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Role of Rhinoplasty in Management of Nasal Valve Collapse

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Abstract:

Nasal valve collapse (NVC) is one of the most common but frequently underdiagnosed causes of chronic nasal obstruction. The condition arises from structural weakness, surgical disruption, trauma, or age-related tissue changes affecting the internal or external nasal valve. Patients often present with persistent nasal blockage, impaired airflow, snoring, and reduced quality of life. Accurate diagnosis requires a comprehensive assessment including clinical examination, anterior rhinoscopy, endoscopy, Cottle or modified Cottle maneuvers, and objective airflow measurements. Management options range from medical therapy targeting mucosal inflammation to a wide spectrum of surgical and minimally invasive interventions aimed at restoring structural support. Current advances include bioabsorbable implants and suture-based techniques, providing less invasive alternatives to traditional cartilage grafting. This review summarizes pathophysiology, evaluation strategies, and evidence-based therapeutic options to guide optimal management of nasal valve collapse.

Keywords: Nasal valve collapse; Internal nasal valve; External nasal valve; Nasal obstruction; Rhinoplasty; Lateral wall insufficiency; Airflow resistance; Nasal implant; Functional nasal surgery.

Introduction:

Nasal valve collapse (NVC) is an important structural cause of nasal obstruction and remains a significant challenge in functional rhinology. The nasal valve area consists of the internal nasal valve which includes the junction of the upper lateral cartilage, septum, and inferior turbinate and the external nasal valve, located at the alar rim and nostril aperture. Together, these segments regulate nasal airflow and resistance, making them essential for efficient breathing. Weakness, malposition, or collapse of these structures can produce persistent, often debilitating nasal obstruction **(1).**

Etiologies of NVC are multifactorial. Congenital anatomical variations, iatrogenic cartilage weakening following cosmetic rhinoplasty, scar contracture, trauma, and age-related tissue laxity are among the most frequent causes. Internal valve dysfunction may arise from acute angles less than 10–15 degrees, while external valve collapse often results from inadequate alar rim support or lateral wall insufficiency. Clinically, patients report increased obstruction during inspiration, improvement with manual lateral wall support, and symptoms disproportionate to mucosal findings **(2).**

Diagnosis requires a structured approach integrating patient history, physical examination, and targeted maneuvers. The Cottle or modified Cottle test, assessment of alar rim integrity, endoscopic evaluation, and objective tools such as rhinomanometry or acoustic rhinometry enhance diagnostic accuracy. Misdiagnosis is common if only mucosal disease is treated without addressing underlying structural weakness (3).

Management aims to restore valve competence while minimizing morbidity. Medical therapy including intranasal corticosteroids or antihistamines may help when inflammation exacerbates symptoms but rarely resolves true structural collapse. Surgical techniques, such as spreader grafts, alar batten grafts, butterfly grafts,

and lateral crural repositioning, remain the gold standard for severe internal or external valve dysfunction. Recently, minimally invasive approaches including absorbable nasal implants and suture-based lateral wall stabilization have shown promising results in patients seeking lower-downtime alternatives **(3).** Selecting the appropriate technique depends on detailed anatomical evaluation and individualized patient needs.

Treatment of nasal valve collapse is site-specific depending on the particular pathology leading to its manifestation. Treatment is typically aimed at either increasing the cross-sectional area of the valve for static obstructions (i.e., opening maneuvers) or supporting the lateral walls to prevent collapse for dynamic collapse (i.e., strengthening maneuvers). Treatment of the lateral wall is considered a distinct surgical entity from procedures to address the septum or turbinate. Surgical management may be necessary depending on the etiology of NVC, but promising advances have been made in minimally invasive office-based procedures as an alternative. Assessment of the efficacy of interventions can be subjective (e.g., visual analog scale (VAS), NOSE, SNOT-22) or objective (e.g., rhinomanometry, acoustic rhinometry), although more credence is given to subjective measures **(4).**

Nonsurgical Interventions

Traditional nonsurgical options have been directed toward poor surgical candidates or those hesitant to pursue surgery. Nasal adhesive strips (e.g., Breathe-Rite strips) may strengthen the lateral wall and expand the valve outward to prevent collapse. External splinting can be used to support the lateral wall and INV. Internal dilators, such as nasal cones, can be temporarily placed within the anterior nasal airway to stent the INV and ENV. However, adherence to these interventions is limited, and they do not address potential underlying fixed anatomic issues (e.g., septal deviation, inferior turbinate hypertrophy) **(5).**

In cases of valve narrowing due to inferior turbinate hypertrophy associated with rhinitis, intranasal corticosteroids or antihistamines may be helpful. It has been identified a potential role for biofeedback training utilizing a home exercise regimen of specific movements, with or without the addition of transcutaneous or intranasal electrical stimulation of the nasal muscles (i.e., dilator naris) **(6).**

