom of modified NOSE scale were also studied and summarized in (Table 2). 6.7% of patients with nasal obstruction showed level 1 improvement postoperatively as compared to what they reported preoperatively on scoring levels. 50% showed improvement by level 2, 36% by level 3 and 6.7% by level 4. Similarly, it was done for all the symptoms. Percentages of improvement postoperatively for all the symptoms as a whole were studied and graded as worsened, static or improved (Table 3). 100% improvement in nasal obstruction was seen although it might have been persisting in a level less than what it was preoperatively as shown in Table 2. Sense of smell remained static in 12% of cases while improved in 80% of cases.

Objective outcome

Preoperative assessment of all the patients was done objectively with help of diagnostic nasal endoscopy and were classified in seven different types on basis of Mladina's classification of septal deviation. Most common type of patients seen in our study was type II (36%) followed by type IV (27%) and type VII (12%). There was no patient which fell into type V of this classification.

On post operative diagnostic nasal endoscopy in Mladina's type 1, 100% patients showed complete correction of septal deviation. In type 2 82% showed complete correction and 18% showed partial correction. In type 3, 100% showed partial correction. In type 4 13% showed complete correction and 87% showed partial correction. There were no cases in type 5. In type 6 100% showed partial correction. In type 7 there was 50% partial and 50% complete correction in septal deviation.

Correlation between subjective and objective outcomes

The decrease in mean modified NOSE score postoperatively in type I patients with complete surgical correction post septoplasty was 100%. This signified that there was a strong correlation between the subjective and objective outcomes in type I patients postoperatively (Figure 2).

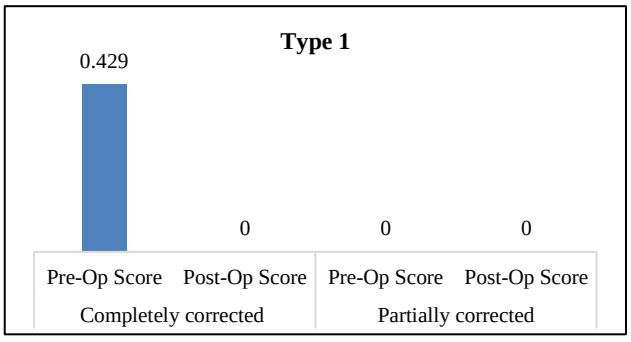

Figure 2: Pre and post-operative mean modified NOSE score in type 1 patients.

The decrease in mean modified NOSE score postoperatively in type II patients with complete correction post septoplasty was 87% while in cases of partial correction the decrease was 83%. Although improvement in mean modified NOSE score was seen in both complete and partial correction, but the improvement was more in completely corrected patients post operatively as depicted by the percentage decrease in the mean scores hereby confirming a positive correlation between subjective and objective outcomes of septoplasty (Figure 3). The decrease in mean modified NOSE score postoperatively in type III patients with partial surgical correction post septoplasty was 57%. This signified that there was a correlation between the subjective and objective outcomes in type III patients postoperatively (Figure 4).

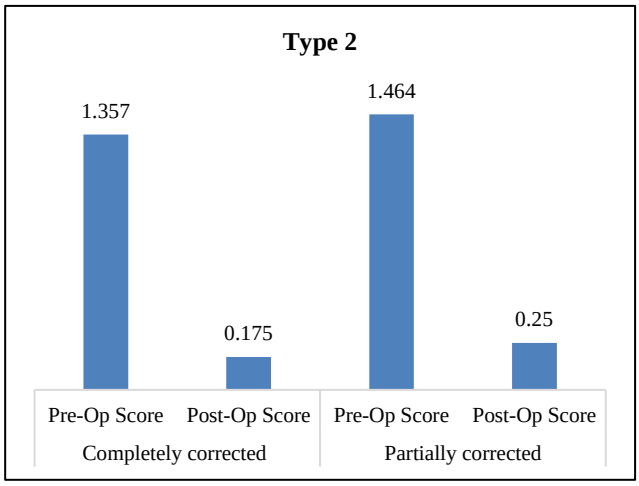

Figure 3: Pre and post-operative mean modified NOSE score in Type 2 patients.

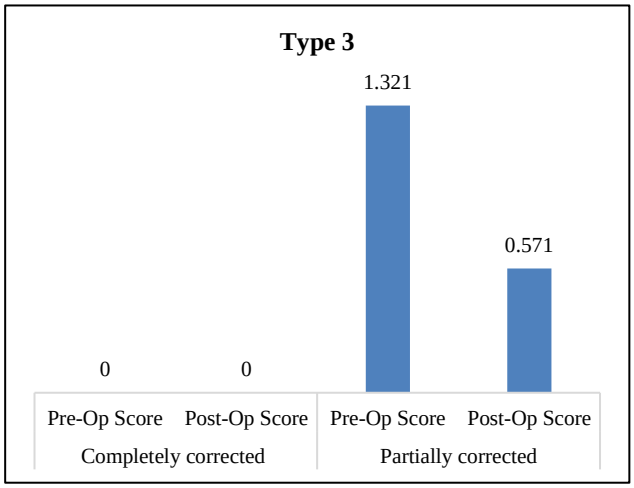

Figure 4: Pre and post-operative mean modified NOSE score in type 3 patients.

