Rhinoplasty

The Endonasal Lateral Crural Underlay and Sandwich Grafts

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Abstract

Background: Previously, the problem created by overly convex, wide, and robust lower lateral cartilages (LLC) required an external or endonasal approach with delivery. Although this method has proven invaluable, it may not be indicated in all patients with large tips, specifically those with overly convex LLC or with thin skin and robust LLC.

Objective: The authors present the results of their straightforward technique for narrowing the bulbous tip through an endonasal nondelivery approach that reinforces the nasal airway while at the same time preventing alar notching, lateral crus recurvature, and bossa formation.

Methods: From August 2008 to February 2010, 29 patients underwent endonasal lateral crural underlay and sandwich graft with the authors' technique. All patients had medium to thin skin and prominent, bulbous, symmetric LLC. Three of the patients presented for secondary rhinoplasty. The authors identified no specific contraindications for this procedure. All patients who remained for follow-up were given a questionnaire that analyzed their nasal tip satisfaction on a five-point categorical scale at seven separate points of follow-up.

Results: Among the 27 patients who remained for follow-up, the results were highly satisfactory, mostly satisfactory, or satisfactory in 25 of the 27 cases (as indicated by patient survey). The two remaining patients requested a thinner nasal tip. No significant complications were noted.

Conclusions: The lateral lower crural underlay sandwich graft is an adjunct to the traditional endonasal approach, further enhancing and expanding the possible outcomes. It appears to equal the predictability and stability identified with traditional tip-narrowing techniques in the external approach but with less operative time, less surgical dissection, and presumably less edema, thereby allowing us to better meet our patients' demands.

Keywords

nose, nasal tip, lower lateral cartilages

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Over the past decade, medicine (and plastic surgery in particular) has experienced a significant movement toward minimally-invasive procedures. Although this trend has been exemplified by the growing popularity of injectables and neurotoxins,1 the benefits of a minimally-invasive procedure also apply to other areas of plastic surgery, specifically rhinoplasty. The endonasal approach generally allows access to the nasal cartilages with less surgical dissection than the external approach.2,3 Postoperatively, patients frequently experience less edema and are likely able to appreciate their improved nasal shape more quickly. For these reasons, it seems that renewed momentum toward and enthusiasm for the endonasal approach is forthcoming.

With the endonasal approach, a common technique for refining a poorly-defined tip and decreasing supratip fullness is a transcartilaginous resection of the cephalic margins of the lower lateral cartilages (LLC).4,5 This maneuver involves minimal dissection and mild postoperative edema; furthermore, improvement in the tip is recognizable within a few weeks of the procedure. However, although this technique is quite effective in those with...
medium-thickness skin and prominent LLC, it is not an effective technique for narrowing a bulbous tip enveloped in thin skin. Because of these limitations, patients with overly convex, wide, and robust LLC are best treated through an external approach or through the delivery method with the endonasal approach.

In either approach, it is common to bind the bulbous domes with a suture, a process that has evolved over the years and is rooted in precise suture placement. The transdomal mattress suture is a horizontal suture spanning the domal arches and is useful for tip narrowing. The specific technique has been described by Daniel as well as others. Often, it is accompanied by an alar rim graft to strengthen the external valve. All derivations involve placing a mattress suture through the intermediate crura. This not only narrows the dome, but also has the secondary effect of flattening and straightening a convex LLC. This technique has endured the test of time and has proven very valuable for treating thousands of patients with large tips.

However, this method may not be indicated in all patients with large tips. Specifically, when the domes of a patient with overly convex LLC are sutured together, recurvature of the distal end of the LLC into the vestibular space may occur, thus risking airway compromise. Additionally, in those with thin skin and robust LLC, a transdomal binding suture may pinch the soft tissue triangle. The resulting alar rim notching, often described as the "operated look" feared by many potential rhinoplasty patients, is common.

In the ideal candidate requesting a narrower nasal tip, placement of a transdomal suture can be performed effectively through either an external or an endonasal approach. If the endonasal approach is utilized, the LLC require delivery. Although this may technically be an endonasal procedure because there are no external incisions, the amount of dissection necessary to dissect a bipedicile flap and deliver the domes increases the risk for scarring forces and postoperative edema, decreasing the predictability of the final outcome and thereby negating many of the potential benefits of employing the endonasal approach. To address this concern, we describe a technically-straightforward technique to narrow the bulbous tip through an endonasal nondelivery approach that reinforces the nasal airway while concurrently preventing alar notching, lateral crus recurvature, and bossa formation.

