Rhinoplasty techniques in repair of secondary cleft lip nasal deformity

Abdelrahman K. A. Hassan[a*], Mahmoud A. Hifny[a], Ahmed A. A. Ali[a], , Samia Saied[b]
[a]Plastic Surgery Department, Faculty of Medicine, South Valley University, Qena, Egypt.
[b]Plastic Surgery Department, Faculty of Medicine, Sohag University, Sohag, Egypt.

Abstract
Background: Tissue distortion and malposition cause clefts in stillborn foetuses. Facial growth complicates the basic cleft nasal deformity into the secondary deformity.
Objectives: The aim of this study was to Evaluation of the different rhinoplasty techniques in management of secondary cleft lip nasal deformity Comparing the results of the secondary rhinoplasty in patients who had primary correction and others with no prior correction.
Patients and methods: This Prospective study was carried out in Plastic surgery department, Qena university hospital, South Valley University on 20 patients with nasal deformities.
Results: There was a significant difference between the two groups with regard to the change in hemicollumellar length and tip height between before and after surgery. In group A, there were considerable variations in preoperative and postoperative results. The Postoperative Alar width were significantly different between the two groups. Regarding the Third Aesthetic rating, there were significant differences between the two groups. In group A, there were substantial differences in preoperative and postoperative satisfaction with appearance as well as contentment with appearance among family and friends.
Conclusion: Successful adjunctive surgery, rhinoplasty, strengthens the alar margin, prevents the alar rim from collapsing, and provides supports for the cleft-side alar rim. Stopping postoperative retraction can be done as a prophylactic treatment in people with damaged lower lateral cartilage.
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***Correspondence**: draman1212@gmail.com
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Introduction

The primary cleft nasal deformity is characterised by, hypoplasia and malposition of the lower lateral cartilage, interruption of the muscle ring across the nasal sill, and abnormal muscle insertions at the alar base along with septal deviation. **McComb (1995)** reported that the nasal structure malposition is the main contributor to this malformation. . Additionally, The ala may be underdeveloped and weak, which contributes further to lower nasal dome on the cleft side (**Byrd et al., 2017**).

Tip projection is further compromised by a foreshortened columella that lies obliquely with its base directed away from the cleft side (**Fisher et al., 2011).** The secondary nasal deformity may comprise most, if not all, of the previous features. It is defined as those distortions that persist despite primary operative maneuvers **(Kim , 2008).**

Residual deformity is a result of "failure to correct," under correction, or relapse (**Elmofty,2019).** The deformed soft tissue and skeletal foundation are further complicated by the long-term effects of anatomic growth and surgical scarring **(Kaufman, 2012).**

There was a controversy about the time of the definitive repair of the cleft nasal deformity and whether it is preferred to perform primary rhinoplasty with the time of chelioplasty (3-6 months), or we should wait for the time of secondary (definitive) rhinoplasty which is above 16 years in females and 18 years in males. Many studies have disagreed with that early nasal cartilage manipulation interferes with growth. studies by (**McComb and Coghlan,1996)** mentioned that repositioning of the lower lateral cartilage without cartilage resection did not interfere with development of the nose or mid-face.

Morovic and Cutting (2005) Showed that primary rhinoplasty is beneficial as it allows for an earlier nasal shape restoration with more symmetric nasal growth which may lessen or eliminate the need for secondary cleft rhinoplasty. However, the secondary cleft nasal deformity is still a common problem that has both consistent and reliable findings, as well as distinctive nuances. Furthermore, it represents a formidable challenge in rhinoplasty. The aim of this study was to compare the results of the secondary rhinoplasty in patients who had undergone primary nasal repair with the repair of the cleft lip and others with no previous surgical intervention

Patients and methods

This Prospective study included 20 patients aged 16 years and older who is complaining of cleft nasal deformity and underwent corrective secondary rhinoplasty. This study was carried out in Plastic surgery department, Qena university hospital, South Valley University, during the period from October 2020 to September 2022

Inclusion criteria: Patients with cleft lip nasal deformity, patients compliant for follow up, a patients with previous operative files

Exclusion criteria: Other congenital non-cleft patients, nasal deformity due to traumatic case, systemic or medical diseases that affect bone healing and patients non-compliant for follow up

An Official permission was obtained from the ethical committee of faculty of medicine, Qena university hospital, South Valley University.

