

## Extended Columellar Strut Graft in Tip Rhinoplasty

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### ABSTRACT

*The thick heavy skin represent a challenge for any surgeon who is performing rhinoplasty. When combined with underprojected tip would be a real problem. The accompanying weak lower alar cartilage could add a real support deficiency. This ethnic problem had led us to think about a solution that could provide a solution for both the tip projection and the heavy skin. Although the extended columellar strut–tip graft proved to be a reliable method to provide nasal tip projection and contour, yet it lacks the adequate tip support for the heavy nasal skin. The combined extended columellar strut-tip graft is the solution in order to maintain the alar cartilage support and providing a good dome definition at the same time. Our study was done on 60 patients, 38 of which were secondary cases, while the remaining were primary cases. The follow-up of cases extends to 24 months. Patient satisfaction was subjected to a patient satisfaction poll over 5 grades. Only 5 cases were not satisfied by the result. We had reached a conclusion, that the combined strut–tip graft is highly versatile in that it offers unique advantages in both primary and secondary rhinoplasty procedures.*

**Keywords:** *Tip rhinoplasty, columellar strut, tip graft, thick skin rhinoplasty, extended columellar strut graft*

### INTRODUCTION

The ability to gain and maintain nasal tip projection in cases with thick heavy nasal skin is one of the most challenging tasks in rhinoplasty. A careful preoperative nasal analysis and physical examination with precise anatomic diagnosis allows the surgeon to evaluate the different factors that play an important role in nasal tip dynamics. Among these are the relation between skin–soft tissue thickness and the available amount of tip support. Unfortunately, it is usually, when the nasal skin is thick and heavy, we find that the cartilaginous support provided by the lower alar cartilage is so weak and soft inadequately providing the desired support for this heavy nasal skin. Also shortening of the caudal septum and deficient premaxilla together with weakness of cartilaginous support altogether contribute to tip under-projection of the tip in these cases.

On reviewing the literature, one can find a large number of different techniques to increase tip projection. These techniques can be broadly classified into grafting techniques which include premaxillary grafting<sup>7</sup>, Columellar struts<sup>8</sup>, Caudal septum extension graft<sup>9</sup>, caudal septum replacement graft<sup>10</sup> and a variety of tip on lay grafts<sup>11-15</sup> and alar cartilage modifying techniques

like lateral crural steal<sup>16</sup>, tongue-in-groove<sup>17</sup> techniques, and medialization of the medial crural footplates<sup>18</sup> and lastly is the dome division technique with its modifications<sup>19</sup> which also provides additional tip projection.

The selection of the most appropriate technique is based on the surgeon's preference and approach as well as the need for additional rotation. While some of these techniques provide projection and tip definition (as on lay grafting and suturing techniques<sup>11-16</sup>) others provide projection as well as support (e.g. Columellar struts, extension grafts and premaxillary grafts<sup>7-10</sup>) yet none of these techniques, alone, can provide support projection and definition all at the same time, which is required for cases of under projected tip with thick nasal skin.<sup>1-5</sup>

In this study we describe a useful grafting technique for the under projected tip with thick nasal skin aimed at providing additional tip projection, support and definition, this technique also proves to be valuable in revision rhinoplasty and secondary tip deformities.

## METHODS

The study was conducted upon 60 rhinoplasty patients (47 females and 13 males) over a period of 5 years the patients ages ranged from 19-44 with a mean age of 31.1 years.

38 patients had previous rhinoplasty procedures with varied tip deformities including scarring, polly beak, over projection, asymmetry or deformed droopy tip, out of which 14 had previous open rhinoplasty and 24 closed.

