Dead Space, the Final Frontier in Rhinoplasty: Review and 10 Key Recommendations

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Summary: Mitigating dead space has been recognized as an essential step toward ensuring a more predictable and aesthetically pleasing outcome in rhinoplasty. The current body of literature leaves a discernible gap in offering a unified, systematic approach to dead-space management in rhinoplasty. The aim of this article is to bridge this gap by presenting an integrative approach to surgical and postsurgical techniques. *(Plast. Reconstr. Surg.* 155: 867e, 2025.)

Rhinoplasty remains one of the most challenging procedures performed in plastic surgery. The complex and intricate internal structures contribute a great deal to this difficulty; however, even a perfect internal framework and external skin envelope can be ruined by unpredictable wound healing and soft-tissue contraction. These postoperative deformities occur more commonly in revisions, men, patients with thick skin, and ethnic rhinoplasty. Predictability in rhinoplasty comes from pushing up and tensioning the structural foundation of the nose and pushing down the soft-tissue envelope to manage dead space, the final frontier in technical nuance for even the most seasoned surgeon. In this special topic article, in addition to providing a comprehensive literature review, the senior author (R.J.R.) reviews the nuances of managing dead space, gained over more than 30 years of experience and more than 8000 rhinoplasties, to help the rhinoplasty surgeon obtain more consistent results.

REVIEW OF THE LITERATURE

Managing dead space in rhinoplasty has evolved with the understanding of its impact on patient outcomes. Recent literature evaluates techniques to mitigate dead-space complications in rhinoplasty, underscoring its importance in decreasing postoperative complications and enhancing outcome predictability and aesthetics. In rhinoplasty, dead space refers to separation between the skin–soft-tissue envelope (SSTE) and the underlying nasal framework.[1] The creation of such dead spaces offers an environment conducive to unpredictable soft-tissue contraction, significantly affecting wound healing and, consequently, the final outcome of the surgery.[1] Patients at increased risk for dead-space formation include those with male sex, a weak internal framework, or thick skin, and those undergoing revision rhinoplasty (Fig. 1).[2]

Challenges posed by unresolved dead space are both functional and aesthetic. Dead space can lead to fluid accumulation or clot formation, which may progress to fibrosis and permanent thickening of the SSTE, impeding successful redraping and adherence of the SSTE to the nasal framework.[3] Common complications from mismanaged dead space include prolonged swelling, loss of contour, and the supratip deformity, due to scar tissue formation in the resultant dead space.[4]

Mitigating dead space has been recognized as an essential step toward ensuring a more predictable and aesthetically pleasing outcome in rhinoplasty. A systematic 5-step procedure to eliminate dead space has been outlined in the literature.[1,2] This approach focuses on achieving controlled skin contraction, maintaining wound-healing predictability, and ultimately improving rhinoplasty

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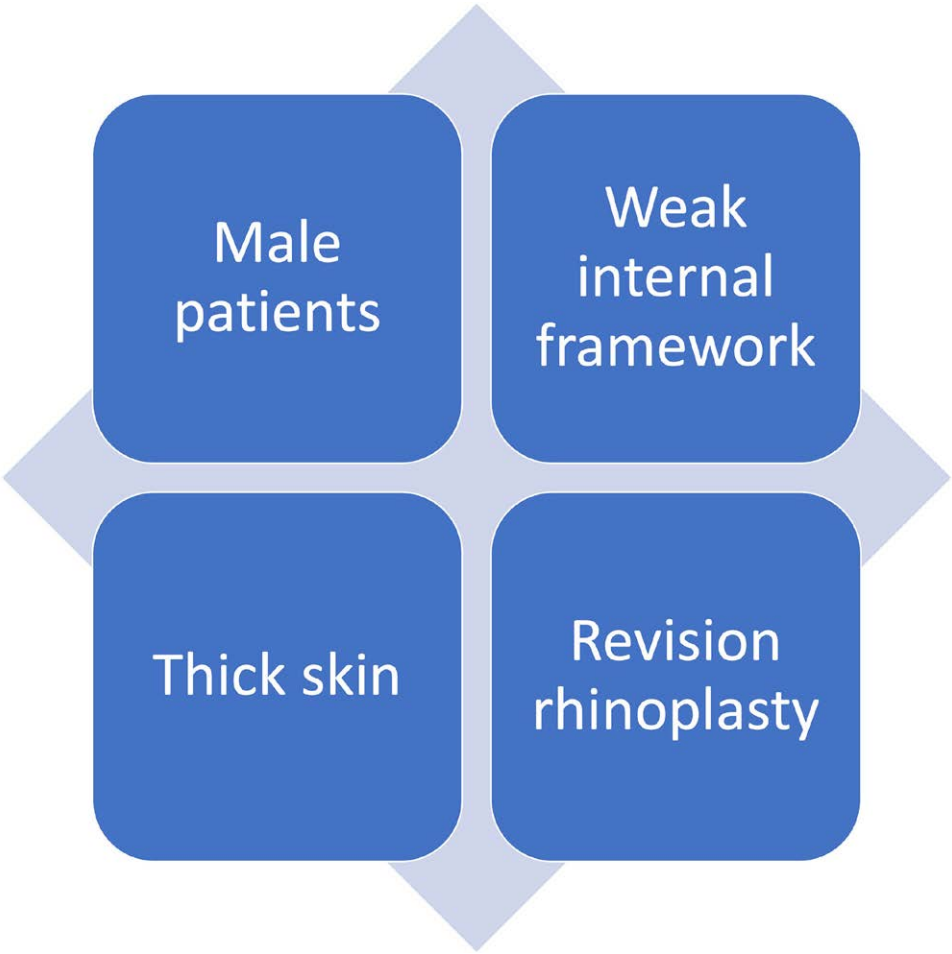

