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Nasal Tip Flexibility and Stability: Comparison of Septal Extension Grafts and Columellar Strut Grafts in a Prospective Trial

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Running Title: Nasal Tip Stability and Flexibility

Abstract

Background: The stability of nasal tip rotation and projection, as well as providing a flexible nasal tip, are important elements in rhinoplasty. Two common options to provide these requirements are the septal extension graft (SEG) and the columellar strut graft (CSG). This study aims to compare the nasal tip stability and flexibility between the two graft options.

Methods: A prospective randomized study was carried out on sixty patients operated on with either the CSG or SEG. Tip rotation and projection stability were analyzed with photographic evaluation at the immediate postoperative period, the first month and the first year. Nasal tip flexibility was evaluated with a Newton meter at the preoperative period and postoperative first, third, and sixth months and the first year.

Results: The CSG showed a significant loss of projection and rotation, while the SEG showed better preservation of projection and rotation. However, both options showed a greater loss of projection and rotation in the first month and then a slight decrease in the following months. Although the SEG had lesser flexibility compared to the CSG anteroposteriorly, there was no flexibility difference between them in the lateral direction in the long term.

Conclusion: The SEG provides better nasal tip stability compared to the CSG. The biggest downside of the SEG is decreased flexibility compared to the CSG. Surgeons should be aware of the loss of projection and rotation with both graft options and adjust their operation plan according to these points.

Keywords: Rhinoplasty, Columellar Strut Graft, Septal Extension Graft, Nasal Tip, Rotation, Projection

INTRODUCTION

One of the most important outcomes of successful rhinoplasty is an aesthetically pleasing nasal tip. The nasal tip is one of the first features noticed when viewing the nose and captures significant attention from people. Nasal tip projection and rotation are the fundamental factors to achieve an aesthetically pleasing tip.[1] Therefore, it is crucial to control this projection and rotation using the proper surgical technique.

Anderson introduced the concept of the nasal tip complex as a tripod, which is now commonly known as the tripod theory.[2] In this theory, the lateral crura are described as two legs, while the two medial crura collectively represent the third leg. Inadequate support, particularly in the medial crura, can lead to a loss of projection and rotation in the postoperative period. To maintain the support, different modifications have been implemented to rhinoplasty surgery in the literature.[3] One of these modifications is using different structural grafts for nasal tip support.[4] The various structural graft options are utilized in tip-plasty to provide support for these structures and to create a foundation for them to rest upon. The most commonly used graft options for this purpose are the septal extension graft (SEG) and the columellar strut graft (CSG). Both remain popular options among surgeons, and neither has completely surpassed the other.[5]

The typical placement of the CSG (floating) is between the medial crura and anterior to the nasal spine caudally. Its function is to support the medial crus and to maintain the nasal tip position. Even though it acceptably shapes the nasal tip, there is an argument about its long-term stability.[6] The SEG is typically fixed to the caudal septum and dome of the nose. Because of the rigid fixation in the SEG, the nasal tip can become extremely taut during the postoperative period. A number of criticisms of the SEG include the potential for cartilage fracture, reduced tip flexibility, and a stiff nasal tip.[7] Therefore, in addition to the projection and rotation, another important factor affecting the desired nasal tip is flexibility and stiffness.

The SEG and CSG have been compared in the literature regarding nasal tip rotation, projection, and flexibility.[8,9] However, these were either retrospective chart reviews or short-term prospective studies. To our knowledge, there is no prospective study that compares the SEG and the CSG for their long-term effect on nasal tip flexibility, as well as the stability of its projection and rotation. A prospective clinical trial has been designed to compare the short and long-term results of the SEG and CSG in rhinoplasty patients regarding nasal tip flexibility and stability of projection and rotation.

PATIENTS AND METHODS

A prospective, interventional, randomized study was designed to compare the two graft techniques (CSG and SEG) used in rhinoplasty. Each patient who applied to our clinic with a request for rhinoplasty was evaluated for eligibility. To be eligible for the study, patients had to be between 18-65 years old and have no prior history of septorhinoplasty, nasal dermal fillers, or cleft lip nose deformity. It was also planned to exclude patients from the study if patients were lost to follow-up, or any intervention was performed on the radix (augmentation-reduction) and alar base (excisions) during the operation. Randomization was performed using a clinical trial randomization tool to assign patients to either the CSG or SEG group, with a 1:1 allocation ratio.[10] All of the eligible patients were operated on between April 2021-April 2022 and all had either the CSG or SEG. Patient binary gender, age, and comorbidities were documented. Nasal tip rotations and projections were evaluated by photographic evaluation and nasal tip flexibility was evaluated by a Newton meter.

