

Effect of Modified Septal Extension Grafts on the Nasal Tip in Rhinoplasty

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Background: One of the faced difficulties of nasal tip surgery is progressive loss of nasal tip projection and rotation postoperatively. Nasal base stabilization by septal extension grafts has shown to improve this loss over time. The aim of this study was to demonstrate that a modified septal extension graft can provide the required tip rotation/derotation by changing the angle of the graft's insertion. In addition, it maintains nasal tip projection without creating a rigid tip. Other than that it avoids the requirement of a large amount of cartilage.

Materials/Methods: This study involves a retrospective review of 37 patients who underwent open rhinoplasty for primary or secondary cases over a period of 12 months. The average age of the patients was 28 years (range = 20–43 years), and all patients were of Middle Eastern origin. Subjective evaluation based on photographic analysis was used pre and postoperatively.

Results: All cases included in this study maintained their operative results of tip rotation. Two cases showed a minimal decrease in tip projection documented upon review 6–12 months postoperatively. No patient needed secondary revision surgery due to changes in tip projection or rotation. The objective pre and postoperative findings were satisfying for the patients and surgeons.

Conclusions: The modified septal extension graft is an effective tool for rotation of the nasal tip as well as derotation of an over rotated tip. It is also capable of maintaining nasal tip projection. (*Plast Reconstr Surg Glob Open* 2021;9:e3880; doi: 10.1097/GOX.0000000000003880; Published online 19 October 2021.)

INTRODUCTION

One of the most challenging procedures in facial plastic surgery is rhinoplasty,^{1,2} and a regular prevalence of frustration is met when trying to control the projection, shape, and rotation of the nasal tip—specifically amid patients with weak lower lateral cartilage.³ It is widely accepted that the tip of the nose is the most arduous part of the operation, and has been described as the greatest challenge in rhinoplasty; therefore, the surgeon's ability to maintain the nasal tip is interconnected with the success of the surgery.⁴ This can lead to disturbing sequelae if not dealt with appropriately regardless of the impeccability of all the remaining steps.² Conserving or increasing nasal tip projection is often a demanding task, and loss

of nasal tip projection is a common occurrence in rhinoplasty.⁵ Consequently it is important to accurately analyze and plan a correct preoperative design that permits the most predictable result.⁶

Modern rhinoplasty constitutes competent control of nasal tip projection and rotation, and a chief factor for enhancing tip projection and rotation is augmentation of the septum.⁷ The anterior septum and lower lateral cartilage (supported by the caudal and dorsal septum) are the structures that dictate the position of the nasal tip.⁸ Likewise, the conjoined medial cruras' position and stability significantly impact the position of the nasal tip.⁴

Tip projection is usually lost following open rhinoplasty if division of the supporting ligaments and attachments are not reattached and maintained by addressing them with techniques such as domal suturing and grafting.⁹ The medial crura, their attachment to the caudal septum, and the presence of additional cartilaginous grafts placed abutting the medial crura are the most important constituents of nasal tip projection following rhinoplasty.

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If measures are not taken to strengthen or lengthen the medial crura by providing additional supporting grafts, nasal tip projection is ultimately lost.⁴

Therefore in this study we used modified septal extension grafts with domal suturing as a means to address and maintain the nasal tip projection by augmenting the septum and supporting the medial crura. The desired tip rotation/derotation is also gained based on the angle of graft fixation to the caudal septum. This angle is measured between the triangular graft and the dorsal septum at 90 degrees for rotation and at approximately 110–120 degrees for derotation. The graft is stably fixed at its base, overcoming the drawbacks of graft instability, and is thin at its apex, overcoming a rigid tip. It is more flexible in upward rotation but not in downward rotation (derotation) as the graft is sutured and stabilized to the middle crura of the lower lateral cartilages. Our graft shares similarity with the keel-shaped septal extension graft introduced by Rohrich, Savetsky, and Avashia,¹⁰ but its design is modified to be small in size, which is advantageous when facing scarcity of cartilage: a frequent finding in Middle Eastern patients. The graft is triangular in shape as opposed to rectangular primarily to escape the need for an end-to-end fixation, which usually requires more cartilage or the addition of the ethmoid bone to execute. Furthermore, it evades side-to-side fixation, which may result in deviation. Moreover, it is placed in a manner allowing for a more horizontal closure of the domes upon it. Our graft adds details to an already-known technique with focused attention on placement angles, concha usage, and a thinner graft tip to elude tip rigidity.

