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ORIGINAL ARTICLES RHINOPLASTY

Tip Support in the Cleft Lip Rhinoplasty: A Comparison of Septal Extension Graft and Columellar Strut Graft

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Abstract

Background We aimed to comparatively analyze nasal projection and rotation changes in patients that underwent secondary cleft rhinoplasty with a columellar strut graft (CSG) or septal extension graft (SEG).

Methods Thirty-three patients were randomly divided into two groups. Preoperative, intraoperative (immediate postoperative), postoperative 1-, 6- and 12-month profile view pictures were analyzed. The nasion (N), alar base-cheek junction (A), tip defining point (T), columella (C), and lips (L) were marked. The AT/AN ratio, NAT angle, Goode ratio, and columellar-labial angle (CLA) were measured.

Results Regarding tip projection, the AT/AN ratio was lower in CSG group compared to SEG group postoperatively. In CSG group, there was a significant progressive decrease in the AT/AN ratio, whereas in SEG group, it decreased until postoperative 6 month. Regarding tip rotation, the NAT angle was higher in CSG group postoperatively and increased progressively. In SEG group, the NAT angle was lower intraoperatively compared to the postoperative period, whereas it did not differ significantly in-between follow-ups. The Goode ratio was significantly lower in CSG group compared to SEG group postoperatively. In SEG group, the Goode ratio was significantly higher intraoperatively compared to the postoperative period, but it did not differ significantly in-between follow-ups. In CSG group, the Goode ratio decreased progressively. The CLA decreased in both groups, but there was no statistically significant difference between the groups.

Conclusion Secondary cleft lip rhinoplasty is a distinct subgroup of rhinoplasty that necessitates stable and strong tip support. SEG provides more reliable and predictable long-term results in secondary cleft lip rhinoplasty than CSG.

Level of Evidence I This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Cleft lip · Rhinoplasty · Septal extension graft · Columellar strut graft · Nasal projection · Nasal tip rotation

Introduction

Cleft lip causes many aesthetic and functional nasal problems. Cleft lip nose describes the nasal deformity accompanying cleft lip. Unilateral or bilateral cleft lip may cause different types of deformities such as deviation of septum, shortened columella, inferiorly rotated lower lateral cartilage [1, 2]. Primary cleft lip rhinoplasty is nasal surgery performed together with lip surgery in infants [3], whereas intermediate cleft lip rhinoplasty is performed in children to treat severe nasal deformities; however, even when primary and intermediate rhinoplasty have been performed, nasal deformities can persist after puberty that require

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secondary cleft lip rhinoplasty. Improving nasal projection and nasal tip rotation is the one of the primary goals of secondary cleft surgery [4, 5]. Cartilage grafts taken from various donor areas can be used as columellar strut grafts (CSGs) or septal extension grafts (SEGs) for nasal tip support. Congenital anatomical malformations and scarred healing due to previous surgeries can adversely affect long-term results [6]. Projection and rotation changes can occur at the tip of the nose, which can negatively affect the cosmetic outcomes. The present study aimed to comparatively analyze nasal projection and rotation changes in patients that underwent secondary cleft rhinoplasty with CSG or SEG for stable nasal tip support.

Materials and Methods

This prospective study included 44 patients that underwent surgery performed by the lead author (FO) at our cleft and craniofacial center between January 2019 and January 2020. Patients with a history of nasal surgery, patients aged < 18 years (due to incomplete midface development), patients with a history of radix reduction or augmentation, or lateral or medial crural sliding, and those with a history of lip surgery combined with nasal surgery were excluded from the study. The remaining 33 patients were randomly divided into 2 groups: the CSG group and SEG group. Written informed consent was obtained from all patients.

Open structural rhinoplasty steps were followed. After local anesthesia, columellar skin incision was made. Cartilage and bony structures were dissected. After the dorsal hump removal, septoplasty was performed. Cartilage grafts were taken from the septal cartilage, and then, the upper lateral cartilages were reshaped using the autospreader flap technique. Following cephalic trimming of the lower lateral cartilages, the trandomal and interdomal sutures were performed. In the CSG group, the graft was placed in the pouch created between the medial crura and fixed to the medial crura. In the SEG group, the graft was fixed caudally to the septum in side-to-side fashion and to the medial crura of the lower lateral cartilages. Photographs of the patients were taken preoperatively, intraoperatively, after the surgery was completed (immediate postoperative look), and at 1, 6, and 12 months postoperatively using a Canon EOS 850D (Canon Inc., Japan). The photographs were analyzed using GNU GIMP v.2.10 (Free Software Foundation, Inc. USA). The nasion (N), middle point of the alar base-cheek junction (A), nasal tip defining point (T), columella (C), and lips (L) are marked in the photographs taken from the right-side angle (Fig. 1). Length was measured in pixels. Photometric analysis of the patients was calculated by considering AN length as a constant, as no procedure was performed on the radix or alar fold. The AT/AN ratio was used for evaluation of projection, the NAT angle was used for evaluation of rotation, the Goode ratio (AT/NT) was used for evaluation of both projection and rotation, and the columellar-labial angle (CLA) was used for evaluation of columella position (Fig. 1).

