Understanding Dorsal Preservation Rhinoplasty
Anatomy and Biomechanics

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KEYWORDS

• Dorsal preservation rhinoplasty • Nasal anatomy • Blocking points
• Dorsal osseocartilaginous horizontal mattress suture

KEY POINTS

- Detailed understanding of the relevant nasal anatomy is important for the application of dorsal preservation rhinoplasty.
- Dorsal hump reduction using preservation techniques requires manipulation of the underlying septum and bony nasal pyramid.
- Identification of anatomic blocking points that prevent dorsal extension and impaction is a key surgical step.
- Fixation of the dorsum into its new lowered position is important to counteract tensile forces that could lead to dorsal hump recurrence.
- The dorsal flattening suture is introduced as a novel technique to assist in combining open dorsal preservation rhinoplasty with modified extracorporeal septoplasty techniques.

INTRODUCTION

Preservation rhinoplasty is a surgical approach focused on reshaping the nose without disrupting native dorsal esthetic lines, nasal ligaments, soft tissue skin envelope, muscle attachments, and limiting excision of alar cartilages. Preservation of nasal ligaments and the soft tissue skin envelope is achieved through a subperichondrial–subperiosteal dissection. The maintenance of the bony-cartilaginous dorsum without violation of the osseocartilaginous interface is the goal of dorsal preservation rhinoplasty (DPR) and can be performed with or without disruption of the nasal soft tissues. The DPR technique and tip rhinoplasty are made more accessible through an open approach as it provides direct visualization of the entire nasal framework and is the preferred method for "structural preservation" rhinoplasty approaches.

Open structural rhinoplasty with Joseph or conventional hump reduction (CHR) techniques remains the predominate approach to rhinoplasty teaching and practice. However, the surgeon must attend to iatrogenic deformities that result from these procedures. An original advantage of DPR over conventional dorsal hump reduction techniques is the opportunity to achieve a more natural esthetic and functional result by avoiding disruption of the dorsal keystone area and osseocartilaginous vault. With adoption of some bony surface modification techniques, the primacy of preservation of the cartilaginous vault has become most fundamental. Ultimately, dorsal preservation techniques have 2 related components: approaches to the

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bony nasal pyramid and management of the septum. The reader may find it useful to conceptualize and compare the movements of the osseocartilaginous vault in CHR (medial) with DPR (extension/flattening and impaction). The goal of this study is to highlight pertinent nasal anatomy as it applies to the biomechanics underlying DPR.

ANATOMY OF DORSAL PRESERVATION RHINOPLASTY

Nasal Septum and Upper Lateral Cartilages

The nasal septum is a midline structure composed of hyaline cartilage anteriorly and bone posteriorly. The bony septum is formed by 4 bones: the vomer, perpendicular plate of the ethmoid (PPE), the maxillary, and the palatine bone.[1] The maxillary and palatine bones form the septal crest. The attachment of the upper lateral cartilages (ULCs) to the undersurface of the nasal bone and cartilaginous septum at the midline is known as the dorsal keystone area (DKA).[1,2] Extension of the ULCs under the lateral portion of the nasal bones makes up the lateral keystone area (LKA). The quadrangular cartilage (QC) is securely attached to the ethmoid and vomer posteriorly maxillary crest and anterior nasal spine inferiorly.[1,3] The ethmoid point is the location where the PPE joins the QC on the undersurface of the nasal bones and in the majority of cases is located more proximal to the dorsal hump (**Fig. 1**).[4]

In DPR, the DKA and LKA are preserved. The overlap of the nasal bones and ULC at the keystone area is variable with anatomists reporting an average length of approximately 9 mm.[5,6] A key variable in this area for DPR is the fusion of the perichondrium of the cartilaginous vault with the periosteum of the nasal bones over the dorsum which makes this junction flexible.[7] Additionally, the extension of the cartilaginous septum and ULCs underneath the nasal bones is a major tenant of DPR because the bony cap sits above cartilage and not septal bone. Therefore, dorsal hump descent can occur via removal of a cartilaginous strip with minimal or no subdorsal septal bone removal.[8] The dorsum will descend from a point cephalic to the DKA and result in a lowering effect of the dorsum as well as increased rotation at the anterior aspect of the septum and nasal tip due to the flexible bony-cartilaginous connection at the dorsum.[9]

Nasal Bones

The attachment of the nasal bones to the frontal bone corresponds with the radix or nasal root. The radix angle is obtuse with variations in values and position with gender. In female individuals, it tends to lie at the level of the upper lashes, while in male individuals, it is at the level of the superior tarsal crease and is less obtuse.[8] The nasal profile demonstrates 4 key anatomic points for the nasal bones: (1) the nasion is the midpoint of the nasofrontal suture line; (2) the sellion is the deepest depression of the nasal bones; (3) the kyphion is the most prominent point of the bony dorsum; and (4) the rhinion is the most caudal point of the nasal bones.[10] There are 2 major configurations to the nasal bones: S shaped and V shaped. The S-shaped nasal bones have a curve that begins at the sellion with an apex at the kyphion and plateaus at the rhinion. The V-shaped nasal bones have a nearly straight configuration from the sellion through the rhinion. In DPR, the nasal vault is pushed inferiorly; the kyphion is not resected.