The decrease in mean modified NOSE score postoperatively in type IV patients with complete correction post septoplasty was 74% while in cases of partial correction the decrease was 71%. Although improvement in mean modified NOSE score was seen in both complete and partial correction, but the improvement was more in completely corrected patients post operatively as depicted by the percentage decrease in the scores hereby conforming a positive correlation between subjective and objective outcomes of septoplasty (Figure 5). The decrease in mean modified NOSE score postoperatively in type VI patients with partial surgical correction post septoplasty was 58%. This signified that there was a correlation between subjective and objective outcomes in type VI patients postoperatively (Figure 6).

The decrease in mean modified NOSE score postoperatively in type VII patients with complete correction post septoplasty was 80% while in cases of partial correction the decrease was 79%. Although improvement in mean modified NOSE score was seen in both complete and partial correction, but improvement more in completely corrected patients post operatively as depicted by percentage decrease in the scores hereby conforming a positive correlation between subjective and objective outcomes of septoplasty (Figure 7).

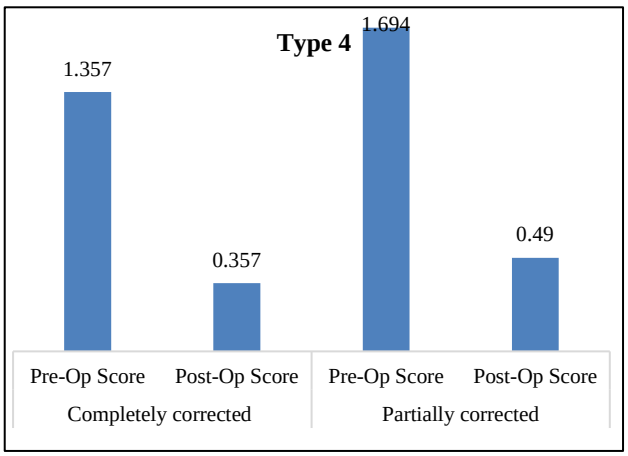

Figure 5: Pre and post-operative mean modified NOSE score in type 4 patients.

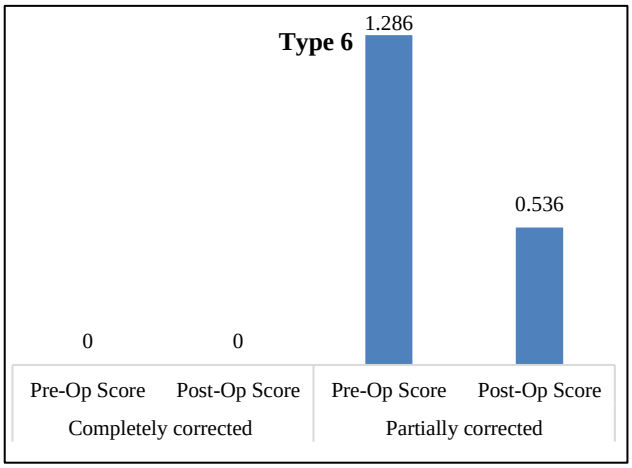

Figure 6: Pre and posto-perative mean modified NOSE score in type 6 patients.

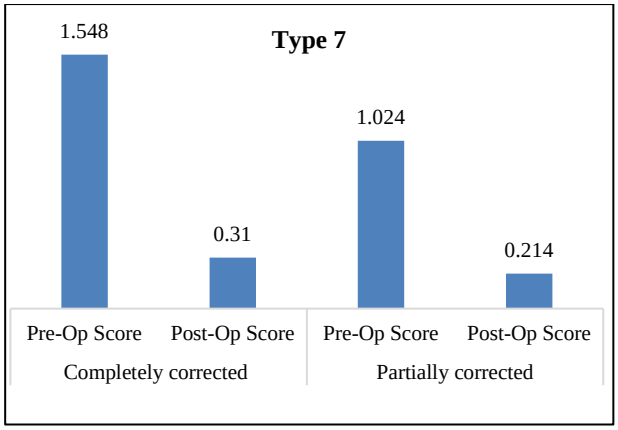

Figure 7: Pre and post-operative mean modified NOSE score in type 7 patients.

DISCUSSION

This study was an attempt to evaluate the subjective and objective outcomes of septoplasty using modified NOSE scale and diagnostic nasal endoscopy respectively.

