



Assessment of Lip Symmetry following Unilateral Cheiloplasty using the Rotation-Advancement Principle



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Introduction

The aim of cheiloplasty is to restore continuity of the orbicularis oris muscle, achieve lip symmetry including the Cupid’s bow, and align the scar aesthetically with natural lip landmarks. Because the procedure is performed on hypoplastic tissues in early infancy, small surgical inaccuracies may lead to noticeable deformities as growth proceeds. Furthermore, inherent growth deficiencies in cleft-affected tissues often result in secondary deformities despite technically sound repair. Thus, outcome analysis is essential in modern cleft lip surgery, with lip symmetry serving as a key indicator in unilateral cases. This study therefore performed an anthropometric evaluation of lip symmetry after unilateral cheiloplasty using the rotation-advancement principle.

Objectives

The objective of this study is to assess upper lip symmetry following primary cheiloplasty in patients with unilateral cleft lip.

Materials and Methods

Patients with unilateral cleft lip who underwent primary cheiloplasty employing the rotation-advancement technique, performed by a single surgeon between 2014 and 2019, were enrolled in this investigation.

Exclusion criteria encompassed individuals with syndromic clefts or concomitant craniofacial anomalies, microform cleft lip, those treated using the triangular flap approach, cases complicated by impaired wound healing, and subjects without adequate facial photographic documentation. Ultimately, a total of 79 patients were included in the final cohort.

Standardized frontal-view photographs, obtained within two weeks post-cheiloplasty, were subjected to facial symmetry analysis utilizing dedicated image-analysis software (Image J, <http://rsb.info.nih.gov/nih-image>). In instances requiring correction (27 cases), frontal alignment of the images was adjusted with Adobe Photoshop Elements 2022. Photogrammetric evaluation was performed based on predefined anthropometric landmarks (Fig. 1), derived from Farkas’ cleft-specific anthropometric indices (Fig. 2).

Postoperative upper lip symmetry was quantified by calculating the Cleft Lip Component Symmetry Index (CLCSI), defined as the ratio of cleft-side to non-cleft-side dimensions. Outcomes were deemed asymmetric when values deviated more than 5% above (excessive) or below (deficient) the reference index of 100.

Additionally, independent t-tests were conducted to compare morphometric parameters between the complete cleft group (CG) and the incomplete cleft group (IG), with statistical significance established at the 95% confidence level ($p < 0.05$).

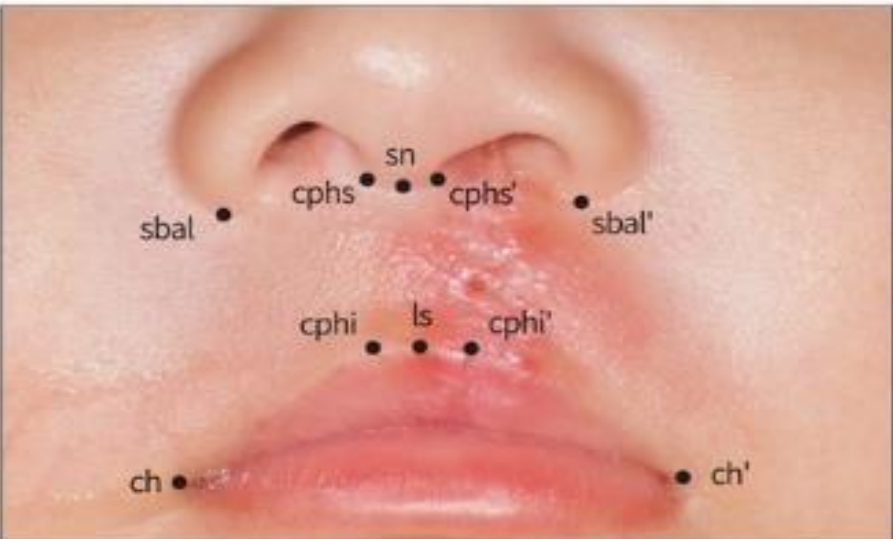


Figure 1. Anthropometric landmarks of both normal and cleft (') sides: ch (cheilion), ls (labiale superius), sn (subnasale), sbal (subalar), cphi (crista philtri inferioris), cphs (crista philtri superioris)