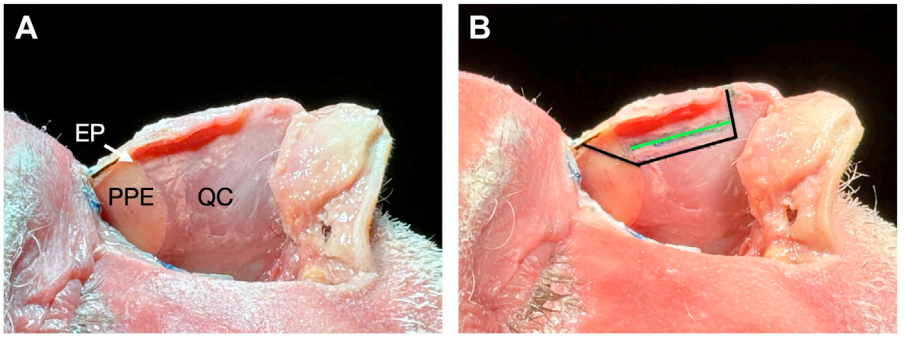

Fig. 1. (*A*) Cadaveric specimen showing a dorsal hump. Note: The quadrangular cartilage (QC) extends underneath the nasal bony cap and contributes to the external contour. Ethmoid point (EP) is location where the QC meets the perpendicular plate of the ethmoid (PPE) under the nasal bones. (*B*) Markings of incisions for the modified subdorsal strip method (MSSM) approach to the cartilaginous and bony septum. Green line delineates the dorsal incision. Black line indicates the lower incision and the intervening strip of septal cartilage is removed. The lower incision (*black line*) extends into the PPE to connect to the transverse osteotomy on the nasal bones.

Therefore, patients with S-shaped nasal bones may be at a higher risk of a residual hump.[8] The nasal bones attach to the ascending maxillary processes laterally. It is important to preserve the attachment of the medial canthal tendons to the ascending processes of the maxilla when performing wedge otectomies or lateral osteotomies.[11]

SURGICAL APPROACHES TO DORSAL PRESERVATION RHINOPLASTY

Osteotomies

A key principle of DPR is maintenance of the bony nasal vault and associated dorsal esthetic lines. Currently, there are 2 approaches that allow for lowering of the dorsum: pushdown and letdown. The pushdown technique was first described by Goodale[12,13] and popularized by Cottle and Loring.[14] It involves single bilateral lateral and transverse osteotomies resulting in disarticulation of the nasal-frontal junction and impacting the nasal pyramid into the pyriform aperture. The letdown technique was first described in 1914 by Lothrop[15] and involves both transverse and lateral osteotomies as well as resection of bilateral bony wedges along the ascending process of the maxilla. Thereby, lowering the nasal pyramid to rest on the maxilla instead of into the nasal cavity. A limitation of the pushdown technique is the inferior turbinate's attachment to the lateral nasal sidewall. Therefore, the letdown technique has the advantage of lowering dorsal humps that are greater than 4 mm.[16] Additionally, it has been shown that the pushdown can cause internal valve narrowing due to medialization of the bones, whereas the letdown preserves the nasal valve.[17] Yet another advantage of the letdown over the pushdown is its application to the crooked nose. Removal of asymmetric wedges of bone between the 2 sides will shift the entire bony pyramid and avoid exposure of challenging high septal deviations.[9]

Septal Excision

Regardless of which osteotomy approach is used, the bony-cartilaginous relationship of the dorsum requires some form of septal excision or manipulation to achieve dorsal hump lowering. Multiple approaches to the septum have been described in DPR with the main differentiating factor between each being the location of the septal cartilage excision. These include subdorsal excision (Saban method), inferior septal excision (Cottle method), subdorsal Z-flap, tetris concept, and modified subdorsal strip method (MSSM) developed by the senior author (S.P.M.).

Subdorsal septal excision

In Goodale's original description of his dorsal preservation technique, he removed a segment of cartilage immediately under the dorsum with a pushdown procedure.[12,13] Lothrop also described using a subdorsal cartilage resection in combination with a letdown procedure to achieve the dorsal hump reduction.[15] The approach was also utilized by the early modern adopters of DPR including Gola and then Saban. The technique involves making an incision along the contour of the dorsal hump immediately under the dorsum and extending it to the anterior septal angle.[18–20] Minimal to no septal cartilage remains superior to this incision. A more inferior cut is made at a location several millimeters below the dorsal cut. The segment of cartilage between these 2 incisions is removed and represents the amount of dorsal reduction.[16,18] A portion of the PPE is also resected in this method to allow for successful descent of the dorsum. If any cartilage remains under the dorsum, it is scored to release tension that may prevent flattening. The dorsum is then sutured to the underlying septum in its lowered position.[19] Advocates for this approach tout the control in the design of the lower incision and thereby the corresponding intended contour of the nasal profile.

