Global Perspective on Middle Vault Reconstruction: Spreader Grafts or Spreader Flaps?

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Abstract

Introduction: Midvault reconstruction is a critical component of rhinoplasty, particularly after dorsal hump reduction, which disrupts the anatomical continuity between the upper lateral cartilages (ULCs) and the dorsal septum. It remains unclear whether spreader grafts should be implanted even in noses with normal anatomy or reserved for cases with structural or functional defects. Which of the two main methods for midvault reconstruction should be chosen?

Methods: This narrative review synthesizes published evidence on spreader grafts and spreader flaps, incorporating anatomical analyses, surgical technique descriptions, functional outcome studies, and expert consensus papers. Sources consulted included publications evaluating internal nasal valve function after middle-vault reconstruction, biomechanical assessments of interactions between the ULC and the septum, and scholarly articles on rhinoplasty.

Results: Analysis showed that spreader grafts are particularly advantageous in cases with weak ULCs, tension noses, severe dorsal deviation, or narrow midvaults because they increase the internal valve angle and provide robust structural support. Nevertheless, excessive use may result in undesired midvault enlargement, unnatural dorsal lines, and the need for revision procedures. Spreader flaps, on the other hand, maintain a smooth dorsal contour and prevent the dorsum from widening. Native cartilage is preserved.

Conclusions: When used appropriately, spreader flaps and spreader grafts are powerful tools for middle-vault restoration. Spreader grafts provide robust, predictable structural support in anatomically compromised noses, whereas spreader flaps offer a tissue-sparing alternative for patients with adequate ULC length and strength.

1. Middle Vault Reconstruction

Reducing the dorsal hump during open rhinoplasty disrupts the continuity of the dorsal septum and the upper lateral cartilages. Options for reconstructing the midvault include primarily closing the upper lateral cartilages to the dorsal septum, placing spreader grafts, and creating spreader flaps. By restoring the nasal valve angle and addressing the aesthetic and functional concerns associated with a destabilized cartilaginous vault architecture, these techniques can repair the nasal bridge and keep the internal nasal valve open long term. In addition, the specific biomechanical demands of the nasal airway and the patient's preoperative aesthetic objectives must be considered in therapeutic decision-making. Surgeons must weigh the cosmetic risks of supratip fullness or dorsal widening against the risk of valve collapse and adapt the reconstruction approach to the unique thickness and resilience of the patient's cartilaginous tissues. Choosing among these methods requires balancing two competing goals: reducing airflow resistance and maintaining the patient's natural dorsal aesthetic lines. Patients with questionable cartilaginous support should be the primary focus of future research aimed at refining these indications through long-term objective airway measures.

A typical rhinoplasty procedure involves reducing the dorsal hump. A graded approach to dorsal modification, such as component dorsal hump reduction, is becoming more common due to the acknowledged necessity to obtain optimal dorsal aesthetic lines while maintaining midvault integrity. By contrast, component reduction enables management of the extra upper lateral cartilage, in addition to the dorsal septum, compared with en bloc hump resection. It naturally gives you more leeway to rebuild the midvault following a dorsal hump reduction.

One typical approach to midvault reconstruction is to directly approximate and suture the upper lateral cartilages to the dorsal aspect of the septum. Another usual strategy is to implant spreader grafts. Finally, spreader flaps can be created. Each has found more applications thanks to technological advancements and additional suture techniques. Roostaeian et al. recently detailed an algorithmic strategy for midvault restoration that takes into account both anatomical predispositions and planned alterations to the middle third of the nose. In addition, previous research has failed to definitively establish whether spreader flaps or grafts are more functional. This is true regardless of whether or not nasal obstructive symptoms are present; furthermore, there is still no consensus on how to make a decision.