Management of Nasal Septum and Inferior Turbinate

Depending on a patient's anatomy and functional etiology for NVC, the traditional surgical interventions for nasal obstruction such as septoplasty and inferior turbinate reduction may resolve static NVC without the need to specifically address any lateral nasal wall collapse. Given that the INV is bound by the septum, ULC, and inferior turbinate, a septal deviation especially dorsally and inferior turbinate hypertrophy can easily narrow the nasal valve. The narrowed valve is then prone to higher airflow speeds due to Poiseuille's law and subsequent collapse due to the Bernoulli effect. Widening the static cross-sectional area of the valve may mitigate these forces and restore adequate valve competence. If the septal defection is particularly dorsal or caudal, involving the supporting strut, the crooked and obstructing septum may need to be addressed with an open septorhinoplasty approach, possibly with caudal septal repositioning or the addition of spreader grafts. In cases of septal loss and saddle nose deformity, due to trauma or otherwise, total extracorporeal septal reconstruction may be required **(7).**

The inferior turbinate likewise may contribute to astatically, anatomically constricted narrowed nasal valve with subsequent collapse. No clear evidence has been established on an optimal surgical intervention for turbinate with regard to improvement in nasal valve function, with several options commonly utilized in practice (e.g., thermal ablation, radiofrequency ablation, ultrasound reduction, submucosal resection with or without bony removal) **(8).**

Functional Septorhinoplasty

The 2010 AAO-HNS consensus guidelines on NVC suggest that it should be surgically treated due to the futility of nasal corticosteroids in the treatment of this structural issue. Functional septorhinoplasty has traditionally been considered the treatment of choice and refers to a collection of surgical techniques to correct

obstruction of the INV, ENV, or both. Both the static and dynamic components of NVC can be addressed by functional septorhinoplasty **(9).**

Graft Techniques

A number of cartilage graft techniques performed through a functional septorhinoplasty approach have been identified to address NVC with substantial evidence to support their use. This is not an exhaustive list but rather introduces the most common maneuvers **(10).**

Spreader Graft

Spreader grafts are extremely versatile and considered a workhorse of surgical nasal valve repair. These linear strips of cartilage (1–2 mm in thickness, 3–6 mm in width, 10–15 mm in length) are harvested from the septum if performed with concurrent septoplasty or otherwise from the conchal cartilage. These grafts are placed in a submucosal subperichondrial pocket between the ULC and septum to widen the INV. It has been identified patients most likely to benefit from spreader grafts during primary rhinoplasty to prevent development of NVC. Those with dorsal septal deviations and valve narrowing may need placement of these grafts in addition to correction of the septal deviation. While the spreader grafts widen the nasal valve, they do not specifically address weakness of the lateral nasal wall, as compared to batten, butterfly, and lateral crural strut grafts **(11).**

Spreader Flap

This variation of the spreader graft uses the ULC, folded on itself, to provide extra support and widen the INV angle. They are used less frequently than spreader grafts because the ULCs are often thin with limited strength, thereby making the intervention less versatile. The only RCT for surgical maneuvers in the treatment of NVC evaluated the use of spreader faps, no difference was found in its use versus controls on either subjective VAS or objective acoustic rhinometry **(12).**

Alar Batten Graf

These grafts were originally reported by Tardy and Toriumi in the 1990s. Their main role is in the setting of over-resection of the LLC and can be used to bolster the ENV, INV, or both. The graft is usually harvested from the septum or concha and is placed subcutaneously at the ULC and scroll region, often in conjunction with a spreader graft, to bolster the INV. By its placement superficial to the ULC, it is able to improve the ULC strength and resistance, as well as support otherwise flaccid LLCs and stabilize the lateral wall during dynamic inspiration. The graft extends into the soft tissue over the bony piriform apertures to provide lateral support to the ENV, but it does not have any medial support structure. The use of batten grafts has been associated with a decreased use of nasal corticosteroid sprays for congestion due to an improved airway **(13).**

Lateral Crural Strut Graft

This graft helps to correct issues with the lateral crus and supra-alar groove given the LLC's major role in ENV dysfunction. The strut is placed into a pocket lateral to the piriform aperture in a more caudal orientation to provide underlay support. While caudally positioned LLCs can be addressed with these strut grafts alone, cephalically positioned LLCs often need formal repositioning with release of their lateral attachments in addition to strut graft placement. The lateral crural cephalic turn-in fap is a variation of this graft in which the cephalic portion of the lateral crura themselves are turned inward and sutured together to add support and prevent collapse. Both the strut and fap variations are associated with subjective improvement and improved mean nasal peak inspiratory flow, but without change in mean nasal airway resistance or minimum cross-sectional area **(14).**