Inferior septal excision

Cottle and Loring[14] first applied excision of septal cartilage from the premaxilla in the setting of nasal fractures to allow for mobilization after downfracture of the nasal bones. They then translated this technique to rhinoplasty and found that resection of a strip of cartilage at the maxillary spine allowed for descent of the dorsum. The amount of cartilage removed corresponds to the observed dorsal reduction. To facilitated complete removal of the dorsal hump, the inferior cartilage excision is combined with resection of a vertical 4 mm segment at the bony cartilaginous junction and resection of PPE under the nasal bone. The remaining cartilage and dorsum are then stabilized into position with sutures. The disadvantages of this approach include the complexity of the cartilage cuts and the degree of difficulty associated with anchoring the septal cartilage to the nasal spine.

Subdorsal Z-flap

Kovacevic and colleagues[21] describe a modification to the inferior septal excision by combining it with the high septal strip approach. The technique involves making a vertical subdorsal cartilaginous septal incision at the highest point of the corresponding dorsal hump. Then, a 30° angled cut is extended from the caudal end of the septal

junction with the ULC (W-point) to create a triangular-shaped incision that meets the vertical incision. Lastly, a subdorsal resection just below the bony hump is completed connecting the vertical septal cut with the median radix osteotomy. The dorsum is then secured in its new position with sutures. The authors advocate its use in V-shaped and S-shaped humps and noses with axis deviations.[21]

Tetris concept

The tetris concept was developed by Neves and colleagues[22] as a modification of the midseptal excision. The midseptal excision technique had been advocated for by Ishida, Neves, and their colleagues[23,24] for its ability to lower the cartilaginous nasal vault. The excision starts from the bony-cartilaginous junction and extends anteriorly into the caudal aspect of the septum inferior to the anterior septal angle. However, a limitation with this technique arose in that the caudal border of the septum often needed to be stabilized to prevent lateralization.[22] Therefore, Neves and colleagues[22] described the tetris concept that involves maintaining a caudal strut and rectangular subdorsal strip while excising a midseptal strip of cartilage and triangular wedge of bony septum under the nasal bones. The result is flattening of the dorsum while leaving the caudal strut intact.

Modified subdorsal strip method

The MSSM was developed by the senior author (S.P.M.) as an intermediate between the classic subdorsal and inferior septal resections.[25] Similar to the tetris concept, the approach involves maintaining a 3 mm to 5 mm subdorsal strip of cartilage and incising parallel to the dorsum from the bony cartilaginous junction toward the caudal septum terminating posterior to the anterior septal angle (see **Fig. 1**). Therefore, a 1 cm to 1.5 cm strut of caudal septal cartilage is maintained. The paraseptal cleft of fibrous attachments between the ULC at the anterior septum is released to allow for improved visualization of the septum and unimpeded dorsal descent. An advantage of the remaining caudal strut of septum is the freedom to attach the tripod complex in any desired projected or rotated position. While a triangular segment of ethmoid bone is commonly removed in other techniques, the senior author prefers to create a longitudinal cut into the bony septum such that there is slight side-to-side overlap between bones once the dorsum is lowered (**Fig. 2**). This conservative approach to the bony septum aims to minimize over displacement of the disarticulated nasal vault into the nose. Additional advantages of this method compared to others include the ability to resect lower and posterior septum and the caudal strut remains in continuity with the maxillary spine (**Fig. 3**). As such, septal deviations are corrected, additional cartilage is harvested for grafting purposes and there is no need to stabilize the septum to bone.

Blocking Points

A complication that is unique to DPR is dorsal hump recurrence.[26] In DPR, the hump is not excised but is instead flattened through mobilization, expansion, and reshaping. Therefore, any persistent tensile forces can potentially push the dorsum back to its original convexity overtime and have been termed the "spring effect."[26] Anatomic blocking points are commonly the source of the resistance forces and can contribute to hump recurrence.[27] Currently, 7 blocking points have been described and include remnant subdorsal cartilage at the keystone area, PPE and bony spicules, overlapped lateral osteotomy edges in the pushdown method, Webster triangle, mucoperiosteal resistance, medial canthal ligament, and LKA. The long-term maintenance of the lowered dorsal hump depends on the release of these relevant blocking points and secures fixation of the dorsum in its new position.[28]

One way to conceptualize the biomechanics of blocking points is to remember that the fundamental motion of the osseocartilaginous framework is one of (1) extension (though we as preservation surgeons incorrectly often call this flexion) and (2) impaction. Blocking points will generally affect one or the other of these processes and herein we will categorize them accordingly.