Surgical Method

All surgeries were performed using open structural rhinoplasty and were performed by a senior surgeon (A.K.). After the skin was elevated by sub-perichondrial and sub-periosteal dissections, excess nasal bone, dorsal cartilage, and upper lateral cartilage were excised. Following the

endonasal lateral and medial oblique osteotomies, and L-strut septoplasty, nasal dorsal reconstruction was performed with spreader flaps. During the septoplasty, the caudal support of the septum was retained by preserving the connection of the septum to the anterior nasal spine. The cartilage grafts excised from the septum were prepared according to the graft type (CSG or SEG). New tip-defining points were created by the transdomal and dome equalizer sutures after the cephalic trims of the lateral crura. From this point onward, either the SEG or CSG was used according to grouping.

In the CSG group, the CSGs were placed between the medial crura. The CSG was then secured to the medial crura across two points using 5-0 Polydioxanone (PDS). After this, the CSG was sutured to neo-domes with 5-0 PDS to stabilize the tip complex. The dimensions of the CSGs were approximately 14-16 mm in length, 2-3 mm in width, and 1-2 mm in thickness. It was not sutured to the anterior nasal spine and was left as a floating CSG.

The SEGs had dimensions of approximately 18-20 mm in length, 10 mm in width, and 1-2 mm in thickness. The SEGs were placed in an overlapping manner with the caudal septum (Figure 1). In our experience, even when we operate on a straight nose, there is always a slight septal deviation to one side. Therefore, we always place the SEG on the opposite side. After the SEGs were positioned, they were secured with two 27 gauge needles at two points to the septum. After making sure the SEG was in the correct position and angle, the graft fixation started. The SEGs were first fixed to the septum with two 6-0 polypropylene sutures, one on the most inferior part of the graft and the other at the intersection of the nasal dorsum. To further strengthen the fixation, horizontal mattress sutures were placed with 5-0 PDS sutures that pass both septum and the graft across 6-8 points. A horizontal mattress suture was placed between the neo-domes and the SEG to stabilize the tip complex using 5-0 PDS. The SEG was attached to the medial crura by placing two

horizontal mattress sutures with 5-0 PDS. (See Video, Supplementary Digital Content 1, which shows the securing of the tip complex to the SEG with a horizontal mattress suture)

Stability Evaluation

Preoperative and postoperative photographs were taken with a Canon EOS 90D camera (manufactured by Canon Inc., Tokyo, Japan) and a tripod was used from a distance of two meters. Several photographs of each patient from various angles, including frontal, profile, basal, and oblique views were captured immediately after the operation, as well as at the one-month and one-year marks after the procedure. The resulting photos were transferred to the Image J program for analysis.[11] From a profile view the nasal landmarks were marked as follows: nasion (N); the midpoint of the alar-facial grove (A); tip defining point (T); and the columella (C). The distance between points A and T (AT) and the distance between points N and A (AN), as well as the angle between points N, A, and T (NAT angle), were measured (Figure 2). The AT/AN ratio was used for nasal tip projection measurement while the NAT angle was used to measure nasal tip rotation.

Flexibility Evalutaion

To evaluate the nasal tip flexibility, the force required to move the nasal tip defining point was measured. The lateral movement and deprojection (anteroposterior) movement of the nasal tip were carried out and measured by a Newton meter (Geratech SH-20, EgeRate Elektronik, Istanbul). The Newton meter was chosen since it had already been used to evaluate nasal tip flexibility in the literature.[12] Patients were in supine positions and no patient movement was allowed in order to achieve accurate results. To measure lateral direction movement a ruler was placed perpendicular to the columella, and to measure the anteroposterior movement, a ruler was placed parallel to the columella. The force required to displace the nasal tip for 1mm, 2mm and 3mm in the anteroposterior direction, and 2mm, 4mm and 6mm in the lateral direction were

measured by the Newton meter (Figure 3). Newton meter evaluations were carried out one day before operations and at one-month, three-month, six-month, and one-year postoperatively.

Quantitative and qualitative data were statistically analyzed within and between the groups using an SPSS 24 (IBM Corp., Armonk, NY). The results with a P value of less than 0.05 were considered statistically significant. Differences within the groups were evaluated using the one-way repeated measures ANOVA test for normally distributed data and the Friedman test if the normal distribution was not present.

RESULTS

Ninety-one patients were enrolled in the study, but three patients with radix augmentation or reduction, thirteen patients with alar base reduction and fifteen patients who were lost to follow-up were excluded from the study according to the exclusion criteria. The final study comprised a total of sixty patients, with thirty patients (which included twenty-four females) in the CSG group and thirty patients (which included twenty-eight females) in the SEG group (Figure 4). The mean age of the patients in the CSG group was 27.5 years, while in the SEG group it was 25.9 years.