MATERIALS AND METHODS

Thirty seven patients who underwent primary or secondary rhinoplasty by the senior author using the modified septal extension graft technique between October 2019 and January 2020 were studied retrospectively. The open rhinoplasty approach was used for all patients, and all cases received modified septal extension grafts. Postoperatively patients were reviewed in clinic at 6, 9, and 12 months, with photographic analysis performed by the senior author with the same camera, same focus, and at a distance of 1 meter zoomed in to standardize the photographs and allow for accurate comparison.

Assessment Parameters

Nasal tip projection was defined as the distance that the tip defining point extends anterior to the facial plane. Nasal tip projection pre and postoperatively was measured using the Goode method: the ratio of the nasal projection to the nasal length. An aesthetically pleasing projection measures 67 ± 5 .

Nasal tip rotation was defined as movement of the nasal tip along an arc with constant distance from the facial plane. Nasal tip rotation was measured on pre and postoperative photographs by measurement of the nasolabial angle. An aesthetically pleasing angle for this measurement is 90–100 degrees in men and 100–115 degrees in women.

Takeaways

Question: Is the septal extension graft a useful method in maintaining the nasal tip projection and rotation?

Findings: The nasal septal extension graft has proved to be a valuable method of controlling nasal tip projection, rotation, and derotation, and eluding their decrease in the postoperative period of rhinoplasty procedures.

Meaning: A modified technique for nasal tip surgery to address and maintain the nasal tip projection and obtain an aesthetically pleasing angle that has proved to be an effective technique to use in the Middle Eastern patient with a predilection for insufficient cartilage, as it does not require harvesting a sizeable amount of cartilage.

We first determined where the nasal tip must be located by preoperative analysis. The graft's size, location, and angle of rotation/derotation depended on the individual requirements of the case. The analysis also included whether elongation of the nose or an increase in tip rotation and or projection was required.

Operative Technique

With the patient under general anesthesia, a total of 10–15 mL of lidocaine solution and 1/100,000 adrenaline was infiltrated into the mucoperichondrium, dorsal skin, nasal floor, and nasal septum. We used the open approach

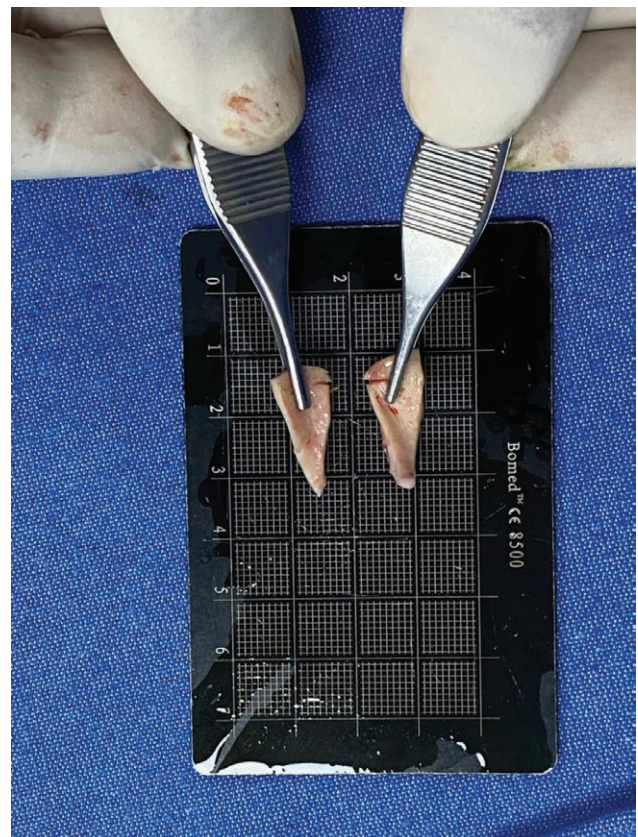


Fig. 1. Concha cymba and concha cavum separated and shaped into isosceles triangles.

to perform this technique. Adequate L-strut residue of the septum measuring 1–1.5 cm in both the caudal and dorsal limbs was left behind. For secondary cases lacking sufficient septal cartilage, either conchal or costal cartilage was used.

An isosceles triangle-shaped cartilage graft prepared from the septal cartilage with a base measuring 1 cm and sides that amount to 1.5–2 cm was carved out of the harvested cartilage. The triangle was fashioned thinner at the apex to avoid tip rigidity and provide tip flexibility and thicker at the base for providing more stable fixation to the caudal septum. Thickness of the base measured 2 mm and that of the apex measured between 1 and 1.5 mm. A 1–1.5 mm dense apex did not in our hands undergo tearing during graft insertion or show significant postoperative nasal tip drop during the followup period.

