Concurrent Elevation of the Upper Lateral Cartilage Perichondrium and Nasal Bone Periosteum for Management of Dorsum: The Perichondro-Periosteal Flap

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Abstract
A meticulous nasal dorsal dissection is an indispensable tool for a successful rhinoplasty. To achieve an aesthetically pleasing dorsum, fine dissection of the upper lateral cartilages (ULC), nasal bones, and keystone area is crucial. In this Featured Operative Technique article, the author describes a different concept of nasal dorsal skeletonization: the perichondro-periosteal flap technique. This technique has several advantages in restoring the nasal dorsum after hump reduction. Namely, the preparation and protection of the perichondrium and the periosteum of the nasal dorsum as a single entity allows a healthier, separate-layer closure over the osseocartilaginous dorsum.

Keywords
rhinoplasty, nasal dorsum, keystone area, perichondrium, periosteum

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A smooth and natural dorsum is essential for a successful rhinoplasty. To perform maneuvers on the nasal dorsum—such as hump reduction, spreader flaps or spreader grafts, osteotomies, and onlay grafts—significant exposure of the nasal bones and upper lateral cartilages (ULC) is required. A meticulous dissection of the ULC and nasal bones is crucial to achieving an aesthetically pleasing nasal dorsum and avoiding dorsal irregularities. This is especially important in the keystone area, where the caudal portion of the nasal bones overlaps the cephalic portion of the ULC. This is where the majority of postrhinoplasty deformities appear, because the nasal skin is thinnest in the keystone area. Dissection of this area is rather difficult due to the complex anatomy, and extra care should be taken to avoid postoperative deformities.

To address these difficulties, I describe a different concept of nasal dorsum dissection—the perichondro-periosteal flap.

CLINICAL EXPERIENCE
I applied the perichondro-periosteal flap technique in 1213 rhinoplasty patients between 2005 and 2012. Of these, 842 patients were women and 371 were men. The age range of the patients was 17 to 61 years (mean, 26 years).

Of the 1213 cases, 1165 (96%) were primary rhinoplasty procedures and 48 (4%) were secondary. Thirty-one of the 48 secondary rhinoplasty cases were revisions, while 17 patients underwent their primary operation with another surgeon. All patients were operated on under general anesthesia, with an average operating time of 150 minutes.

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An open rhinoplasty technique is used, with a midcolumellar inverted-V incision to expose the nasal dorsum. The dorsal skin flap is elevated on the sub–superficial musculoaponeurotic system and supraperichondrial, supraperiosteal planes using a pair of sharp tip scissors, and the osteocartilaginous vault is exposed. With a No. 15 blade, a straight incision is made on the ULC perichondrium in the midline, starting from the caudal border of the nasal bones and extending caudally up to the anterior septal angle (Figure 1). Using a semi-sharp 2-mm Freer elevator, the perichondrium is elevated on both sides (Figures 2 and 3). The extent of the lateral dissection of the perichondrial flaps depends on the amount of dorsal reduction but is usually around 8 to 10 mm. In patients with large dorsal humps, a wider dissection is required.

After bilateral elevation of the perichondrium, a 2- to 3-mm vertical incision of the nasal bone periosteum is made at the midline to facilitate periosteal elevation (Figure 4). A sharp, 2-mm dissector (Figure 3) is used to elevate the periosteum superiorly and laterally (Figure 5). Periosteal elevation is extended up to the glabella. Periosteal attachments at the caudal border of the nasal bones are divided using a sharp tip dissector or a No. 15 blade (Figure 6) and the perichondrial and periosteal flaps are united, creating a continuous perichondro-periosteal flap on both sides (Figures 7 and 8). A video of this technique is available at www.aestheticsurgeryjournal.com. You may also scan the code on the first page of this article with any smartphone to be taken directly to the video on www.YouTube.com. Care should be taken not to avulse the perichondrium of the ULC during the division of the caudal attachments of the nasal bones, which can be technically difficult.

In patients who require a dorsum reduction, ULC are separated from the septum following the elevation of perichondro-periosteal flaps, and the cartilaginous hump is reduced incrementally, preserving the ULC. Bony hump removal is performed using a 6-mm straight osteotome (Figure 9). If necessary, median oblique and lateral osteotomies are also performed using a 2-mm straight osteotome. After the reduction of the cartilaginous and bony hump, spreader flaps are placed in most cases to restore the cartilaginous nasal dorsum (Figure 10). If required, spreader grafts are placed (or spreader grafts are combined with spreader flaps) to refine the dorsal aesthetic lines and correct internal nasal valve problems.

To restore the keystone area, onlay grafts are needed in some patients. If there is an open roof deformity or irregularity following bony hump reduction and osteotomies, the resected nasal bone is thinned with a blade or power burr.
and replaced to the dorsum between the 2 nasal bones (Figures 11-16). Alternatively, a cartilage graft from cephalic resection of the lower lateral crura or a crushed cartilage graft from the septum can be placed to eliminate the open roof deformity and camouflage the irregularities of the keystone area due to hump removal (Figure 17). Since suturing of perichondro-periosteal flaps provides the stabilization of the grafts in situ, there is no need for a separate fixation of these camouflage grafts (Figures 15, 16, and 18). When a dorsal augmentation is needed,
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Dorsal onlay grafts, radix grafts, or supratip grafts can be placed and secured with the help of the perichondro-periosteal flaps (Figures 19 and 20).