Alar Rim Grafts

These cartilage grafts are placed in tunnels caudal to the border of the lateral crus of the LLC to prevent ENV collapse **(15).**

Butterfly Graft

This graft, typically harvested from the conchal cartilage due to its natural curvature, is most often used in the revision rhinoplasty setting. The graft is placed at the junction of the ULC and LLC in the scroll region and over the septum. The graft mimics the ULCs to widen the nasal valve angle and support the sidewall. However, placement may lead to widening of the supra tip region and changes in nasal tip projection **(16).**

Upper Lateral Strut Graft

A cadaveric study assessed the use of strut grafts placed in a sub perichondrial pocket on the undersurface of the ULC extending over the piriform aperture and fixed to the dorsal septum and contralateral strut graft. A mean increase of 22% in INV cross-sectional area was noted on acoustic rhinometry **(14).**

Upper Lateral Splay Graft

The ULC splay graft was first described by Guyuron in 1998 and utilizes conchal cartilage placed over the septal dorsum and below each upper lateral cartilage to reconstruct the middle vault of the nose **(11).**

Stairstep Graft

This method provides an alternative to the alar batten graft for dynamic ENV collapse. The 1.5-mm by 6–9-mm cartilage graft is placed via a trans vestibular approach to span the lateral 2/3 of the lateral crus and overlaps the piriform crest by 3–4 mm, with an inter positional graft secured to one end to increase the basal width **(4).**

Alloplastic Implants

Alloplastic implants, such as polytetrafluoroethylene (PTFE), high-density porous polyethylene, and titanium, have been used to provide additional support to the lateral wall in lieu of autologous grafts, but their role has not been fully clarified. Furthermore, the implants may be associated with an increased risk of infection and extrusion due to rejection **(17).**

Lateral Implant

For those who would like to avoid the potential risks of soft tissue manipulation, another minimally invasive in-office treatment has been developed to bolster and stabilize the lateral nasal sidewall with a bioabsorbable implant. Unlike other alloplastic implants that have been used in lieu of autologous cartilage, the Latera implant (Stryker Corporation) is made from an absorbable 70:30 copolymer of poly(l-lactide) and poly(d-lactide). The copolymer is shaped into a ribbed, semi-rigid cylindrical structure with an apical forked end and is introduced percutaneously via an endonasal delivery tool starting in the vestibular skin. Once deployed, the proximal end of the implant is positioned above the alar crease and the distal forked end over the ipsilateral nasal bone or frontal process of the maxilla. The implant is laid over or through the LLC and ULC, potentially helping with dysfunction of both the INV and ENV. The implant resorbs over 18 months, leaving a fibrous capsule that continues providing support even after its dissolution, with histologic analyses demonstrating that structural support remains from mature collagenized fibrous tissue at least 24 months post-procedure **(18).**

Suture Techniques

Several suture techniques have been identified to mitigate the lateral wall collapse associated with NVC. However, they have been reported to potentially lose suspension over time with associated loss of patient satisfaction. Data on additive effects of sutures over graft techniques are lacking **(19).**

Flaring Sutures

This nonabsorbable suture is placed in a horizontal mattress fashion through the caudal and lateral border of the ULC, across the nasal dorsum, and then through the contralateral ULC, thereby widening the nasal valve angle **(18).**

Suspension Suture

Paniello introduced nasal valve suspension in 1996. Typically placed and secured via a transconjunctival incision, this suture suspends the lateral border of the ULC to a fixed point on the ipsilateral medial infraorbital rim, thereby widening the angle of the INV. Numerous modifications have been made over the years, with some incorporating a bone anchor suspension technique (BAST) system that secures the suture to the bony orbital rim. This technique can be very effective but may add unwanted fullness to the nasofacial groove **(4).**

Given the risk of complications associated with these adjunctive open surgical procedures, the potential for unwanted cosmetic changes, and the costs of operating facilities and general anesthesia, attention has been directed toward the development of novel minimally invasive alternatives to address NVC **(20).**

Radiofrequency Induced Thermotherapy (RFITT) Technique

Radiofrequency (RF) technology, which has been used with some success for turbinate reductions, has now been studied for its effects on nasal valve repair, and in particular dynamic LWI. In the described technique, the probe is placed into a soft tissue pocket lateral to the lateral crus of the LLC in the direction of the piriform aperture. Three separate sites are ablated for 10 searches to create scar tissue and increase tone to reduce lateral wall collapse. Physiologically, the tissue is ablated by heat desiccation and frictional energy, creating finely controlled necrotic lesions to induce scar formation. The resulting tissue contraction leads to reduced volume, and ultimately, the scar is resorbed while increased tone remains **(21).**