**METHODS**

From August 2008 to February 2010, 29 consecutive patients with medium to thin skin and prominent, bulbous, symmetric LLC were treated with the authors' endonasal nondelivery technique. Three of the patients were secondary rhinoplasty patients. Of note, the technique can also be performed in patients with thin skin and weak LLC to prevent bossa formation and/or alar retractions. We have identified no specific contraindications for this procedure.

All patients who remained for follow-up were given a questionnaire that analyzed their nasal tip satisfaction on a five-point categorical scale (not satisfied, slightly satisfied, satisfied, mostly satisfied, and highly satisfied). The patient questionnaire was administered at one week, one month, three months, six months, nine months, one year, and in an additional telephone call placed during retrospective chart review as this study was being prepared.

**Surgical Technique**

The vestibular mucosa under the LLC was anesthetized with 1% lidocaine with epinephrine 1:100,000 (Hospira, Inc., Lake Forest, Illinois). Every attempt was made to inject the solution immediately under the perichondrium, in order to hydrodissect the enveloping perichondrium on both the dorsal and ventral surfaces of the LLC, thereby facilitating surgical dissection and pocket formation.

Ideally, two straight, strong pieces of cartilage—each approximately 5 by 20 mm—were harvested from the nasal septum. It was generally beneficial to correct the native lower lateral convexity if the cartilage had a slight curve (Figure 1). An incision was then made at the caudal surface of the LLC border (Figure 2), and a subperichondrial flap was elevated on the undersurface of the LLC (Figure 3). A pocket was developed toward the undersurface of the nasal dome and extended laterally beyond the distal end of the lateral crus (Figure 4). It was important that the pocket extended far laterally; otherwise, the weight of the foreshortened graft accentuated the lower
lateral crus recurvature. If the distal LLC was already obstructing the vestibule, its distal 5 mm was freed from the surrounding attachments and amputated. The graft was then fit precisely into the appropriately-sized pocket (Figure 5). The graft could have been fixed to the lateral crus with a 5-0 polydioxanone suture (PDS), but if all skin and soft tissue attachments on the dorsal surface of the LLC were left intact, the underlay lateral crural graft was often enough to straighten the convex crus and a fixation suture was not necessary.

The vestibular incision was closed with a 5-0 fast-absorbing catgut suture (Ethicon, Inc., Somerville, New Jersey) (Figure 6). Occasionally, a strongly convex LLC was resistant to flattening and a small, 2- to 3-mm pocket was elevated on the dorsal surface of the LLC in the area of greatest curvature. A 5-0 PDS mattress suture was then placed to secure the convex LLC to the strut graft (Figure 7). Although only performed rarely, if more correction of the bulbosity was desired, a second pocket was dissected supraperichondrially over the lateral two-thirds of the LLC (Figure 8), extending laterally and caudally into the thickened skin of the nasal ala toward the pyriform aperture. This pocket sometimes deviated from the LLC as it developed over the pyriform aperture, especially if the native LLC extended cephalically.
A smaller, thinner graft taken from the septum—measuring approximately 5 by 15 mm—was then placed within the pocket (Figure 9). Although the majority of the pocket was positioned under the lateral, thickened skin of the ala, the medial portion of the pocket and graft sometimes partially extended to the thinner skin of the lateral tip. Therefore, prior to insertion, the edges of the graft were morselized, facilitating camouflage. The two grafts, once placed, sandwiched the disfigured LLC, essentially splitting it into a straight position (Figure 10). Over the course of the procedure, the skin over the domes remained undissected, so these attachments were left intact. If desired, additional projection and refinement of the tip were achieved by placing crushed cartilage or postauricular fascia within a precise pocket over the domes through an intermediate alar rim incision. Last, a 5-0 PDS suture was placed to suture the complex together and the vestibular incision was closed with a 5-0 fast-absorbing gut suture (Ethicon) (Figure 11).

It was essential to the procedure that the crural grafts extended beyond the pyriform aperture; otherwise, nasal obstruction and compromise of the external valve could result from the weight of two grafts. At the conclusion of the procedure, the nasal alar sidewall was straightened and strengthened. If cephalic margin trim was performed, the risks for bossa formation and alar retraction were thereby mitigated.

