Rhinoplasty in secondary nasal deformities: Subjective and objective outcome evaluation

ABSTRACT

Introduction: Secondary nasal deformities are associated with trauma and secondary cleft nose (after primary cleft nose surgery). Nasal deformities affect esthetic, function, and psychological status of the patient. The goal of the secondary rhinoplasty is to correct both form and function, so that this positively impacts on their facial appearance.

Aims: The study aimed to evaluate the patient satisfaction (subjective outcome) by rhinoplasty outcome evaluation questionnaire (ROEQ) preoperatively and postoperatively and esthetic outcome (objective outcome) by surgical team in patients with secondary nasal deformities.

Materials and Methods: Secondary rhinoplasty was done in 13 patients of traumatic and unilateral secondary cleft nose through the external approach. Objective outcome was assessed by surgical team with clinical measurement, radiograph (lateral cephalometric), and photographic documentation pre- and postoperatively. Clinical measurements include nasolabial and nasofrontal angle. The patients completed the ROEQ for the subjective outcome evaluation.

Results: There was significant improvement of subjective outcome (83.30%) based on the ROEQ and objective outcome based on the clinical measurement.

Conclusion: Our study suggests that secondary rhinoplasty in trauma and cleft patients leads to both subjective and objective improvement of the facial appearance.

Keywords: Nasal injury, rhinoplasty outcome evaluation, secondary cleft nose, secondary rhinoplasty

INTRODUCTION

Rhinoplasty is a surgical procedure that improves the form and function of the nose. In social cognition, facial appearance plays an important role. Symmetrical faces are considered to be more attractive. Thus facial asymmetries in persons with nasal deformities are probably a source of emotional and social distress.[1]

According to various literature, the incidence rate of posttraumatic nasal deformities varies from 9% to 62%.[2-7] Proper function of the nose is needed for normal respiration, humidification, speech production, smell sensation, and it also has a great role in facial esthetic. Secondary nasal deformities may be congenital or traumatic. Most common causes of nasal injuries are falls, motor vehicle accidents, and athletic injuries. The incidence is more in males as compare to females at the age of 11–20 years. The age and the environment play a key role in determining the injury type and pattern.[8]

The fracture of the nose is more common and about 39% of all facial fractures.[9]

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Nasal deformity associated with congenital cleft lip is a complex defect that affects aesthetic and function. All the tissue layers may be involved in nasal deformity including the cartilaginous framework, the bony platform, the inner nasal lining, and the skin. The extend of deformity varies with the involvement of lip abnormality; it may be partial or complete and unilateral or bilateral. The mid-facial skeleton affected by fusion disorders of cleft lip and cleft palate. The worldwide incidence rate of cleft lip and palate is between 0.8 and 2.7 cases per 1000 live births.\[^{10}\]

Nose is an important organ of the body which has a significant role in a person’s self-respect and social acceptance. The main goal of corrective surgery of the nose is to achieve the new form of the nose which will be matched perfectly with the rest of the facial appearance.\[^{11}\]

Rhinoplasty is among the most commonly performed surgeries for both esthetic and functional purposes.\[^{12}\] Intermediate and definitive rhinoplasty is included in secondary rhinoplasty. Rhinoplasty performed before the completion of nasal growth is called intermediate rhinoplasty which is based on the two separate time periods. At the age between of 4 and 6 years for lip revision, to minimize any psychological distress. Ages between 8 and 12 years waiting until after alveolar bone grafting and completion of orthodontic alignment gives a skeletal base for the correction of nasal deformities. As compare with definitive rhinoplasty, the intermediate rhinoplasty techniques are more conservative.\[^{10}\]

Definitive rhinoplasty is done after maxillary and nasal growth completion. It is done in between 16 and 18 years of age. Different procedures such as osteotomy, septoplasty, and cartilage grafting is needed for definitive rhinoplasty according to the severity of soft tissue and skeletal deformities.\[^{13}\]

Different donor site for cartilage grafting are the rib, conchal, and nasal septum to achieve adequate nasal support. The primary aim of the secondary rhinoplasty is relief of nasal obstruction, the creation of symmetry and definition of the nasal base and tip, and management of nasal webbing and scarring.\[^{14}\]

Some individuals are more concern about their nasal profile, with a considerable decreased or increased nasofrontal and nasolabial angle being an important reason for the required rhinoplasty. The patient attractiveness is determined by the morphology of nasofrontal and nasolabial region in the profile view.\[^{15}\]