The Viv Aer Stylus (Aerin Medical) is a newly commercially available device using bipolar temperature-controlled RF at 60 °C and a console setting of 4 W. The tip is positioned into the mucosa overlying the lower edge of the ULC and used on 3 non-overlapping areas of the lateral wall of the nasal valve for 18 sat each site. The underlying submucosal collagen and elastin fibers provide scaffolding for the mucosa and dictate its firmness and elasticity. RF-induced heating is thought to improve nasal valve patency either by tissue tightening and contraction through immediate effects on existing collagen accompanied by induction of new collagen production, or alternatively by temporarily softening the alar cartilage itself to allow remodeling before regaining its elasticity in a new anatomic conformation **(22).**

Nasal valve lift

This novel approach utilizes placement of polylactic acid threads at the lateral nasal wall and valves, presumably increasing the body's production of collagen and promoting fibrosis thereby strengthening local tissue. The threads are placed in a sub-SMAS layer over the later wall and ENV under local anesthesia. Patients enrolled in a study provided positive feedback regarding subjective symptoms, but no objective measures were assessed **(4).**

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Spreader Graft Placement for The Management of Internal Nasal Valve Insufficiency : Open Rhinoplasty Approach versus Closed Approach.

Closed technique

Sheen described the original technique of spreader graft placement, which used a closed, or endonasal, approach to repair the internal nasal valve **(23).** The closed technique uses a hemitransfixion or Killian incision with a standard septoplasty approach. For more information on the closed technique.

During elevation of the bilateral submucoperichondrial flaps, a fairly precise 5-mm – wide pocket is developed medial to the upper lateral cartilage. Elevating the mucoperichondrium sufficiently is important to separate the septal attachment of the upper lateral cartilage while not violating the mucosal surface. This pocket is created such that it extends beyond the sellion, or bony-cartilaginous junction, beneath the caudal edge of the bony pyramid.

The actual spreader graft may be fashioned from septal cartilage harvested during the septoplasty or from auricular cartilage if prior surgery precludes adequate septal material. See the image below.

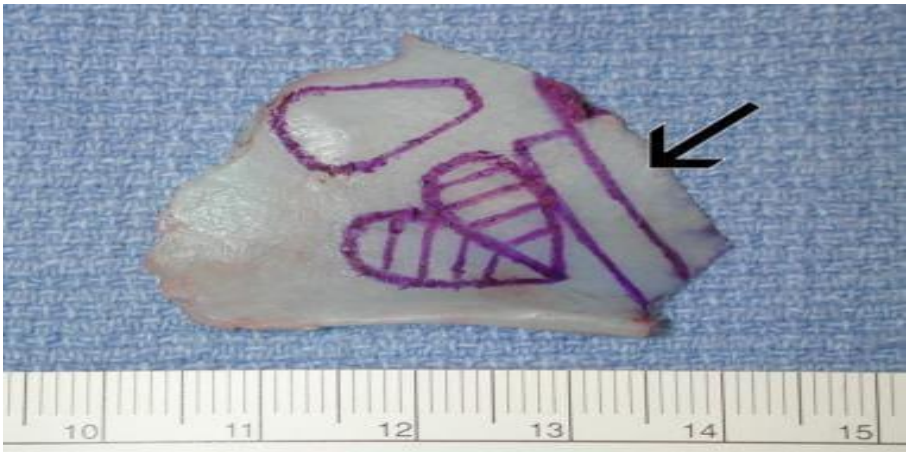

FIG (1) Example of explanted septal cartilage to be used for grafting purposes. Notice ample amount of cartilage material that can be harvested during a primary case. Cartilage is usually sufficient to fashion 2 equivalent-sized spreader grafts (see black arrow) as well as tip and batten grafts, if necessary **(24).**

Spreader grafts typically are contoured in a rectangular shape and measure 1-3 mm in thickness by 4-6 mm in width by 20-35 mm in length, depending on the individual's nasal anatomy. Occasionally, longer, broader, or even double-thickness grafts are indicated.

Alternatively, some surgeons have opted to use synthetic materials for creating spreader grafts. These range from bioabsorbable polylactic acid-based materials (Stal S. Hollier 2000 September) to nonabsorbable implants made of porous polyethylene. (Martyn Mendelsohn *2005 March*)

Use of a synthetic material as a graft substitute has the obvious advantages of unlimited supply, ease of use, and absence of donor site morbidity. Although results can be satisfying with use of these materials, concern exists regarding long-term stability with bioabsorbable grafts and rejection with porous polyethylene. Thus, the authors prefer to use autogenous cartilage grafting for these purposes.

Proper placement of a spreader graft is under the caudal aspect of the bony vault, with extension toward the tip, parallel to the dorsal margin of the septum and medial aspect of the upper lateral cartilage. The graft may be placed within the precise pocket or may be secured using a 4-0 or 5-0 absorbable mattress suture. This suture is intended to prevent migration and should be placed meticulously through the graft and both mucoperichondrial flaps or just inferior to the grafts through both mucoperichondrial flaps.