- Males were 17 cases, Females were 43
- Primary rhinoplasty done in 22 cases but Revision rhinoplasty in 38
- Indications of the graft in primary cases were thick skin in 17 cases but weak cartilage in 5 cases, however in revision cases they were all due to weakened cartilage and scarred tissues
- Cartilage donor graft was always the septum in primary cases, but in revision cases, 26 were septal cartilage while the rest from conchal ear cartilage

Photography was taken for all patients in (7) views as part of a pre-operative analysis. Also follow up photos were taken at 6 month 1 year and 2 years postoperatively, but for presentation purposes, we will show only 3 views

### Indications

In primary rhinoplasty, we consider using this graft in cases where the lower alar cartilages ineffectively support the nasal tip, the lower lateral cartilages are small and/or soft, the high point of the dorsum is at the supratip, and/or the nasal tip skin is very thick. Small and soft lower alar cartilages are the cardinal anatomic feature of the underprojected tip. In these patients, the addition of a columellar strut to the dome-defining sutures may not achieve the desired projection.

The combined strut-tip graft is useful in secondary rhinoplasty when either maximum projection of the tip or tip contouring is required or in cases where the cartilages are soft, transected, over resected or partially resorbed by the previous surgery. In these cases, the combined strut-tip graft can provide both contour and projection independent of the lower alar cartilages. It also proves beneficial in cases where the nasal tip skin is thick or in the presence of thick scarring in the tip and supratip areas that abolishes the contouring effect of conventional tip grafts

### Technique

All our patients had undergone the surgery under general anesthesia.

### Harvesting of the graft

Using a classical open rhinoplasty approach<sup>20-22</sup>, access to the septal cartilage is gained by separating both upper lateral cartilages from the dorsal septum and septal exposure in the subpericondrial plane which is started first by scraping the mucosa over the septum using a number 15 blade until reaching the proper plane then the flap can be easily continued in the submucopericondrial plane using a Cottle elevator cranially to the perpendicular plate of the ethmoid and inferiorly over the maxillary crest.

It is important to continue the dissection downwards till reaching the bony maxillary crest to ensure full exposure of the ventral part of the Septum which lies directly on the maxillary crest as this part is the thickest part of the septum which is the best part to provide a solid support for the strut-tip graft. It is also important to continue dissection cranially till reaching the perpendicular plate of the ethmoid to ensure taking the longest possible graft length. A long graft is taken from this part of the septum leaving the dorsal part of the septum with vertical height of 1.5-2 cm depending on the amount of graft material needed for other grafts (eg. Spreader grafts). Leaving this part intact ensures adequate dorsal septal support. After graft harvesting it is important to cauterize any bleeding points over the maxillary crest using suction diathermy to prevent septal hematomas.

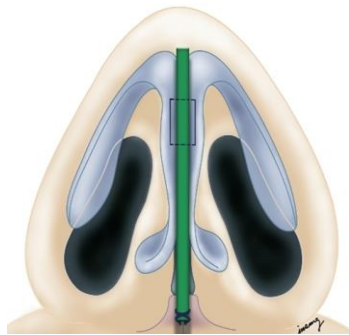
In cases of revision rhinoplasty, if septal cartilage is inadequate, a sandwich graft from conchal cartilage might be used as a secondary alternative. This graft is harvested via anterior approach through a curvilinear incision along the antihelical fold obtaining a large concave conchal graft which is transferred into a straight double layered graft by making a partial thickness cut on the concave side and turning it to a back to back and securing it with a series of 6/0 prolene mattress sutures to provide a graft with the desired length and strength to be suitable as a combined strut tip graft.<sup>23</sup>