Following completion of cartilaginous and bony dorsum reduction and manipulation, both perichondro-periosteal flaps are approximated with 5-0 chromic catgut sutures (Figure 15). The closure begins caudally and continues cranially. Usually, 3 or 4 separate sutures are sufficient for closure of the dorsal perichondro-periosteal flaps (Figures 16 and 18). However, any absorbable suture material is suitable for this closure. A video of this closure technique is available at www.aestheticsurgeryjournal.com. You may also scan the code on the first page of this article with any smartphone to be taken directly to the video on www.YouTube.com.

It is worth noting that it is possible to reelevate the perichondro-periosteal flaps in revision surgeries (Figure 21). Clinical results are shown in Figures 22 through 24.

Figure 5. Elevation of the periosteum of the nasal bone using a sharp-tip 2-mm dissector is shown intraoperatively (A) and in illustration (B).

Figure 6. Release of the periosteal attachments at the caudal border of nasal bones using a fine elevator with sharp tip is shown intraoperatively (A) and in illustration (B).

Figure 7. The perichondrium and periosteum are elevated in continuity.
Postoperative problems related to improper nasal dorsal handling can be quite distressing even for an experienced rhinoplasty surgeon. Over- or underresection of the hump, an excessively narrowed dorsum, an inverted-V deformity, dorsal deviation, an open roof deformity, and dorsal irregularities are the most common deformities. The creation of an aesthetically pleasing nasal dorsum requires

**DISCUSSION**

Figure 8. The perichondro-periosteal flaps are prepared on both sides, exposing bare bone and the upper lateral cartilages. This maneuver is shown intraoperatively (A) and in illustration (B).

Figure 9. The bony hump is removed with a 6-mm straight osteotome.

Figure 10. The upper lateral cartilages are folded in and sutured to the septum to restore cartilaginous dorsum after hump removal (spreader flaps).
thorough understanding of the anatomical and functional features of this area. Fine dissection and good exposure of the nasal dorsum is the primary and vital step in achieving a satisfactory outcome.

Traditionally, elevation of the nasal skin flap proceeds adjacent to the nasal cartilages below the superficial musculoaponeurotic layer. Once the subcutaneous dissection of the nasal dorsum is completed, nasal bone periosteum is incised and elevated with a dissector cranially.2 With this

Figure 11. The resected bony hump is thinned using a No. 11 blade.

Figure 12. The resected bony hump is thinned with a power burr.

Figure 13. The thinned bone graft is replaced in the keystone area.

Figure 14. Perichondro-periosteal flaps are approximated over the bone graft.
technique, ULC perichondrium is left attached to the ULC. The transition from the cartilage to the bone may not be visualized clearly due to the complicated pattern of the nasal bones and the ULC.

In this article, I present a technique to elevate the perichondrium of the ULC and the periosteum of the nasal bones concurrently, as a single flap on both sides (which exposes bare cartilage and bone throughout the nasal dorsum), after incising the perichondrium and the periosteum in the midline. This enables excellent visualization of the ULC, nasal bones, and, most important, the keystone area.

The perichondro-periosteal flap dissection in dorsum management has several advantages. First, this technique enables excellent visualization of the nasal bones and ULC. Since the anatomy of the nasal dorsum can be seen clearly, deformities can be determined more accurately and correction of the deformities is easier. Also, this extra layer of connective tissue helps to smooth minor irregularities of the nasal dorsum, particularly in the keystone area. This is important in patients with thin nasal dorsal skin, in whom miniscule dorsum irregularities can become visible in the long term.

Spreader flaps are one of the most useful recent developments in rhinoplasty surgery. Spreader flaps can help restore dorsal aesthetic lines after hump reduction. Elevation of the perichondrium of the ULC with this technique facilitates preparation and suture of spreader flaps, which is also an advantage. With the elimination of perichondrial forces, the ULC can be

Figure 15. The perichondro-periosteal flaps are sutured over the bone graft.

Figure 16. Suture of the perichondro-periosteal flaps is completed. The bone graft is stabilized under the perichondro-periosteal flaps. This maneuver is shown intraoperatively (A) and in illustration (B).
easily folded and suturing of the spreader flaps can be performed more accurately.

Bony hump removal distorts the anatomy of the nasal dorsum. The reconstitution of dorsal anatomical structures similar to normal anatomy and the creation of the “dome shape” of the bony dorsum are mandatory to obtain a smooth and natural dorsum. The placement of a thin onlay graft to the keystone area between 2 lateral bony walls restores the anatomy in this region while creating the dome shape, preventing the open roof deformity and camouflaging dorsal irregularities. This is particularly important for patients with thin dorsal nasal skin. It is difficult to fixate onlay bone or cartilage grafts in this area, and graft migration may occur when classic dorsum dissection techniques are used. With the perichondro-periosteal flap technique, onlay grafts can be placed without the need for graft fixation. The perichondro-periosteal flap stabilizes onlay grafts and prevents graft migration. Similarly, supratip grafts, dorsal onlay grafts, and radix grafts can be placed underneath the perichondro-periosteal flap without fixation.