An alternative method of fixation reported among some surgeons involves use of cyanoacrylate glue. However, cyanoacrylate glue can predispose to granuloma formation when contacted with a more vascular soft tissue surface. One must keep in mind that cyanoacrylate glue is actually intended for use only on the cutaneous skin surface. If use of the glue is strictly limited to contact between the 2 cartilage surfaces, its application in this setting is theoretically acceptable. However, exercise caution when opting for this method of fixation **(24).**

Unilateral or bilateral grafts may be placed depending upon how much augmentation is needed to improve aesthetic symmetry. Functional problems also can be corrected with either unilateral or bilateral graft placement, depending upon the nature of the obstruction.

A composite spreader graft is placed in a similar fashion with the closed technique. However, with this technique, the mucosal scarring in the apex of the blunted valve angle needs to be released or excised. The composite graft then is placed meticulously and sutured with the cartilage positioned between the dorsal septum and the medial margin of the upper lateral cartilage. The attached skin component needs to be positioned precisely to face within the nasal cavity to help resurface the vestibular lining and recreate a sharper nasal valve angle. See the image below.

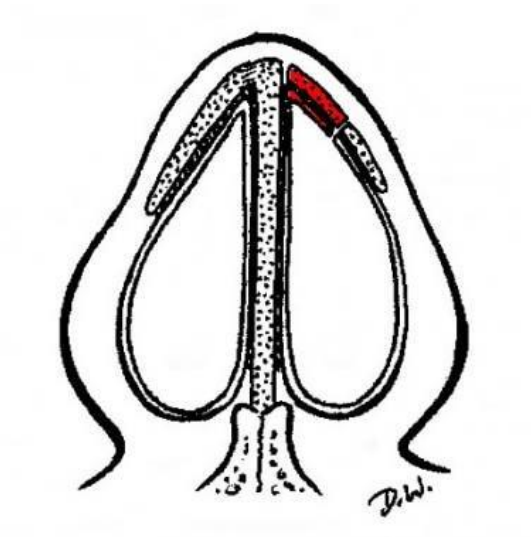

FIG (2) Diagram of composite spreader graft placement in between the upper lateral cartilage and dorsal septum. As noted, the composite graft includes cartilage and skin intended to replace the cartilage and mucosal lining that is deficient in the internal nasal valve segment **(25).**

In some cases, a small temporary soft pack can be placed to further stabilize the graft during the early postoperative period.

Overall, the closed approach for spreader graft placement is considered technically challenging even for the more experienced rhinoplasty surgeon. Although the closed technique may be useful in reconstructive cases in which only spreader grafts are indicated, the limited exposure often makes accurate and reliable positioning and securing of spreader grafts difficult. Additionally, use of the closed technique precludes placement of the spreader graft variations intended to simultaneously target the nasal tip region.

Open technique

Placement of spreader grafts with the open rhinoplasty approach is begun in standard fashion with elevation of the soft tissue envelope off of the underlying cartilaginous and bony framework. Once the domes have been separated and the anterior septal angle has been identified, bilateral submucoperichondrial flaps are developed using a Cottle or Freer elevator.

As the dissection is extended toward the nasal dorsum, the medial attachment of the upper lateral cartilage is separated sharply from the septum on each side. This effectively exposes the entire middle vault region in preparation for placement of the grafts. See the image below **(23).**

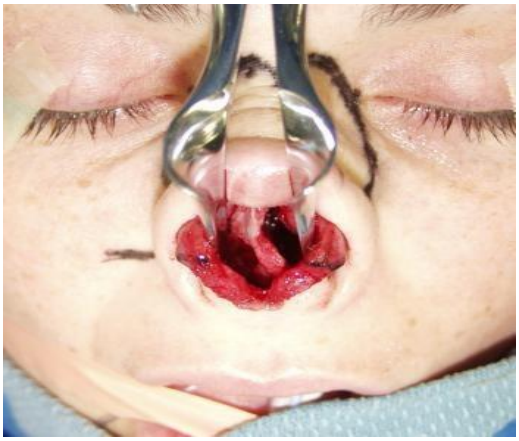

FIG (3) Example of surgical exposure of middle vault region in preparation for spreader graft placement. Notice separation of the medial edge of the upper lateral cartilage from the dorsal septum margin. Also note how crooked the dorsal septum is in this patient. The primary indication for placement of the spreader grafts in this patient was to achieve more bridge symmetry **(23).**

Cartilage is then harvested from the quadrangular septum using standard techniques, paying careful attention to preserve a 10-15 mm dorsal and caudal L strut. If insufficient septal cartilage is available, ear cartilage may be harvested instead. In rare revision cases where septum and ear have already been harvested, costal cartilage grafting may be warranted. Cut the cartilage and contour it to the appropriate dimensions as noted above for the closed technique.