Impaction: septum, bones, periosteum

Regardless of the technique chosen to perform DPR, lowering of the cartilaginous dorsum is dependent on the reduction and release of the underlying septum. Premature contact of new septal edges due to cartilaginous remnants within the planned resection area can block reduction. Complete mobilization of the nasal dorsum is only achieved when the subdorsal septal resection extends to the level of the radix osteotomy.[27] The amount of bony septum or PPE removed to create this connection depends on the location of the dorsal hump in relation to the ethmoid point. The ethmoid point has been demonstrated as proximal to the dorsal hump and level of the radix osteotomy in the majority of cases.[4,29] Therefore, subdorsal resection will often consist of cartilaginous septum rather than bone. However, it is still important for the surgeon to check for a more distally

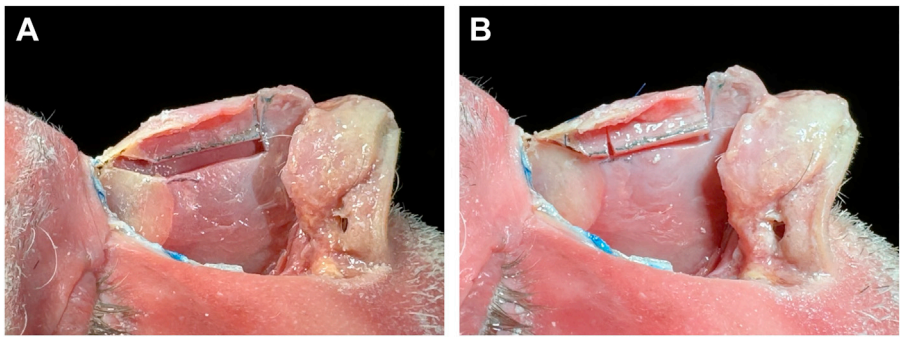

Fig. 2. (*A*) Same cadaveric specimen as shown in **Fig. 1** with subdorsal strip of cartilaginous septum and perpendicular plate of ethmoid (PPE) removed. (*B*) Note the vertical flexion cut into the subdorsal strip of septal cartilage placed at the apex of the previous dorsal hump. This chondrotomy allows the dorsum to flatten when the transmucosal circumferential dorsal stitch is placed to fixate it into its new position.

located ethmoid point and to remove any residual bony spicules that may hinder dorsal descent.

In the pushdown technique, the thick bones of the frontal process of the maxilla can prevent impaction of the nasal pyramid within the pyriform aperture, especially at the site of attachment of the medial canthal ligament where the bone is the thickest. If this occurs, it can be addressed by changing the direction of the bony cuts from horizontal to sagittal. The sagittal plane creates an osteotomized edge that is parallel to the maxilla and the nasal pyramid and decreases resistance.[28] With the letdown technique, the shape of the wedge ostectomies can hinder descent of the nasal pyramid. The senior author (S.P.M.), as well as others, has described making a banana-shaped ostectomy that is tapered at both the proximal and distal edges (**Fig. 4**). A pitfall and potential blocking point occurs with inadequate bony resection often at the proximal or distal edge of the ostectomy that creates premature contact of the nasal pyramid with the ascending process of the maxilla. This is corrected by precisely removing more bone using the piezoelectric saws to allow the nasal pyramid to descend to the desired position.

Webster and colleagues[30] advocated for the preservation of a small triangle of maxilla at the inferior portion of the lateral osteotomy due to its proximity to the head of the inferior turbinate. However, subsequent studies have shown no difference in airway dynamics regardless of whether Webster's triangle is removed or preserved.[31] This has led practitioners of DPR to advocate for its removal by performing a separate triangular ostectomy at the caudal portion of the nasal pyramid at the pyriform aperture in the pushdown technique[28] or including it within the ostectomy during the letdown approach.[32] (**Fig. 5**).

The resistance presented by the mucoperiosteal lining of the inner surface of the maxilla is another potential blocking point specifically in the pushdown approach. After performing the osteotomies, release of the mucoperiosteum along the lateral

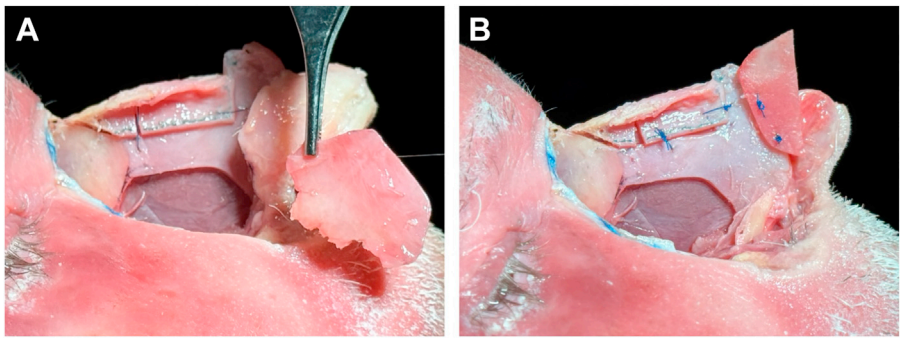

Fig. 3. (*A*) Cadaveric specimen with additional resection of remaining subdorsal cartilaginous septum performed leaving a "T-strut" of caudal septal cartilage and dorsum in place. Note: The resection has been done after fixating the dorsum into its new position with a tensioning stitch to the remaining caudal septum and a transmucosal circumferential dorsal stitch. (*B*) Use of the harvested septal cartilage for a septal extension graft.

