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Comparison of Columellar Strut Graft (CSG) and Septal Extension Graft (SEG) Methods of Nasal Tip Plasty in Changes of Nasal Tip Position

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Abstract

Objective: The aim of this study is to compare the methods of columellar strut graft and septal extension grafts innasal tip plastic surgery in changing the position of the nasal tip.

Methods: In this cross-sectional study, information and parameters recorded in the files of 50 patients applying for rhinoplasty surgery who were operated on the personal office of Dr. Ali Shabani were examined, 25 of whom underwent columella strut graft and 25 of whom underwent septal extension graft and were also examined or changes in the position of the nasal tip. Patients were photographed before, during, and six months after rhinoplasty, and the position of the nasal tip were compared using Chi-square, repeated measurements, paired samples t-test, and independent t-test in the two methods. A significant level of 0.05 was considered.

Findings: Changes in the nasolabial angle over time between the SEG and CSG methods were not significant (P=0.197). Changes in the upper part of the nasolabial angle over time were significantly higher in the SEG method than in the CSG method (P=0.024). Changes in the lower component of the nasolabial angle over time between the SEG and CSG methods were not significant (P=0.815).

Conclusion: In this study, both columellar strut grafts and septal extension grafts methods showed similar changes in the position of the nasal tip over time. However, in the long term, changes in nasal tip elevation were greater in the SEG method compared to the columellar strut graft. It seems that changes in the position of the nasal tip decrease from the time of surgery to 6 months later.

Keywords: Rhinoplasty, Nose, Columellar Strut Graft, Septal Extension Graft, Tip Plasty

Introduction

Because of position of the nose in the middle of the face , it plays a key factor in the beauty of every person. Thus, rhinoplasty surgery is one of the most challenging facial plastic surgery procedures with aesthetic and functional effects on patients (1). Modifying the nasal tip in rhinoplasty causes many complex challenges. To achieve a desirable aesthetic and functional outcome, the nasal tip rotation, projection, and symmetry should be considered along with the appropriate structural support to maintain the desired result with long-term predictability (2). Cartilage grafting and degenerative techniques were performed on alar cartilage for many years. Many of these noses look good in the short term. However, some techniques have shown unpredictable long-term outcomes over

time (3). A return to more conservative and non-destructive nasal tip techniques has been re-considered hoping that long-term aesthetic outcomes can be achieved without damaging the nasal airway(4).

Several cartilage grafts have been introduced to alter the nasal tip rotation and projection effectively. Columellar strut grafts (CSG) and septal extension grafts (SEG) are commonly used in modern rhinoplasty to affect nasal tip rotation and function. Some studies have indicated that using columellar strut grafts may be unpredictable. SEG has functional and aesthetic advantages and is a beneficial technique, especially in patients with poor nasal tip support, lower lateral crura in an inappropriate position, short nose, or caudal septum deviation (5). Like any surgical procedure, a thorough understanding of anatomy and physiology is essential. Spending time to listen to the patient's concerns and desires is crucial to help set surgical goals and determine whether the patient has realistic expectations from the surgery or not. When the patient decides to undergo surgery, the surgeon should perform a comprehensive examination considering the dynamic effect of skin type, bone and cartilage structure, and anatomical limitations. Developing an accurate 3D plan with a structured sequence helps the surgeon achieve more predictable outcomes. Several years of training, experience, and continuing medical education are needed to communicate the many techniques that should be designed for each patient (6).

The nasal tip projection is affected by several anatomical factors such as the length and strength of the lower lateral cartilages, the suspensory ligament, fibrous connections to the upper lateral cartilages, and the anterior septal angle (7). Alar cartilages act as the primary factors of nasal tip projection and structural integrity (2). The concept of relying merely on lower lateral cartilages to change the nasal tip projection adding cartilage graft has been slowly lost in modern rhinoplasty. The increase of the septum is currently considered the primary factor in the increase of nasal tip rotation and projection (7). Among the various aesthetic aspects of rhinoplasty, changes in the nasal tip rotation often occur in this surgery. However, several rhinoplasty techniques affect the support mechanism of the nasal tip and thus may alter the stability of tip rotation (1). One of these methods involves placing a Columellar Strut Graft (CSG), mostly made from autologous septal cartilage, although conchal and costal cartilage may also be used. The cartilage used for the graft is cut before placing it between the internal crura alongside the caudal edge of the septum and adjacent to the nasal spine into a rectangular section with dimensions that complement the patient's anatomy. CSGs are a vital component of open-structure rhinoplasty and are necessary for maintaining tip support (8).