The results of the AT/AN ratios and the NAT angles are listed (Table 1). The mean AT/AN ratio in the CSG group was 0.63 immediately after the operation, 0.60 at the first month, and 0.59 at twelve months after the operation. In the SEG group, the mean AT/AN ratio was 0.61 immediately after the operation, 0.60 at the first month, and 0.58 at twelve months after the operation (Figure 5). In the CSG group, the AT/AN ratio significantly decreased at the postoperative first month compared to the immediate postoperative period, but the decrease from the first month to the first year was not statistically significant. The decrease in the AT/AN ratios in the SEG group during the postoperative period was not statistically significant.

The mean NAT angles in the CSG group were 60.0 immediately after the operation, 69.1 at the first month, and 70.6 at the first year after the operation. The mean NAT angles in the SEG group were 63.9 immediately after the operation, 69.9 at the first month, and 71.1 at the first year after the operation (Figure 6). The NAT angle and nasal tip rotation have an inverse correlation; the bigger the NAT angle the lower the rotation. The immediate postoperative rotation in the CSG group was higher compared to the SEG group and it was statistically significant ($p<0,05$). In both groups, decreases in the tip rotation from the immediate postoperative period to the first month were significant, but decreases from the first month to the first year were not statistically significant (greater loss of rotation in the first month).

The flexibility results for lateral and anteroposterior movement of the nasal tip for both groups are listed (Table 2). In both groups, anteroposterior flexibility across all periods for 1mm, 2mm and 3mm movements was significantly lower compared to the preoperative period, except for 1mm movement of the CSG group. For the 1mm movement, the difference between the preoperative period, the postoperative sixth month and the first year was not statistically significant in the CSG group; flexibility for the 1mm movement returned to normal within six months in the CSG group. The SEG group exhibited less flexibility anteroposteriorly compared to the CSG group, and it was statistically significant (Figure 7).

In both groups, lateral flexibility in the postoperative first month for 2mm, 4mm and 6mm movements was significantly lower compared to the preoperative period. However, lateral flexibility returned to normal earlier in the CSG group compared to the SEG group (Figure 8). The CSG group exhibited normalization of lateral flexibility at the third month after the surgery, while the SEG group achieved normalization in the first year. At one-year postoperatively, no statistically significant difference in lateral flexibility was observed between the groups.

DISCUSSION

The SEG and CSG are workhorse grafts for nasal tip stabilization and have been compared in the literature.[13,14] Akkus et al. compared the SEG and CSG regarding nasal tip stability.[15] Their findings demonstrate that the SEG provides superior results in terms of tip stabilization compared to the CSG. The authors specifically recommend the use of the SEG in cases of short, weak medial crura and droopy nose. Another study focused on evaluating the effects of the SEG and CSG on aesthetic and functional outcomes. Even though they both showed similar functional outcomes, the SEG exhibited superior preservation of nasal tip rotation.[16] A comparison of the SEG and CSG in the matter of tip stability and flexibility has been carried out in the literature but, to the best of our knowledge, no prospective study has been carried out on this topic.[8,15]

SEGs can be divided into two groups; side-to-side or end-to-end fixation.[17] In our study, we secured the SEGs in a side-to-side fashion. Even though it requires more cartilage compared to end-to-end methods, we believe side-to-side fixation creates a more robust scaffold. However, contrary to our intuition, several authors showed no difference between these methods in their long-term stability.[17] It is also possible to use extended spreader grafts to secure septal extension grafts in an end-to-end fashion.[7] Rohrich et al. point out that the CSG can be effective, especially in patients with weak medial crura, asymmetric lower lateral cartilages, and short medial crura.[18] However, as there is no consensus on how to objectively measure the strength of the medial crura in the literature, our study randomizes patients irrespective of their lower lateral cartilage anatomy before surgery.

In this study, the AT/AN ratio was utilized to determine tip projection, while the NAT angle was employed to determine tip rotation. The N and A points were expected to change when interventions were carried out in the radix and alar base, respectively. To ensure that the N and A points were constant, patients treated at these sites were excluded from the study. The reasons

behind the use of the AT/AN instead of AT distances were the following: 1. Even though all the photographs were taken from the same distance, we wanted to analyze our results more accurately keeping the AN distance constant; 2. To eliminate inconsistency with different nasal lengths which can affect the desired projection. We believe that the AT/AN ratio is more accurate compared to the Goode ratio, because the tip-defining point is not constant, and using it both as a numerator and denominator, as in the Goode ratio, can provide inconsistent results.

The only variable in the NAT angle is the T point, so it provides a better representation of tip rotation compared to other measurements. One of the commonly used angles to measure nasal tip rotation is the nasolabial angle. Regardless of the tip position, columellar positional changes can affect the nasolabial angle and can cause inconsistent results with the nasolabial angle.[19] In this study, the NAT angle is used to measure the changes in the rotation. To the best of our knowledge, because no prior study has been conducted for the aesthetically acceptable NAT angle, it is beyond the scope of this study and the NAT angle was only used to show changes in the rotation.