Fig. 1. Risk factors for increased dead space in rhinoplasty.

results. Upon review of the literature, several other authors have described how they handle dead-space closure; however, these techniques are often limited to a single anatomic area and not that of the entire SSTE dead-space closure in rhinoplasty. For example, to address the challenge of soft-tissue triangle concavity, Campbell et al.[5] placed morselized cartilage to fill dead space internally, thereby providing some support and preventing concavity in this area. To close down supratip dead space and undesirable fibrosis, Finocchi et al.[6] described suturing the scroll ligament complex to the mucosa.

Comprehensive management of dead space allows surgeons to optimize outcomes, reduce complications such as pollybeak deformity, and better meet patient expectations in rhinoplasty.

The current body of literature leaves a discernible gap in offering a unified, systematic approach to dead-space management in rhinoplasty. The aim of this article is to bridge this gap by presenting integrative surgical and postsurgical techniques that combine the previously isolated methodologies into a coherent operative and postoperative framework.

10 CARDINAL POINTS FOR DEAD-SPACE MANAGEMENT

These 10 points are based on both the literature and more than 30 years' experience of the first author (R.J.R.) in management of dead space in more than 8000 rhinoplasty procedures—both primary and revision rhinoplasty. This has been an evolution. See Table 1 for a summary of the 10 cardinal points and ancillary techniques.

1. Role of Tranexamic Acid

Tranexamic acid (TXA) decreases bleeding, edema, and postoperative bruising in rhinoplasty, while being anti-inflammatory.[7–10] It stabilizes existing clots through inhibiting the activation of plasminogen to plasmin.[11] It has been proven safe in randomized controlled trials, without increasing