The proper nasal tip projection and rotation significantly affect the nose's beauty. Septal Extension Graft (SEG) is one of the tools used to improve nasal tip projection and rotation during rhinoplasty. This graft mostly overlaps the existing caudal septum in the midline position, lengthens it, and facilitates repositioning of the tip (1, 9). The extent to which each of these grafts changes the nasal tip projection and rotation depends on the composition of the underlying structures and the type of effect a person intends for the nasal tip. For example, a floating columellar strut is not effective in increasing projection, although it is effective in leveling the nasal tip and maint*aining its position (10).

Some studies have indicated that using columellar strut grafts may be unpredictable (11). Although fixed columellar strut grafts are no longer considered in aesthetic rhinoplasty, floating columellar struts are still commonly used (7). Columellar strut graft can be beneficial in properly selected patients, but it may have significant drawbacks. Columellar strut grafts are not very reliable in increasing the nasal tip projection. The lack of control of the nasal tip rotation is their most significant limitation (10, 12). Creating structural support with columellar strut graft is common, but it often yields unpredictable results. Additionally, grafts fixed on the septum were more reliable for controlling the nasal tip projection, rotation, and position (2). The septal extension graft was proposed as a method to redefine the skeletal relationship between the dorsum and the nasal tip. Creating structural support for the nasal tip complex based on the anterior septum allows predictable control of the nasal tip projection or rotation (7).

Septal extension graft is extensively used in rhinoplasty as a method to control the nasal tip position (13). SEG has functional and aesthetic advantages. It is also a beneficial technique especially in patients with poor nasal tip support, lower lateral crura in an inappropriate position, short nose, or caudal septum deviation (13). In addition, this graft mostly covers the caudal septum in the midline position, lengthens it, and facilitates the repositioning of the nasal tip. In the presence of a thick soft tissue cover, weak lower lateral cartilages are recommended. This

technique is popular all over the world (14). Depending on the purpose of use and the volume of taken septal cartilage, three different types of grafts have been designed including spreader type, batten type, and direct type. However, the unilateral use of SEG has been criticized due to the possibility of displacement to the sides of the caudal septum. Sufficient stability can be achieved using the tongue-and-groove method. This method stabilizes the dorsum and provides a base for the columellar strut, which is then sutured to the medial crura bilaterally. This process provides sufficient stability and support. It also makes the SEG maintain its position in the middle line and does not deviate to the sides (15).

To make septal extension grafts effective, they should be extended beyond the anterior septal angle into the intermodal space. The most caudal and inferior part of the graft is placed in the cephalic border of the internal crus in the columellar-lobular angle. The most important point is the fixation to the divergence in the lower middle crura, where the cephalic borders of the medial crura are connected. At this stage, the graft considers the desired columellar-lobular angle. Then, an interdomal fixation point can be used to control the desired interdomal distance and projection (7). Most of the similar studies have examined each of the columellar strut and septal extension grafts separately. A limited number of studies have compared these two grafts (16). In addition, it is necessary to investigate the effect of these two grafts on different races. Thus, the present study intends to investigate the difference between the two methods of septal extension graft and columellar strut graft on the nasal tip position.

Materials and Methods

In this cross-sectional study, 50 rhinoplasty candidates examined in 2021 in the personal clinic of Dr. Ali Shabani (Otorhinolaryngologist) (if the patient met the inclusion criteria) were investigated. A convenience sampling method was used. The inclusion criteria included patients aged between 18 and 35 years and undergoing rhinoplasty for the first time (primary rhinoplasty) in 2024. The exclusion criteria included people with a history of severe injuries in the middle part of the face and especially the nose, suffering from significant deviation and deformity in the middle part of the nose (crooked nose), and any aesthetic intervention in the studied area such as gel and filler injections.

The minimum of 25 patients was determined for each group (50 patients in total) based on the studies by Harel et al. (14) and the formula for determining the sample size and considering the error of 5% and the β error of 20%. Accordingly, 25 people underwent columellar strut surgery and 25 underwent septal extension surgery. One surgeon performed all surgeries. The recorded information and parameters were extracted from the medical records of patients who were candidates for surgery. Based on the surgical method in tip plasty, the patients were divided into two groups. The first group of patients received a columellar strut graft and the second group received a septal extension graft.