Ethical approval code :SVU-MED-PIS013-2-21-4-179. All participants gave informed consent after being told of the purpose, methodology, and any applicable goals of the study.

All patients included in the study were subjected to the following: Complete and accurate history taking with reviewing of all prior operative notes, and assessment for cleft nasal deformity through standard and systematic nasofacial analysis. All patients underwent four photograph views (full face frontal view, submental oblique view, right profile view, and left profile view). The deformity of each patient should be examined carefully and stated **(Table.1).**

Operative techniques

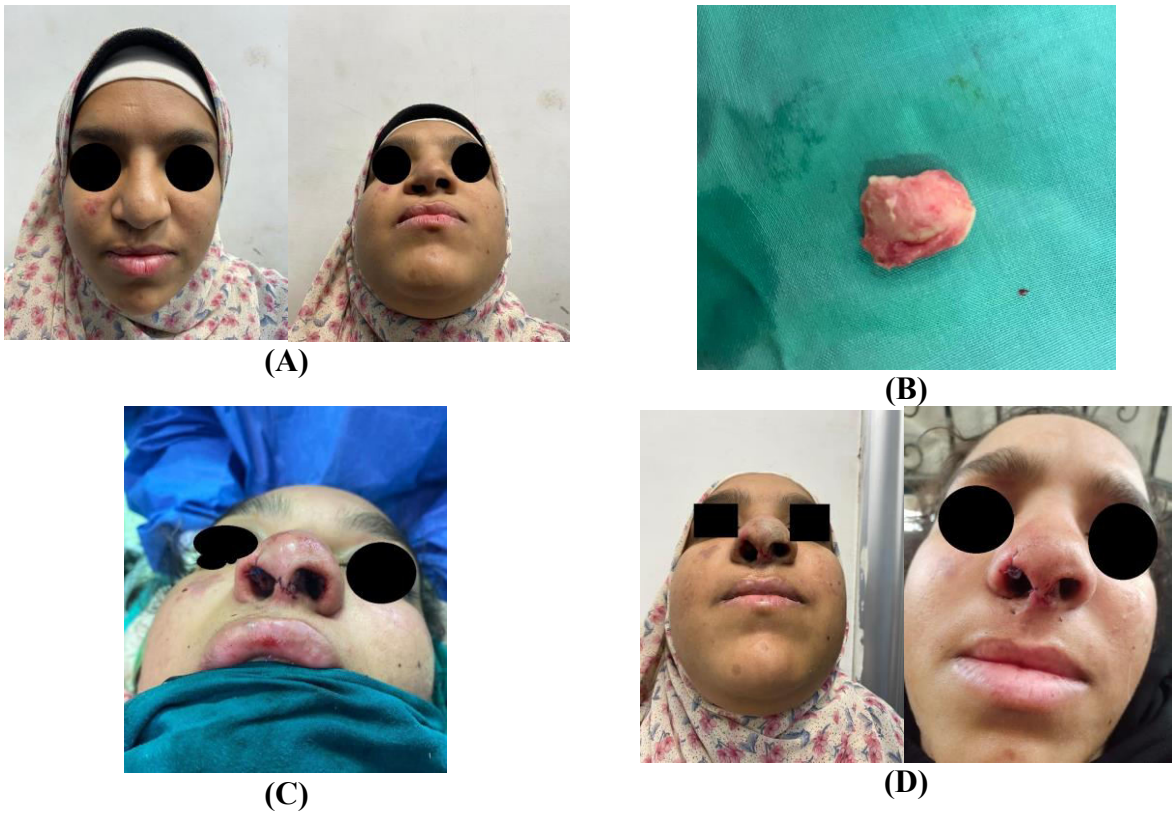
Tip rhinoplasty was done to the patients with open technique **(Fig. 1)** including, a Columellar strut graft by **Dibbell (1982)** in 25% of cases, Alar strut graft and an alar base excision in the rest of cases as was described by **Haddock et al. (2012)** , Moified Tajima technique (inverted U alar rim incision) also was used in mild cases without the need for cartilage grafting, (**Tajima, 1977).**

