

# Assessment of Surgical Outcome in Patients with Unilateral Cleft Lip Repair Using Two-Dimensional Clinical Photographs

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## Abstract

**Aim:** This study aimed to evaluate the treatment outcomes of surgical therapy for unilateral cleft lip repair using quantitative (anthropometric) assessment and two-dimensional (2D) photographic analysis. **Materials and Methods:** The study included 125 participants who met the “rule of 10,” had a unilateral cleft lip, and were seeking primary surgery. A comparative retrospective study was conducted using patients’ clinical records and facial photographs from the archives of a prestigious cleft lip and palate center in India. This study evaluated the clinical outcomes of cleft lip surgery in children aged 6–72 months old. Extraoral 2D photographs, Adobe Photoshop CS6 software, and visual and measurable parameters were evaluated. **Results:** The average pre- and post-operative difference in lip length was  $-1.504 \pm 1.6$  cm, indicating a significant increase in lip length following the procedure. The mean pre- and post-operative differences in lip height were  $-1.856 \pm 1.312$  mm, which showed a significant increase in lip height post-operatively. Similarly, a significant increase in columella size was observed. The mean pre- and post-operative differences in nostril height were  $-0.216 \pm 0.989$ . The findings indicated a significant increase in the post-operative nostril height. **Conclusion:** It was concluded that quantitative (anthropometric) assessment using 2D photographic analysis can be an effective tool for assessing surgical outcomes in patients with unilateral cleft lip.

**Key words:** Anthropometry assessment, Two-dimensional photographic analysis, Unilateral cleft lip

## INTRODUCTION

Lip and palate clefts result from inadequate development, defects, and dislocation caused by functional disequilibrium of the split musculature of the soft palate and lip, rather than from a basic absence of tissue structure or supporting skeletal components.<sup>[1-3]</sup> Both parents and affected persons are concerned about related functional and cosmetic limitations, particularly those who become self-conscious about an unresolved deficiency or substandard repair. Numerous psychosocial aspects were also affected. Perfect surgery for the correction of unilateral lip/palate (UCL/P) would result in an upper lip that is symmetrical with an equivalent length of the philtral column on both sides.<sup>[4-6]</sup> The scar should not cross the philtral column, but should reflect the other

side. In addition, there should be no cutting of the vermillion or peeping at the Cupid’s bow on the side of the cleft. Furthermore, Cupid’s bow must be of the right size.<sup>[7-9]</sup>

The results of treating UCL/P may differ greatly due to differences in the timing and sequence of procedures, as well as in the training and expertise of different surgeons. Therefore, evaluating therapy results is crucial for determining and

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implementing the most appropriate levels of care.<sup>[10-12]</sup> Since nasolabial presentation permits both evolving and harmonious growth of the mid-face along with esthetic rectification of the malformation, it is perhaps one of the most significant indicators of the effectiveness of therapy for UCL.<sup>[13-15]</sup>

Surgery-based treatment outcomes are required to help surgeons defend timing or technique changes and to provide a better understanding of the varying sensitivity of maturing tissues to surgical reconstruction. Numerous studies have shown that cheiloplasty significantly alters the appearance of the nasolabial region. In addition, because developing tissues frequently respond differently to surgical repair, post-operative outcomes are unpredictable.<sup>[12-14]</sup> Outcomes differ depending on the surgical technique and center. One of the most important markers of the success of UCL surgical reconstruction is nasolabial presentation, which allows for both esthetic correction of the deformity and progressive harmonic evolution of the mid-face.<sup>[15-17]</sup>

Techniques for measuring nasolabial presentation can be broadly divided into two categories: Quantitative and qualitative. Earlier methods objectively assessed the degree of asymmetry and abnormal morphology using facial dimensions.<sup>[18-20]</sup> Subjective assessment of beauty and esthetics is difficult, but it typically reflects the patient's and society's perception of facial handicaps.<sup>[21,22]</sup> Scoring systems, ranking systems, indices, and scales are used in qualitative approaches, which are more subjective in assessing impairments related to appearance and facial esthetics.<sup>[23-26]</sup>

Several variables affect the response of cleft lip and palate (CLP) patients to treatment. Nonetheless, most studies conducted worldwide have assessed treatment outcomes using various indices and individual characteristics.<sup>[27,28]</sup> However, few studies have examined the factors affecting children with CLP by simultaneously considering multiple factors.