In our study maximum patient were observed in type II (36%) followed by type IV (27%) and type VII (20%). Hubballi et al in his study mentioned the most common type as type II (33%) followed by type V (45%).[16] In another study conducted by Sam et al, found type VII (29%) to be most common. In our study least common was type V with no patients falling into this type.[17]

Preoperative mean modified NOSE score were calculated for all patients and were calculated again postoperatively for all. Amongst all the symptoms as per modified NOSE scale used, almost all the patients had nasal obstruction of different severity as one of the symptoms. Similar results were observed in study conducted by Hubbali et al using NOSE scale.[16] Similar results were seen in study conducted by Konstantinidis et al. Mean scores of modified NOSE scale were compared and all showed a significant reduction in mean score ($p<0.5$). In our study a significant improvement was seen in all the symptoms of the modified NOSE score. Percentage improvement in mean modified NOSE score for symptoms of throat irritation, bleeding from nose and blocking sensation in ear was less than that of others mainly because fewer patients reported them as a symptom preoperatively and those who did, reported them of mild severity on modified NOSE scale. Similar results of improvement in subjective outcome of septoplasty were reported from several previous studies. Gandomi et al published similar results and said that there was improvement in symptomatology following septoplasty.[19]

Arunachalam et al also reports the same using Fairley nasal symptom score.[20] Eren et al reported that there was a significant improvement in the Visual analogue scale and NOSE scores post septoplasty.[13] In our study we measured the objective outcome by categorizing the patients post operatively into four groups. These were completely corrected anatomical deviation, partially corrected deviation, deviation not corrected and deviation aggravated with complications. There were only 2 patients in type II and all of them showed complete correction post operatively. In type II 82% showed complete correction and 18% showed partial correction. In type III all the patients showed partial correction. In type IV 13% showed complete correction and 87% showed partial correction. Type VI showed 100% partial correction. In type VII complete and partial correction was 50% each.

There were no cases in type V. Similar results were proposed by Siegel et al which documented success rate of septoplasty to be between 43% to 85%.[21] Not many studies have been done to evaluate the objective outcomes of septoplasty using diagnostic nasal endoscopy. Eren et al used acoustic rhinometry, rhinomanometry and peak nasal inspiratory flow as objective tests to evaluate the outcome of septoplasty. His study revealed that there was significant improvement in all the parameters post septoplasty.[13]

We went a step ahead in our study and tried to correlate the subjective and objective outcomes of septoplasty. Mean score of modified NOSE score preoperatively was compared with postoperative mean score and was correlated in every single group of improvement categorised on basis of diagnostic nasal endoscopy in all the types of patients.

In type I patients 100% improvement in mean modified NOSE score was documented in patients with complete correction on diagnostic nasal endoscopy post septoplsty. In type II patients completely corrected and partially corrected groups post septoplasty showed 87% and 83% improvement in postoperative mean modified NOSE score. In type III patients all were partially corrected and showed 57% improvement in post septoplasty mean modified NOSE score. In type IV patients completely, corrected group showed 74% decrease in the mean modified NOSE score post operatively while partially corrected group documented 71% improvement. There were no patients in type V. In type VI all were partially corrected and showed 58% improvement in mean modified NOSE score. Type VII documented 80% improvement in completely corrected and 79% in partially corrected groups.

Although improvement was seen in both completely corrected and partially corrected groups of all types of patients but the improvement was more in completely corrected as compared to partially corrected group. So, the results were consistent and showed a clear positive correlation between subjective and objective outcomes of septoplasty in our study. Eren et al in his study also found a positive correlation between subjective and objective outcomes.[13] Although he used NOSE scale and visual analogue scale for subjective evaluation and Acoustic

rhinometry, Rhinomanometry and peak nasal inspiratory flow for objective evaluation. A limitation of our study was lack of control group but as there is no alternative management for deviated nasal septum other than the surgical option and a non-surgical control group was not possible.

CONCLUSION

In patients with septal deformity objective assessment with diagnostic nasal endoscopy showed significant improvement following septoplasty. A high patient satisfaction was also noted in symptomatology using modified nose scale. There was a strong correlation between objective and subjective improvement outcome of the septoplasty in all the patients. Post-operative mean modified NOSE scores were significantly lower compared to the preoperative scores in all types of septal deviation as classified by Mladina's classification ($p<0.05$). Our study concluded that modified NOSE scale addresses wider range of symptomatology and is a good tool for subjective assessment of septoplasty and correlated with objective outcomes of diagnostic nasal endoscopy findings post operatively. Diagnostic nasal endoscopy is very important for the diagnosis of the septal deviation in patients reporting with symptoms. Use of modified NOSE score will be helpful and prove to be a valuable tool to assess the results of nasal septal surgery.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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