Open rhinoplasty technique was used in all cases, with collumellar incision and marginal lateral nasal wall incision in order to visualize the lower lateral cartilages **(Fig.2)** According to **Haddock et al. (2012)**, the patients in both groups were classified into mild (no need for collumellar lengthening), severe (need more than 5 mm collumellar lengthening) and , moderate cases (in between). In our study, tip rhinoplasty was done through modified Tajima technique (inverted U

alar rim incision) in mild cases with suturing of the LLC through either interdomal, transdomal and medial crural sutures and without the need for cartilage grafting **(Fig. 3).**

Table1. Pre-operative deformities in both groups

	Group A	Group B	Operations done
Alar collapse	3	4	Alar contour and strut grafts
Short collumella	4	7	Collumellar strut and V-Y incision
Poor tip definition	6	8	Transdomal, Interdomal and medial crural suturing
Nasal floor	1	2	Alar base excision



(A) **(B)** **(C)** **(D)**

Fig. 1. (A) Preoperative Photos for 18 yrs old pt. With Rt. CL nasal deformity; **(B)** Intraoperative photo for post Conchal cartilage for reconstruction by alar strut graft; **(C)** Immediate postoperative Photo; **(D)** Late postoperative Photos.

Fig. 2.Direct visualization of LLC with hypoplasia on the Lt. side

Fig. 3. LLC exposure and preparing for trans- and inter-domal sutures

Moderate and severe cases needed cartilage onlay grafts, collumellar Strut **(Fig. 4)** and Alar Strut grafts **(Fig. 5,6)** Furthermore, in severe cases we added (V-Y) collumellar incision with open rhinoplasty as recommended by **Guyuron (2008)** in order to elongate the collumella and lift the nasal tip. The cartilage grafts were harvested from either Conchal cartilage or Costal cartilage. The alar base excision was done as needed. After good hemostasis the skin envelope is redraped and closed **(Fig. 1C. &Table 2)**.

Fig. 4. Collumellar strut and medial crural sutures

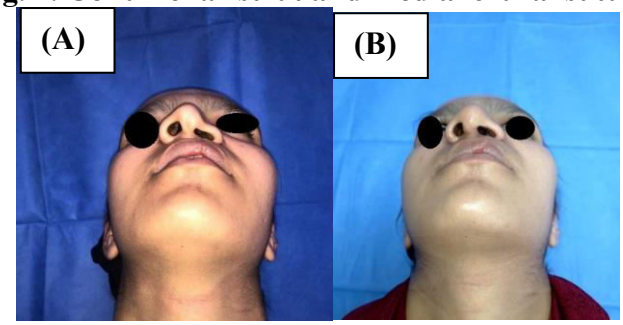


Fig. 5. 16 year-old female pt. with lt. CL nasal deformity(Group A); (A) pre-operative; (B) post-operative

Table 2. Procedures done in both groups

	Group A		Group B	
Type	**Unilateral 8**	**Bilateral 2**	**Unilateral 9**	**Bilateral 1**
Suturing the LLCs	**3**	**0**	**2**	**0**
Alar strut graft	**5**	**0**	**6**	**0**

Collumellar strut graft	**0**	**2**	**1**	**1**
Alar resection	**3**	**2**	**4**	**1**

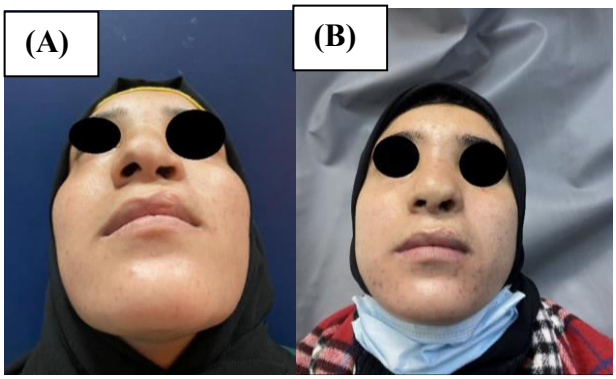


Fig. 6. 18 year-old female pt. with lt. CL nasal deformity (Group B); (A)Pre-operative; (B)Post-operative

The cartilage grafts were harvested from Conchal cartilage (6 cases in group A and 7 in group B) **(Fig. 1B)**, and costal cartilage (1 case in group A and 2 in group B)

Postoperative evaluation parameters: Anthropometric measures (hemicollumellar length , hemitip height and alar width) , Patient's satisfaction and surgeon's satisfaction.