The CSG group showed a greater loss of rotation compared to the SEG group, but final rotations were similar between the groups. There was a higher rotation in the CSG group immediately after the operation. Because in our experience the CSG option will have a greater loss of rotation in the postoperative period, we tend to rotate the tip even more in the CSG patients.

In our study, the CSG group showed a statistically significant loss of projection (AT/AN ratio) in the first month, but no significant loss was found in the following months. Even though there was a loss of projection in the SEG group during the postoperative period, it was not statistically significant. These results show that the SEG option offers better projection stability than the CSG option. However, surgeons should anticipate a certain degree of rotation and projection loss even with the SEG option, and adjust their intraoperative decisions accordingly, based on these findings.

A greater loss in the projection and rotation in the CSG group compared to the SEG group can be explained by the lack of stable fixation of the CSG as it was a floating CSG in all of the cases.[6]

Flexibility refers to the ability of a material to bend without being permanently deformed.[20] The flexibility of the nasal tip can be affected by different factors in addition to the cartilage properties, such as the thickness of the skin, fibrosis, and condition of the membranous septum.[21] What we call 'flexibility' here, a number of authors call elasticity of Young's modulus.[22] The term 'elasticity' cannot be used in this case, as there are multiple factors that influence it and we are not measuring the force required to change the length of the cartilage. Furthermore, the term 'flexibility' also encompasses the stiffness of the nasal tip. Therefore, using the term 'flexibility' instead of 'elasticity' is more appropriate in this context.

Aydogan et al. found that suturing the medial crura to the septum or septal extension graft will result in a stiffer nasal tip.[23] In our study, the SEG group had a long-term decreased flexibility in the anteroposterior movement, but the lateral movement of the nasal tip was normal at the postoperative first year. The CSG group maintained its flexibility both in anteroposterior and lateral movements without any reduction.

There are several limitations of this randomized prospective study that should be addressed. Many SEG types are described in the literature.[24,25] Our results are limited to the type of SEG used in our study. Although other variables such as edema, skin thickness, medial crura, and lateral crura strengths have not been accounted for in our study, these downsides have been minimized by randomization of the groups. Other limitations include, but are not limited to, a relatively small sample size, short follow-up period, single-center, and one surgeon study. Additionally, we did not perform any patient-reported outcome measurements, so the effect of these results on patients' lives has not been put forth.

CONCLUSION

The septal extension graft provides better tip rotation and projection stability compared to the columellar strut graft. Nevertheless, both options showed a loss in the rotation and projection over time. The biggest loss in the rotation and projection was seen in the first month, with a gradual but slight decrease in the following months. The septal extension graft has decreased flexibility compared to the columellar strut graft, especially in the anteroposterior movement. This study expands the knowledge of the postoperative changes in nasal tip stability and flexibility with a prospective randomized design. Multiclinical and multi-surgeon studies with longer follow-up periods are warranted to further the knowledge on this topic.

REFERENCES

1. Armijo BS, Brown M, Guyuron B. Defining the Ideal Nasolabial Angle. *Plastic and Reconstructive Surgery*. 2012;129(3):759-764. doi:10.1097/PRS.0b013e3182402e12

2. Anderson J. The dynamics of rhinoplasty. 1969:

3. Erdal AI, Genç İ G, Pasinlioğlu B, Findikçioğlu K. Flexible Tongue-in-Groove Technique and Its Effectiveness Compared to Classic Tongue-in-Groove and Columellar Strut Graft Techniques: A Retrospective Analysis of 237 Open Rhinoplasty Cases. *Plast Reconstr Surg*. Dec 1 2021;148(6):1221-1232. doi:10.1097/prs.0000000000008511

4. Rohrich RJ, Hoxworth RE, Kurkjian TJ. The Role of the Columellar Strut in Rhinoplasty: Indications and Rationale. *Plastic and Reconstructive Surgery*. 2012;129(1):118e-125e. doi:10.1097/PRS.0b013e3182362b7a

5. Rohrich RJ, Durand PD, Dayan E. Changing Role of Septal Extension versus Columellar Grafts in Modern Rhinoplasty. *Plastic and Reconstructive Surgery*. 2020;145(5):927e-931e. doi:10.1097/prs.0000000000006730

6. Sawh-Martinez R, Perkins K, Madari S, Steinbacher DM. Control of Nasal Tip Position: Quantitative Assessment of Columellar Strut versus Caudal Septal Extension Graft. *Plast Reconstr Surg*. Nov 2019;144(5):772e-780e. doi:10.1097/prs.0000000000006178

7. Kim MH, Choi JH, Kim MS, Kim SK, Lee KC. An introduction to the septal extension graft. *Arch Plast Surg*. Jan 2014;41(1):29-34. doi:10.5999/aps.2014.41.1.29