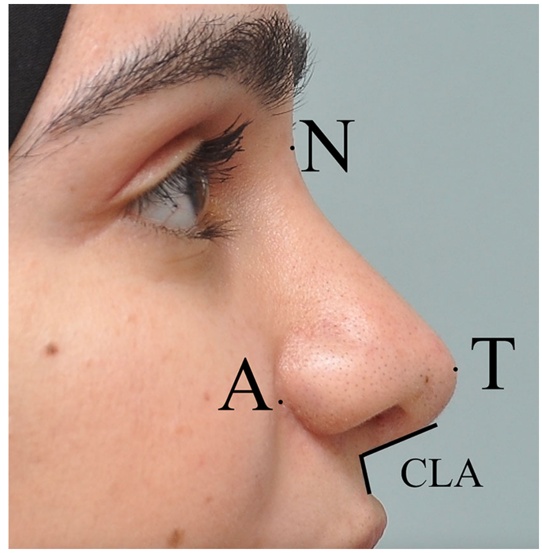

Fig. 1 N: Nasion; A: middle point of the alar base-cheek junction; T: nasal tip defining point; CLA: columellar-labial angle

Data were analyzed using IBM SPSS Statistics for Windows v.23 (IBM Corp., Armonk, NY). The distribution of quantitative variables was analyzed using the Shapiro–Wilk test of normality. Comparisons between 2 independent groups were made using the independent samples t test, as the parametric test assumptions were met. Repeated measures ANOVA was used to identify differences between repeated measurements, as the assumptions of normality of residuals were met. In cases of significant difference, multiple comparisons were made using the Bonferroni test. Numerical variables are shown as mean ± SD, as parametric test assumptions were met.

Results

The mean duration of postoperative follow-up was 15 months (range 12–19 months), and the mean age of the patients was 21.9 years (range 18–37) years. Among the 33 patients, 18 were female and 15 were male. In all, 8 patients had bilateral cleft lip, 11 had right cleft lip, 14 had left cleft lip, 26 had cleft palate, and 7 had isolated cleft lip deformity. In total, 17 patients underwent surgery with CSG and 16 patients with SEG for tip support.

There was not a significant difference in duration of follow-up, mean age, gender distribution, or cleft type between the 2 groups. Evaluation of the preoperative and intraoperative (immediate postoperative look) photographs showed that the AT/AN ratio, NAT angle, AT/NT ratio, and CLA parameters were normally distributed, and that there were not any significant differences between the CSG and SEG groups ($P > 0.05$).

At 1, 6, and 12 months postoperative, the AT/AN ratio was significantly lower in the CSG than in the SEG group ($P < 0.05$). In the CSG group, there was a significant progressive decrease in the AT/AN ratio at 1, 6, and 12 months postoperative, whereas in the SEG group, it decreased until postoperative 6. month. There was not a significant difference in the AT/AN ratio between 6 months and 12 months postoperative in the SEG group (Fig. 2).

At 1, 6, and 12 months postoperative, the NAT angle was significantly higher in the CSG group than the SEG group ($P < 0.05$). In the SEG group, the intraoperative NAT angle was significantly lower than at 1, 6, and 12 months postoperative, whereas it did not differ significantly between 1, 6, and 12 months postoperative. In the CSG group, the NAT angle progressively increased at 1, 6, and 12 months postoperative, as compared to the intraoperative NAT angle ($P < 0.05$) (Fig. 3).

The Goode ratio was significantly lower in the CSG than in the SEG group at all times postoperative. In the SEG group, the intraoperative Goode ratio was significantly higher than at 1, 6, and 12 months postoperative, but it did not differ significantly between 1, 6, and 12 months postoperative. In the CSG group, the Goode ratio decreased progressively at 1, 6, and 12 months postoperative, as compared to the intraoperative value ($P < 0.05$) (Fig. 4).