Anthropometric measures:

We use anthropometric clinical measurements to assess postoperative outcome results:

1. **Hemicollumellar length:** The distance measured between the collumellar base and the connection between nostril tip and subnasale in one side.
2. **Hemitip height :** the distance between the nasion and point at which nasal septum joins the upper lip**.**
3. **Alar width :** Distance between the most distal point on the ala and the columella (medial edge).

Patient's satisfaction

Rhinoplasty Outcome Evaluation (ROE) questionnaire **Alsarraf (2001)** is a reliable tool for measuring patient satisfaction after rhinoplasty. There are six questions here that probe the patients' perceptions of their nasal structure and performance. Each metric is given a score between 0 and 4, wherein the lowest and highest possible marks indicate the best and worst cases, respectively. The final satisfaction score is calculated by dividing the sum by 24, then multiplying by 100. Patients can range from being extremely happy (75-100%) to merely satisfied (50%-75%), or even dissatisfied (0%-50%) **.**

This questionnaire includes:

1- How well do you like the appearance of your nose?
2- How well are you able to breathe through your nose?
3- How much do you feel that your friends and loved ones like your nose ?
4- Do you think your current nasal appearance limits you social or professional activities?
5- How confident are you that your nasal appearance is the best that it can be ?
6- Would you like to surgically alter the appearance or function of your nose ?

Each question has five answers with grades as following:

0- Not at all
1- Somewhat
2- Moderately
3- Very much
4- completely

Both the pre- and post-op nasal conditions were to be recorded on the ROE, which the patients were requested to fill out. Last but not least, patients were asked if they would go through with the procedure again knowing the outcome.

Surgeon's satisfaction

An objective method in evaluation is the surgeon's satisfaction, three experts evaluate the results (3-6) months postoperatively with grades (0-10), and calculating the mean in each group , comparing the result with the other group .

Statistical Analysis

Using SPSS version 20, data entry, processing, and statistical analysis were completed (Statistical Package for the Social Sciences). The significance tests for Kruskal-Wallis, Wilcoxon, Chi-Square, logistic regression analysis, and Spearman's correlation were used. Each variable's data type (parametric and non-parametric) was reported, and the appropriate analysis was run. Statistical significance was defined as a P-value of 0.05 or below (5%).

Results

This study was done on 20 patients with nasal deformities due to cleft lip who are admitted to plastic surgery department, South Valley University. The patients categorized into 2 groups with 10 patients each: **Group (A)**: Patients who had primary repair of the nose. **Group (B):** Patients who had no prior repair. The demographic traits of the two study groups 40% of the members of group A were males, and the average age was 18.3±4.5. The mean age of group B was 18.4±4.6, and 40.0% of the participants were males. Between the two groups, there were no discernible differences in terms of demographic traits **(Table 3).**

Table 3. Demographic characteristics among the studied groups

Variables		Group (A) (n = 10)		Group (B) (n = 10)		Test value	P-value
		N	%	N	%		
Sex	Male	4	40.0 %	4	40.0%	X^2= 0.0	1.0
	Female	6	60.0 %	6	60.0%		
Age		18.3± 4.5		18.4± 4.6		1.32	0.45

P value< 0.05 is significant, P value< 0.01 is highly significant, SD: Standard deviation, ZMWU = Mann- Whitney U test, X^2= Chi- Square test

The differences in HEMICOL LENGTH between the two groups before and after surgery. Preoperative HEMICOL LENGTH in **group A** was 3.6±0.83 and postoperative HEMICOL LENGTH was 5.1±1.4. Preoperative HEMICOL LENGTH in **group B** was 4±1.1, while postoperative HEMICOL LENGTH was 4±1.0. Regarding the change in HEMICOL LENGTH between before and after surgery, there was a substantial difference between the two groups. There were notable differences between preoperative and postoperative outcomes in group A **(Table.4).**

Table 4. Comparison between both groups regarding the difference in HEMICOL LENGTH (hemi-collumellar) before and after surgery

Variables	Group (A) (n = 10)	Group (B) (n = 10)	Test value	P-value
Preoperative	3.6±0.83	4±1.1	1.69	0.20
Postoperative	5.1±1.4	4.0± 1.0	1.05	0.90
P	**0.001**	0.09		

P value< 0.05 is significant, P value< 0.01 is highly significant, SD: Standard deviation, ZMWU = Mann- Whitney U test, X^2= Chi- Square test . Group (A): Patients who had primary repair of the nose. Group (B): Patients who had no prior repair.