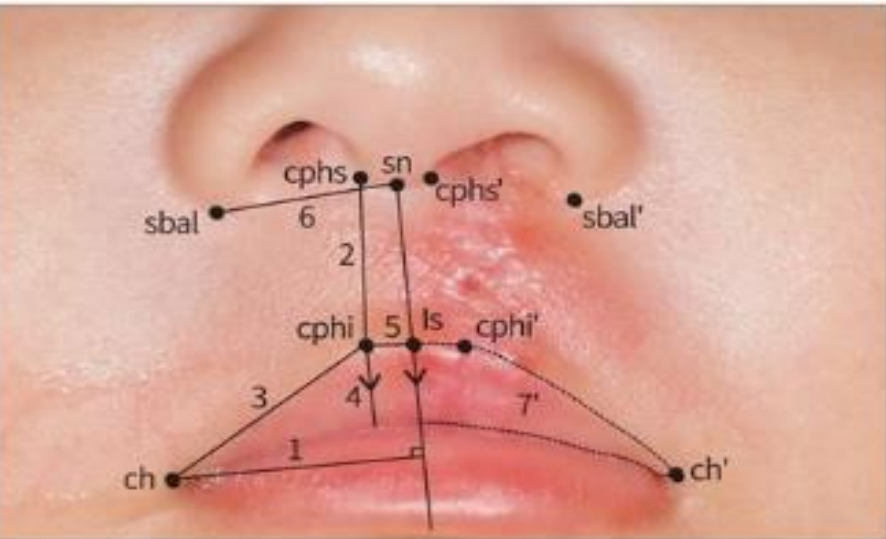


Figure 2. Measuring parameters for upper lip symmetry. Vertical reference line is defined as a line running through sn (subnasale) and ls (labiale superius) in the patient's frontal photograph. 1: upper lip width 2: upper lip length 3: lateral lip length 4: red vermilion height 5: Cupid's bow width 6: nasal floor width of the normal side, and 7: red vermilion area of the cleft side.

Results

Within the complete cleft group (CG), the mean CLCSI values demonstrated adequate symmetry in parameters such as lateral lip length, vermilion height, Cupid’s bow breadth, and nasal floor dimension, whereas lip width/length and vermilion area exhibited relative deficiency.

In contrast, the incomplete cleft group (IG) revealed reduced values for lip width and length, while vermilion height and nasal floor width were found to be augmented; the remaining parameters maintained symmetry (Table 1).

Statistical comparison showed no significant intergroup differences between CG and IG (Table 2).

Discussion

This study demonstrated that unilateral cleft lip repair using Millard’s rotation-advancement principle yielded clinically acceptable symmetry in approximately 50% of surface anthropometric parameters, with no significant differences between complete and incomplete clefts.

The study cohort had a higher mean age at surgery (8.8 months), largely due to cases treated during volunteer missions in underdeveloped regions, where patients often lacked preoperative management. This contributed to relatively lower symmetry outcomes compared with other reports.

Modifications such as back-cuts, triangular flaps, and Mohler’s technique were selectively employed depending on cleft severity. Postoperatively, the cleft-side lip width and length remained deficient in both groups, reflecting inherent tissue hypoplasia and limitations of the rotation-advancement method. Vermilion height and nasal floor width were significantly increased in incomplete clefts, whereas complete clefts showed relative tissue deficiency.

Despite these differences, intergroup comparisons revealed no statistically significant variation in overall lip symmetry, indicating that appropriate intraoperative adjustments mitigated the influence of pathological differences. However, long-term follow-up is required, as this study only assessed immediate postoperative results without accounting for scar maturation, relapse, or growth-related changes.

Conclusion

Approximately 50% of the measured variables demonstrated symmetry in the immediate postoperative period following unilateral cheiloplasty employing the rotation-advancement technique.

For enhanced restoration of symmetry, it may be advisable to position the lateral landmark further outward in cases of complete cleft lip.

In contrast, management of incomplete cleft lip may necessitate more aggressive resection of the affected tissues.

Moreover, longitudinal evaluation is warranted to assess temporal changes in postoperative outcomes.

Conflicts of Interest

No potential conflicts of interest relevant to this article are reported.

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Table 1. Mean CLCSI (Cleft Lip Component Symmetry Index) values of the complete and incomplete cleft lip groups

Cleft lip type		Lip width	Lip length	Lateral lip length	Vermilion free edge	Cupid’s bow width	Width of nostril floor	Red vermilion area
Complete	Mean (%)	90.5±19.4	88.8±13.4	96.4±15.9	102.8±17.5	97.3±11.1	101.7±22.9	88.8±22.6
	Category	Deficient	Deficient	Symmetric	Symmetric	Symmetric	Symmetric	Deficient
Incomplete	Mean (%)	94.2±24.7	92.4±11.7	99.5±18.8	112.0±35.9	98.1±13.9	108.7±25.5	100.3±39.0
	Category	Deficient	Deficient	Symmetric	Excessive	Symmetric	Excessive	Symmetric

Category - Symmetric: 96-104%, Deficient: ≤95%, Excess: ≥105%.

Table 2. Significant differences between the complete and incomplete cleft lip groups

Cleft lip type	Lip width		Lip length		Lateral lip length		Vermilion free edge		Cupid’s bow width		Width of nostril floor		Red vermilion area	
	Mean	P	Mean	P	Mean	P	Mean	P	Mean	P	Mean	P	Mean	P
Complete (n=34)	90.5	0.614	88.8	0.060	96.4	0.327	102.8	0.195	97.3	0.470	101.7	0.191	88.8	0.188
Incomplete (n=45)	94.2		92.4		99.5		112.0		98.1		108.7		100.3	

Independent samples t-test.