8. Lathif A, Alvarado R, Kondo M, Mangussi-Gomes J, Marcells GN, Harvey RJ. Columellar strut grafts versus septal extension grafts during rhinoplasty for airway function, patient satisfaction and tip support. *J Plast Reconstr Aesthet Surg*. Jul 2022;75(7):2352-2358. doi:10.1016/j.bjps.2022.02.017

9. Akkus A, Eryilmaz E, Guneren E. Comparison of the Effects of Columellar Strut and Septal Extension Grafts for Tip Support in Rhinoplasty. *Aesthetic plastic surgery*. 05/25 2013;37doi:10.1007/s00266-013-0141-1

10. "Clinical Trial Randomization Tool." The National Cancer Institute's Division of Cancer Prevention AM. https://ctrandomization.cancer.gov.

11. Schneider CA, Rasband WS, Eliceiri KW. NIH Image to ImageJ: 25 years of image analysis. *Nature Methods*. 2012/07/01 2012;9(7):671-675. doi:10.1038/nmeth.2089

12. Erol O, Buyuklu F, Koycu A, Bas C, Erbek SS. Evaluation of Nasal Tip Support in Septorhinoplasty. *Aesthetic Plastic Surgery*. 2019/08/01 2019;43(4):1021-1027. doi:10.1007/s00266-019-01352-2

13. Rohrich RJ, Hoxworth RE, Kurkjian TJ. The role of the columellar strut in rhinoplasty: indications and rationale. *Plast Reconstr Surg*. Jan 2012;129(1):118e-125e. doi:10.1097/PRS.0b013e3182362b7a

14. Rohrich RJ, Savetsky IL, Avashia YJ. The Role of the Septal Extension Graft. *Plast Reconstr Surg Glob Open*. May 2020;8(5):e2710. doi:10.1097/gox.0000000000002710

15. Akkus AM, Eryilmaz E, Guneren E. Comparison of the effects of columellar strut and septal extension grafts for tip support in rhinoplasty. *Aesthetic Plast Surg*. Aug 2013;37(4):666-73. doi:10.1007/s00266-013-0141-1

16. Lathif A, Alvarado R, Kondo M, Mangussi-Gomes J, Marcells GN, Harvey RJ. Columellar strut grafts versus septal extension grafts during rhinoplasty for airway function, patient satisfaction and tip support. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2022/07/01/ 2022;75(7):2352-2358. doi:https://doi.org/10.1016/j.bjps.2022.02.017

17. Brandstetter M, Bhatt M, Pham M, Gubisch W, Haack S. Comparative Analysis and Long-Term Results of Various Septal Extension Graft Types. *Facial Plast Surg*. Jun 2020;36(3):263-267. doi:10.1055/s-0040-1712468

18. Rohrich RJ, Durand PD, Dayan E. Changing Role of Septal Extension versus Columellar Grafts in Modern Rhinoplasty. *Plast Reconstr Surg*. May 2020;145(5):927e-931e. doi:10.1097/prs.0000000000006730

19. Harris R, Nagarkar P, Amirlak B. Varied Definitions of Nasolabial Angle: Searching for Consensus Among Rhinoplasty Surgeons and an Algorithm for Selecting the Ideal Method. *Plast Reconstr Surg Glob Open*. Jun 2016;4(6):e752. doi:10.1097/gox.0000000000000729

20. Peng J, Grayson M, Snyder GJ. What makes a material bendable? A thickness-dependent metric for bendability, malleability, ductility. *Matter*. 2021/09/01/ 2021;4(9):2694-2696. doi:https://doi.org/10.1016/j.matt.2021.07.015

21. Aydogan F, Tastan E, Aydin E, et al. The effects of nasal base stabilization techniques on nasal tip rigidity. *Aesthetic Plast Surg*. Apr 2014;38(2):288-94. doi:10.1007/s00266-014-0295-5

22. Atighechi S, Dadgarnia M, Vaziribozorg S, et al. Changes in elastic properties of the nasal tip using Columellar strut graft versus tongue-in-groove method over one year after rhinoplasty. *Eur Arch Otorhinolaryngol*. Jan 2020;277(1):147-150. doi:10.1007/s00405-019-05662-8

23. Aydogan F, Tastan E, Aydin E, et al. The Effects of Nasal Base Stabilization Techniques on Nasal Tip Rigidity. *Aesthetic Plastic Surgery*. 2014/04/01 2014;38(2):288-294. doi:10.1007/s00266-014-0295-5

24. Ponsky DC, Harvey DJ, Khan SW, Guyuron B. Nose Elongation: A Review and Description of the Septal Extension Tongue-and-Groove Technique. *Aesthetic Surgery Journal*. 2010;30(3):335-346. doi:10.1177/1090820x10374103

25. Byrd HS, Andochick S, Copit S, Walton KG. Septal extension grafts: a method of controlling tip projection shape. *Plast Reconstr Surg*. Sep 1997;100(4):999-1010. doi:10.1097/00006534-199709001-00026