Table 1. Ten Cardinal Points for Dead-Space Management

Point	Intervention	Result
1	TXA (all cases) • IV: 1 g with redosing PRN • Topical: 3% pledgets	• Hemostasis
2	Soft-tissue/scar debulking (revisions or thick skin)	• Release of distorted skin • Restoration of lymphatic drainage
3	Closure of membranous septum (all cases) • 4-0 chromic mattress sutures	• Correction of deformation of the septum • Dead-space elimination
4	Internal framework restoration and strengthening (all cases) • Tension spanning sutures • Spreader flaps/grafts • Fixed-mobile SEG • LLC tensioning • Grafts of the tip/columella	• Pushing up the internal framework
5	Alar-rim shaping (nearly all cases) • Alar-flare correction • Alar-base resection • Alar-contour grafts	• Pushing down the soft-tissue envelope
6	Supratip-spanning suture (nearly all cases) • 5-0 Vicryl suture at desired supratip break	• Dead-space elimination • Definition of supratip
7	Drainage ports (all cases) • Infracartilagenous and retro–soft-triangle incisions left open • Unilateral caudal septal opening	• Fluid egress • Edema management • Prevention of septal hematoma
	External percutaneous sutures (select cases) • 2-3 × 5-0 nylon sutures at alar grooves for 5 d	• Edema management • Definition of alar grooves if needed at end of case
9	Splints (all cases) • Antibiotic-coated internal splints • External splints for 3 wk followed by up to 6 mo of taping	• Edema management • Stabilization of nasal framework • Pushing down soft-tissue envelope
10	Surgicel to soft triangles (all cases)	• Edema management • Allows incision to be left open • Enhances definition
Ancillary	Steroid injection (rarely intraoperatively, frequently postoperatively) • 10 mg/mL triamcinolone and 1% lidocaine 1:1 • Intraoperatively for revisions, every 6 to 8 wk for up to 2 yrs	• Edema management • Scar-tissue reduction
Ancillary	Isotretinoin (rarely) • 0.25 mg/kg/d for 4 mo or 0.5 mg/kg/d for 2 mo • Laboratory monitoring/contraception per dermatologist	• Edema management • Skin-thickness reduction • Tip-definition enhancement
Ancillary	Doxycycline rhinodesis (select cases) • 3 mL of 20 mg/mL doxycycline administered through 18-G angiocatheter for 3 to 5 min	• Dead-space elimination • Tip-definition enhancement

IV, intravenous; LLC, lower lateral cartilage; SEG, septal extension graft; TXA, tranexamic acid.

the risk of thromboembolic events, and has led to mortality benefits in some series.[12–15]

TXA can be used as an intravenous infusion, orally, and topically.[16] The senior author prefers a combination of intravenous and topical administration. A 10 mg/kg bolus followed by 1 to 5 mg/kg/h infusion has been shown to be safe. However, this can be simplified with a 1-g bolus, with repeated dosing if significant bleeding persists. For topical administration, neuropledgets are soaked in 3% TXA solution.[9] These pledgets are placed into the nasal cavities, along the dorsum, or between the septum and mucoperichondrium. In nearly all cases, this is performed after the initial dissection, and repeated during the procedure after obtaining final meticulous hemostasis to minimize the blood interface between the internal nasal framework and soft-tissue envelope.

2. Soft-Tissue Debulking and Scar Removal

In primary rhinoplasty, the superficial musculoaponeurotic system (SMAS) and soft tissues are usually not debulked. The only exception is the coupling of thick skin with a significant SMAS layer, which can be removed easily. This can occur in ethnic rhinoplasty. In this event, conservative debulking is performed, but the dermis must be left intact to prevent excessive scarring.

In revision rhinoplasty, scar tissue is often present and causes distortion of the skin envelope and, potentially, the underlying framework if severe. It also increases edema through restriction in locoregional lymphatic drainage.[17] This scar tissue should be debulked to increase the pliability of the soft-tissue envelope, decrease bulk, and aid in reestablishing lymphatic outflow.

In patients who do not require any soft-tissue debulking (ie, thin skin, non–ethnic rhinoplasty) and who have strong cartilaginous framework, the subperichondrial plane can be elevated instead of the supraperichondrial plane. This approach can expedite clearance of edema and reduce the risk of unwanted scar-tissue formation.[6] However this approach should be used with caution in patients with weak cartilage, as it will further weaken and destabilize the framework of the nose.

3. Membranous Septum, Columella, and Medial Foot Plates: Dead-Space Closure

Fluid can accumulate within the membranous septum, columella, and supporting grafts if dead space is not addressed. In addition, soft-tissue memory can contribute to deformation if correction of caudal septal deviation has been performed.[1] The senior author addresses this with multiple 5-0 absorbable chromic mattress sutures placed from inferior and posterior to anterior, as depicted in Video 1. (**See Video 1 [online]**, which demonstrates membranous septum dead-space closure.)