The CLA decreased significantly in both groups and at all times postoperative ($P < 0.05$) and did not differ significantly between the 2 groups ($P > 0.05$) (Fig. 5). (Figs. 6 and 7, Supplementary Figure 1–34).

All the study findings are summarized in Table 1.

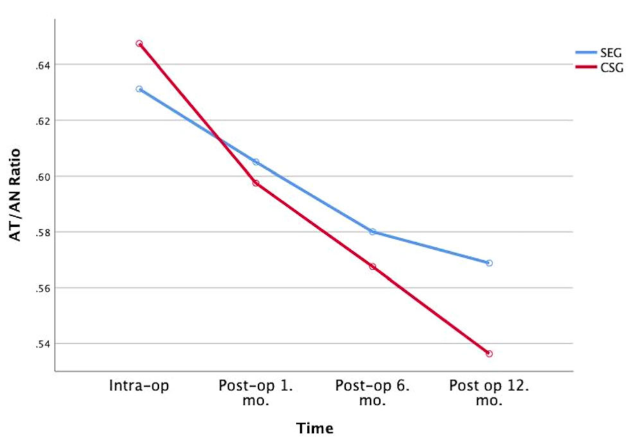

Fig. 2 Comparison of the AT/AN ratio between the CSG and SEG groups at intraoperative, postoperative 1, 6, and 12 months

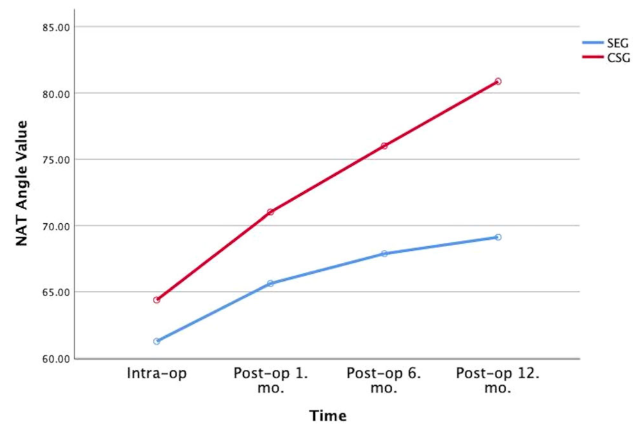

Fig. 3 Comparison of the NAT angle (degrees) in the CSG and SEG groups at intraoperative, postoperative 1, 6, and 12 months

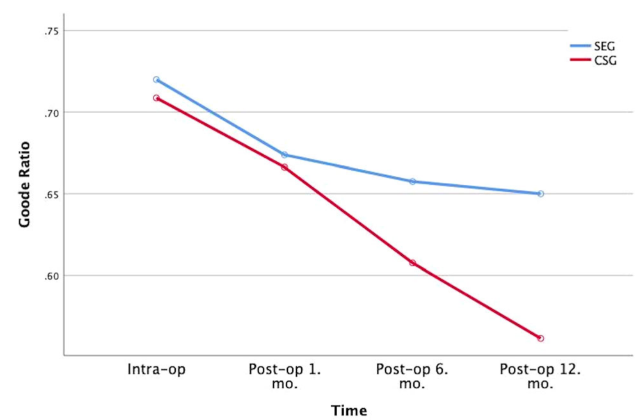

Fig. 4 Comparison of the Goode ratio between the CSG and SEG groups at intraoperative, postoperative 1, 6, and 12 months

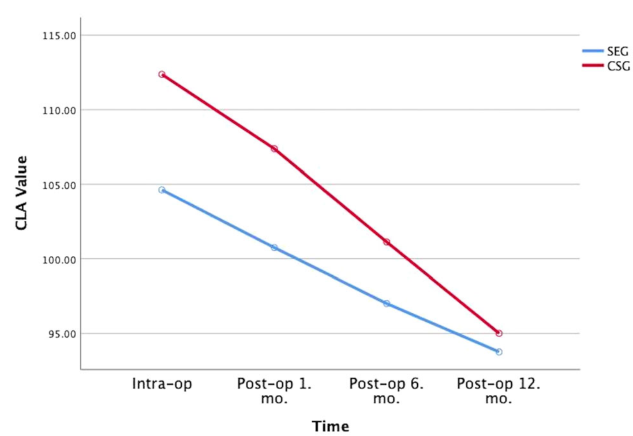

Fig. 5 Comparison of the CLA (degrees) between the CSG and SEG groups at intraoperative, postoperative 1, 6, and 12 months