2 Spreader grafts

The middle nasal vault needs to be contoured and stabilized for a large percentage of patients who want cosmetic rhinoplasty. The nasal bones and the upper lateral cartilages (ULC) may be visiblely delineated in some of these patients, and their central vaults may be unusually narrow or humped. Endonasal examinations of these individuals frequently show reduced valve patency, early collapse of the ULCs following inspiration, and pinching of the internal nasal valve. This is especially prevalent in cases when the patient has a so-called tension nose deformity, characterized by a high, peaked nasal dorsum. Nostril hump reduction patients are more likely to experience middle vault distortion or collapse if they have small nasal bones, long and weak ULCs, or thin nasal skin. Surgically separating the ULC from the dorsal septum can cause pinching, malposition, or concave collapse of the ULC in almost every nose. Unattractive cosmetic consequences of nasal surgery are common when risk factors are not identified and addressed appropriately. Symptomatic nasal airway blockage and inward collapse of the lateral nasal sidewalls (sometimes with a little middle vault saddle deformity) are the usual presentation of this. A stigmatic upside-down V-shaped shadow becomes evident at the bony-cartilaginous junction, an unattractive contour **abnormality called the "inverted V" deformity, when the middle vault narrows significantly compared to the upper vault width. Besides the V-shaped** shadow, the dorsal aesthetic lines are frequently broken or "washed out," especially following an excessive removal of the dorsal hump.

Rhinoplasty specialists now agree that, right after hump reduction, it is critical to rebuild the middle nasal vault and ensure that the internal nasal valve continues to function properly. Sheen was the pioneer who first suggested using spreader grafts to stabilize the center vault and improve the contours. When it comes to maintaining or repairing the middle vault's shape and structural integrity, spreader grafts are now considered the gold standard. Although hump reduction was once the only choice for middle vault repair, spreader flaps have recently emerged as a second option for some individuals. By making use of the patient's own autologous upper lateral cartilage, these flaps mimic the results of standard grafting without the risk of donor site morbidity that commonly comes with harvesting cartilage from the ear or septum. With the help of these flaps, surgeons can strengthen the middle vault only while keeping the autologous tissue in place. This allows them to adjust the strength of the nasal sidewalls without taking any extra grafts, which shortens the operation and reduces the chance of dorsal irregularities afterward.

To prevent an inverted-V deformity and collapse at the internal valve, midvault reconstruction has long been acknowledged as an essential step following dorsal hump reduction. These iatrogenic implications were the primary emphasis of Keen's initial description of spreader grafts. Spreader grafts have gained widespread acceptance and are now prescribed for many primary cases. These grafts can be placed unilaterally, bilaterally, or asymmetrically, with two grafts of different thicknesses. Unilateral or asymmetrical spreader graft placement can help improve or hide nasal dorsal angulation. The original idea behind spreader grafts was to increase the internal valve angle and provide support to withstand medial movement under the negative pressure of inspiration by separating the lateral walls from the septum. A number of concerns have arisen about the widespread use of spreader grafts for midvault reconstruction in primary cases. These concerns include the potential for undesired or excessive widening of the midvault and the formation of straight dorsal (un)aesthetic lines. The panelists discussed how often spreader grafts are removed in secondary rhinoplasty cases due to their overuse in primary ones. Recent research has proposed other ways to put spreader grafts in order to reduce the risk of these complications. One method involves placing the grafts 2 to 3 mm below the septum's dorsal surface and using the upper laterals as a flexible fulcrum.

3.The spreader flap, an alternative name for the autospreader flap

To reinforce and stabilize the middle vault that has been surgically weakened, the extra vertical height is not used to trim the ULCs to fit the newly-established dorsal profile, but rather to make two inwardly folded cartilage flaps that are sutured to the upper margin of the dorsal septum. By keeping the nasal valve's apex wide and raising the threshold for inspiratory nasal valve collapse, in-folded ULCs work in theory similarly to conventional spreader grafts. The partially folded ULCs provide this advantage primarily because they imitate the natural anatomical structure of a functional ULC-septal junction, which causes them to act like springs. Unfortunately, spreader flap fabrication is only an option for patients who have a long enough ULC and sufficiently hard cartilage. On the other hand, patients with weak or fragile cartilaginous tissue might not have enough bone to hold the joint together, thus additional structural grafting might be needed to keep the middle vault from deteriorating. It is also important for the surgeon to be able to control the tension across the repaired dorsal junction so that the flaps are precisely tailored without distorting the patient's natural dorsal aesthetic lines due to the folded cartilaginous borders. As a result, using permanent or progressively absorbable mattress sutures to bind the flaps without compromising the soft tissue envelope is essential for creating a healthy transition through attentive suturing techniques. In order to avoid revision surgery due to flap migration or uneven retraction, it is crucial to fixate the flap correctly so that it stays motionless as the body heals.