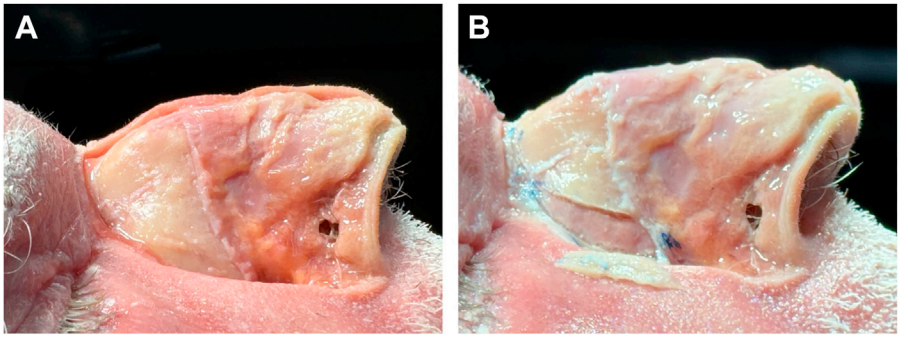

Fig. 4. (*A*) Cadaveric specimen demonstrating the lateral keystone area and relationship of the nasal bones with the upper lateral cartilages. (*B*) Letdown ostectomy performed along the ascending process of the maxilla. Note the tapered edges of the ostectomy site superiorly and inferiorly.

osteotomy line will prevent periosteal tissue resistance to dorsal impaction.[33,34] In the letdown technique, the wedge of bone in the ostectomy is released from the underlying mucoperiosteum to allow for its removal.

The medial canthal ligament attaches to the periosteum of the maxillary process and can prevent adequate radix descent. While this is protective in cases where the radix height does not need to significantly change, in cases where radix descent is desired, it can be addressed by performing subperiosteal tunnels up to the level of the ligament before making osteotomies.[28]

Extension/flattening: subdorsal strip, lateral keystone

When using techniques that leave a remnant of subdorsal cartilage, the inherent tension in that segment must be released to enable necessary dorsal mobility. This is achieved by making vertical cuts into the remnant of subdorsal cartilage to allow for release of tension and expansion of the remnant as the dorsal hump is flattened. With the MSSM, the vertical chondrotomy is made at the previous peak of the dorsal hump in the keystone area[25] (see **Fig. 2**). In the high septal strip technique, there is frequently a remnant of intact subdorsal cartilage immediately beneath the dorsal hump at the keystone area. This is also addressed with vertical cuts into the remnant of septal cartilage.[33] The dense mucoperiosteal attachments of the ULC to the nasal bones in the LKA can restrict the hinge mobility of the DKA. If kept intact, the LKA attachments can prevent adequate flattening of the dorsum, a particularly important step in cases of a convex or kyphotic bony hump. The mucoperiosteal attachments are released via the "ballerina maneuver" whereby the LKA is freed with blunt dissection between the ULC and nasal bones while maintaining the connection at the DKA.[27,33] The mobility at the LKA allows for the surgeon to flex the dorsum and change it from a convex to straight configuration.

Dorsal fixation. To counteract ongoing tensile forces that occur during the postoperative healing process, it is necessary to fix the dorsum in its new position. Low septal strip techniques rely on a single point of fixation of the freed caudal septum to the anterior nasal spine. High septal strip

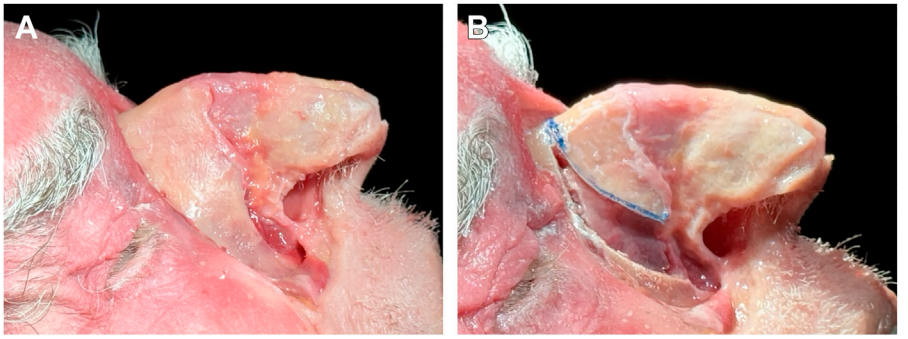

Fig. 5. (*A*) Cadaveric specimen with a significant dorsal hump. (*B*) Letdown ostectomy performed with inclusion of "Webster's triangle" into the bony resection.