Spreader grafts should be placed after bony vault work has been completed and prior to tip modification. Place the spreader graft parallel to the dorsal septal margin and medial to the free edge of the upper lateral cartilage. The graft typically is positioned just underneath the caudal margin of the bony pyramid. The graft then extends downward toward the anterior septal angle.

Secure the graft with slow-absorbing suture such as 5-0 polydioxanone (PDS) in a horizontal mattress fashion. See the image below.

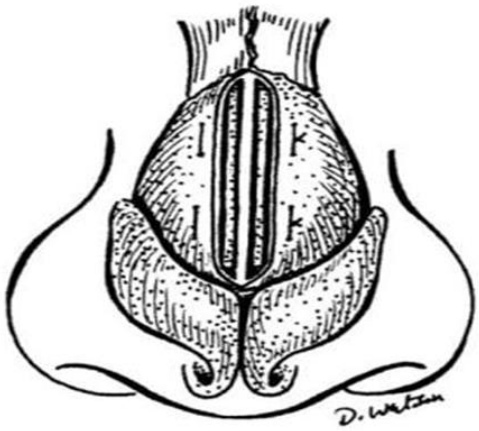

FIG (4) Diagram of spreader graft placement with use of horizontal mattress sutures for secure positioning **(25).**

Suturing the graft to both the dorsal septum and the medial margin of the upper lateral cartilage is important to ensure optimum integrity of the reconstructed internal valve angle. When bilateral grafts are being used, the suture may be passed through both upper lateral cartilages, both spreader grafts, and the septum to provide a more stable middle vault unit. The graft may be secured above, below, or even with the plane of the dorsal septum, depending on how much middle vault aesthetic alteration is desired.

If the graft is positioned above the septal plane, the dorsal edges of the graft may need to be beveled to avoid an unnatural appearance, particularly in thin-skinned individuals. Spreader grafts placed more for functional concerns are typically of similar thickness. Conversely, two different grafts of variable thickness may be used in the same patient to correct dorsal aesthetic asymmetries **(26).**

The open technique is obligatory when placing spreader grafts to correct a high dorsal septal deflection. See the image below.

FIG (5) This is an example of spreader graft placement for a crooked nose deformity. This patient had a high dorsal deflection (crooked dorsal septum) that was causing the lower aspect of her nose to deviate to her left side. A spreader graft was placed to splint the dorsal septum into a straighter position, thus creating more symmetry, as seen on her postoperative frontal view **(27).**

The wide exposure gained with the external approach provides maximum visualization of the entire dorsum and allows optimum placement and stabilization of the grafts. After the soft tissue envelope has been elevated, the entire dorsum is exposed from the caudal margin of the bony vault to the anterior septal angle. Grafts are harvested and fashioned as already discussed. The graft is then placed along the concave side of the dorsal deflection in between the upper lateral cartilage and septum. See the image below.

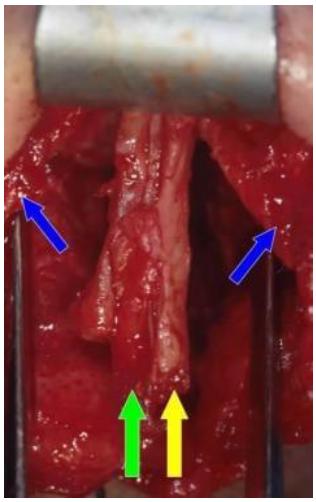

FIG (6) This intraoperative photo demonstrates proper placement of the spreader graft in cases of a high septal deflection. The blue arrows correspond to the medial margin of the upper lateral cartilage, which has been separated from the dorsal septum. The yellow arrow corresponds to the spreader graft placed on the left side (green arrow), helping to splint the concave side of the deviated septum **(28).**

In this setting, using a fairly stiff and straight spreader graft that resists bending, helps straighten the concavity, and provides lasting rigidity is important. A batten graft may be placed on the opposite convex side to further strengthen the reconstruction.

The open rhinoplasty approach also is required when placing spreader septal extension grafts for both internal valve collapse and improved tip support. Once the framework and dorsum are exposed using standard techniques, the grafts are harvested and placed between the dorsal septum and the medial edge of the upper lateral cartilage. The difference with this technique is that the spreader graft is fashioned to extend from the middle vault into the tip-lobule complex to help control tip position and definition. See the image below.

FIG (7) This is an example of spreader graft placement for a crooked nose deformity. This patient had a high dorsal deflection (crooked dorsal septum) that was causing the lower aspect of her nose to deviate to her left side. A spreader graft was placed to splint the dorsal septum into a straighter position, thus creating more symmetry, as seen on her postoperative frontal view **(27).**

Position the distal end of the graft at the junction of the medial and middle crura and extend it up between the domes to create the desired tip projection. This variation of the traditional spreader graft, thus, simultaneously can straighten the septum, correct internal valve collapse, and alter tip projection.