The effect of the interventions on the HEMITIP HEIGHT parameters. In **group A**, Preoperative HEMITIP HEIGHT was 9.5±1.51, Postoperative was 11.2±2.55. In **group B**, Preoperative

HEMITIP HEIGHT was 9.8±1.62, Postoperative was 10.5±2.72**.** In group A, there were significant difference between Preoperative and Postoperative **(Table. 5).**

Table 5. Comparison between both operations and their effect on the HEMITIP HEIGHT parameters

Variables	**Group (A) (n = 10)**	**Group (B) (n = 10)**	**Test value**	**P-value**
Preoperative	9.5±1.51	9.8±1.62	1.68	0.40
Postoperative	11.2±2.55	10.5±2.72	1.07	0.98
P	**0.01**	**0.01**		

P value< 0.05 is significant, P value< 0.01 is highly significant, SD: Standard deviation, ^{Z}MWU = Mann- Whitney U test, X^2= Chi- Square test

The effect on the Alar width parameters**.** In group A, the mean Preoperative Alar width parameters was 12±2.5, Postoperative was 10.7±1.45. In group B, the mean Preoperative Alar width parameters was 10.2±1.05, Postoperative was 9.8±2.22. There was high significant difference between both groups as regard Postoperative Alar width parameters. There was high significant difference between Preoperative and Postoperative in group A as regard Alar width parameters **(Table.6).**

Table 6. Comparison between pre and post operative effect on the Alar width parameters

Variables	**Group (A) (n = 10)**	**Group (B) (n = 10)**	**Test value**	**P-value**
Preoperative	12±2.5	10.2±1.05	1.69	0.20
Postoperative	10.7±1.45	9.8±2.22	3.5	**0.016**
P	**0.01**	0.05		

Aesthetic assessment of the three experts (3-6) months after the operation between both groups. In **group A**, First was 6.8 ±0.76, Second was 6.6± 0.51, Third was 5.6 ±0.51. In **group B**, First was 6.9 ±0.78, second was 6.6 ±0.84, and third was 6.6 ±0.84. There were significant differences between both groups **(Table 7).**

Table 7. Aesthetic assessment of the three experts after the operation between both groups

Variables	**Group (A) (n = 10)**	**Group (B) (n = 10)**	**Test value**	**P-value**
First	6.8 ±0.76	6.9 ±0.78	1.69	0.20
Second	6.6± 0.51	6.6 ±0.84	1.04	0.98
Third	5.6 ±0.51	6.6 ±0.84	2.3	**0.01**

P value< 0.05 is significant, P value< 0.01 is highly significant, SD: Standard deviation, ^{Z}MWU = Mann- Whitney U test, X^2= Chi- Square test

In **group A**, there were high significant difference between preoperative and postoperative Satisfaction with appearance. In **group B**, there were high significant difference between preoperative and postoperative Satisfaction with appearance **(Table.8).**

Table 8. Comparison between pre- and post-operative satisfaction with appearance.

Satisfaction with appearance	Group (A) (n = 10)						Group (B) (n = 10)						Test value	P-value
	Very satisfied		Satisfied		Dissatisfied		Very satisfied		Satisfied		Dissatisfied			
	N	%	N	%	N	%	N	%	N	%	N	%		
Preoperative	0	0 %	3	30%	7	70%	0	0%	2	20%	8	80%	0.0	1.00
Postoperative	4	40 %	5	50%	1	10%	2	20%	7	70%	1	10%	1.00	0.607
P-value	**0.011**						**0.006**							

P value< 0.05 is significant, P value< 0.01 is highly significant, SD: Standard deviation, ^{Z}MWU = Mann- Whitney U test, X^2= Chi- Square test

Discussion

In cases with cleft lip nasal deformity, rhinoplasty aims to restore nasal symmetry from an aesthetic and functional standpoint, as well as to improve the nasal airway. Understanding the pathogenesis and characteristics of the deformity is necessary for this **(Olds et al., 2022)**.