Hence, the present study aimed to evaluate the treatment outcomes of surgical therapy for unilateral cleft lip repair using quantitative (anthropometric) assessment and two-dimensional (2D) photographic analysis. This study will contribute useful data regarding primary cleft lip repair surgical outcomes, which may be helpful for clinicians and oro-maxillofacial surgeons to impart ideal and overall facial esthetics. This study investigated, for the 1<sup>st</sup> time, the surgical outcomes of primary cleft lip repair using 2D photograph acquisition. To date, no such study has been performed in such centers for various populations.”

## MATERIALS AND METHODS

### Study population

The study included 125 participants who met the “rule of 10,” had unilateral cleft lip, and were seeking primary

surgery. A comparative retrospective study was conducted using patients' clinical records and facial photographs from the archives of a prestigious CLP center in India. This study evaluated the clinical outcomes of cleft lip surgery in children aged 6–72 months old. Participants with bilateral cleft lips and those who underwent cleft surgery were excluded.

Using a straightforward random sampling technique, 125 participants who met the inclusion or exclusion criteria were selected to participate in the study. First, the UCL subjects were chosen from the record archives of several centers. Every UCL subject had a special number. To prevent selection bias, a program running on a computer “random number generator” randomly chooses codes that have been allocated to every participant of the UCL population in a distinctive manner for selection from all centers.

### Pre-operative evaluation

All patients underwent standard pre-operative blood tests, including electrocardiography, creatinine and urea levels, hemoglobin estimation, and electrolyte testing. Echocardiography was performed when necessary. To exclude cardiovascular congenital malformations, infections of the upper respiratory tract, ear infections, and other types of clinically significant congenital anomalies, the participants were referred to a physician for clinical assessment. The subjects weighed 4.5 kg (10 pounds), were at least 3 months old, and had a hemoglobin content of at least 10 g/dL.

### Operative procedure

Surgical repair was performed under general anesthesia using endotracheal intubation for subjects under the age of 12 years and under local anesthesia using 2% xylocaine and adrenaline 1:80,000 for patients above the age of 12 years. Surgeons with expertise in CLP surgery performed the surgical corrections. Two surgeons used the Millard technique.

The other study employed only the afroze technique. To assess surgical success, the participants were examined after the procedure and subsequently once a month for 3 months.

### Evaluation of surgical outcome

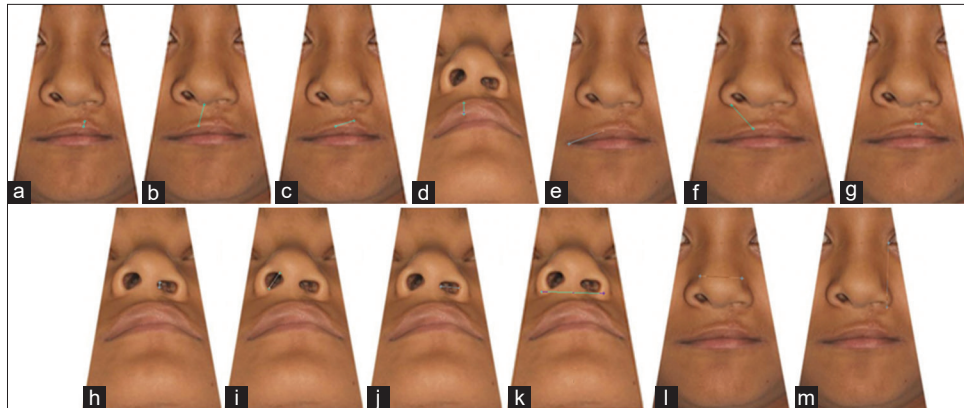
Extraoral 2D photographs, Adobe Photoshop CS6 software, and visual and measurable parameters were evaluated.