In cases requiring conchal cartilage, a unilateral concha was harvested via the posterior approach. The concha cymba and concha cavum were separated and shaped into isosceles triangles, with a base measuring 8 mm and sides measuring 1–1.2 cm each (Fig. 1). They were then placed on either side of the septum with the concave side medially and convex side laterally sandwiching the septum (Fig. 2). The grafts were then sutured together up to their apex. This overcame the inherent cartilage properties to obtain a firm structural graft.

Tip Work

Standard cephalic trimming of the lateral cartilage was performed, leaving a minimum of 6 mm of cartilage

behind. The septal graft was placed on the one side of the caudal septum with a focus on not reaching the columella (Fig. 3). We did not extend beyond the caudal septum except in the upper fourth, where the angle of rotation or derotation exists.

The base of the cartilage graft was fixed to the upper half of the caudal end of the L-strut residue with 2–3 mattress sutures (numbers 3–5 in Fig. 3). The angle at which the triangle projects beyond the septal cartilage is stabilized with a simple suture on both cephalic and caudal sides (numbers 1 and 2 respectively in Fig. 3). The angle is formed between the triangular-shaped graft’s caudal end and the dorsal septum at 90 degrees for rotation and approximately 110–120 degrees for derotation. The base and sides of the triangle provide the stabilization of the tip, but the upper part provides the new tip projection and rotation/derotation.

Hemitransdomal (Gruber’s sutures) with lateral crural steal using 5-0 PDS were used to define the tip. The septal extension graft extends beyond the anterior septal angle into the interdomal space (Fig. 4). More caudal positioning of the septal extension graft was used to perform tip derotation, if required (red dotted triangle on Fig. 4). More cephalic advancement helped in increasing the rotation of the tip (blue dotted triangle on Fig. 4). Either of the two previous triangles increases nasal tip projection.

The newly created domes are then sutured to the extension graft by a figure of eight sutures to maintain the



Fig. 2. Grafts placed on both sides of the septum sandwiching the septum with the concave side medially and convex side laterally.

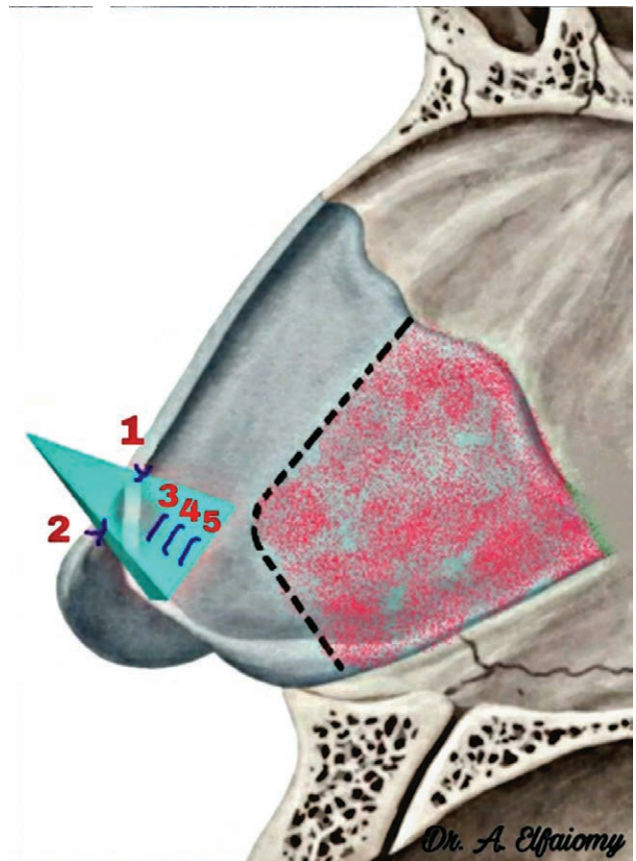


Fig. 3. Schematic depiction of fixation of the modified septal graft to the L-strut residue.

RESULTS

A total of 37 patients were included in this study. They were operated upon from the period of October 2019 to January 2020. Twenty nine cases (78.38%) were women, and eight cases (21.62%) were men. The age range was 20–43 years with a mean of 28 years. A total of 24 were primary cases and 13 secondary cases (65% and 35% respectively). Septal cartilage grafts were used in 24 patients (64.86%), conchal cartilage grafts were used in eight patients (21.62%), and autologous costal cartilage grafts were used in five patients (13.51%). Alar rim grafts were used for all cases.