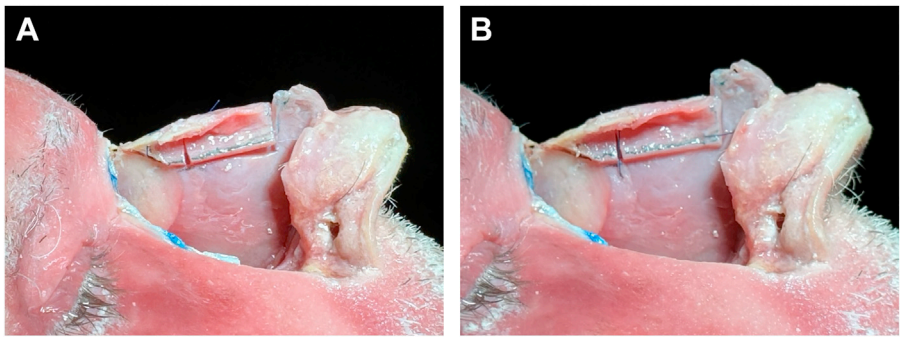

Fig. 6. (*A*) Lateral view of the bony and cartilaginous septum after modified subdorsal strip method (MSSM) resection and flexion cut placed at the apex of the external dorsal hump. Note: The reduced and flattened appearance of the dorsal hump and corresponding gap at the site of the flexion cut. (*B*) Fixation of the dorsum into position with a transmucosal circumferential dorsal stitch and a second tensioning stitch to the caudal septal strut.

techniques require the septum to be secured directly to the dorsum via cerclage or crisscross suture method to secure the osseocartilaginous dorsum to the underlying septum.[33] Subdorsal flap techniques such as the subdorsal Z-flap and MSSM afford the ability to use septal sutures for fixation. After using the MSSM approach, the senior author (S.P.M.) prefers to use a transmucosal circumferential cartilaginous dorsal stitch, as well as a second tensioning stitch to secure the lowered dorsum to the caudal septal strut (**Fig. 6**).

The dorsal flattening suture The situation may arise wherein the surgeon does not have the opportunity to fix the subdorsal strut (or Cottle flap) to a stable underlying structure. For example, if the caudal strut must be removed because of significant anterior septal deviation, the senior author has performed anterior septal reconstruction (ASR)[35,36] in conjunction with dorsal preservation techniques.[37] However, securing the second tensioning stitch to the reconstructed caudal strut does introduce an unfavorable posterior force onto the newly positioned ASR graft. Thereby, increasing the risk of posterior displacement of the graft from its location in a groove created in the maxillary spine. To obviate the need for a second caudal strut tensioning stitch, the senior author has developed a new suture technique that can be used in situations where ASR and DPR are performed concurrently. The concept of the suture is related to Gruber's "universal horizontal mattress suture" that has been applied to straighten and strengthen unwanted concavities and convexities in cartilage grafts and the crooked septum.[38] The "dorsal flattening suture" (DFS) is performed by first drilling 2 holes into the nasal bones cephalic to the peak of the dorsal hump. A 4-0 PDS on a P-2 needle is passed between the holes in the nasal bones then transmucosally through the dorsal surface of the medial ULCs caudal to the peak of the dorsal hump in a horizontal mattress fashion (**Fig. 7**).

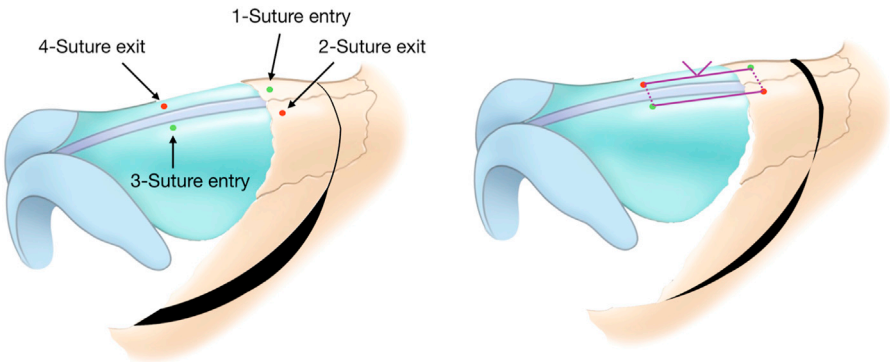

Fig. 7. Schematic representation of dorsal flattening suture (DFS). The needle is first passed between the nasal bones and then transmucosally through the medial upper lateral cartilages including the dorsal septal strip and secured on the dorsal surface.

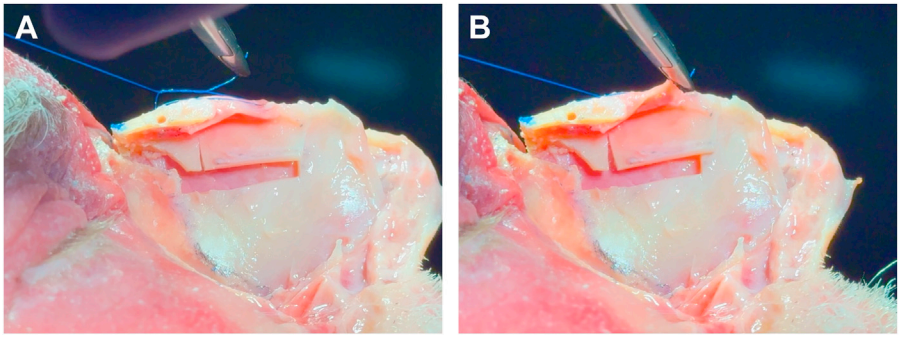

Fig. 8. (*A*) Placement of the dorsal flattening suture (DFS). Stitch is first passed through the drill holes on the nasal bones then transmucosal from the dorsal surface of the medial upper lateral cartilages then through the dorsal septal strip and secured on the dorsal surface. (*B*) Tightening of the DFS causes flexion and flattening of the dorsum with splaying of the flexion cut in the subdorsal strip.