### Placement and Fixation of the graft

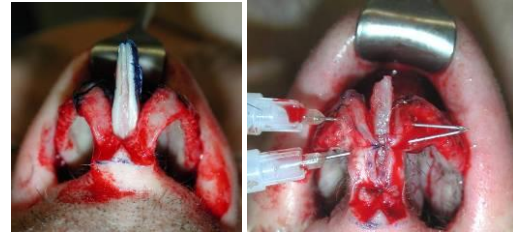
After adjusting the dorsal profile to the desired level, a pocket is developed between the medial crura and their footplates of the medial crura using a small tenotomy scissors the pocket

is extended down to the premaxilla but stopping short of the anterior nasal spine also cranially the pocket should be continued taking care to stop a few millimeters from the caudal septum to prevent connecting the created pocket with the septal space. The graft is then tucked snugly in to the pocket but it should be lying floating, not in contact with the nasal spine or the septum to prevent it from shifting to one side or clicking with any side-to-side movement. The graft is then fixed with a series of 3-4 horizontal mattress sutures starting from below upwards (5/0 PDS) ensuring that each suture would bind the two medial crura as well as the graft and will advance them upwards over the graft stopping short of the point where the domes should diverge laterally (usually 5-6mm from tip defining points) to maintain the aesthetic diversion of the two domes, at the same time it is important that the highest stitch would bring the tip of the graft to lie more caudal than the dome defining points thus resulting in a 3 point tip definition. The graft is usually left higher than the domes by a few millimeters as it can be later trimmed to the desired level after adjusting the level of the domes.

Dome defining sutures are placed symmetrically on both sides with a tendency to steal part of the lateral crus to add to the intermediate crura using 5/0 prolene mattress sutures. This is followed by a dome equalization suture which includes the cranial part of the domes as well as that of the graft to ensure that the that the leading end of the graft lies in a more caudal position than the domes and also to ensure the natural divergence of the caudal end of the domes to achieve the desired three point tip definition



**Fig 1. A drawing showing the extended collumellar strut graft in place**



**Fig 2. Showing photos of the extended columellar strut in place**

Paramedian osteotomies followed by lateral osteotomies are done as the final step of the operation after which the dorsal alignment is reevaluated and the skin is redraped to its normal anatomic position to assess the amount of trimming of the graft needed to achieve the desired degree of tip projection.

Any modification of alar base is performed after closure of the columellar incision as the final step of the rhinoplasty. All incisions are closed meticulously and Micropore tape as well as metal nasal splint is tailored to the nasal bones and fixed with adhesive. A light nasal pack is carefully introduced in the nasal cavities to prevent displacement of the fractured nasal bones.

## RESULTS

All patients were examined regularly at one week, 4 weeks, 3, 6, 12 and 24 month after surgery.

Patient satisfaction was subjected to a patient satisfaction poll, which was classified into:

- 1 Not satisfied
- 2 Acceptable
- 3 Good
- 4 Very good
- 5 Completely satisfied

The majority of patients 53 (88.3%) were satisfied from the procedure score 4,5

<i>Number of patients</i>	<i>% percentage</i>	<i>Satisfaction</i>
53	88.3	Satisfied (score 4-5)
2	3.3%	Moderately satisfied (score 3)
5	8.4%	Unsatisfied (score 1-2)

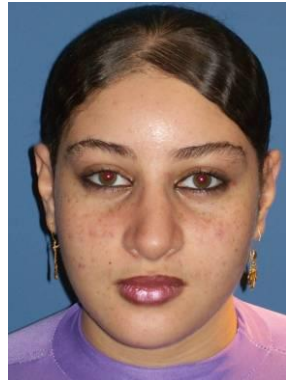
2(3.3%) patients stated it was average score 3  
5(8.4%) were not satisfied from the surgery score 1 and 2  
All patients of score 1,2 & 3 were considered unsatisfied

On photographic analysis of the unsatisfied patients as well as inquiry about the cause of their dissatisfaction.