This technique can also be effective in revisionary cases. If perichondro-periosteal flaps are elevated using the described technique and approximated at the end of the primary operation, the preparation of the flaps is
uncomplicated, and they can be raised as easily as in a primary case. I believe I could use the technique in all my revisional rhinoplasties requiring dorsal modification.

However, in secondary cases where dorsum reduction was performed using another technique during the primary operation (ie, one that did not preserve the perichondrium and periosteum), raising of a continuous perichondro-periosteal flap as described is difficult. I found that it was rarely possible to use my technique in secondary rhinoplasties of this type. This is evident in the current series, which included only 17 secondary rhinoplasty patients who underwent primary surgery in another clinic.

It should be noted that the technique has some drawbacks, in that preparing a continuous perichondro-periosteal flap requires fine dissection skills, and this may lengthen the operative time.

**CONCLUSIONS**

Achieving an aesthetically pleasing nasal dorsum requires meticulous skeletonization of the osteocartilaginous framework. The elevation of the perichondro-periosteal flap of the nasal bones and the ULC in continuity enables the surgeon to visualize the nasal dorsum in detail and facilitates the maneuvers in dorsal restoration. This technique allows the surgeon to place onlay grafts without fixation. The closure of the perichondro-periosteal flap as a separate layer provides additional support to the dorsal nasal soft tissues and reduces the frequent problems related to dorsal hump removal in patients with thin dorsal nasal skin.

**Disclosures**

Marina Medical Instruments, Inc manufactures rhinoplasty instruments designed by the author. The author does not receive payment from the company.
Figure 22. (A, C, E, G) This 23-year-old woman presented for removal of a large dorsal hump and a nasal size reduction. (B, D, F, H) Two years after rhinoplasty with the author’s perichondro-periosteal flap technique. An open technique was used to expose the nasal dorsum. Perichondro-periosteal flaps were elevated. After bony and cartilaginous hump reduction, spreader flaps were used to restore the cartilaginous dorsum. Low-to-high lateral osteotomies were performed. Resected nasal bone was thinned and used to camouflage the keystone region. Perichondro-periosteal flaps were sutured to stabilize the replacement graft on the keystone area. Note the patient’s smooth, straight dorsum, with refinement of dorsal aesthetic lines.
Figure 22. (continued) (A, C, E, G) This 23-year-old woman presented for removal of a large dorsal hump and a nasal size reduction. (B, D, F, H) Two years after rhinoplasty with the author’s perichondro-periosteal flap technique. An open technique was used to expose the nasal dorsum. Perichondro-periosteal flaps were elevated. After bony and cartilaginous hump reduction, spreader flaps were used to restore the cartilaginous dorsum. Low-to-high lateral osteotomies were performed. Resected nasal bone was thinned and used to camouflage the keystone region. Perichondro-periosteal flaps were sutured to stabilize the replacement graft on the keystone area. Note the patient’s smooth, straight dorsum, with refinement of dorsal aesthetic lines.
Figure 23. (A, C, E, G) This 21-year-old woman presented with a bony and cartilaginous hump, inadequate tip projection, low columella-labial angle, a pointed nasal tip with weak cartilages in the dome area, and retracted alae. (B, D, F, H) Eighteen months after rhinoplasty with the author’s perichondro-periosteal flap technique. An open approach was used to expose the dorsum. Perichondro-periosteal flaps were elevated. After a 2-mm bony and cartilaginous hump reduction, spreader flaps were placed to restore the cartilaginous dorsum and refine the dorsal aesthetic lines. Medial oblique and internal low-to-low osteotomies were performed. Perichondro-periosteal flaps were sutured after completion of dorsal reduction and restoration. Medial crura were advanced on a long columellar strut to increase tip projection. A subdomal graft was placed to strengthen weak domes, and an onlay tip graft was used to give an additional projection to the nasal tip. Bilateral alar rim grafts were also placed to correct the retracted alae. Note the patient’s smooth, straight nasal dorsum.
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Figure 24. (A, C, E) This 19-year-old woman requested augmentation of her nose to establish improved facial harmony. (B, D, F) Two years after rhinoplasty with the author’s perichondro-periosteal flap technique, note the patient’s increased tip projection, augmentation of the radix and supratip region, and improvement of facial harmony. Intraoperatively, the nasal dorsum was exposed using an open technique via midcolumellar incision. Perichondro-periosteal flaps were elevated. A large septal cartilage graft was harvested, ensuring that a 12-mm L-strut remained intact for support. (G) To increase tip projection, medial crura were advanced on a columellar strut. (H) A single-layer cartilage graft was placed at the radix and a double-layer cartilage graft was placed at the supratip area. The graft edges were beveled and the grafts were mildly crushed. Suturing of the perichondro-periosteal flaps over the cartilaginous grafts provided adequate stability.
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