### Visual parameters

Standardized digital photographs of the patients' entire faces, profiles, submental oblique views, and nasolabial areas were considered for esthetic assessment of the nasolabial region. The photos were standardized. Light color was used as the background for the photo to improve the distinction between skin tone and reduce the likelihood of shadows. The grading methodology has been described by Johnson and Sandy (2003) [Table 1 and Figure 1].

**Table 1:** Anthropometric measurement outcomes of cleft lip and nose parameters

Dimension	No disparity	Mild disparity	Severe disparity
White roll (A)	Matched	Disparity of <1 mm	Disparity of more than 1 mm
Philtral height (B)	Equal	Disparity of <1 mm	Disparity of more than 1 mm
Cupids bow width (C)	Equal	Distortion of <2 mm	Distortion of more than 2 mm
Vermillion (D)	Matched	Disparity of <1 mm	Disparity of more than 1 mm
Lip length (E)	Equal	Disparity of <2 mm.	Disparity of more than 2 mm
Lip height (F)	Equal	Disparity of <2 mm.	Disparity of more than 2 mm.
Scar (G)	Normal (linear scar of 1 mm)	Scar <2 mm	Scar more than 2 mm
Columella length (H)	Equal	Difference of <1 mm	Difference of more than 1mm
Nostril height (I)	Equal	Variation <2 mm	Variation more than 2 mm
Nostril width (J)	Equal	Variation <2 mm	Variation more than 2 mm
Nasal width (K)	Equal	Variation <2 mm	Variation more than 2 mm
Nasal dome (L)	Curvatures are equal on both sides	Variation of <1 mm	Variation of more than 1 mm
Nasocanthal length (M)	At the same level as the normal side	Difference <2 mm compared to the normal side	Difference more than 2 mm compared to the normal side



**Figure 1:** (a-m) Illustrates anthropometric measurements of cleft lip and nose parameters

**Esthetic assessment grading was carried out as followed**

Grade 1: Excellent – good in all features.

Profile: Class I soft tissue profile.

Frontal: Upper lip: Symmetrical, scarring minimal, vermillion continuous.

Nose: Nostrils symmetrical in size, shape, and height, columella central, alar bases symmetrical.

Grade 2: Good – imperfections in two or three features.

Profile: Class I or very mild Class III soft tissue profile.

Frontal: Upper lip: slight asymmetry, scarring minor faults, vermillion discontinuity.

Nose: Nostrils slightly flawed columella off central, alar bases asymmetrical.”

Grade 3: Fair – several poor features.

Profile: Mild–moderate class III soft tissue profile.

Frontal: Upper lip: Asymmetry, scarring more noticeable, vermillion discontinuity.

Nose: Nostril asymmetry or flattening, columella deviated, alar bases asymmetrical.”

Grade 4: Poor – some very poor features.

Profile: Moderate–severe Class III soft tissue profile.

Frontal: Upper lip: Asymmetry, scarring quite noticeable, vermillion discontinuity.

Nose: Nostrils very flattened, columella deviated, alar bases asymmetrical and distorted.”

Grade 5: Very poor – overall very poor features.

Profile: Severe Class III soft tissue profile.

Frontal: Upper lip: Asymmetry, scarring noticeable, vermilion discontinuity.

Nose: Nostrils very flattened, columella deviated, alar bases asymmetrical and distorted.

### Measurement of various parameters

Various anthropometric measurement outcomes of cleft lip and nose parameters with their dimensions are shown below [Figure 1]:

White roll (A): Measured from the superior point on the skin and the inferior point of the mucosa at the junction of the peak of cupid's at the cleft side.

Philtral height (B): Measured from the peak of Cupid's bow to the midpoint of the columella for both the cleft and non-cleft sides.

Cupid's bow width (C): Measured from the peak of Cupid's bow on one side to the peak on the other side.

Vermillion (D): The height of vermilion is measured between the white skin roll and the red line of mucosa.

