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Lateral Crural Steal Technique and its Influence on Tip Rotation in Rhinoplasty

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Abstract

Achieving predictable and aesthetically pleasing nasal tip rotation is a fundamental objective in rhinoplasty. The lateral crural steal (LCS) technique is widely used to improve nasal tip projection and rotation by modifying the lower lateral cartilages. This study aimed to evaluate the effect of the LCS technique on nasal tip rotation in patients undergoing primary open rhinoplasty. A retrospective cohort study was conducted on 47 consecutive patients who underwent primary open rhinoplasty with the LCS technique between January 2021 and December 2023. The study included 34 females and 13 males with a mean age of 28.4 ± 6.1 years. Standardized preoperative and postoperative lateral photographs obtained after a mean follow-up of 14.5 ± 2.3 months were analyzed. Nasal tip rotation was assessed using the nasolabial angle (NLA). Preoperative and postoperative measurements were compared using the paired *t*-test. The mean preoperative NLA was 94.2 ± 5.8°, which increased significantly to 101.5 ± 4.9° after surgery. The mean improvement in NLA was 7.3 ± 2.1°, demonstrating a statistically significant enhancement in nasal tip rotation ($p < 0.001$). Intraoperative assessment showed that moderate increases in the nasal tip angle were achieved in most patients, while a predictable reduction occurred after wound closure without compromising the overall postoperative improvement. No major complications were observed. The lateral crural steal technique is a reliable and effective method for improving nasal tip rotation in primary rhinoplasty. It produces significant increases in the nasolabial angle while preserving nasal tip support and maintaining a low complication rate. Careful surgical planning and meticulous operative technique are essential to achieve consistent and aesthetically satisfactory outcomes.

Keywords: Rhinoplasty, Nasal Tip Rotation, Lateral Crural Steal, Nasolabial Angle, Surgical Technique, Aesthetic Surgery

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Introduction

Rhinoplasty is widely regarded as one of the most complex procedures in facial plastic surgery, demanding a thorough grasp of nasal anatomy, aesthetic principles, and refined surgical skills. [1,2] Among all nasal features, the tip holds particular importance, as its shape, projection, and rotation greatly influence the balance and attractiveness of the face. Achieving the right tip rotation is essential—too much or too little can lead to disappointing results [3]. One common way to assess this is by measuring the nasolabial angle (NLA), which ideally falls between 90–95° for men and 95–105° for women, though personal facial structure may call for slight adjustments [4].

Numerous surgical maneuvers have been described to modify nasal tip rotation, including cephalic trim of the lower lateral cartilages (LLCs), placement of columellar struts, tip sutures (medial crural fixation, interdomal sutures), and cartilage grafts [5]. However, achieving precise and lasting control over tip rotation can be challenging [6].

The lateral crural steal (LCS) technique, popularized by Kridel and colleagues, is a powerful suture-based method designed primarily to increase tip projection and refine the domes, but it also inherently influences tip rotation [7, 8]. The technique involves advancing the medial crura inferiorly relative to the lateral crura and securing this new relationship at the domes with sutures. This maneuver effectively "steals" length from the lateral crura, recruiting it medially, which shortens the overall crural length and tends to pull the tip complex superiorly and posteriorly, thereby increasing rotation [9].

While the effect of LCS on projection is well-documented, its specific, quantifiable influence on tip rotation requires further elucidation. This study aims to evaluate the change in nasal tip rotation, as measured by the NLA, specifically attributable to the application of the LCS technique in patients undergoing primary open rhinoplasty.

Materials and Methods

1. Study Design and Patient Selection

A retrospective review was performed on the medical records and standardized photographic documentation of patients who underwent primary open rhinoplasty by a single surgeon (initials blinded for review) between January 2021 and December 2023 at Al Jumhoree teaching hospital. Inclusion criteria were patients undergoing primary rhinoplasty, utilization of the LCS technique as a primary method for tip modification, and availability of high-quality, standardized pre-operative and minimum 12-month post-operative lateral photographs. Exclusion criteria included: revision rhinoplasty, significant pre-existing nasal trauma or congenital deformity affecting tip structures disproportionately, concurrent use of major tip rotation techniques that would confound the effect of LCS (extensive caudal septal manipulation solely for rotation), and incomplete records or follow-up. A total of 47 patients met the criteria.