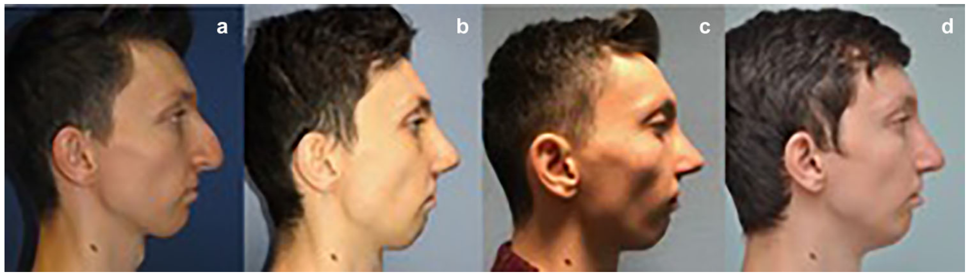

Fig. 6 A 19-year-old male in the CSG group with right cleft lip and Veau III cleft palate. a. Preoperative b. Postoperative 1 month c. Postoperative 6 month d. Postoperative 12 month

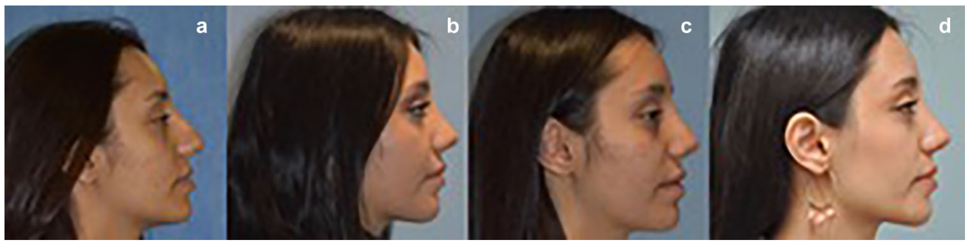

Fig. 7 An 18-year-old female in the SEG group with left cleft lip and Veau III cleft palate. a. Preoperative b. Postoperative 1 month c. Postoperative 6 month d. Postoperative 12 month

Table 1. Rotation and projection measurements in the CSG and SEG groups

	CSG group				SEG group			
	Intra-op.	Post-op. 1. mo.	Post-op. 6. mo.	Post-op. 12. mo.	Intra-op.	Post-op. 1. mo.	Post-op. 6. mo.	Post-op. 12. mo.
AT/AN ratio	0.6475	0.5975	0.5675	0.5363	0.6313	0.605	0.58	0.5688
NAT angle (°)	64.375	71	76	80.875	61.25	65.625	67.875	69.125
Goode ratio	0.7088	0.6663	0.6075	0.5613	0.72	0.6738	0.6575	0.65
CLA (°)	112.375	107.375	101.125	95	104.625	100.75	97	93.75

Discussion

Among the most important postsurgical problems associated with secondary cleft nose rhinoplasty are loss of projection and rotation over time. Due to congenital anatomical malformations and scar tissue formation caused by previous surgeries, postoperative loss of projection and rotation problems continues to be major problems in patients with cleft nose. Surgeons have typically tried to reduce loss of projection and rotation using cartilage grafts and various techniques in cleft rhinoplasty including SEG [5, 7], CSG [8], Medpor [9], and shield grafts [10].

The present findings show that there was some degree of loss of projection at the beginning of the recovery period in both groups, but in the SEG group, this stopped after postoperative month 6. Additionally, nasal projection was better preserved in the SEG group than in the CSG group in the long term. Moreover, there was a degree of loss of rotation in both groups until postoperative month 1, and then, there was no loss in the SEG group after postoperative month 1, indicating that SEG supports rotation better than CSG in the long term.

There is ongoing debate regarding the long-term efficacy and stability of CSG and SEG used during primary rhinoplasty. Many surgeons advocate the use of CSG due to its elasticity. Bucher et al. [11] and Alghonaim et al. [12] showed that CSG is sufficient to support projection and rotation in primary rhinoplasty patients. The present findings show that cleft lip nose rhinoplasty is a distinct subgroup of rhinoplasty that necessitates more stable and strong tip support with SEG due to the inherent tendency for scarring and congenital anatomical malformations in patients with cleft lip nose.