Surgical procedure

The surgical steps were transcolumellar incision, skeletonization, removal of cartilaginous hump, removal of cartilage from the caudal septum, stretched rasp, the lateral upper cartilage, and internal and external osteomy of the nasal, respectively. Transdomal and interdomal, nasal dorsum graft was performed in patients with columellar strut surgery and septal extension surgery in the second group. Then, the nose was sutured. All patients were photographed before, during, and six months after surgery by a Canon EDS 750d camera (camera lens was 13-18mm).

Photography conditions

First, the patient was sitting on a suitable chair for photography. A photographer with the same lighting conditions took all the photos. The photography camera was fixed on a tripod and the patient's head was placed in NHP mode. The photo background was blue. The patient's ear was placed inside the photo frame. The patients were photographed directly (at a zero-degree angle) in such a way that the two ears were aligned, and the nose was in the photo center.

Profile photo conditions

The profile view was such that one eyebrow of the patient was seen and the opposite eyebrow was not included in the photo frame. The profile of the patient was taken at a 90-degree angle and a photo of the patient's profile was taken in NHP mode. The nasolabial angle (NLA) was measured on the photos to examine the nasal tip rotation. The NLA angle was defined as the angle between the most anterior point of the nose and the subnasal area (the area where the upper lip meets the nose base in the middle point of the coronal view). The subnasal point was also defined as the most forward point of the upper lip, the mean of which is 90 to 95 degrees in males and 95 to 110 degrees in females (17). The nasolabial angle is divided into upper and lower parts by a horizontal line drawn perpendicular to the subnasal point, as shown in Figure 1. In the nasolabial angle changes, its upper part was examined separately from the lower part. A change in the upper part indicates a change in the inclination of the nasal tip, and a change in the lower part indicates a change in the upper lip inclination. A better understanding of the changes in the upper and lower part helps to decide the best method of surgical treatment (18).

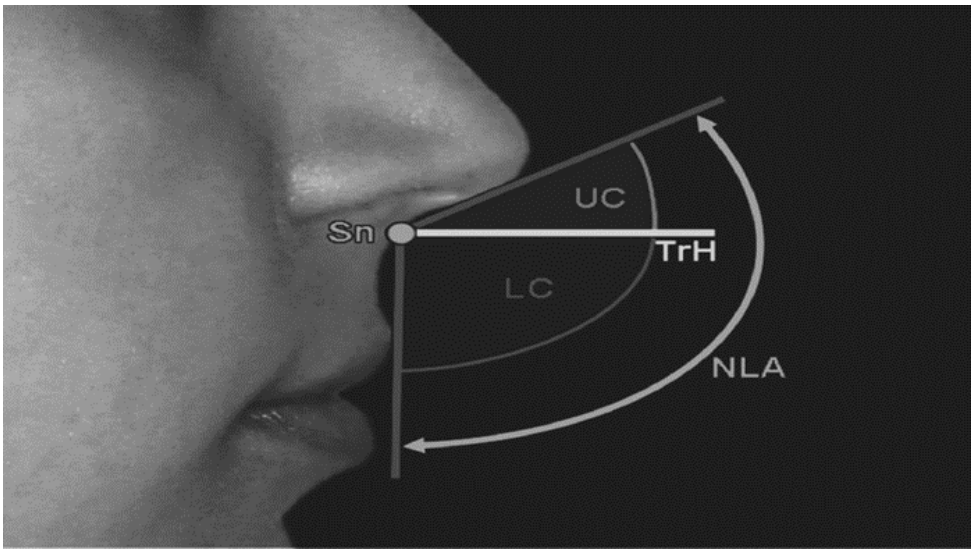

Figure 1- The nasolabial angle is divided into two upper components (UC) and lower (LC) components by a true horizontal line (TrH) that is perpendicular to the subnasal point (Sn).

Finally, the data were analyzed in SPSS-22 software. The data were analyzed by descriptive statistics indices and were presented in the form of tables and graphs. To compare the means of the studied variables in the follow-up and pre-surgery periods, repeated measurements, Paired samples T-test, Independent T-test, and Chi-square tests were used. The significance level was considered 0.05.

Results

The mean age of patients was 23.16±3.84 with a median of 24 years, a minimum age of 18, and a maximum of 33 years. The mean age was 22.76 ± 3.92 years in the SEG group and 23.56 ± 3.00 years in the CSG group. No statistically significant difference was observed between the two groups (P=0.423). Eleven patients (22%) were male and 39 patients (78%) were female. The gender distribution between the two groups revealed that 6 people (24%) were male and 19 people (76%) were female in the SEG group. Five people (20%) were male and 20 people (80%) were female in the CSG group. The frequency of males and females showed no statistically significant difference between the two groups (P=0.733). Examining the normality of the data revealed that the data followed the normal distribution and parametric tests were used. Changes in the nasolabial angle between SEG and CSG methods over time were not significant (P=0.197) (Figure 2).