Rotation/derotation showed a significant improvement based on clinical and photographic examination and patient satisfaction. All cases maintained nasal tip projection of 0.62–0.72 in the late postoperative period. In two cases, projection dropped to 0.63 and 0.62 1 year postoperatively. Both cases were primary cases performed with grafts harvested from the septum with no statistical significance. No cases needed revision surgery, and no changes in nasal tip rotation were observed. Case examples are shown in Figures 5 and 6.

Nasolabial Angle Measurements

One year postoperatively the nasolabial angle of patient number 5 changed from the 6 month postoperative measurement of 101–99 degrees, and the nasolabial angle of patient number 19 changed from the 6 month postoperative measurement of 101–98 degrees (Table 1).

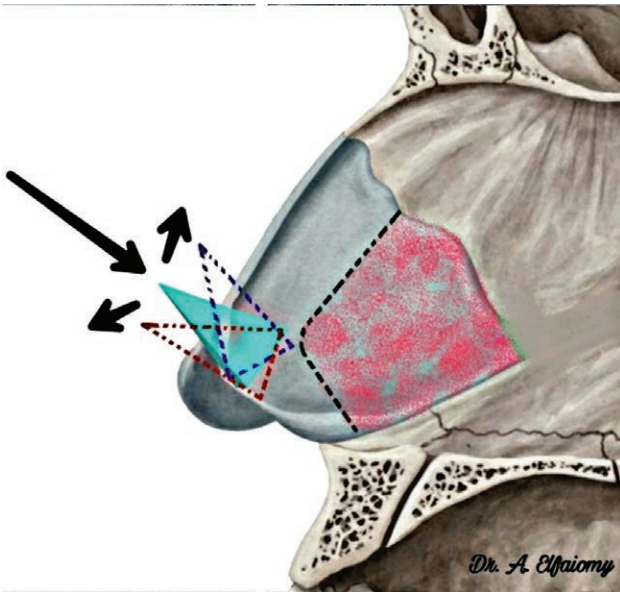


Fig. 4. Schematic depiction of location and angle of rotation or derotation depending on the individual requirements of the case.

tip projection (see Video 1 [online], which demonstrates septal extension graft fixation to the caudal septum.). Alar rim grafts were inserted into newly created pockets at the caudal end of the alae.

Table 1. Patients’ Preoperative and Postoperative Nasolabial Angle Measurements

Rotation/ Derotation	1 Year Postoperative Nasolabial Angle	6 Month Postoperative Nasolabial Angle	Preoperative Nasolabial Angle	Area of Cartilage Harvest	Patient No.
Rotation	98	98	86	Septal	1
Rotation	96	96	79	Costal	2
Rotation	99	99	96	Septal	3
Rotation	98	98	82	Conchal	4
Rotation	99	101	86	Septal	5
Rotation	101	100	78	Septal	6
Rotation	110	110	94	Septal	7
Rotation	98	98	87	Septal	8
Rotation	102	102	94	Septal	9
Rotation	110	110	106	Costal	10
Rotation	115	115	109	Conchal	11
Rotation	110	110	110	Costal	12
Derotation	109	109	119	Septal	13
Rotation	105	105	96	Conchal	14
Rotation	99	99	86	Conchal	15
Rotation	108	108	90	Septal	16
Derotation	105	105	114	Costal	17
Rotation	99	99	84	Septal	18
Rotation	98	101	87	Septal	19
Rotation	99	99	85	Septal	20
Rotation	110	110	102	Conchal	21
Rotation	105	105	90	Septal	22
Rotation	100	100	88	Septal	23
Rotation	105	105	95	Septal	24
Derotation	109	109	118	Conchal	25
Rotation	104	104	91	Septal	26
Rotation	99	99	93	Septal	27
Rotation	106	106	90	Septal	28
Rotation	105	105	98	Conchal	29
Rotation	108	108	92	Septal	30
Rotation	103	103	90	Septal	31
Rotation	98	98	79	Conchal	32
Rotation	105	105	94	Septal	33
Rotation	103	103	88	Septal	34
Rotation	100	100	85	Septal	35
Rotation	105	105	96	Costal	36
Rotation	102	102	87	Septal	37