LEGENDS

Figure Legend

Figure 1: We present a visual representation of our method for the placement of the Septal Extension Graft (SEG). The figure displays the location of the SEG, as well as the positions and types of sutures we use with a color code. The SEG is located on the right side of the septum: *SEG*, Septal Extension Graft; *LLC*, lower lateral cartilage. *Purple*: 5-0 PDS horizontal mattress suture between the neo-domes and SEG. *Red*: Two 5-0 primary prolene sutures between the SEG and septum at two points. *Green*: Two 5-0 PDS sutures between the medial crura and SEG. *Navy Blue*: 5-0 PDS horizontal mattress sutures going through the septum and SEG across 6-8 points.

Figure 2. AT/AN ratio for evaluation of projection, and NAT angle for evaluation of rotation.

Figure 3a. The anteroposterior application of the Newton Meter. The moment when the probe touches the tip skin is accepted as a zero point. The values obtained at the displacements of 1 mm, 2 mm, and 3 mm were recorded.

Figure 3b. The lateral application of the Newton Meter. The moment when the probe touches the tip skin is accepted as a zero point. The values obtained at the displacements of 2 mm, 4 mm, and 6 mm were recorded.

Figure 4. A 29-year-old patient was operated on with a septal extension graft. a-c: Preoperative, d-f immediate intraoperative, g-i postoperative first year.

Figure 5. Changes in the mean AT/AN ratios of both groups over time.

Figure 6. Changes in the mean NAT angles of both groups over time.

Figure 7. Average forces in Newtons (N) required to displace the nasal tip anteroposteriorly to the specified length (mm). The septal extension graft is shown with dotted lines while the columellar strut graft is shown with uninterrupted lines.

Figure 8. Average forces in Newtons (N) required to displace the nasal tip in a lateral direction to the specified length (mm).

SDC Legend: Video, Supplementary Digital Content 1; a video which shows the securing of the tip complex to the SEG with a horizontal mattress suture.

Table 1: Mean measurements of AT/AN and NAT angles representing projection and rotation, respectively.

	Intraop		Postoperative 1 month		Postoperative 12 month	
	AT/AN	NAT	AT/AN	NAT	AT/AN	NAT
CSG	0,632125	60,07875	0,605625	69,14875	0,593375	70,6825
SEG	0,610625	63,97	0,607125	69,99875	0,588625	71,10875

CSG: Columellar Strut Graft SEG:

	Preoperative						Postoperative 1 month						Postoperative 3 month						Postoperative 6 month						Postoperative 12 month					
	Anteroposterior			Lateral			Anteroposterior			Lateral			Anteroposterior			Lateral			Anteroposterior			Lateral			Anteroposterior			Lateral		
mm	1	2	3	2	4	6	1	2	3	2	4	6	1	2	3	2	4	6	1	2	3	2	4	6	1	2	3	2	4	6
CSG	0,57	1,25	1,98	0,56	1,06	1,73	1,25	2,17	3,35	0,67	1,35	2,07	1	1,89	2,86	0,57	1,25	2,04	0,65	1,58	2,47	0,51	1,24	2,02	0,59	1,45	2,39	0,56	1,24	1,93
SEG	0,48	1,09	1,79	0,48	0,96	1,65	2,06	4,05	6,56	0,56	1,34	2,3	1,42	3,16	4,83	0,51	1,21	2,03	1,3	2,57	3,97	0,45	1,19	1,92	0,94	2,3	3,79	0,44	0,98	1,71

Table 2: Mean measurements of required forces (Newton) for tip displacement

CSG: Columellar Strut Graft SEG:

Figure 1

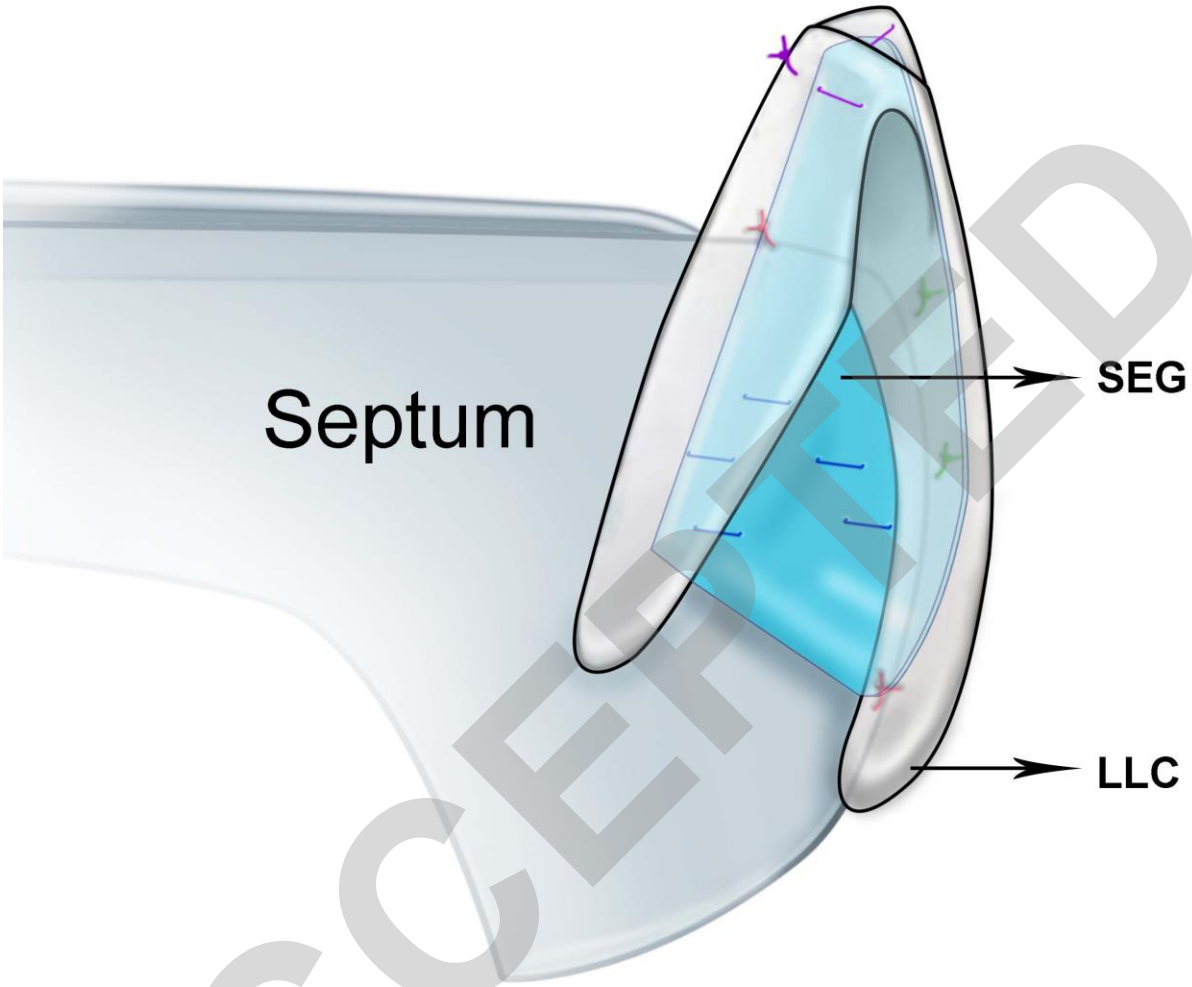

Figure 2

Figure 3a

Figure 3b

Figure 4a

Figure 4b

Figure 4c

Figure 4d

Figure 4e

Figure 4f

Figure 4g

Figure 4h