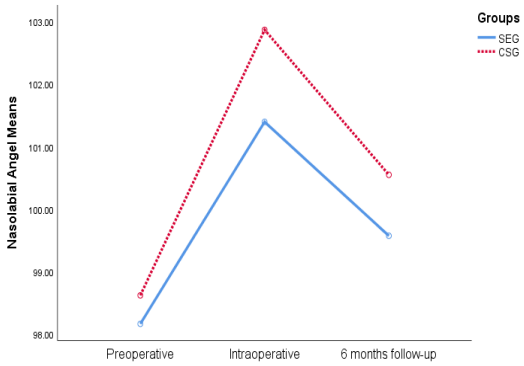

Figure 2- Comparison of the nasolabial angle between SEG and CSG methods in follow-up times

Table 1- Comparison of the nasolabial angle between the follow-up times (pairwise) and at any time between the two methods

nasolabial angle (degrees)	*Follow-up times*			*P value**
	Before surgery SD±Mean	*During surgery SD±Mean*	*Difference SD±Mean*	
group SEG	86.16±2.98	41.39±3.101	83.23±-1.3	*<0.001*
group CSG	14.61±4.98	37.87±4.102	13.25±-2.4	*<0.001*
*P value***	0.653	0.190	0.077	
nasolabial angle (degrees)	*Before surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
group SEG	86.16±2.98	10.57±3.99	56.41±-1.1	*<0.001*
group CSG	14.61±4.98	17.54±4.100	56.93±-1.1	*<0.001*
*P value***	0.653	0.352	0.244	
nasolabial angle (degrees)	*During surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
group SEG	41.39±3.101	10.57±3.99	26.82±1.1	*<0.001*
group CSG	37.87±4.102	17.54±4.100	17.32±1.2	*<0.001*
*P value***	0.190	0.352	0.156	

* Paired samples t-test

** Independent T-test

The mean nasolabial angle in both methods increased significantly during surgery compared to before surgery (P<0.001). However, the mean nasolabial angle before and during surgery did not show a significant difference between the two graft methods (P=0.653 and 0.190, respectively). The mean nasolabial angle also increased significantly in both methods 6 months after surgery compared to before surgery (P<0.001). However, the mean nasolabial angle before and 6 months after surgery did not show a significant difference between the two graft methods (P=0.653 and 0.352, respectively). Additionally, the mean nasolabial angle in both methods was

significantly reduced 6 months after surgery compared to during surgery (P<0.001). However, the mean nasolabial angle during and 6 months after surgery did not have a significant difference between the two graft methods (P=0.190 and 0.352, respectively). The increase in the upper part of the nasolabial angle is defined as the inclination in the nasal tip in patients. Changes in the upper part of the nasolabial angle over time were significantly higher in the SEG method than in the CSG method (P=0.024) (Figure 3).

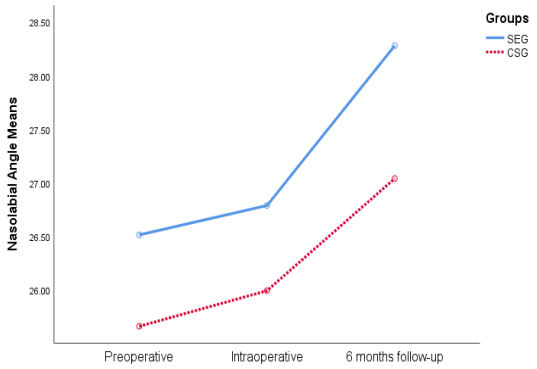

Figure 3-Comparison of changes in the upper part of the nasolabial angle during the follow-up times between SEG and CSG methods