Nasolabial angle is measured between columellar and plane of the upper lip with its apex at subnasale. The ideal angle is $90^\circ$–$95^\circ$ for males and $100^\circ$–$110^\circ$ for females.\[^{9}\]

Nasofrontal angle is formed between the dorsum of the nose and glabellar part of the forehead. In a normal profile, the nasofrontal angle is about $125^\circ$.\[^{9}\]

**MATERIALS AND METHODS**

The study was approved by the Ethical Committee of our hospital (Reference number: 2015–2018). Thirteen patients of trauma (9) and secondary cleft nose (4) came to the department of oral and maxillofacial surgery. The age range was 17–40 years, and 8 male and 5 female patients were included. In our study, inclusion criteria were fracture of nose, as well as secondary cleft. Patients who were willing to participate in the study along with informed consent and readily available for periodic follow-up without any systemic disease were included in the study.

The clinical finding was nasal septum deviation, saddle nose (depressed nasal dorsum), short columella with nostril, and nasal obstruction. Pre and post–operative photographs (full face frontal view, basal view, left profile view, and right profile view) and radiograph (lateral cephalometric) were taken for the assessment of facial angle (nasolabial and nasofrontal) and objective (esthetics) outcome. Subjective outcome through rhinoplasty outcome evaluation questionnaire (ROEQ) (Alsarraf et al.; 2000) was assessed preoperatively and 6 months postoperatively.

**Rhinoplasty outcome evaluation**

The ROEQ is a tool which is used for the assessment of the result after the correction of secondary nasal deformities.\[^{16}\] ROEQ in which six questions were asked regarding the patient’s view on both nasal form and function [Table 1]. Each parameter was scored on a scale from 0 to 4, with 0 and 4 reflecting the worst and best scores, respectively. After getting total score, it was divided by 24 and multiplied by 100. An excellent score was considered of above 85% ROE score and shows high patient satisfaction. ROEQ was used to study the patient’s satisfaction level. The rhinoplasty satisfaction outcome evaluation is a tedious task to perform, especially when it is being performed by different consultants. To overcome this difficulty, we use the ROEQ to access our results.\[^{17}\] A commonly used evaluation method for nose satisfaction after ROE, assessing the state of the nose preoperatively and postoperatively.\[^{18}\]

**Demographic profile**

In our study, secondary deformities patients were secondary cleft and saddle nose.

The cleft lip and cleft palate in the poverty stricken Sub-Himalayan Garhwal region of India being a commonly
seen congenital abnormality and scarcity of studies about the demography of cleft in this region. The cleft in tropical counties such as India is worse due to poverty and illiteracy. Lack of multivitamins, inappropriate use of drugs and problems such as high fever and anemia during pregnancy are likely etiological factor in the development of cleft deformity. Drivedi et al.\textsuperscript{[19]} found unilateral cleft were more common than bilateral and unilateral to bilateral ratio was 10.4:1. They noticed that left side defects were more common than the right side, and male-to-female ratio was 2:1. The isolated cleft lip (52.24%) was much higher than isolated cleft palate (13.47) or cleft lip associated with cleft palate (34.29). However, females had a higher incidence of the cleft palate than male.\textsuperscript{[19]}

Out of four patients of unilateral secondary cleft lip and palate, one was on left and three were on the right side. The highest incidence of this deformity was recorded in 21 years (median age) in all female patients. The majority of our patients were poor and illiterate.

Saddle nose may be caused by many factors: biologic, genetic, and iatrogenic. The saddle nose may result from traumatism followed by septal abscess. The nose complex deformity of the saddle nose may be followed by other abnormalities such as nasal hypoplasia, septal deviation, low projection of nasal tip, and short columella. The etiological factor of the saddle nose is the infection such as hanseniasis, syphilis, tuberculosis, and blastomycoses.\textsuperscript{[20]}

In our study, trauma was the main cause of saddle nose and reported nine patients.

The patient’s satisfaction varies based on gender, age, education level, culture, ethnicity, and most importantly, the patient’s level of expectation. Due to diversity of the procedure and difficulty in interpreting patient expectations, the postrhinoplasty satisfaction is low. A recent study suggested that meeting esthetic expectation was more important than meeting functional expectation to satisfy a patient.\textsuperscript{[17]}

The limitation of this study was that the sample size was too small for additional analysis, to evaluate the predictors for patient satisfaction.