When placing spreader grafts for management of a pinched nasal tip, use of the open technique is also indicated. Harvest the cartilage graft in similar fashion as with traditional spreader grafts using septal, conchal, or costal cartilage. However, instead of creating a rectangular-shaped graft, a bar- or triangular-shaped graft is fashioned. The graft is then placed and secured across the tip in between the lower lateral crura to separate these structures and correct the alar collapse. See the image below.

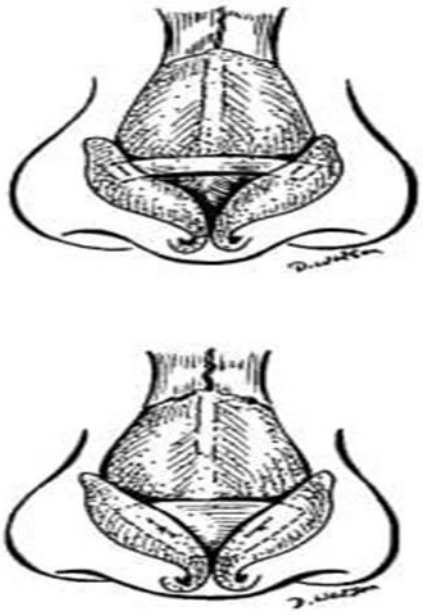

FIG (8) Diagram of spreader graft variation used to correct a pinched nasal tip. The graft is shaped as either a rectangle or triangle and placed in between the lower lateral cartilages to widen the tip contour and shape **(25).**

In both the closed and open approaches, the spreader graft insertion technique is performed similarly whether synthetic material or autogenous cartilage is used for the graft. The spreader graft is fashioned to the appropriate dimension and size and secured in place with nonabsorbable sutures.

If temporal fascia is used to help bolster the soft tissue envelope, the harvesting is done well in advance of the actual nasal surgery. This allows the temporal fascia to air dry so that trimming and placement of the fascia are simplified. The fascia graft should be slightly wider than the dorsum and sufficiently long to extend above and below the reconstructed middle vault region. The fascia graft can be secured along its cephalic margin with a transcutaneous 5-0 PDS suture that is removed at 4-6 days postoperatively. The graft is then secured to the cephalic margin of the lower lateral cartilage with a similar suture.

References:

1. Rhee, J. S., Weaver, E. M., Park, S. S., Baker, S. R., Hilger, P. A., Kriet, J. D., & Toriumi, D. M. (2017). Clinical consensus statement: Diagnosis and management of nasal valve compromise. Otolaryngology–Head and Neck Surgery, 156(1), 29–36. https://doi.org/10.1177/0194599816676793