2. Surgical Technique: Lateral Crural Steal

All procedures were performed via an open rhinoplasty approach using a transcolumellar incision. After elevation of the skin–soft tissue envelope and exposure of the lower lateral cartilages, the lateral crural steal (LCS) technique was performed. The vestibular skin was carefully elevated from the undersurface of the lateral crura as needed. A horizontal mattress suture (typically 5-0 PDS or 5-0 Nylon) was placed through the proposed new domal points. The suture was passed through the medial aspect of the lateral crus on one side, crossed to the contralateral side through the medial aspect of the opposite lateral crus, and then returned through the cephalic margin of the ipsilateral medial crus and the cephalic margin of the contralateral medial crus before being tied. The key maneuver involved advancing the medial crura inferiorly relative to the lateral crura before tightening the suture, thereby creating new domes in a more medial and superior position relative to the native anatomy.

The amount of lateral crural steal (1–5 mm) was determined intraoperatively according to the desired increase in nasal tip projection and rotation. A sterile **Castroviejo Caliper** was used to accurately measure the planned amount of lateral crural advancement and to ensure consistent and reproducible positioning of the new domes. Following completion of the maneuver, nasal tip projection and rotation were reassessed intraoperatively, and minor adjustments were made as required to achieve optimal symmetry and aesthetic balance.

Other standard rhinoplasty procedures, including dorsal modification, osteotomies, septoplasty when

indicated, and alar base reduction, were performed according to each patient's anatomical requirements but were not the primary focus of the present analysis.

3. Outcome Measurement

Standardized pre-operative and minimum 12-month post-operative digital lateral photographs were obtained using consistent lighting, patient positioning (Frankfort horizontal plane parallel to the floor), and distance. The angles measurements were performed using a **Nasal Measuring Gauge** designed for rhinoplasty and facial aesthetic assessment. The NLA was defined as the angle formed by the intersection of a line tangent to the columella and a line drawn perpendicular to the Frankfort horizontal plane passing through the subnasale [10]. All measurements were performed twice by two independent reviewers (initials blinded), and the average was used for analysis. Inter-rater reliability was assessed using the intraclass correlation coefficient (ICC).



Figure 1. Nasal Measuring Gauge



Figure 2. Castroviejo Caliper

4. Statistical Analysis

Data were collected and managed using Microsoft Excel. Statistical analysis was performed using SPSS version 26. Descriptive statistics (mean, standard deviation) were calculated for demographic data and NLA measurements. A paired t-test was used to compare the mean pre-operative and post-operative NLA values. Statistical significance was set at $p < 0.05$.

Results

Table 1. Demographic and Clinical Characteristics of the Study Population (N = 47)

Characteristic	Value
Total patients	47
Female	34 (72.3%)
Male	13 (27.7%)
Mean age (years)	28.4 ± 6.1*
Mean follow-up (months)	14.5 ± 2.3*

A total of 47 patients were included in the study, with females representing the majority of the sample (72.3%). The mean age was 28.4 ± 6.1 years, and the mean follow-up period was 14.5 ± 2.3 months, indicating that most participants were young adults with an adequate postoperative follow-up period for clinical assessment.

Table 2. Nasolabial Angle (NLA) Measurements Before and After Lateral Crural Steal

Parameter	Mean ± SD	p-value
Pre-operative NLA (°)	94.2 ± 5.8	**< 0.001**
Post-operative NLA (°)	101.5 ± 4.9	
Mean Change in NLA (°)	**+7.3 ± 2.1**	

NLA = Nasolabial Angle; SD = Standard Deviation. P-value calculated using paired t-test comparing pre- and post-operative NLA.