Cleft nasal deformity is a complicated problem that should be addressed during multiple stages of the patient's life **(Kaufman, 2012).**

Early primary nasal correction at the time of cleft labial repair provides a cartilaginous foundation that minimizes subsequent deformity but does not obviate the likely need for "revisions**" (Lo,2006) .**

This current study aimed to compare the results of the secondary rhinoplasty in patients who had undergone primary nasal repair to the others with no previous surgical intervention. We evaluated our outcomes through postoperative anthropometric measurements including hemicolomellar, hemitip length and alar width, and demonstrate the subjective and objective satisfaction for each case.

This study involved 20 individuals who had secondary cleft nasal deformities. We divided our patients into two groups **Group (A) include patients** who underwent initial primary rhinoplasty and **Group (B) involve** those who had no prior repairs

Regarding The demographic characteristics of the two research groups, were quite similar and not significantly different.. The average age of **group A** participants was 18.3± 4.5, and 40% of them were male. The participants in **Group B** had a mean age of 18.4±4.6 and were 40.0% male.

Our study showed the the HEMICOL LENGTH hasasignificant difference between the two groups. The difference was highly significant among preoperative and postoperative results found in group A. Concerning to the HEMITIP height, there was significant differences among preoperative and postoperative results were found in group A.

As regards to the Alar width, the mean preoperative and postoperative alar width in group A were 12±2.5 and 10.7±1.45 respectively, while the alar width in group B were 10.2±1.05 and 9.8± 2.22 respectively. There was a high significant difference among Preoperative and Postoperative in group A **.**

In accordance with our results **An et al.(2021),** reported that anterior projection of the cleft-side alar base showed improvement in 100% of the treated cases, with ameliorated alar symmetry in unilateral cleft patients.

Cho et al. (2022) demonstrated through photogrammetric evaluation that the height of the medial nostril and short axis of the nostril on the cleft side were increased and corrected similar to that of the non-cleft side. Additionally, **Vass et al. (2016)** noticed that all patients showed

improvement of the appearance of their nose with less stigmatization from the society.

Our results showed that as regard Aesthetic assessment of the three experts after the operation between both groups. In group A, first was 6.8 ±0.76, Second was 6.6± 0.51, Third was 5.6 ±0.51. In group B, first was 6.9 ±0.78, second was 6.6 ±0.84, third was 6.6 ±0.84. There was significant difference between both groups as regard Third Aesthetic assessment.

Our results were supported by study of **An et al. (2021),** as they reported that anterior projection of the cleft-side alar base showed improvement in 100% of the treated cases, with ameliorated alar symmetry in unilateral cleft patients. All individuals were satisfied with cosmetic improvement (20/20) and nasal function (16/16). A single case of graft displacement was found, and underwent successful treatment by a secondary operation. Despite the impressive improvement observed in their study, the alar base position remained imperfect long time after surgery. This may be explained by challenging nasal sill area augmentation. Another potential reason is that diced costal cartilage grafts may be absorbed partially for a long time, and the muscle may be slightly displaced with time.

Similarly, **Zhang et al. (2021)**, demonstrated that more than 95% of the patients were satisfied with the overall aesthetic outcome of the surgery.

Byrd et al. (**2007)** in creating an algorithm for secondary cleft lip nasal repair, noted that lesser degrees of the deformity are seen in those that have had nasal repair at initial lip repair. Our experience reinforces their report in that primary nasal repair is durable and decreases the extent of secondary surgery in adolescents.

Conclusion

Rhinoplasty, an effective adjunctive technique, improves the alar margin, prevents the alar rim from collapsing, and provides supports to the cleft-side alar rim. It can be a prophylactic measure to prevent postoperative retraction in patients with weakened lower lateral cartilages. Lower lateral cartilage repositioning, columellar strut, and nasal tip plasty are useful for correcting severe secondary unilateral CLND.

The benefit of nasal repair at time of chelioplasty is that it allows for an earlier nasal shape restoration with more symmetric nasal growth, and some authors mentioned that this had more successful outcomes.

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