Table 2. Patients' Preoperative and Postoperative Goode Ratio Measurements

1 Year Postoperative Goode Ratio	1 Year Postoperative Length	1 Year Postoperative Projection	6 Month Postoperative Goode Ratio	6 Month Postoperative Length	6 Month Postoperative Projection	Preoperative Goode Ratio	Preoperative Length	Preoperative Projection	Patient Number
0.72	44	32	0.72	44	32	0.63	46	29	1.
0.70	44	31	0.70	44	31	0.62	45	28	2.
0.68	45	31	0.68	45	31	0.63	47	30	3.
0.68	44	30	0.68	44	30	0.60	45	27	4.
0.67	46	31	0.67	46	31	0.61	48.5	30	5.
0.71	45	32	0.71	45	32	0.61	47	29	6.
0.68	45	31	0.68	45	31	0.61	46	28	7.
0.68	44	30	0.68	44	30	0.62	44	27.5	8.
0.69	46	32	0.69	46	32	0.61	49	30	9.
0.70	47	33	0.70	47	33	0.62	49	30.5	10.
0.70	44	31	0.70	44	31	0.60	46.5	28	11.
0.67	44	29.5	0.67	44	29.5	0.61	42	26	12.
0.71	45	32	0.71	45	32	0.63	47	30	13.
0.67	44	29.5	0.67	44	29.5	0.60	44	26.5	14.
0.67	44	29.5	0.67	44	29.5	0.60	45	27	15.
0.70	44	31	0.70	44	31	0.61	46	28.5	16.
0.68	45	31	0.68	45	31	0.61	47	29	17.
0.69	46	32	0.69	46	32	0.62	48	30	18.
0.68	47	32	0.68	47	32	0.61	49	30	19.
0.70	44	31	0.70	44	31	0.60	46	28	20.
0.63	44	28	0.67	44	29.5	0.62	40	25	21.
0.68	44	30	0.68	44	30	0.58	46	27	22.
0.67	43	29	0.67	43	29	0.61	43	26.5	23.
0.66	48	32	0.66	48	32	0.60	48	29	24.
0.68	48	33	0.68	48	33	0.62	50	31	25.
0.62	47	29.5	0.65	47	31	0.60	46	28	26.
0.67	44	29.5	0.67	44	29.5	0.57	45	26	27.
0.67	46	31	0.67	46	31	0.56	49	27.5	28.
0.65	47	31	0.65	47	31	0.62	48	30	29.
0.65	45	29.5	0.65	45	29.5	0.56	47	26.5	30.
0.66	48	32	0.66	48	32	0.59	50	29.5	31.
0.66	45	30	0.66	45	30	0.58	46	27	32.
0.68	47	32	0.68	47	32	0.61	49	30	33.
0.68	45	31	0.68	45	31	0.60	47	28.5	34.
0.69	46	32	0.69	46	32	0.58	50	29	35.
0.65	47	31	0.65	47	31	0.56	46	26	36.
0.66	45	30	0.66	45	30	0.58	47	27.5	37.

Goode Ratio Measurements

One year postoperatively, patient number 21's nasal projection dropped to 28 and Goode ratio became 0.63. Similarly, 1 year postoperatively patient number 26's nasal projection dropped to 29.5 and Goode ratio became 0.62. No changes in nasal length occurred. Both patients were still within the aesthetically acceptable projection range (Table 2).

Statistical Methods

Comparisons between preoperative and postoperative data were done using paired *t* test. *P* values less than 0.05 were considered statistically significant (Tables 3, 4).

DISCUSSION

In 1997, septal extension grafts were introduced by Byrd et al³ as a more reliable method of controlling tip projection and rotation. This predominantly assisted in patients with weak lower lateral cartilages. Septal extension grafts since then have been successfully used to control tip projection, rotation, and shape by safeguarding the nasal tip to the septum³ and have become the first choice for autologous grafting owing to their feasibility to harvest and capability of providing the required support without radical donor site morbidity.¹¹ Numerous factors have contributed to the septal extension graft's popularity, including its

Table 3. Rotation and Derotation Count and Percentage

	Count	%
Rotation	34	91.9%
Derotation	3	8.1%

Table 4. Comparison between Preoperative and Postoperative Data using Paired *t* Test

	Mean	SD	<i>P</i> Value Compared with Preoperative
Preoperative nasolabial angle	93.08	10.39	—
Six-month postoperative nasolabial angle	103.49	4.59	<0.001
One-year postoperative nasolabial angle	103.38	4.68	<0.001
Preoperative projection	28.27	1.53	—
Six-month postoperative projection	30.95	1.06	<0.001
One-year postoperative projection	30.86	1.16	<0.001
Preoperative length	46.59	2.23	—
Six-month postoperative length	45.30	1.39	<0.001
one-year postoperative length	45.30	1.39	<0.001
Preoperative Goode ratio	0.60	0.02	—
Six-month postoperative Goode ratio	0.68	0.02	<0.001
One-year postoperative Goode ratio	0.68	0.02	<0.001

P < 0.05 were considered statistically significant.