RESULTS

Patients in this series ranged in age from 18 to 46 years (average, 29). Two patients were lost to follow-up, leaving 27 patients available for data analysis. The follow-up periods ranged from six to 23 months (μ = 10.48), with 10 patients having a follow-up greater than one year. Of the 29 procedures, 41 lateral crural underlay grafts and 15 sandwich grafts were placed (Table 1). Ten patients underwent additional definition to the nasal tip with crushed cartilage or with a postauricular fascial graft placed over the domes.

Ten of 27 patients reported being highly satisfied with their results (Figures 12-15), 10 reported being mostly satisfied, three reported being satisfied, two were only slightly satisfied, and two were not satisfied (Table 2). These responses remained relatively consistent at all follow-up points. One patient initially reported being not satisfied with the wideness of her tip at three months, but converted her response to mostly satisfied at six months. One patient reported being not satisfied at 13 months because she desired a thinner nasal tip, but has not requested a revision surgery. One early patient who underwent sandwich grafting complained of nasal obstruction and requested revision.

DISCUSSION

The fastest growing segment of cosmetic medicine involves nonsurgical procedures. The successful impact of office-based “lunchtime procedures” has influenced surgical patients who now also seek out less invasive procedures with less downtime and results that are more quickly evident. In short, patients have become less interested in deep laser resurfacing, deep plane facelifts, and extended nasal procedures.
Nasal reshaping, or rhinoplasty, is the third most common cosmetic surgical procedure in the United States, with over 135,000 procedures performed in 2009. Most patients undergoing rhinoplasty experience approximately one week of downtime before returning to their routine work and social schedule. However, as most rhinoplasty surgeons recognize, the final result from rhinoplasty can take many months to be realized. In addition, it is generally accepted that the more extensive the surgery, the longer the nose takes to heal. Patients undergoing less surgical dissection seem to experience less edema and are able to appreciate their final result sooner. For these reasons, a less-invasive surgical approach is preferable, as long as the results are as accurate and predictable as those achieved with the current standard of care. Today, the external nasal approach is the primary technique taught in most fellowship programs. This method, which allows for greater visibility and surgical access, is indicated in many patients, but not all. It may be that some patients are better candidates for a less-invasive endonasal surgical approach. The endonasal approach was the preferred approach for the greater part of the past century, but many surgeons abandoned it because it was felt to result in nasal instability, high complication rates, and unpredictable outcomes. If the fixative grafting techniques from the external approach are translated to an endonasal approach, as with the maneuver we describe, the benefits of stability and predictability common to the external approach can be provided without the untoward effects associated with the endonasal rhinoplasty of a generation ago. Specifically, for those patients requesting only a subtle modification, the endonasal rhinoplasty approach is advantageous in that it allows for an outcome very much within the context of the patient’s face and recognized appearance, deviating less from the pretreatment nose.

Table 1. Distribution of Patients Receiving Underlay or Sandwich Grafts

<table>
<thead>
<tr>
<th>Type of Graft</th>
<th>Number of Grafts</th>
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<tbody>
<tr>
<td>Lateral crural underlay grafts</td>
<td>41 grafts</td>
</tr>
<tr>
<td>Bilateral</td>
<td>18 patients</td>
</tr>
<tr>
<td>Unilateral</td>
<td>5 patients</td>
</tr>
<tr>
<td>Lateral crural underlay and overlay grafts (sandwich grafts)</td>
<td>15 grafts</td>
</tr>
<tr>
<td>Bilateral</td>
<td>5 patients</td>
</tr>
<tr>
<td>Unilateral</td>
<td>5 patients</td>
</tr>
<tr>
<td>Additional tip definition from crushed cartilage or a postauricular fascial graft</td>
<td>10 patients</td>
</tr>
</tbody>
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Table 2. Patient Satisfaction Results