**Surgical procedure**

Rhinoplasty was performed through the open approach in which marginal with transcolumellar incision was used. Surgical procedures included lateral osteotomy and septoplasty. Septorhinoplasty was done for the correction of airway obstruction. In which deviated part of bony and cartilaginous part of septum was removed with the help of luc forceps after elevation of the mucoperichondrium and mucoperiosteum by giving incision on the deviated site of the septum. External nose correction was achieved by lateral osteotomy. Grafting for columellar and alar region strut graft was taken from conchal and septal cartilage [Figure 1a and b]. For dorsum onlay grafting, rib cartilage and iliac crest bone was used [Figure 1c and d]. Osteotomy and grafting was
done for esthetic purpose. Postoperatively, nasal cavities were packed loosely with vaseline lubricated gauze for the prevention of septal hematoma. It was removed after 48 h. At the end of operation, nasal splint (cast) was used on the nasal dorsum for stability of the nose. These splints were removed after 1 week.

RESULTS

Objective outcome

Nasolabial angle
Preoperative and postoperative photo and cephalometric analysis showed a significant improvement of the characteristic facial angle. The mean nasolabial angle was significantly higher than mean preoperative nasolabial angle ($t_{24} = 3.09; P < 0.0001$). The nasolabial angle altered from a median of 97°–105°, thus significant improvement was observed over nasolabial angle after surgery [Figure 2a, b, Table 2 and Graph 1].

Nasofrontal angle
The mean value of nasofrontal angle was significantly lower than mean preoperative nasofrontal angle, ($t_{24} = 3.09; P < 0.0001$). The median nasofrontal angle altered from 140° to 135°, thus significant improvement was observed over nasofrontal angle after surgery [Figure 2c, d, Table 3 and Graph 2].

Subjective outcome

Overall, patient’s satisfaction was high and changed from a median score of 41.66% preoperative to 83.30% postoperative. $T$-test showed that mean postoperative subjective outcome was significantly higher than mean preoperative subjective outcome ($t_{26} = 7.27; P < 0.0001$) [Table 4 and Graph 3].

DISCUSSION

The aim of the present study was to evaluate the subjective and objective outcome of rhinoplasty in secondary nasal deformities due to secondary cleft and trauma patients.

Nasolabial angle
The mean value of nasolabial angle was 105° after the surgery. Hence, we found that the significant improvement of the nasolabial angle was seen after the surgery [Figure 2a and b]. We agree in our findings with Powell and Humphreys study described a range of 90°–120° though in their “esthetic triangle” they found a range of 90°–105°. There is variation of the value in different ethnics, and average values for a Chinese population have been provided as 89° ± 11° in women and 87° ± 12° in men, and in an African-American population as 74° ± 15° in women and 72° ± 15° in men.[21]

For the Indian population, the ideal angle is 90°–95° for males and 100°–110° for females by V. P Sood.[9]

Nasofrontal angle
After the follow-up observation of 2 years, it was found that median nasofrontal angle decreased from 140° to 135° [Figure 2c and d] which correlates with the study of Gräber et al.; 1995[22] and Guyuron 1988.[23]

Subjective outcome

Table 2: Distribution of nasolabial angle in degree (°) of the patient

| Descriptive statistics | Preoperative ($n=13$) | Postoperative ($n=13$) | $t$-test ($t_{24}$) | $P$ |
|------------------------|-----------------------|------------------------|--------------------|-----|
| Mean±SD                | 101.46±16.85          | 106.23±10.96           | 3.09               | <0.01* |
| Median                 | 97.00                 | 105.00                 |                    |     |
| Range                  | 80-130                | 85-130                 |                    |     |

Table 3: Distribution of nasofrontal angle in degree (°) of the patients

| Descriptive statistics | Preoperative ($n=13$) | Postoperative ($n=13$) | $t$-test ($t_{24}$) | $P$ |
|------------------------|-----------------------|------------------------|--------------------|-----|
| Mean±SD                | 137.31±7.33           | 132.62±5.12            | 3.23               | <0.01* |
| Median                 | 140.00                | 135.00                 |                    |     |
| Range                  | 125-150               | 125-145                |                    |     |

Table 4: Distribution of subjective outcome (in percentage) of the patients

| Descriptive statistics | Preoperative ($n=13$) | Postoperative ($n=13$) | $t$-test ($t_{26}$) | $P$ |
|------------------------|-----------------------|------------------------|--------------------|-----|
| Mean±SD                | 41.98±19.41           | 84.70±8.48             | 7.27               | <0.0001* |
| Median                 | 41.66                 | 83.30                  |                    |     |
| Range                  | 12-83                 | 75-100                 |                    |     |