Table 2- Comparison of the changes in the upper part of the nasolabial angle between the follow-up times (two by two) and at any time between the two methods

upper part of nasolabial angle (degrees)	*Follow-up times*			*P value**
	Before surgery SD±Mean	*During surgery SD±Mean*	*Difference SD±Mean*	
group SEG	42.51±2.26	24.78±2.26	46.27±-0.0	*<0.001*
group CSG	91.66±2.25	79.99±2.25	37.33±-0.0	*<0.001*
*P value***	0.266	0.274	0.627	
upper part of nasolabial angle (degrees)	*Before surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
group SEG	42.51±2.26	29.28±2.28	73.76±-0.1	*<0.001*
group CSG	91.66±2.25	73.04±2.27	65.37±-0.1	*<0.001*
*P value***	0.266	0.089	0.056	
upper part of nasolabial angle (degrees)	*During surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
group SEG	24.78±2.26	29.28±2.28	58.49±-0.1	*<0.001*
group CSG	79.99±2.25	73.04±2.27	64.04±0.1	*<0.001*

*P value***	0.274	0.089	0.013	

* Paired samples t-test

** Independent T-test

The mean of the upper part of the nasolabial angle in both methods increased significantly during surgery compared to before surgery (P<0.001). However, the mean of the upper part of the nasolabial angle before and during surgery was not significantly different between the two graft methods (P=0.266 and 0.274, respectively). The upper part of the nasolabial angle also increased significantly in both methods 6 months after surgery compared to before surgery (P<0.001). However, the mean of the upper part of the nasolabial angle before and 6 months after surgery was not significantly different between the two graft methods (P=0.266 and 0.089, respectively). Also, the average of the upper part of the nasolabial angle in both methods increased significantly 6 months after surgery compared to during surgery (P<0.001). However, the average of the upper part of the nasolabial angle during and 6 months after surgery was not significantly different between the two graft methods (P=0.274 and 0.089, respectively) (Table 2). The increase in the lower part of the nasolabial angle is defined as an increase in the inclination of the upper lip in patients.

Changes in the lower part of the nasolabial angle over time between SEG and CSG methods were not significant (P=0.815) (Figure 4).

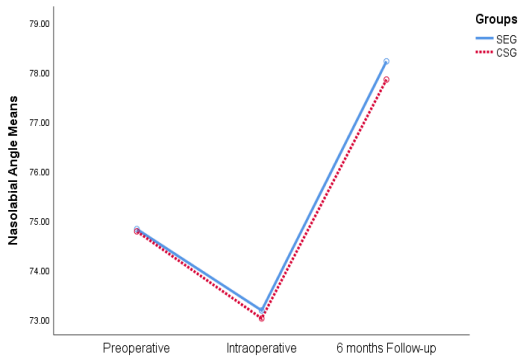

Figure 4- Comparison of the changes in the lower part of the nasolabial angle during the follow-up times between the SEG and CSG methods

Table 3-Changes of the lower part of the nasolabial angle between the follow-up times (pairwise) and at any time between the two methods

lower part of the nasolabial angle (degrees)	*Follow up times*			*P value**
	Before surgery SD±Mean	*During surgery SD±Mean*	*Difference SD±Mean*	
group SEG	67.81±3.74	18.17±3.73	10.64±1.1	*<0.001*
group CSG	24.77±3.74	80.00±2.73	91.76±0.1	*<0.001*
*P value***	0.963	0.849	0.689	
lower part of the nasolabial angle (degrees)	*Before surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
group SEG	67.81±3.74	20.21±2.78	87.39±=-3.1	*<0.001*

group CSG	24.77±3.74	09.84±2.77	83.07±-3.1	*<0.001*
*P value***	0.963	0.547	0.540	
lower part of the nasolabial angle (degrees)	*During surgery SD±Mean*	*6 months after surgery SD±Mean*	*Difference SD±Mean*	*P value**
SEG group	18.17±3.73	20.21±2.78	75.04±-1.5	*<0.001*
group CSG	80.00±2.73	09.84±2.77	77.84±-1.4	*<0.001*
*P value***	0.849	0.547	0.680	

* Paired samples t-test

** Independent T-test

The mean of the lower part of the nasolabial angle in both methods during surgery was significantly reduced compared to before surgery (P<0.001). However, the mean of the lower part of the nasolabial angle before and during surgery was not significantly different between the two graft methods (P=0.963 and 0.849, respectively). Additionally, the mean of the lower part of the nasolabial angle increased significantly in both methods 6 months after surgery compared to before surgery (P<0.001). However, the mean of the lower part of the nasolabial angle before and 6 months after surgery was not significantly different between the two graft methods (P=0.963 and 0.547, respectively). In addition, the mean of the lower part of the nasolabial angle increased significantly in both methods 6 months after surgery compared to during surgery (P<0.001). However, the mean of the lower part of the nasolabial angle during and 6 months after surgery was not significantly different between the two graft methods (P=0.849 and 0.547, respectively) (Table 3).