Lip length (E): Measured from the peak of Cupid's bow on the non-cleft side to the ipsilateral commissure of the mouth. Horizontal lip length on cleft side: Measured from where the white roll starts to fade out to the ipsilateral commissure.

Lip height (F): Measured from the alar base to the peak of Cupid's bow on the same side. Vertical lip height on cleft side: Measured from the alar base on the cleft side to a point where the white roll begins to disappear.

Scar (G): Measurement from mesial end to distal end.

Columella (H): The highest part of the nostril sill to the base of the nose.

Nostril height (I): Measured by a perpendicular line from the highest part of the nostril sill to the base of the nostril.

Nostril width (J): Measured by a perpendicular line from the narrowest part of the columella to lateral wall of ala.

Nasal width (K): Measured from the ala base on the cleft side to the alar base on the non-cleft side.

Nasal dome (L): The highest point on the curved cartilage on one side to the other side.

Nasocanthal length (M): Medial canthus to the alar base.

The anthropometric measurement outcomes of cleft lip and nose parameters are shown [Table 1 and Figure 1]. The anthropometric measurement grading utilized in this study is shown in Table 2.

## RESULTS

The upper lip was symmetrical in 86 (68.8%) patients, asymmetrical in 27 (21.6%) patients, and slightly asymmetrical in 12 (9.6%) patients. Scarring was minimal in the upper lip in 62 (49.6%) patients, minor faults in 36 (28.8%) patients, more noticeable in two (1.6%) patients, and noticeable in 20 (25%) patients. The upper lip vermilion was continuous in 95 patients (76.0%), whereas vermilion deformity was observed in 30 patients (24%). Nostril symmetry was symmetrical in 82 (65.6%) patients and asymmetrical in 43 (34.4%). The nasal shape was symmetrical in 81 patients (64.8%) and asymmetrical in 44 (35.2%). The nasal height was symmetrical in 86 (68.8%) and asymmetrical in 39 (31.2%) patients. The columella was centrally located in 96 (76.8%) patients and deviated in 29 (23.2%). The alar was symmetrical in 113 (90.4%) patients and asymmetrical in 12 (9.6%). Based on the post-operative photographic analysis of the variables, the overall outcome was excellent in 51 (40.8%) patients, good in 29 (23.2%), fair in 27 (21.6%), and poor in 18 (14.4%) [Table 3].

In this study, 70 patients were male and 55 were female. No correction was required in 22 (31.4%) patients, and lip correction was performed in 21 (30.0%) patients. Cheiloplasty was required in 27 (38.6%) male patients. In contrast, no correction was required in 29 (52.7%) patients, and lip corrections were required in eight (14.5%) patients. Cheiloplasty was required in 18 female patients (32.7%). The proportion of patients without correction was greater in female than that in male. These findings are statistically significant. Surgical outcomes were significantly associated with patient sex ( $P = 0.032$ ) [Table 4].

The mean pre- and post-operative differences in the white roll were  $-0.464 \pm 0.501$ . The findings were statistically significant, with an increase in the white roll post-operatively (95% confidence interval) CI  $[-0.553, -0.375]$  [ $P < 0.001$ ]. The mean pre- and post-operative differences

**Table 2: Anthropometric measurement grading**

Excellent	All the parameters have no disparity.
Good	<2 parameters of lip show mild disparity.
Fair	More than 2 parameters of lip show severe disparity, and <2 nasal parameters show mild disparity.
Poor	More than 2 lip parameters show severe disparity, and more than 2 nasal parameters show severe disparity.
Very Poor	When all the parameters have a severe disparity

in the philtral ridge were  $2.816 \pm 1.227$ . The findings were statistically significant, with an increase in the philtral ridge