Tightening of the stitch results in flattening and tensioning of the dorsal hump (**Figs. 8** and **9**). An ASR graft can then be placed in the usual fashion and no posterior forces are introduced by the flattened and tensioned dorsum (**Fig. 10**). The senior author (S.P.M.) has provided a patient example of the DFS suture applied in a patient with a rightward nasal axis deviation extending to the caudal septum requiring ASR for correction. Intraoperatively, the patient was noted to have short nasal bones with missing bone and required a cartilage-only impaction. The dorsum was flattened with the DFS suture and images of stitch placement obtained endoscopically (see **Fig. 9**). The deviated subdorsal cartilage was removed and repurposed as an ASR graft (**Fig. 11**). Early 6 week postoperative results demonstrate improved dorsal contour on lateral view and straightening on the frontal view (**Fig. 12**). This method can be used as an alternative to subdorsal flap fixation (see **Fig. 9**-patient example).

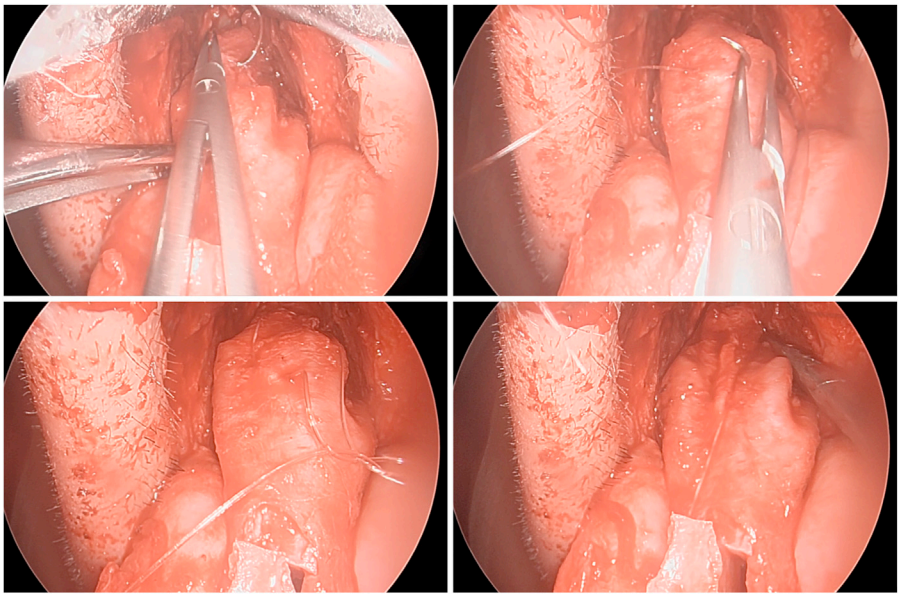

Fig. 9. Endoscopic view of intraoperative placement of dorsal flattening suture (DFS). 4-0 PDS on a P2 needle is first passed through drill holes on the nasal bones then transmucosally from the dorsal surface intranasally and back dorsally. The stitch is then tightened on top of the dorsum to produce the desired flattening of the dorsum.

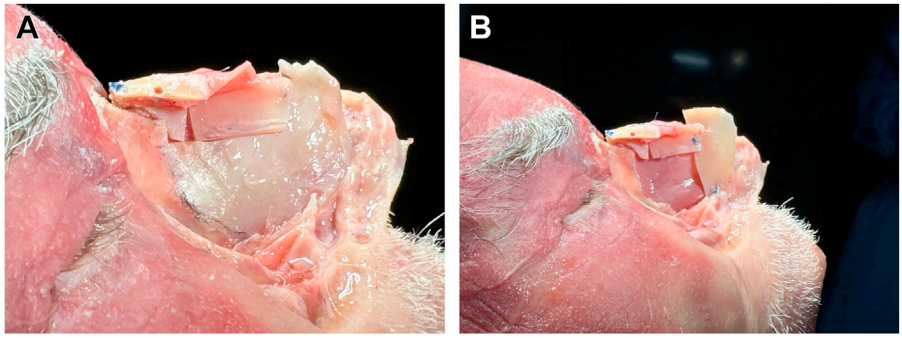

Fig. 10. (*A*) Lateral view of the flattened dorsum and splaying of the subdorsal strip after placement of DFS. (*B*) Modified extracorporeal septoplasty with placement of anterior septal reconstruction (ASR) graft. Note: The graft is secured to the caudal edge of the flattened dorsum without additional posterior forces.