4. Internal Framework Restoration and Strengthening: Dorsum and Tip Tensioning

The obliteration of dead space can be reinforced by pushing up the nasal framework while pushing down the soft-tissue envelope. Pushing up the nasal framework begins with the upper lateral cartilages (ULCs). Tension spanning sutures can provide stability and straighten dorsal aesthetic lines in most cases. Spreader flaps can be used for additional stability if ULC redundancy is present; however, if 5 mm or more of dorsal reduction is needed, or there is significant internal nasal valve collapse, spreader grafts are usually required.[18] The resultant widening of the dorsum may be partially alleviated by recessing spreader grafts 1 to 2 mm below ULCs that are secured with tension spanning sutures.[19]

Next, tip projection, shape, and rotation is set with a septal extension graft (SEG).[20] A fixed-mobile SEG extends from the anterior septal angle and into the interdomal space, allowing for reliable tip support, sturdy suspension of alar cartilages, stretching of the soft-tissue envelope, and control of tip position.[21] Preservation of projection and rotation has been shown to be superior with the SEG than with a columellar strut.[1,22]

Finally, the nasal tip, soft triangles, and columella are addressed. A neo–lower lateral cartilage complex is created by tensioning the lower lateral cartilage, transecting the medial crura at its weakest point if necessary, and defining the tip with intradomal and interdomal sutures secured to the SEG.[23] The skin is redraped, with assessment of contour and dead space. The tip may be augmented with a shield graft contoured from septal or costal cartilage, and a butterfly graft made from cephalic trim may be positioned horizontally at the infratip lobule.[24] If dead space is present at the columella or the skin is retracted, cartilage from a cephalic trim may also be positioned vertically to address this. After closure of the columella, the soft triangles are evaluated, and morselized cartilage is placed as needed. If the nose is deprojected by more than 4 mm, then excision of excess columella skin is considered to eliminate a potential area of dead space.

5. Alar Rim and Alar Base Reshaping: Soft-Tissue Envelope Contouring

Alar contouring is an essential tool for optimizing aesthetic results, as well as tightening the soft-tissue envelope over the nasal framework. Following restoration and strengthening of the nasal framework, the ala and nasal bases must be assessed and soft-tissue excess tailored, as described by the senior author in his earlier trilogy of articles.[25–27] Changes in tip projection affect alar flare, so correction of the ala should be deferred until after finalizing the nasal framework and tip position. If further strengthening or contour correction of the ala is desired, alar contour grafts may be placed in either an anterograde or retrograde manner.[28]

6. Supratip Spanning Suture

The importance of the supratip cannot be emphasized enough. Particularly in women, a well-defined supratip break is highly desirable, and unwanted fullness in the form of a pollybeak deformity is unacceptable and will likely lead to a revision. Some authors advocate for preservation or reconstruction of the Pitanguy ligament to eliminate dead space and define the supratip, as is performed in preservation rhinoplasty.[29] Although reconstruction of this ligament may accomplish this goal in some patients, after reconstructing the nose, the Pitanguy ligament may not lie at the exact position of the desired break. Internal sutures to the underside of the dorsum soft tissue have been used to place the new breaking point more precisely.[30–32]

The senior author prefers to use a single absorbable 5-0 Vicryl suture. The desired position of the supratip may be marked by passing a hypodermic needle. The suture is passed through the

SMAS layer at this location, and then secured to the underlying portion of the lower lateral cartilages and septal extension graft, as shown in Video 2. (**See Video 2 [online]**, which demonstrates the supratip spanning suture.)

7. Drainage Ports

While minimizing dead space, it is important to leave ports for fluid egress.[2] The soft-tissue interface with mucosa is one such port. The internal infracartilaginous incisions, as well as the incisions directly behind the soft triangles, are never closed; these areas heal well without the need for sutures. This allows the tip complex, ala, and lateral nasal sidewalls to drain. The columella and skin along the sides of the columella are closed with sutures.

Septal harvest or septal reconstruction with wide mucoperichondrial dissection may lead to a hematoma unless there is a suitable port to drain the septum inferoposteriorly. If one is not present after mucoperichondrial dissection, a unilateral caudal septal opening is made with a Cottle elevator.

8. External Percutaneous Sutures

External sutures have been used by some to adhere the soft-tissue envelope to the underlying osseocartilaginous framework.[32,33] The senior author prefers to place 2 or 3 transcutaneous permanent sutures within each alar groove. These are placed through the skin, into the nasal cavity, and back out to the nasal skin. These are tied over the tips of pickups to avoid ischemia of the skin, as shown in Video 3. (**See Video 3 [online]**, which demonstrates rhinodesis and external percutaneous suture placement.) This helps define the alar groove in cases where the alar groove is convex and not contouring well at the end of the case. These sutures are removed at 5 days to prevent scarring.