<table>
<thead>
<tr>
<th>Satisfaction Rating</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly satisfied</td>
<td>10</td>
</tr>
<tr>
<td>Mostly satisfied</td>
<td>10</td>
</tr>
<tr>
<td>Satisfied</td>
<td>3</td>
</tr>
<tr>
<td>Slightly satisfied</td>
<td>2</td>
</tr>
<tr>
<td>Not satisfied</td>
<td>2</td>
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The lateral crural graft, whether placed as an overlay or underlay, is commonly employed in the external approach. This type of graft has proven to be a very valuable tool for straightening and strengthening the LLC in both primary and revision rhinoplasty surgery. Additionally, the lateral crural graft builds a foundation for greater tip definition and improves external nasal valve competency. These grafts can be placed for the same indications in a delivery endonasal approach. However, to decrease our surgical dissection even further, the lateral crural underlay and sandwich graft technique was employed to avoid the need for delivering and binding the LLC. We have been pleasantly impressed with the amount of tip definition achieved with the underlay graft alone or

Figure 12. (A, C) This 38-year-old woman presented with thin skin and asymmetric nasal tip. (B, D) Six months after rhinoplasty with the authors’ technique, including cephalic margin trim and placement of lateral crural underlay grafts.
in conjunction with an overlay graft, obviating the need for any further tip-defining maneuvers. However, on occasion in patients with thinner skin, a visible intercrural cleft, and a prominent supratip, we place crushed cartilage or a postauricular fascial graft within a precise pocket over the domes through a rim incision to further define and project an amorphous tip.

Although the degree of tip narrowing achieved with the lateral crural underlay and sandwich graft is not as significant as with a transdomal suture, a refined, sculpted, and natural tip is quickly realized for most patients who originally present with a bulbous tip. It should be noted that there may be some patients with overly convex nasal tips whose high expectations cannot

Figure 13. (A, C) This 23-year-old man presented with medium skin and a wide tip. (B, D) One year after rhinoplasty with the authors’ technique, including sandwich grafting to yield a narrowed tip.
be met with our described technique. Similar to noses treated utilizing other rhinoplasty techniques, continued refinement and definition of the tip have been noticed throughout the postoperative year. It is recognized by most rhinoplasty surgeons that a narrow nasal tip achieved through traditional endonasal approaches that satisfies both the patient and surgeon at one year can (and often will) continue to narrow over time. Occasionally, the

Figure 14. (A, C) This 31-year-old woman presented with thin skin, asymmetric bulbous tip, and airway obstruction. (B, D) Six months after rhinoplasty with the authors’ technique, including lateral crural underlay grafts that resulted in improved tip definition and vestibular patency.
well-sculpted nasal tip realized soon after surgery becomes tomorrow’s revision.

We have found endonasal crural grafting to be a technically straightforward, versatile tool for treating the bulbous tip. When placing the lateral crural underlay graft alone, we have not recognized any cosmetically-unappealing changes in the thickness of the nasal sidewall. When a lateral crural overlay graft is also placed, it is important to limit the graft to the lateral half of the lower two-thirds of the LLC, with the lateral graft extending caudally into the naturally thicker skin under the nasal ala. This prevents an overly thickened appearance of the lateral nasal sidewall (Figure 16). Although this has not been an issue in the 15 sandwich grafts we placed in this series, there was one patient from early in our experience in whom the crural grafts did not extend beyond the pyriform aperture, resulting in nasal obstruction that was accentuated with inspiration.

Although it has been well documented in the rhinoplasty literature that outcomes cannot necessarily be judged at one year, we have been satisfied with the predictability demonstrated at one year and believe that the strengthening and support provided by the lateral crural underlay and sandwich grafts will provide the stability and predictability often associated with an external approach. We see no theoretical reason why the positive results recognized at one year should not persist.

From laparoscopic access to endovenous stent placement, surgical medicine has evolved to achieve equivalent (if not superior) outcomes while minimizing invasiveness in its approaches, and aesthetic surgeons should take notice. The trend seems to be toward minifacelifts, endoscopic browlifts, and injectables. Likewise, our approach to rhinoplasty is now following suit. By adopting the grafting techniques learned from the external approach into the endonasal approach, a stable, well-functioning nose can be achieved with reduced operating room time and expedited patient satisfaction.
CONCLUSIONS

The placement of lower lateral crural underlay and sandwich grafts is an adjunct to traditional rhinoplasty, further enhancing and expanding the possible outcomes achieved with the endonasal approach. It appears to equal the predictability and stability benefits identified with the external approach but with less edema, reduced operative time, and more limited surgical dissection, thereby allowing us to better meet our patients’ demands.

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REFERENCES