P<0.01* significant; SD: Standard deviation

Figure 2: (a) Preoperative and (b) postoperative nasolabial angle. (c) Preoperative (d) postoperative nasofrontal angle.
In our study, patients satisfaction was high and changed from a median ROE score of 41.66%–83.30%. Thus, significant improvement was observed over subjective outcome after surgery, which was acceptable and correlated with other study of Alsarraf; reported mean postoperative ROE score increase of 44.5%. Celik and Altintas was noted improvement score of 75%. and Gassling et al.; seen mean postoperative score of 87.5%

Subjective outcome was associated with patient satisfaction from functional as well as an aesthetic point of view by using ROEQ, commonly used for cosmetic and post traumatic rhinoplasty. As compared to other aesthetic procedures, rhinoplasty patients are less satisfied with their appearance after surgery. There may be unexpected responses from patients even after good surgical correction because rhinoplasty has a huge psychological impact.

We identified two main areas of nasal defects in unilateral secondary cleft and traumatic nose. One was the depressed dorsum of the nose, and the other was a drooping tip. We have therefore, addressed these two defects in these patients. The dorsal graft is an excellent way to raise the depressed dorsum found in some unilateral cleft and traumatic nose defects. This graft also aids in supporting the tip of the nose which can be lifted by attaching the alar cartilages to it. In patients with short columella using only a strut graft from concha or septum to strengthen the medial crura of the lower lateral cartilages and considered adequate for lifting the nasal tip. Grafting onto the columella is aimed to strengthen the tip support and correct the buckled and malpositioned alar cartilages. The graft will increase the columella length, a nasolabial angle, the nasal projection, and the structural integrity of the tip support and nasal base. Preservation of nasal tip rotation and refinement are best corrected using interdomal transdomal sutures (Arnnop et al.; 2011). In our study of 13 patients, conchal cartilage, costochondral graft, septal cartilage, and anterior iliac crest bone graft were used in three, one, four, and two patients, respectively, along with lateral osteotomy. Out of 13 cases, three patients did not need any graft placement, only septorhinoplasty were done with lateral osteotomy to correct the nasal function and axis deviation through external approach. Overall, in 2 cases, ORIF was done along with rhinoplasty out of 13 cases. After 6 months follow-up, we assessed the objective parameter by clinical measurements, and we found the improvement of nasal function, characteristic facial angle [Figure 2a-d], symmetry of nostril, columella length, vertical positioning of alar base [Figure 3a and b], depressed nasal dorsum [Figure 3c and d], and nasal axis deviation [Figure 3e and f]. Arima et al. found no difference in quality of life between follow-up periods of 6 months and 10 years. Our data correlated with the study of Gassling et al.; 2015, Reddy et al.; 2013, and Pitak-Arnnop et al.; 2011.

In the literature, no reports exist that concerning the combined use of objective and quantitative measures of

Graph 1: Showing significant improvement of nasolabial angle

Graph 2: Showing significant improvement of nasofrontal angle

Graph 3: Showing significant improvement of subjective outcome
esthetich assessment and morphology to predict and evaluate the nasal and facial esthetics. However, our study has combinedly used both objective and subjective outcomes which are similar to that of Gassling et al., 2015.

Rhinoplasty in the cleft lip and palate improves both subjective and objective outcome of facial appearance and thus may help in the psychological rehabilitation of affected patient.

CONCLUSION

Our study suggests both objective and subjective improvement of facial appearance after secondary rhinoplasty in trauma and cleft lip and palate patients. We included nasal trauma patients with associated other facial fractures for this study. There was total male predominance in our study with only five female cases. The peak incidence of nasal trauma was mostly seen in males within the age group of 21–40 years. The secondary cleft nose patients were only female and treated within age of 17–20 years. Rhinoplasty contributes to function even though it was correlated to objective esthetic rating by the surgeon and subjective patient satisfaction as a result of their perceived improvement in the appearance. The mean postoperative subjective outcome was significantly higher than mean preoperative subjective outcome ($t_{19} = 7.27; P < 0.0001$). Thus, significant improvement was observed over subjective and objective outcome after the surgery.

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Conflicts of interest
There are no conflicts of interest.

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Figure 3: (a) Preoperative and (b) postoperative symmetry of nostril, columella length, vertical positioning of alar base. (c) Preoperative and (d) postoperative nasal dorsum. (e) Preoperative and (f) postoperative nasal axis.
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