**Table 3: Post-surgical Photographic analysis of the unilateral cleft lip**

Variables	n	%
Upper lip symmetry		
Symmetrical	86	68.8
Asymmetrical	27	21.6
Slightly asymmetrical	12	9.6
Upper lip scarring		
Scarring minimal	62	49.6
Scarring minor faults	36	28.8
Scarring more noticeable	2	1.6
Scarring quite noticeable	25	20.0
Scarring Noticeable	0	0.0
Upper lip vermilion		
Continous	95	76.0
Vermilion discontinuity	30	24.0
Nostril symmetry		
Symmetrical	82	65.6
Asymmetrical	43	34.4
Nasal shape		
Symmetrical	81	64.8
Asymmetrical	44	35.2
Nasal height		
Symmetrical	86	68.8
Asymmetrical	39	31.2
Columella		
Central	96	76.8
Deviated	29	23.2
Alar base		
Symmetrical	113	90.4
Asymmetrical	12	9.6
Outcome		
Excellent (1)	51	40.8
Good (2)	29	23.2
Fair (3)	27	21.6
Poor (4)	18	14.4

post-operatively, 95% CI (-3.033, -2.599) ( $P < 0.001$ ), and the mean pre-operative difference in the cupid bow was  $-0.2 \pm 1.040$ . The findings were statistically significant, with an increase in the Cupid's bow post-operatively, 95% CI (-0.384, -0.016) ( $P < 0.001$ ). The mean pre- and post-operative differences in vermilion were  $-1.048 \pm 1.023$ . The findings were statistically significant, with an increase in vermilion post-operatively, 95% CI (-0.867—11.456) ( $P = 0.033$ ). The mean pre- and post-operative differences in lip length were  $-1.504 \pm 1.688$  cm. The findings were statistically significant, with an increase in lip length post-operatively, 95% CI (-0.867, -11.456) ( $P < 0.001$ ) [Table 5].

The mean pre- and post-operative differences in lip height were  $-1.856 \pm 1.312$ . The findings were statistically significant, with an increase in lip height post-operatively (95% CI [-2.088, -1.624] [ $P < 0.001$ ]). The mean pre- and post-operative difference in the columella was  $-0.624 \pm 0.737$  mm. The findings were statistically significant, with an increase in columellar height post-operatively (95% CI [-0.754, -0.494] [ $P < 0.001$ ]). The mean pre- and post-operative differences in nostril height were  $-0.216 \pm 0.989$ . The findings were statistically significant with an increase in nostril height post-operatively (95% CI [-0.391, -0.041] [ $P = 0.016$ ]) [Table 5].

The mean pre- and post-operative differences in the nostril width were  $4.592 \pm 2.236$ . The findings were statistically significant, with a decrease in nostril width post-operatively (95% CI [4.196, 4.988] [ $P < 0.001$ ]). The mean pre- and post-operative differences in the nasal dome were  $0.12 \pm 1.33$  cm. The findings were statistically significant, with a decrease in the nasal dome post-operatively (95% CI [4.196, 4.988] [ $P = 0.315$ ]), and the mean pre- and post-operative difference in nasocanthus length was  $-0.624 \pm 1.6$ . The findings were statistically significant, with an increase in the post-operative NCL and 95% CI (-0.907, -0.341) ( $P < 0.001$ ). The mean pre- and post-operative difference in nasal width was  $2.488 \pm 1.673$ . The findings were statistically significant, with a post-operative decrease in nasal width (95% CI [2.192, 2.784] [ $P < 0.001$ ]) [Table 5].

“The philtral ridge was  $5.78 \pm 1.34$  mm on the cleft side post-operatively, while it was  $6.45 \pm 1.50$  mm on the side where the cleft was absent. Post-operatively, the philtral ridge is less pronounced on the cleft side. The findings were statistically significant ( $P = 0.000$ ). Vermilion was  $3.42 \pm 0.75$  at the side

**Table 4: Surgical outcomes based on the gender of the patients**

Outcome	Male		Female		$\chi^2$	df	P
	n	%	n	%			
No correction	22	31.4	29	52.7	6.888	2	0.032
Corrections at lip only	21	30.0	8	14.5			
Redo cheiloplasty.	27	38.6	18	32.7			
Total	70	100.0	55	100.0			