The mean pre-operative nasolabial angle increased significantly from 94.2° to 101.5° following surgery. The mean improvement of 7.3° was statistically significant ($p < 0.001$), demonstrating that the lateral crural steal technique effectively enhanced nasal tip rotation and achieved a more favorable aesthetic nasolabial angle.

Table 3. Distribution of Angle Increase Before and After Opening (N=47)

Increase (∠ ∗)	Female	Male	Total	%
4	4	1	5	10.6
5	2	0	2	4.3
6	8	1	9	19.1
7	3	2	5	10.6
8	4	3	7	14.9
9	4	0	4	8.5
10	6	6	12	25.5
11	1	0	1	2.1
12	1	0	1	2.1
18	1	0	1	2.1
Total	**34**	**13**	**47**	**100**

∠ ∗ = degree

Following the opening step, all patients demonstrated an increase in the nasolabial angle. The most common increase was 10 mm (25.5%), followed by 6 mm (19.1%) and 8 mm (14.9%). Larger increases (11–18 mm) were uncommon, indicating that moderate increases in angle were the most frequently observed intraoperative changes.

Table 4. Distribution of Angle Increase After Opening and Before Lateral Crural Steal after transdomal suture (N=47)

Increase (∠ ∗)	Female	Male	Total	%
1	1	0	1	2.1
2	1	2	3	6.4
3	0	1	1	2.1
4	3	3	6	12.8
5	5	2	7	14.9
6	6	3	9	19.1
7	5	0	5	10.6
8	5	2	7	14.9
9	6	0	6	12.8
10	2	0	2	4.3
Total	**34**	**13**	**47**	**100**

∠ ∗ = degree

Additional increases in the nasolabial angle were observed after the opening stage and before performing the lateral crural steal maneuver. The most frequent increases were 6 mm (19.1%), followed by 5 mm and 8 mm (14.9% each), suggesting progressive improvement in nasal tip rotation during surgical manipulation.

Table 5. Relationship Between Amount of Lateral Crural Steal and Angle Increase

Amount of Steal (mm)	Female (n)	∠ ∗	Male (n)	∠ ∗	Total
1.0	1	3	0	-	1
2.0	3	4-8	5	4-8	8
2.5	1	8	1	8	2
3.0	22	8-12	1	10	23
3.5	1	10	0	-	1
4.0	1	10	3	10-15	6
	2	17-18			
5.0	1	17	3	15-18	4
Total	**32**	**-**	**13**	**-**	**46**

∠ ∗ = degree

Table 5 shows that greater amounts of lateral crural steal resulted in greater increases in the nasolabial angle. The 3.0-mm steal was the most commonly performed (23/46 patients) and produced an angle increase of 8°–12°. Smaller steals (1.0–2.5 mm) achieved modest increases (3°–8°), whereas larger steals (4.0–5.0 mm) produced greater increases (10°–18°).

Table 6. Distribution of Angle Decrease After Closure (N=47)

Decrease (angle)	Female	Male	Total	%
3	0	2	2	4.3
4	2	0	2	4.3
5	4	1	5	10.6
6	4	1	5	10.6
7	4	2	6	12.8
8	9	1	10	21.3
9	4	1	5	10.6
10	6	5	11	23.4
11	1	0	1	2.1
Total	**34**	**13**	**47**	**100**

Following wound closure, a decrease in the nasolabial angle was observed in all patients. The most common reductions were 10 mm (23.4%) and 8 mm (21.3%), whereas decreases of 3 mm, 4 mm, and 11 mm were relatively uncommon. These findings indicate a predictable reduction in nasal tip rotation after closure while maintaining the overall postoperative improvement achieved during surgery.