2. Hansen, M. R., & Most, S. P. (2021). Internal nasal valve collapse: Current concepts, evaluation, and treatment strategies. Current Opinion in Otolaryngology & Head and Neck Surgery, 29(4), 250–256. https://doi.org/10.1097/MOO.0000000000000735
3. Sidle, D. M., Steele, T. O., & Katz, E. (2022). Bioabsorbable implants and minimally invasive techniques for nasal valve collapse: Evidence and outcomes. Aesthetic Surgery Journal, 42(3), 303–312. https://doi.org/10.1093/asj/sjab356
4. Khanwalkar, A., & Welch, K. (2021). Update on the evaluation and Management of Nasal Valve Collapse. *Current Otorhinolaryngology Reports*, 1-10.
5. Deot, N., Obayemi, A., & Davila, R. O. (2022). Non-Surgical Devices for Nasal Obstruction. *Facial Plastic Surgery*, *38* (04), 359-363.
6. Dilek, D., Kar, M., & Bedrosian, J. C. (2023). Nasal Obstruction: Symptoms, Causes and Treatment. In *Airway diseases* (pp. 1-15). Cham: Springer International Publishing.
7. Lajdam, G. B., Alaryani, K., Ghaddaf, A. A., Aljabri, A., Halawani, A., Alshareef, M., ... & Al-Hakami, H. (2022). Septoplasty versus septoplasty with turbinate reduction for nasal obstruction due to deviated nasal septum: a systematic review and meta-analysis. *Rhinology*, *60*(06), 411-420.
8. Moubayed, S. P., & Most, S. P. (2022). Evaluation and management of the nasal airway. *Clinics in Plastic Surgery*, *49*(1), 23-31.
9. Justicz, N., Gadkaree, S. K., Fuller, J. C., Locascio, J. J., & Lindsay, R. W. (2020). Preoperative characteristics of over 1,300 functional septorhinoplasty patients. *The Laryngoscope*, *130*(1), 25-31.
10. Garg, L. N., Singh, N. K., Kappagantu, K. M., & Yadav, A. (2021). Spreader graft placement: an effective procedure for alleviation of internal nasal valve collapse. *Journal of Oral and Maxillofacial Surgery*, *79*(10), 2134-2142.
11. Kapı, E., Kopal, C., Seyhan, T., & Celik, Y. (2022). Comparison of the effect of spreader and T-splay graft in internal nasal valve management. *Aesthetic Plastic Surgery*, *46*(4), 1783-1793.
12. Naguib, M. B., Ahmed, M. R., Madian, Y. T., Elnahriry, T. M., & Eldeeb, W. E. (2020). Functional and aesthetic outcomes of spreader graft and auto-spreader flap after nasal hump removal. *The Egyptian Journal of Otolaryngology*, *36*, 1-6.
13. Raposo, A., Lajara, J., Guillén, A., & García-Purriños, F. (2022). Modified alar batten grafts for treatment in nasal valve dysfunction: Our experience. *Auris Nasus Larynx*, *49*(3), 396-400.
14. Taha, M. A., Hall, C. A., Zylicz, H. E., Barham, W. T., Westbrook, M. B., Barham, M. J., ... & Barham, H. P. (2023). Costal cartilage lateral crural strut graft for correction of external nasal valve dysfunction in primary and revision rhinoplasty. *Ear, Nose & Throat Journal*, *102*(3), 175-180.
15. Kondo, M., Orgain, C., Alvarado, R., Marcells, G. N., & Harvey, R. J. (2020). The effects of lateral crural tensioning with an articulated alar rim graft versus lateral crural strut graft on nasal function. *Facial Plastic Surgery & Aesthetic Medicine*, *22*(4), 281-285.
16. Sinkler, M. A., Wehrle, C. J., Elphingstone, J. W., Magidson, E., Ritter, E. F., & Brown, J. J. (2021). Surgical management of the internal nasal valve: a review of surgical approaches. *Aesthetic Plastic Surgery*, *45*, 1127-1136.
17. Jomah, M., Smith, O., Villemure-Poliquin, N., & Cunningham, H. (2024). Use of alloplastic implants for correction of deviated nasal septum: Systematic review and meta-analysis. *American Journal of Otolaryngology*, 104240.
18. Kim, J. Y., Nam, G. Y., & Kwon, J. H. (2021). Surgical correction of nasal valve collapse. Journal of Cosmetic Medicine, 5(2), 67-73.
19. San Nicoló, M., Berghaus, A., Jacobi, C., Kisser, U., Haack, M., & Flatz, W. (2020). The nasal valve: new insights on the static and dynamic NV with MR-imaging. *European Archives of Oto-Rhino-Laryngology*, *277*, 463-467.
20. Jones, E. A., & Sivam, S. (2022). Minimally invasive nasal valve treatment. *Facial Plastic Surgery*, *38*(04), 353-358.

21. Kang, Y. J., Kim, D. H., Stybayeva, G., & Hwang, S. H. (2024). Effectiveness of Radiofrequency Device Treatment for Nasal Valve Collapse in Patients With Nasal Obstruction. *Otolaryngology–Head and Neck Surgery*, *170*(1), 34-44.
22. Casale, M., Moffa, A., Giorgi, L., Pierri, M., Lugo, R., Jacobowitz, O., & Baptista, P. (2023). Could the use of a new novel bipolar radiofrequency device (Aerin) improve nasal valve collapse? A systematic review and meta-analysis. *Journal of Otolaryngology-Head & Neck Surgery*, *52*(1), s40463-023.
23. Sheen, J. H., & Rees, T. D. (1984). Spreader graft: a method of reconstructing the roof of the middle nasal vault following rhinoplasty. *Plastic and reconstructive surgery*, *73*(2), 238-239.
24. Samaha M, Rassouli A (2015). Spreader graft placement in endonasal rhinoplasty: Technique and a review of 100 cases. Plast Surg (Oakv). 2015 Winter
25. David W Clark, Anthony G Del Signore, Roheen Raithatha, Brent A Senior Ear, Nose, & Throat Journal 2018 June.
26. Victor D de Pochat, Nivaldo Alonso, Rogério R S Mendes, Marcelo S Cunha, José V L Menezes Journal of Plastic, Reconstructive & Aesthetic Surgery : JPRAS 2012 June.
27. Mendelsohn M. Straightening the crooked middle third of the nose: using porous polyethylene extended spreader grafts. Arch Facial Plast Surg. 2005 Mar-Apr.
28. Courtiss EH, Goldwyn RM. The effects of nasal surgery on airflow. Plast Reconstr Surg. 1983 Jul. 72(1):9-21.