**Table 5: Pre- and post-operative comparison of variables in patients**

Variable	Comparison	Mean difference	SD	SEM	95% confidence interval of the difference		t	df	P	Effect size
					Lower	Upper				
					White roll	Pre-post				
Philtral ridge	Pre-post	-2.816	1.227	0.110	-3.033	-2.599	-25.654	124	<0.001	-2.29
Cupids bow	Pre-post	-0.2	1.040	0.093	-0.384	-0.016	-2.151	124	0.033	-0.19
Vermillion	Pre-post	-1.048	1.023	0.091	-1.229	-0.867	-11.456	124	<0.001	-1.02
Lip length	Pre-post	-1.504	1.688	0.151	-1.803	-1.205	-9.963	124	<0.001	-0.89
Lip height	Pre-post	-1.856	1.312	0.117	-2.088	-1.624	-15.818	124	<0.001	-1.41
Columella	Pre-post	-0.624	0.737	0.066	-0.754	-0.494	-9.468	124	<0.001	-0.85
Nostril height	Pre-post	-0.216	0.989	0.088	-0.391	-0.041	-2.443	124	0.016	-0.22
Nostril width	Pre-post	4.592	2.236	0.200	4.196	4.988	22.956	124	<0.001	2.05
Nasal dome	Pre-post	0.12	1.33	0.119	-0.115	0.355	1.009	124	0.315	0.09
Naso-canthal length	Pre-post	-0.624	1.6	0.143	-0.907	-0.341	-4.361	124	<0.001	-0.39
Nasal width	Pre-post	2.488	1.673	0.150	2.192	2.784	16.623	124	<0.001	1.49

SD: Standard deviation, SEM: Standard error of mean

**Table 6: Post-operative comparison of variables between cleft and non-cleft sides**

Variables	Cleft side		Non-cleft side		t	df	P	Mean Diff	95% CI of the difference		Effect size
	Mean	SD	Mean	SD					LB	UB	
	Philtral ridge	5.78	1.34	6.45					1.5	-3.732	
Vermillion	3.42	0.75	3.2	0.55	2.583	227.687	0.010	0.216	0.051	0.381	0.33
Lip length	8.78	1.31	8.88	1.39	-0.607	248	0.544	-0.104	-0.441	0.233	-0.08
Lip height	6.33	1.16	6.77	1.16	-2.998	248	0.003	-0.440	-0.729	-0.151	-0.38
Columella	2.14	0.5	2.35	0.48	-3.495	247.665	0.001	-0.216	-0.338	-0.094	-0.44
Nostril height	3.58	0.90	3.64	0.7	-0.549	248	0.583	-0.056	-0.257	0.145	0.80
Nostril width	6.16	1.4	5.46	0.85	4.812	204.144	0.000	0.704	0.416	0.992	0.61
Naso-canthal length	18.16	1.3	18.19	1.26	-0.198	247.805	0.843	-0.032	-0.351	0.287	1.28

SD: Standard deviation, CI: Confidence interval

of the cleft ( $3.20 \pm 0.55$  mm on the cleft side). The vermilion was greater on the cleft side. These findings were statistically significant. ( $P = 0.010$ ) Lip length on the cleft side was  $8.78 \pm 1.31$  mm, while it was  $8.88 \pm 1.39$  mm on the non-cleft side. There was no statistically significant difference between the values on the cleft and non-cleft sides. Lip height was  $6.33 \pm 1.16$  mm on the side of the cleft, while it was  $6.77 \pm 1.16$  mm on the side where the cleft was absent. Lip height was lower on the cleft side. This difference was statistically significant ( $P = 0.003$ ). The mean columella length on the cleft side was  $2.14 \pm 0.50$  mm, while it was  $2.35 \pm 0.48$  mm on the non-cleft side. The columella was significantly lesser on the cleft side ( $P = 0.001$ ). Nostril height was  $3.58 \pm 0.90$  at the side of the cleft, while it was  $3.64 \pm 0.70$  mm on the side where the cleft was absent. The nostril height is lower on the cleft side. The findings were not statistically significant ( $P = 0.583$ ). Nostril width was  $6.16 \pm 1.40$  at the side of the cleft, while it was  $5.46 \pm 0.85$  mm on the side where the cleft was absent. The nostril width is greater on the cleft side.