Fig. 5. The preoperative (A, C, E, G) and 12 months postoperative (B, D, F, H) appearance of a 21-year-old patient who presented with bulbous, downward rotated, underprojected tip and flared ala nasi. Modified septal extension graft was inserted at a 90 degrees angle; hemitransdomal figure of eight sutures was used to fix the dome to SEG. Bilateral alar base wedge excision was performed.

convenience during harvest, its wide and flat configuration, its strength, and its reduced tendency for warping.¹² When attached to the nasal septum, they have been found to better control the projection, shape, and rotation of the tip when compared with columellar struts that were deemed both defective in increasing tip projection and limited in preserving tip rotation.¹³ However, up to this point, use of this technique has been debatable due to tip rigidity, bending of the graft, and insufficient septal cartilage material to harvest.¹⁴ With the previous methods of graft fixation, some of the following downsides were faced.

Side-to-side fixation of rectangular grafts rendered some incidence of columellar deviation and meticulous placement and care must be taken to minimize asymmetry when using this technique. End-to-end fixation proved less stable, and columellar deviation was still present as its fixation to the anterior septal angle by a horizontal figure eight suture was not sufficiently firm, and therefore it easily shifts from the midline or does not allow a sustained tip projection.¹⁵

Using the ethmoid bone to substitute for deficient cartilage had its own drawbacks. Manipulations of the

perpendicular plate of ethmoid bone may be transmitted to and injure the cribriform plate.¹⁶ Furthermore the prevention of CSF fistula must always remain more important than its treatment.¹⁷ Another method that showed disadvantages was the septal extension grafts that were harvested and carved with the same thickness throughout as they rendered a postoperative rigid tip.¹⁸

Our technique shows that modified septal extension graft is capable of providing the needed tip projection. One of the most valuable characteristics of our approach is its feasibility when changing the angle of rotation/derotation of the graft by turning the graft cephalically or caudally at 90 degrees for rotation and approximately 110–120 degrees for derotation. More cephalic rotation of the graft renders the tip more rotated and projected, whilst more caudal rotation of the tip can be used to correct over-rotation (for derotation) and still maintain the tip projection. This provides the desired effect without the requirement of extra cartilage or bone as the graft itself is small and requires a minimal amount of material. In turn this means that there is less encountered secondary site morbidity in primary cases, and in some secondary cases



Fig. 6. The preoperative (A, C, E, G) and 12 months postoperative (B, D, F, H) appearance of a 31-year-old woman who presented for secondary rhinoplasty with short upturned nose, bulbous nasal tip, and high radix due to previous synthetic prolene mesh insertion for dorsal augmentation. Removal of synthetic mesh was performed and costal cartilage was harvested for bilateral spreader graft insertion and diced for dorsum augmentation. Modified septal extension graft was inserted at a 70 degree angle to produce downward rotation and projection of the tip.

there may even be sufficient remaining septal cartilage left behind from the previous surgery to carry out our technique. As the graft was fixed in a side-to-side fashion, a series of time-consuming figure of eight sutures that are required for fixation of end-to-end grafts was not needed. Our modified septal cartilage graft did not extend into the columella; therefore, no columellar deviation was witnessed with our technique. Also, derotation of the tip did not result in collumellar retraction, as it was supported by the caudal septum. Furthermore, the tip showed good flexibility as the graft was fashioned thinner at the apex.

CONCLUSIONS

The modified septal extension graft is a valuable method to control nasal tip projection and rotation/derotation as it avoids their decrease in the postoperative period. It has proved to be an effective technique to use in the Middle Eastern patient with a predilection for insufficient cartilage as it does not require harvesting a sizeable amount of cartilage. This technique has also eluded the drawbacks of columella deviation and a rigid nasal tip. This was clinically assessed postoperatively as the tip was flexible when pushed in a caudal-to-cephalic direction, but was more fixed when assessed in a downward direction.

Our study has shown statistically significant differences between the preoperative and postoperative values of the nasal tip projection ratio and nasal tip rotation ratio.

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PATIENT CONSENT

The patients provided written consent for the use of their images.

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