In the present study, nasal projection was analyzed based on the Goode and AT/AN ratios. Kehrer et al. [13] used only the Goode ratio to analyze tip projection. We think that the AT/AN ratio is more useful than the Goode ratio for evaluating nasal projection, as AN distance remains the same postoperatively. Any loss of rotation or projection might change NT distance. NLA is a well-defined parameter for measuring tip rotation and Kehrer, Nijhuis [13] used NLA to analyze tip rotation; however, we think that the NAT angle is a more precise way of evaluating nasal tip rotation, as NLA is dependent on the depth of the columellar–labial transition point, which is highly variable in patients with cleft lip due to previous surgeries, maxillary hypoplasia, and scarring. Tip rotation is more closely related to the region anterior to the columellar breakpoint, whereas CLA is more closely related to the region posterior to the columellar breakpoint. Slight changes in tip rotation might not affect CLA, but they do change the NAT angle. Likewise, whereas slight columellar positional changes affect CLA, the NAT angle or tip position might not change.

Various methods can be used to increase tip rotation and projection in patients with a CSG, such as tip grafts, septocolumellar sutures, and the tongue in groove method. Olds and Sykes [3] applied CSG along with tongue in groove techniques to maximize tip projection and rotation support. Aksakal [14] and Şirinoğlu [15] observed that the combination of CSG and a septocolumellar suture or tongue in groove technique can provide adequate rotation and projection in patients undergoing primary rhinoplasty. Regarding SEG, various methods can increase long-term tip stability. Harel et al. [16], Sazgar et al. [17] demonstrated that SEG with tongue in groove improves reliability and efficacy of the graft. In cleft patients, SEG with tongue in groove technique can improve long-term stability of tip projection and rotation as well. The present study did not use septocolumellar sutures, the tongue in groove technique, or extended spreader grafts. Tip grafts were used in 3 cases in the CSG group, but we think tip grafts do not provide long-term support, as they are onlay grafts; therefore, these 3 patients were not excluded.

To the best of our knowledge, the present study is the first to compare long-term tip stability outcomes of SEG and CSG used during secondary cleft lip nose rhinoplasty. As cleft lip nose rhinoplasty has unique challenges that make it difficult for surgeons to fix deformities stably, surgeons should know how to manage and prevent long-term loss of tip rotation and projection.

Patients with bilateral and unilateral clefts were included in this study. Long lateral crura, short medial crura and increased angle between medial and lateral crura can be seen in both bilateral and unilateral cleft patients. In unilateral cleft patients, retrodisplaced dome in cleft side, tip asymmetry, deviation of columella to non-cleft side can be seen, whereas in bilateral cleft patients, short and weak columella, bilaterally retrodisplaced domes, wide and depressed tip can be seen [4, 18]. Due to these different characteristics between bilateral and unilateral cleft patients, cleft type-specific evaluations can be made with more homogeneous groups in future studies.

The present study has several limitations. As tip rotation and projection measurements can be affected by several parameters, many patients were excluded to make a reasonable comparison; therefore, the patient population was small. The nose is a 3-dimensional structure, and its cosmetic appearance should be evaluated in all directions; however, only right-side profile photographs of the patients were used to evaluate tip projection and rotation. The T-point is the most anterior point of the nose. Therefore, its position is consistent regardless of the side and cleft type. However, the A-point may change according to the cleft side especially in unilateral cases. Although we have described the A-point's location clearly in our study, it might be located a little bit posteriorly on the cleft side. Even though we used ratios rather than actual lengths in our analysis, we acknowledge this as a limitation. In this study, we only used septal cartilage grafts. As costal and auricular grafts have different biomechanical properties [19], their effects in long-term tip stability can be different.

Conclusion

Secondary cleft lip rhinoplasty is a distinct subgroup of rhinoplasty that necessitates stable and strong tip support. Due to the inherent tendency for scarring and congenital anatomical malformations in cleft lip patients, more powerful techniques should be used for pleasing long-term results. Based on the present findings, SEG provides more reliable and predictable long-term results in patients undergoing secondary cleft lip rhinoplasty than CSG.

Declarations

Conflict of interest All authors have no conflicts of interest to disclose.

Ethical approval "All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (Approval number: GO 21/1213) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards."

Informed consents Written informed consent for publication of their clinical details and clinical images was obtained from the patient. A copy of the consent form is available for review by the Editor of this journal.

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