These findings were statistically significant. ( $P = 0.000$ ) Naso canthal length was  $18.16 \pm 1.30$  at the side of the cleft, while it was  $18.19 \pm 1.26$  mm on the side where the cleft was absent. The difference in nasocanthal length between the cleft and non-cleft sides was not statistically significant. ( $P = 0.843$ ), respectively [Table 6].

## DISCUSSION

This study evaluated the treatment outcomes of surgical therapy for unilateral cleft lip repair using quantitative (anthropometric) assessment and 2D photographic analysis. The upper lip was symmetrical in 86 (68.8%) patients, asymmetrical in 27 (21.6%) patients, and slightly asymmetrical in 12 (9.6%) patients. Scarring was minimal in the upper lip in 62 (49.6%) patients, minor faults in 36 (28.8%) patients, more noticeable in two (1.6%) patients, and noticeable in 20 (25%) patients. The upper lip

vermilion was continuous in 95 patients (76.0%), whereas vermilion deformity was observed in 30 patients (24%). Nostril symmetry was symmetrical in 82 (65.6%) patients and asymmetrical in 43 (34.4%). The nasal shape was symmetrical in 81 patients (64.8%) and asymmetrical in 44 (35.2%). The nasal height was symmetrical in 86 (68.8%) and asymmetrical in 39 (31.2%) patients. The columella was centrally located in 96 (76.8%) patients and deviated in 29 (23.2%). The alar was symmetrical in 113 (90.4%) patients and asymmetrical in 12 (9.6%).

Based on the post-operative photographic analysis of the variables, the overall outcome was excellent in 51 (40.8%) patients, good in 29 (23.2%), fair in 27 (21.6%), and poor in 18 (14.4%).

The findings of our study are similar to those of Mabrouk *et al.*<sup>[2]</sup> and Abdullateef *et al.*<sup>[3]</sup> who also found that only 14–20% of patients had poor results, while the rest had excellent, good, or fair results after surgical repair. Rogers-Vizena *et al.*<sup>[1]</sup> conducted a study to evaluate the surgical outcomes in patients with UCL and found that almost half of the study participants had minimal upper lip scars. These findings are similar to those of the present study. Saikia *et al.*<sup>[4]</sup> and Abdullateef *et al.*<sup>[3]</sup> in their studies found that most patients had good outcomes after surgical repair of the UCL. These findings are similar to those of the present study. Adetayo *et al.*<sup>[5]</sup> in their study found that post-operative nostril shape, nostril height, and nostril symmetry were symmetrical in most patients after surgical repair using both surgical techniques. These findings are consistent with those of the present study. Zhang *et al.*<sup>[7]</sup> and Xu *et al.*<sup>[9]</sup> reported that more than 50% of study participants were found to have a columella in the central location and a symmetrical alar of the nose. These findings are similar to those of the present study.

In this study, 70 patients were male, and 55 were female. No correction was required in 22 (31.4%) patients, and lip correction was performed in 21 (30.0%) patients. Cheiloplasty was required in 27 (38.6%) male patients. In contrast, no correction was required in 29 (52.7%) patients, and lip corrections were required in eight (14.5%) patients. Cheiloplasty was required in 18 female patients (32.7%). The proportion of patients without correction was greater in females than that in males. These findings are statistically significant. Surgical outcomes were significantly associated with patient sex.

The findings of this study are similar to those of other studies, although some differ from this finding. Asparini *et al.*<sup>[6]</sup> and Campbell *et al.*<sup>[8]</sup> reported that surgical outcomes were significantly correlated with sex. These findings are similar to those of the present study. Zelko *et al.*<sup>[10]</sup> and Zhang *et al.*<sup>[7]</sup> conducted a study to evaluate the surgical outcomes of the UCL and found no significant association between surgical outcomes and sex. Similarly, Adetayo *et al.*<sup>[5]</sup> and Xu *et al.*<sup>[9]</sup>

found no significant association between surgical outcome and sex.