In 1998, Oneal and Berkowitz introduced the concept of in-folded ULC flaps and came up with the name "spreader flaps." Subsequently, other groups—including Rohrich, Byrd, Gruber, Ozmen, and Neu—made improvements to this method. Our research indicates that these adjustments were not sufficient to achieve optimal nasal valve performance and airway patency.

Several writers in the 1990s detailed an alternate method to the spreader graft. One of these authors, Oneal and Berkowitz, used the term "spreader flap" to describe a method that restored the midvault's normal T-shape by constructing horizontal flaps from the excess height of the upper lateral cartilage, folding them downward and inward along the dorsal septum, and then reconstructing the midvault. A number of variations on the spreader flap, sometimes called an autospreader flap, have been detailed. These variations include suture techniques that further narrow the nasal dorsum, widen the dorsum, or correct asymmetries. The main benefit of spreader flaps is that they can reconstruct the midvault while preserving the internal nasal valve and the smooth, flowing contours of the dorsal aesthetic lines. In comparison to septal cartilage grafts that are diced or carved, the natural cartilage-perichondrium contact can be efficiently preserved during autologous repair, which may lead to more predictable long-term integration. Avoiding a second harvest from the ear, nasal septum, or costal cartilage, this method further reduces the likelihood of donor-site morbidity by making use of local tissue. Despite these advantages, in order to keep the folded flap viable during the postoperative healing period, surgeons must carefully assess the vascular supply to the **pedicled upper lateral cartilage. In addition, a high level of technical expertise is usually necessary to tension these flaps precisely enough such that a** palpable ridge or obvious step-off along the dorsal line is avoided. A sophisticated knowledge of the tension forces at work during suturing is essential for overcoming these technical obstacles, especially in the pursuit of an ideal "T-junction" repair. It is crucial to refine these operations to reduce the possibility of dorsal aesthetic distortion, especially in individuals with thin skin, because flap prominence can become clinically obvious when the edema resolves late. The use of symmetric mattress suturing and exact flap thinning procedures can help surgeons reduce these concerns by facilitating the smooth integration of cartilaginous tissues. The capacity of the surgeon to maintain a natural, non-obstructive dorsal profile while structurally reinforcing the internal valve is crucial to the long-term success of this reconstructive approach. Longitudinal results on the stability of these folded flaps should be the subject of future research, especially in individuals who already have structural or cartilage defects.

Conclusion

Despite the obvious advantages of midvault structural restoration, there is conflicting objective evidence that spreader flaps increase nasal airflow, which has led to continuing disagreement about their therapeutic value. Standardized objective measures should be prioritized in future studies to identify which patient demographics benefit from these maneuvers for respiratory purposes in comparison to traditional grafting approaches. Computational fluid dynamics integration into future clinical trials has the potential to shed light on the unique turbulent flow patterns that continue after structural reconstruction, leading to surgical optimization of functional results through improved guidance. As a result, surgeons need to take a patient-centered approach when reconstructing the midvault, adapting their methods to the specific anatomy of the internal nasal valve. The main goal is to clear the airway while preserving the midvault's aesthetic harmony and structural integrity for the long term, so technical maneuvers take a back seat. In order to gather consensus on whether to use spreader flaps and when to use formal graft grafting procedures, rigorous long-term follow-up studies are required to reconcile these various clinical experiences.