Figure 4i

Figure 5

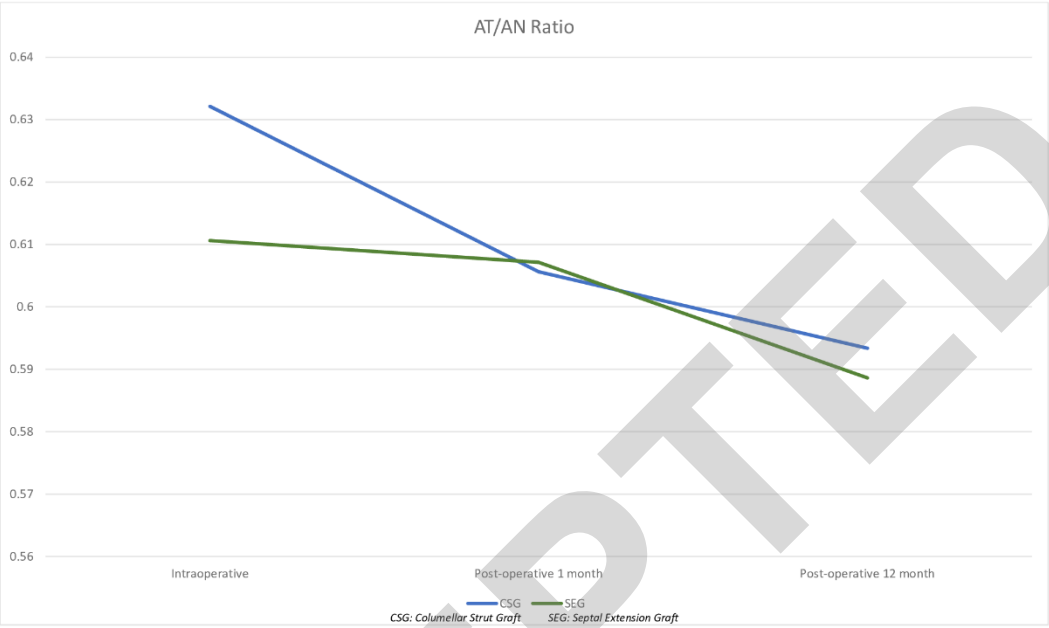

Figure 6

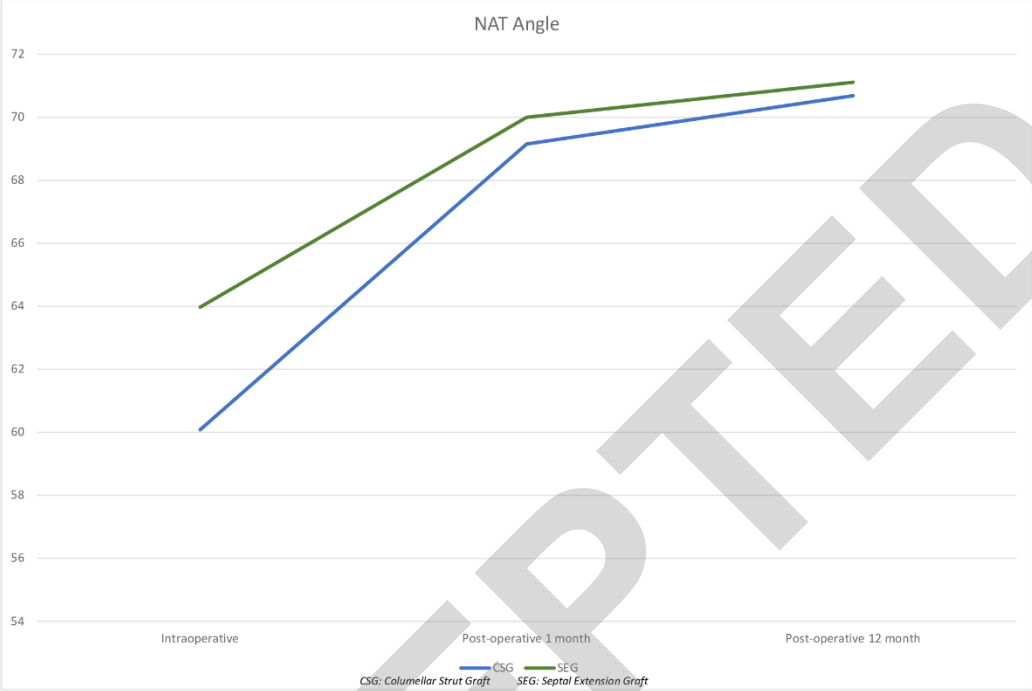

Figure 7

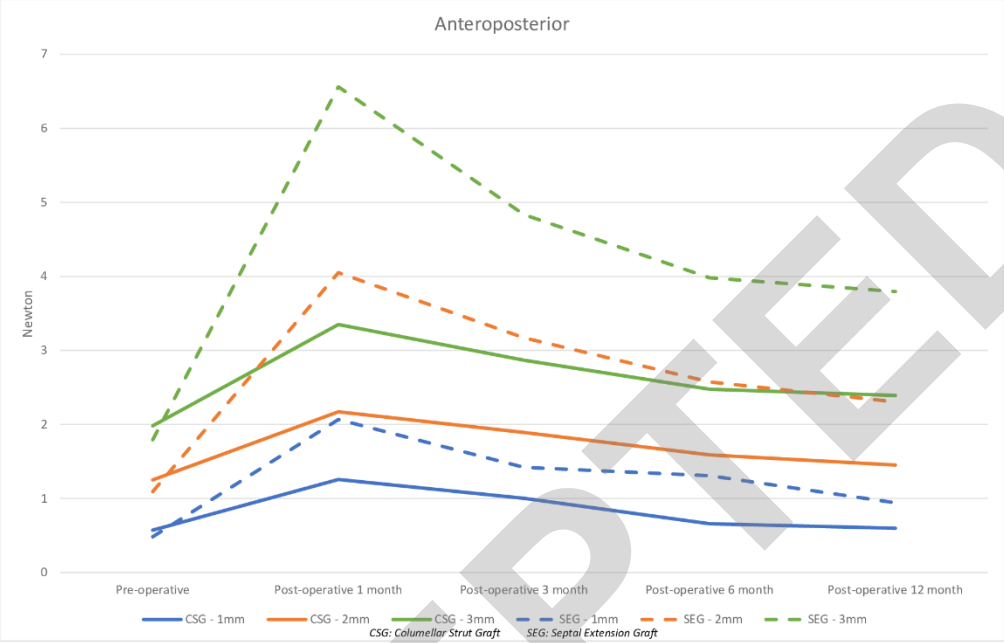

Figure 8