3 (5%) showed overprojection

2 (3.3%) had asymmetry or wide tip

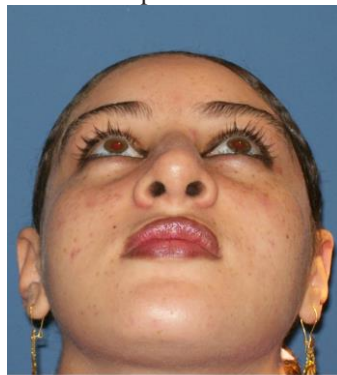
2 (3.3%) had other deformities (osteotomies dorsum or base)



a. Pre-operative front view



d. Post-operative front view



b. Pre-operative mento-vertical view



e. Post-operative mento-vertical view



c. Pre-operative lateral view



f. Post-operative lateral view

**Case 1: revision case with droopy deformed tip**







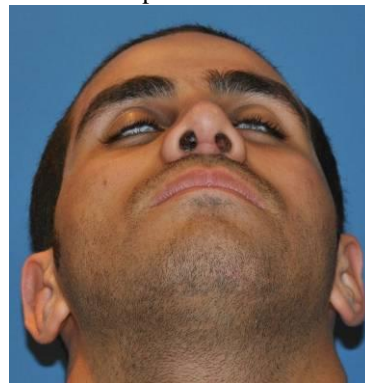
a. Pre-operative front view



d. Post-operative front view



b. Pre-operative mento-vertical view



e. Post-operative mento-vertical view



c. Pre-operative lateral view



f. Post-operative lateral view

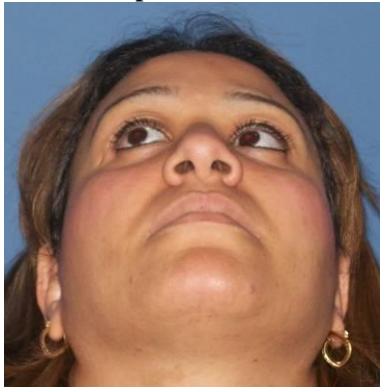
**Case 2: a traumatic case with droopy underprojected tip**



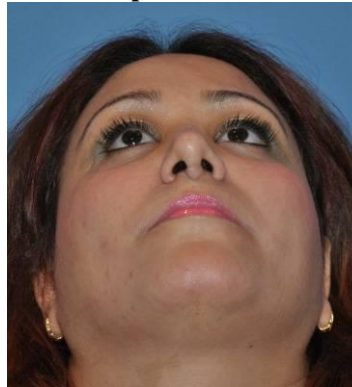
**a. Pre-operative front view**



**d. Post-operative front view**



**b. Pre-operative mento-vertical view**



**e. Post-operative mento-vertical view**



**c. Pre-operative lateral view**



**f. Post-operative lateral view**

**Case 3: A primary case with thick skin**

In this study, there was no incidence of hematoma or infection although two patients (3.3%) showed delayed healing of the external wedge scars which were conservatively managed over a prolonged period.

All but one (1. 65%) patient showed improvement in breathing compared to preoperative condition.

## DISCUSSION

After the Sheen<sup>12</sup> tip graft was first described in the early 1980s, A multitude of other grafting techniques including the sheen as well as peck<sup>11</sup> graft which have been widely used in an attempt to increase tip projection. Porter et al<sup>15</sup> have also described a contoured auricular projection graft as an alternative onlay graft to achieve increased projection in endonasal rhinoplasty. With the wide popularity of the open approaches<sup>20-22</sup> in modern rhinoplasty the meticulous fixation of these grafts has reduced the incidence of graft rotation and migration so overall these techniques have proved to be valuable in providing additional tip projection however these techniques were not able to add support to the tip and were inadequate to provide the support needed specially in cases of weak crural cartilage and with thick nasal skin. On the other hand, graft visibility remained a problem in cases of thin nasal skin if the grafts were not adequately trimmed and weakened to prevent sharp borders.

Other techniques which depended mainly on suturing, like dome defining and dome equalizing sutures, which were popularized in open rhinoplasty by Daniel<sup>24</sup>, were also valuable in providing additional tip definition and projection, also the addition of some lateral crural steal as described by Foda & Kridel<sup>16</sup> was also extremely versatile in achieving maximal tip projection using suturing techniques, but again these techniques were not designed to achieve any increase in tip support which made it necessary to combine these maneuvers with a columellar strut which is placed separately between the medial crura at the same time. A good example of combining both onlay grafts as well as columellar strut is the umbrella graft<sup>25</sup> which consists of a vertical cartilaginous strut between the medial

crura and a horizontal onlay graft overlying the alar domes.