In our study, on evaluating pre- and post-operative comparisons of variables in patients, the findings were statistically significant with a decrease in the white roll post-operatively. The mean pre- and post-operative differences in the philtral ridge were  $-2.816 \pm 1.227$ . These findings were statistically significant with an increase in the post-operative philtral ridge. The findings were statistically significant, with a post-operative decrease in the Cupid's bow. The mean pre- and post-operative vermilion were  $-1.048 \pm 1.023$ .

Some studies have also evaluated anthropometric measurements and have reported significant post-operative results. Rogers-Vizena *et al.*<sup>[1]</sup> Mabrouk *et al.*<sup>[2]</sup> and Abdullateef *et al.*<sup>[3]</sup> reported significant post-operative changes in the white roll, philtral ridge, Cupid's bow, and vermilion dimensions. These findings are similar to those of the present study.

In our study, the mean pre- and post-operative difference in lip length was  $-1.504 \pm 1.6$  cm. The findings were statistically significant, with an increase in lip length observed post-operatively. The mean pre- and post-operative differences in lip height were  $-1.856 \pm 1.312$  mm. The findings were statistically significant, with an increase in lip height post-operatively. The post-operative increase in columella size was statistically significant. The mean pre- and post-operative differences in nostril height were  $-0.216 \pm 0.989$ . The findings were statistically significant with an increase in post-operative nostril height.

Saikia *et al.*<sup>[4]</sup> Abdullateef *et al.*<sup>[3]</sup> and Adetayo *et al.*<sup>[5]</sup> in their studies found significant post-operative changes in lip length, lip height, and columella dimensions. These findings are similar to those of the present study.

The mean pre- and post-operative differences in the nostril width were  $4.592 \pm 2.236$ . The findings were statistically significant, with a post-operative decrease in nostril width ( $P < 0.001$ ). The mean pre- and post-operative differences in the nasal dome were  $0.12 \pm 1.33$ . These findings were statistically significant with a post-operative decrease in the nasal dome. The mean pre- and post-operative differences in nasocanthal length were  $-0.624 \pm 1.6$ . The findings were statistically significant, with an increase in nasocanthus length post-operatively. The mean pre- and post-operative difference in nasal width was  $2.488 \pm 1.673$ . The findings were statistically significant, with a post-operative decrease in the nasal width.

Zhang *et al.*<sup>[7]</sup> and Xu *et al.*<sup>[9]</sup> in their studies found significant post-operative changes in the nostril width, nasocanthal length, and nasal width. These findings are similar to those of the present study.

Post-operative comparison of variables between cleft and non-cleft sides revealed significant variation in different variables, such as philtral ridge, vermilion, lip height, Columella, Nostril height, and nostril width. However, no significant variation was observed in lip length or nasocantonal length. These findings are similar to those of a study conducted by Mabrouk *et al.*,<sup>[2]</sup> Abdullateef *et al.*,<sup>[3]</sup> and Zhang *et al.*<sup>[7]</sup> because these studies also observed significant differences in post-operative comparison of variables between Cleft and non-cleft sides, similar to our study.

This study has several significant benefits. This study is distinct in that it employed standardized methods to evaluate the results of surgical therapy for unilateral cleft lip repair using 2D photographic analysis and quantitative (anthropometry) assessment. Our understanding of the factors influencing surgical outcomes in patients has been improved using this approach. A comprehensive outcome evaluation provides a comprehensive perspective on surgical results. The clinical importance of addressing relevant issues in UCL procedures and examining the relationship between severity and surgical results further strengthens the practical implications of this study.

The limitations of this study include a brief follow-up period, a retrospective design that may be biased due to reliance on a single investigator, a shorter study period, a lack of confounding variable adjustments, and scope limitations resulting from the exclusion of patient satisfaction and speech acquisition. The results may not be fully applicable to the living population because the study was performed using 2D photographs rather than direct patient examinations. These factors draw attention to possible flaws and the need for more thorough future studies with longer follow-up periods, prospective designs, and careful evaluation.

## CONCLUSION

Quantitative (anthropometric) assessment using 2D photographic analysis can be an effective tool for assessing surgical outcomes in patients with unilateral cleft lip.

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