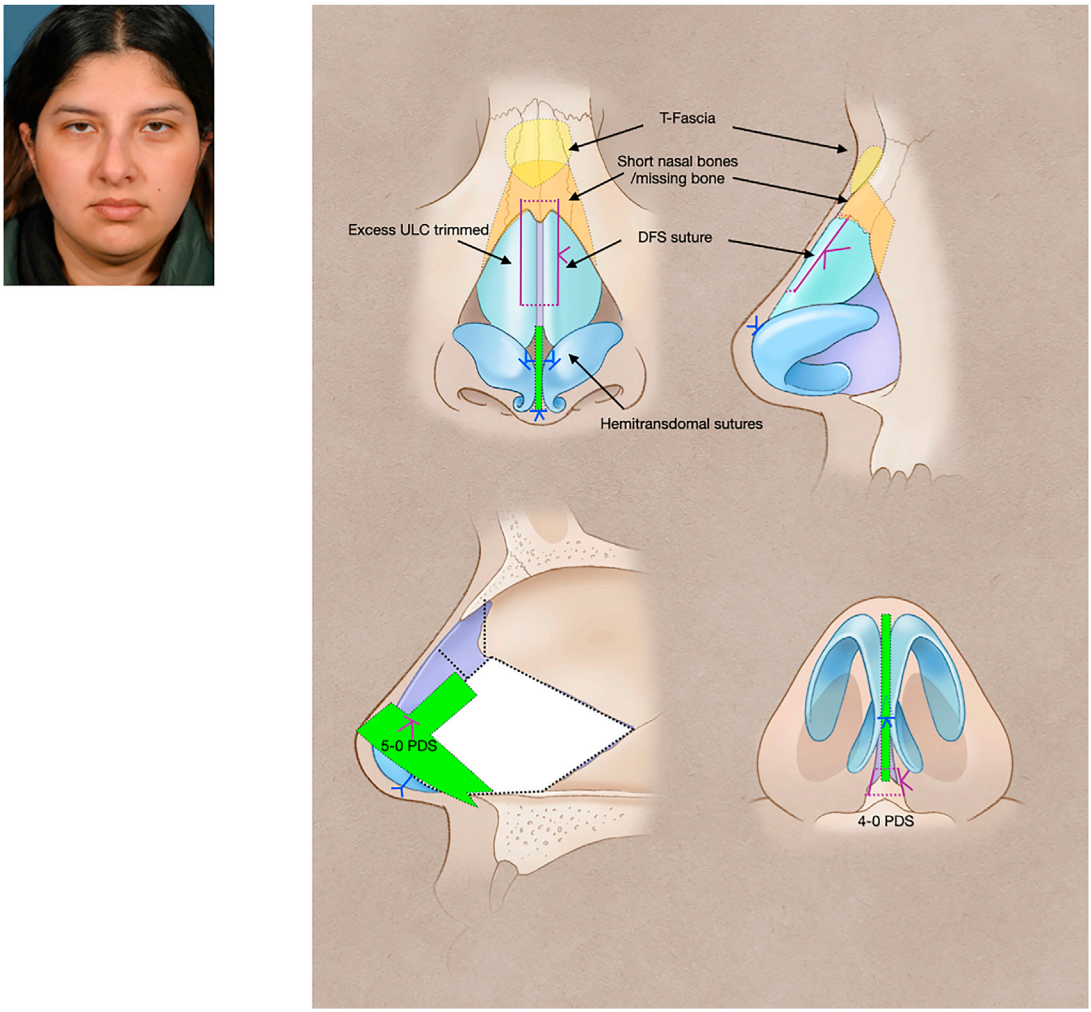

Fig. 11. Diagram shows the ASR-T-strut used to reconstruct her septum. Note: She had a cartilage-only impaction, with unusually short nasal bones.

Fig. 12. Here is the patient whose intraoperative endoscopic photos are in **Fig. 9**. These are early, 6 week postoperative images. Note the improvement in her nasal profile and straightening anteriorly.

SUMMARY

Adoption of preservation rhinoplasty techniques requires in-depth understanding of the osseocartilaginous nasal anatomy. Regardless of the approach utilized, dorsal hump recurrence is a potential complication unique to DPR and preventing it is achieved through recognition of the underlying causes. Addressing blocking points and applying appropriate tensioning forces with suture fixation of the newly lowered dorsum will assist the surgeon in achieving a good result. Combining dorsal preservation and structural rhinoplasty techniques introduces new challenges that the surgeon must anticipate and address to ensure consistent long-term results.

CLINICS CARE POINTS

- The fusion of the perichondrium of the ULCs with the periosteum of the nasal bones over the dorsum creates a flexible junction that allows for descent of the dorsal hump while leaving the DKA intact.
- The contour of the nasal bones contributing to the dorsal hump can affect the result of DPR with S-shaped nasal bones posing a higher risk of residual hump with dorsal preservation techniques.
- The 2 most common techniques to address the bony nasal pyramid in DPR are the push-down and letdown.
- The septum can be addressed in several different ways; this study discusses subdorsal excision, inferior septal excision, subdorsal Z-flap, tetris concept, and MSSM.
- The biomechanics of blocking points that prevent the extension or impaction of the nasal dorsum is a critical to understand and recognize in order to achieve a long-lasting result.
- Dorsal fixation is a key surgical step to counteract tensile forces of the lowered dorsum. The dorsal flattening suture (DFS) is introduced as a novel technique to fix the dorsum when DPR is utilized in the setting of an unstable caudal strut.

DISCLOSURE

None to declare for all authors.

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