9. Internal and External Splints

Mupirocin-coated internal nasal Doyle splints are placed routinely to stabilize the nose and decrease dead space along the septum. External taping and splint application has been shown to decrease edema and swelling at 6 months after rhinoplasty.[34] The senior author prefers to apply Steri-Strips, followed by a thin strip of foam to the dorsum and alar grooves before application of the external Denver splint. The internal and external splints are removed at 7 days. After removal of the Steri-Strips at 3 weeks, nasal taping can be performed for an additional 3 to 6 months in revision cases.

10. Oxidized Regenerated Cellulose Placement to Soft Triangles

Sutures are never placed at the soft triangles, given the high risk of notching and retraction in this region.[2] Instead, mupirocin-coated oxidized regenerated cellulose (Ethicon, Inc.) is placed to eliminate dead space and provide support. This undergoes spontaneous dissolution and usually falls out in 5 days; therefore, it usually does not need to be removed.

ANCILLARY TECHNIQUES

Steroid Injection

Steroid injections have been shown to decrease skin thickness and edema in patients undergoing rhinoplasty.[35] This is used most frequently for preventing excessive future scar formation and addressing contour irregularities in the tip and supratip, such as a soft-tissue pollybeak deformity.[4,36] The senior author prefers triamcinolone (10 mg/mL mixed equally with 1% lidocaine), injected deep, in a subcutaneous plane and around the osseocartilaginous framework to avoid thinning of the skin or pigmentation changes. This is performed intraoperatively in revision cases with severe scarring, and can be begun as early as 1 week postoperatively. This may be repeated every 6 to 8 weeks for up to 2 years depending on the degree of persistent scarring or edema.

Isotretinoin

Isotretinoin is traditionally used to treat cystic acne, rhinophyma, and sebaceous hyperplasia.[37] It decreases skin thickness, oil production, the sebaceous quality of skin, and *Propionibacterium acnes* burden. Traditionally, it has been avoided perioperatively due to concerns of delayed wound healing and keloid formation.[38] However, it has been proven to be safe, reduce skin thickness and oil production, improve definition of the nasal tip, and improve patient satisfaction after rhinoplasty.[39,40] These benefits have been found across nasal anatomic subunits when administered at 0.25 mg/kg/d for 4 months, or at 0.5 mg/kg/d for 2 months.[41] Patients who benefit from this are those with a history of cystic acne or sebaceous hyperplasia. Patients should be followed by a dermatologist while on isotretinoin, use contraception due to teratogenicity, and undergo

routine motoring of their lipid profiles and hepatic function.

Doxycycline

The use of doxycycline in rhinodesis has been advocated recently for adhering the SSTE to the underlying cartilaginous framework in patients with moderate to thick skin undergoing rhinoplasty. This can be used in conjunction with external sutures to address convex skin deformities in areas of underlying concave framework at the end of the case. Two to three milliliters of 20 mg/mL doxycycline solution, administered to the supratip region intraoperatively through an 18-G angiocatheter or facial fat grafting cannula and left for at least 1.5 minutes, has been shown to be safe, and aid in decreasing edema and improving early tip definition in rhinoplasty[3] (**see Video 3 [online]**).

CONCLUSIONS

Rhinoplasty remains one of the most challenging procedures for plastic surgeons. Complex anatomy, a delicate structural framework, and a thin soft-tissue envelope create nearly infinite heights for technical refinements in rhinoplasty. Neglecting dead space leads to edema, obscured definition, and altered wound healing in what could otherwise be an expertly performed operation.

Pushing up the nasal framework and pushing down the soft-tissue envelope allows the rhinoplasty surgeon to obtain superior and more predictable results. This is accomplished through strengthening of the dorsum and tip, as well as alar-rim and alar-base shaping. Sutures are used to eliminate dead space and improve contour through closure of the membranous septum and columella, a supratip spanning suture, and external percutaneous sutures at the alar grooves. Sclerosis and rhinodesis may be performed in select patients with doxycycline. Edema management is accomplished through reduction of bleeding with TXA, scar debulking, drainage ports, internal and external nasal splints, Surgicel placement to the soft triangles, steroid injections, and isotretinoin in select patients. With these measures in hand, a rhinoplasty surgeon can successfully resolve dead space in rhinoplasty.

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DISCLOSURE

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PATIENT CONSENT

The patient provided written informed consent for the use of her images.

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