Table 7. Spearman Correlation Between Amount of Lateral Crural Steal and Increase in Nasolabial Angle (N = 47)

Variables	Spearman's rho (ρ)	P-value	Interpretation
Amount of Lateral Crural Steal (mm) vs. Increase in Nasolabial Angle (°)	0.68	<0.001	Strong positive correlation

A Spearman rank correlation analysis demonstrated a statistically significant positive correlation between the amount of lateral crural steal and the increase in the nasolabial angle ($\rho = 0.68$, $p < 0.001$). This finding indicates that greater amounts of lateral crural steal were associated with larger increases in nasal tip rotation, supporting the effectiveness of the technique in achieving controlled tip elevation.

Discussion

Achieving an optimal degree of nasal tip rotation is a fundamental objective in aesthetic rhinoplasty, as it plays a critical role in facial harmony and patient satisfaction. The present study demonstrated that the lateral crural steel (LCS) technique effectively increased the nasolabial angle (NLA) in patients undergoing primary rhinoplasty. The mean NLA increased significantly from 94.2 ± 5.8° preoperatively to 101.5 ± 4.9° postoperatively, with a mean improvement of 7.3 ± 2.1° ($p < 0.001$). These findings indicate that the LCS technique provides a predictable and clinically meaningful enhancement in nasal tip rotation.

The improvement in nasal tip rotation can be explained by the biomechanical principles of the LCS technique. Advancing the medial crura relative to the lateral crura effectively shortens the functional length of the lower lateral cartilages and creates a new dome position. This structural modification repositions the nasal tip superiorly, resulting in increased tip rotation while simultaneously improving tip projection and contour [8,9].

The intraoperative measurements demonstrated a consistent pattern of angle increase throughout the surgical procedure. Following the opening stage, the greatest proportion of patients exhibited increases of 10 mm (25.5%), followed by 6 mm (19.1%) and 8 mm (14.9%). Additional improvements were observed after the lateral crural steal maneuver, with increases of 6 mm (19.1%), 5 mm (14.9%), and 8 mm

(14.9%) being the most frequent. Although a predictable decrease in the angle occurred after wound closure, most commonly by 10 mm (23.4%) and 8 mm (21.3%), the final postoperative nasolabial angle remained significantly greater than the preoperative measurement, demonstrating that the rotational improvement achieved intraoperatively was maintained.

In this study, a 3-mm lateral crural steal was the most frequently used modification, accounting for 24 patients (51.1%), followed by 2 mm (19.1%) and 4 mm (12.8%). This distribution suggests that moderate cartilage advancement was generally sufficient to achieve satisfactory nasal tip rotation while preserving structural stability. Previous authors have similarly described the LCS technique as providing controlled rotation through conservative cartilage redistribution rather than aggressive cartilage resection [7,11].

Our findings are consistent with previous reports describing the LCS technique as an effective method for improving both nasal tip projection and rotation. Gruber et al. emphasized the role of LCS in refining the nasal tip and increasing projection, while noting its beneficial effect on tip rotation [12]. The present study expands on these observations by providing quantitative evidence of a significant postoperative increase in the nasolabial angle, supporting the reliability of LCS for achieving controlled nasal tip rotation in primary rhinoplasty.

Compared with other tip rotation techniques, LCS offers the advantage of simultaneously enhancing projection, refining dome configuration, and preserving the native lower lateral cartilage framework without routinely requiring cartilage grafts or extensive cartilage division (5,8). Nevertheless, successful outcomes depend on meticulous surgical execution. Excessive cartilage advancement may result in over-rotation, whereas inadequate advancement may fail to produce the desired aesthetic correction [13,14,15]. Therefore, individualized intraoperative assessment remains essential to optimize nasal tip rotation while maintaining symmetry and long-term stability.

Conclusion

The lateral crural steal is a valuable and effective technique in the rhinoplasty surgeon's armamentarium. This study provides quantitative evidence that LCS significantly increases nasal tip rotation, with a mean increase in the nasolabial angle of approximately 7.3° in our cohort. When performed correctly in appropriately selected patients, it offers a predictable method to enhance tip definition, projection, and rotation simultaneously, contributing to improved aesthetic outcomes in primary rhinoplasty.

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