While other techniques which depend mainly on providing tip support as premaxillary grafts described by Webster<sup>7</sup> and columellar struts which was popularized by Anderson<sup>26</sup> were only efficient in providing tip support without providing adequate projection for the tip, hence came the necessity to combine these techniques together to achieve both projection and support as well as tip definition specially in cases with underprojected depressed thick nasal skin with weak cartilage and revision cases with insufficient cartilaginous support.

All of this lead to the evolution of extended columellar strut-tip graft by Pastorek<sup>27</sup> who first used it in an attempt to bring projection and form into secondary rhinoplasty cases when the lower lateral cartilages, following surgery, were ineffective in maintaining support. This graft is a structural unit used through an endonasal approach through a marginal incision and is placed anterior to the medial crura extending from the nasal spine and reaching higher than the domes.

Although the extended columellar strut-tip graft proved to be a reliable method to provide nasal tip projection and contour<sup>27</sup> yet it lacks the criteria which make it reliable to provide adequate tip support for the nasal skin as well as the weak cartilages as it lacks any fixation to the medial crura which makes it inefficient to support the weak nasal cartilage as well as the heavy nasal skin.

With the evolution and the wide practice of open approaches in rhinoplasty, it became a necessity to apply these combined techniques of using a strong tip supporting structure at the same time providing definition and projection particularly for thick skinned patients and revision cases so this lead to the need for what we call a **combined strut tip** graft which is sutured to the medial crura as one component and at the same time extends higher than the domes to provide more projection. It is also important that the most projecting point of the graft should lie anterior to the domes to provide a 3 point definition for the tip in opposition to what was previously stated by Tardy<sup>27</sup> that the columellar strut should never extend to the apex of the tip skin to avoid a visible tent pole appearance.

This graft has proved to be very efficient in case of primary rhinoplasty with depressed underprojected tip and thick nasal skin, and it proved to be advantageous over on lay grafts as well as suturing techniques alone which provide only tip definition without providing any additional structural support for the tip or the weak cartilage. Also this graft is considered superior to other grafting techniques as premaxillary grafts and columellar struts alone which provide a very good tip support without achieving the desired projection of the tip.

This graft is also considered superior to the extended columellar strut- tip graft in that it is firmly attached to the medial crura providing more support to the naturally weak cartilaginous crura in cases of thick nasal skin with weak cartilages so at least in theory it provides more structure to support these cartilages on the contrary to the extended columellar strut-tip graft by Pastorek which is an independent structural element as it is not sutured to the medial crura but is only stabilized by placement in a tight pocket which also carries the risk of malpositioning, displacement as well as graft migration.

### CONCLUSION

The strut-tip graft is highly versatile in that it offers unique advantages in both primary and secondary rhinoplasty procedures. This graft combines the contouring shape of the tip graft with the strength of the columellar strut into a single stable unit. All this has lead to the expansion of the scope of this graft to include revision cases in which this cartilaginous support is weakened by excessive resection and the nasal skin is thickened by scarring as well as in primary cases with thick nasal skin and weak cartilage. Another good indication is the short medial crura where a traditional strut combined with lateral crural steal will not provide the desired amount of projection.

However, there are certain precautions which should be followed during placement of this graft including the pocket dissection which should not be undermined completely to the premaxilla to prevent the strut from slipping to one side of the spine, leading to asymmetry and loss of nasal tip projection. Also the degree of vertical angulation of the graft should be adjusted to modify the nasolabial angle as required. This

is also an additional advantage of this technique as it adds to the versatility of its use.

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