Discussion

The present aimed to predict the possible changes in the nasal tip position in two methods including columellar strut graft and septal extension graft in rhinoplasty. Comparing the two methods of columellar strut and septal extension in tip plasty is limited to a limited number of studies. The present study is one of the first studies conducted in this regard in Iran. The results revealed that the nasolabial angle and its upper and lower parts had similar changes in both methods. The increase in the nasal tip and the inclination of the upper lip were more than 6 months after the surgery. The nasolabial angle decreased from the surgery to the 6 months after the surgery, but it was still higher than before the surgery.

Generally, the difference in changes in the nasal tip position in the SEG method is higher than in the CSG method in the long term (1.49 to 1.04). However, in the period 6 months after the surgery, the changes in the inclination of the nasal tip between the two methods did not show a significant difference. According to the studies, the nasal tip can be significantly stretched after surgery due to the rigid fixation in SEG, justifying the present results. The CSG method's function is to support the internal crus and maintain the nasal tip position. Even if it shapes the nasal tip acceptably, there is a debate about its long-term stability (19). Examining the nasal tip position in the 6-month interval between the two methods is considered one of the strengths of the study, indicating that the SEG method causes an increase in the nasal tip from before the surgery to 6 months after it.

Various nasal tip-retaining grafts are available, which surgeon's preference determines its implementation. Preferring one graft over another may produce more favorable outcomes for both the surgeon and the patient. However, it is necessary to examine all the parameters related to the nasal tip position to select a better method (20). Although the nasal tip projection and rotation regarding different methods of grafting were not compared in this study, it can be the basis for future studies. Most of the studies conducted on changes in parameters related to the nose that affect the nasal tip position have yielded similar results. Based on the study by Shah et al., both of these methods provide the conditions to control the nasal tip support and can increase the nasal tip projection and shape the middle crura. These grafts support the lower limb of the tripod to support the nasal tip (21). These results were also reported in the studies by Petroff et al. and Anderson et al. (22).

In a study by Suh et al., it was concluded that the two nasal tip surgery methods are similar regarding stability (23). Atighechi et al. reported that both methods are suitable for stabilizing the nasal tip position (24). Consistent with the present study, Lathif et al found that SEG has a better aesthetic outcome and less nasolabial angle deviation over time (16). The SEG technique potentially provides a stiffer scaffold and more consistent control of the tip lobule, which has a direct connection from the septum to the tip. More cartilage support, compared to CSG, can help improve the aesthetics perceived by patients (18). The study by Harel et al. also stated that the SEG method is effective in improving nasal tip projection and rotation in the long term (14). All the above studies indicate the long-term effect of the SEG method on the nasal tip position, and this method does not differ from the CSG method in a short period. The same result was obtained in a study by Sazgar et al. Adding SEG to TIG can be an effective method to create and maintain a stable rotation compared to TIG alone (1), which is consistent with the results of our study. Additionally, the nasal tip position, control, and maintenance are the most crucial elements of a successful rhinoplasty and are affected by the surgical approach, maneuvers, and recovery after surgery. Thus, it is necessary to study the graft technique used in the tip plasty. Additionally, some studies also yielded different results than our study. Akkus et al. concluded that the measured values in SEG decreased to a lower value over time and the nasal tip position was more stable in subjects with SEG than CSG subjects (25). In the study by Kucukguven et al., it was concluded that SEG causes fewer changes in the nasal tip position compared to CSG (26). In the study by Bucher et al., it was found that CSG is a beneficial tool in cases where upward rotation is desired (27).

This study also indicated an increase in the nasolabial angle after surgery, which is consistent with the study of Alghonaim et al. (27). However, they only measured nasolabial angle in the CSG method, while both the CSG and SEG methods were examined in the present study, and an increase in the nasolabial angle after surgery compared to before surgery was observed in both methods. Nasal tip support depends on crura length and strength, intercranial ligament integrity, skin/soft tissue thickness, domal suture techniques, and nasal tip grafts (29). Thus, the difference in the results of the studies could be any of the above clinical variables, which are different based on the statistical population of each study. In this study, both stratum columellar and septal extension methods showed similar changes in the nasal tip position over time. However, changes in the elevation in the nasal tip were higher in the SEG method in the long term compared to the columellar strut. It seems that changes in the nasal tip position from the surgery to 6 months after it decreased. It is recommended to conduct a study with a longer follow-up to investigate the changes in the nasal tip position in the two methods in one year.

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