Reconstruction of Small Soft Tissue Nasal Defects

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Abstract

Keywords

- ▶ nasal reconstruction
- ▶ Mohs surgery
- ▶ small tissue defects

Nasal defect repair has been one of the more challenging areas of reconstructive surgery due to the lack of uniform nasal skin thickness and complex contours. Currently, algorithms for medium to large nasal soft tissue defects have been well defined by various authors. Small defects, arbitrarily defined as 1 cm or less, still present significant challenges. In this article, the authors examine the options available to repair small soft tissue nasal defects and the appropriate situations in which each method is best suited.

Background

Nasal defect repair has been one of the more challenging areas of reconstructive surgery due to the lack of uniform nasal skin thickness, complex contours, and small subunits in close proximity to one another. Currently, algorithms for medium to large nasal soft tissue defects have been determined and published in the medical literature.^{1–6} Using either a subunit or defect-only reconstruction, defects larger than 1 cm in diameter can be reliably reconstructed and repaired with various described techniques.⁷ Paradoxically, small defects, less than 1 cm, present significant challenges and are often more difficult to achieve acceptable results following reconstruction. Skin grafts and local flaps applied for these defects often result in frequent or unpredictable pincushioning, violation of aesthetic subunits, and/or worsening of the defect by alar notching. Achieving a well-contoured, aesthetically pleasing result begins with meticulous preoperative analysis of the nasal defect and knowledge of the various reconstructive options. Here we examine the methods involved in the reconstruction of small defects secondary to Mohs micrograph surgery for skin cancer.

Epidemiology

The closure of facial Mohs' defects is a common challenge encountered by plastic surgeons. The nose is particularly vulnerable to cutaneous malignancies⁸ 75% of nonmelanomatous malignancies skin cancers occur on the head and neck,

of which ~30% occur on the nose.⁹ Mohs involves removing a minimal amount of tissue and is beneficial in cosmetically sensitive areas.¹⁰ The nasal defects following these tumor resections vary considerably, commonly creating lesions less than 1 cm in diameter.

Anatomy

The nose serves as a vital structure for both functionality and aesthetics of the face. Knowledge of the anatomy can significantly help the assessment of the defect and determining the appropriate technique for repair. The nose is made up of nine subunits consisting of the dorsum, sidewall (2), ala (2), tip, soft triangle (2), and columella (▶**Fig. 1**). Many plastic surgeons consider the subunit principle, introduced by Burget and Menick, as essential for an optimal aesthetic result.¹¹ However, smaller lesions, particularly those arising secondary to Mohs micrographic surgery, are often more appropriately managed as defect-only reconstructions.¹² These defects are frequently less than 1 cm in diameter, shallow and rarely encompass greater than 50% of the aesthetic subunits. If one relies on strict adherence to the subunit principle, it may result in unnecessary loss of healthy tissue and require a more complex reconstruction due to a resultant larger defect.^{1,13,14}

The final reconstruction should resemble the thickness and texture of the original remaining nasal skin. Achieving a color match is of great importance. The surgeon should be aware that the skin over the upper two-thirds of the nose is

Fig. 1 Nasal subunits.

more mobile and thinner as compared with skin on the lower third of the nose, where it is adherent to the underlying cartilaginous and fibrofatty structures.¹⁵ Therefore, when considering the reconstruction technique to be used, one should consider the unique characteristics of the skin overlying the defect.¹⁶ For example, primary closure of the more adherent skin on the inferior aspect of the nose may result in distortion of the alar rim or the nasal tip.^{3,15} Distortion of the alar rim can be quite visible and exceedingly difficult or impossible to correct secondarily. Restoring the contour and quality of the tissue overlying the defect is essential to aesthetic nasal reconstruction.

Attention can also be given to natural relaxed skin tension lines when repairing small defects. These lines allow for scars to be hidden within these creases.¹⁷ Relaxed skin tension lines can be found horizontal at the nasal root, angulated obliquely from the medial canthus, across the lateral side-walls, and found vertically spanning the dorsum of the nose.³ When performing primary closure of a small nasal defect, following the relaxed skin tension lines can significantly improve the final aesthetic result.

Secondary Intention

A principal-based reconstruction effort generally begins with the safest and least invasive method of repair, with the goal of achieving an acceptable cosmetic result. This relies on an upward progression on the reconstructive ladder from healing by secondary intention, primary closure, skin grafting, to the use of local flaps. The first thing considered in correcting soft tissue defects should be the body's natural ability to heal by secondary intention. Although acceptable in other places in the body, prominent scarring on facial features often results in unacceptable cosmesis. Furthermore, depending on the defects location, the scar retraction that results can distort the alar and tip units. Under the best possible outcome, it often heals as a depressed hypopigmented area that is considered by many unacceptable as a consistent treatment option. However, it may serve as a useful prelude to skin grafting, where the defect is initially allowed to granulate and

fill the unwanted depression, creating a vascularized bed for placement of a skin graft.

When considering a defect to heal by secondary intention, one must consider the location, depth and convexity of the surface. Secondary intention is useful in areas with concave surfaces such as defects located in the medial canthus area, nasal alar sulcus, and the nasal alar crease.¹⁶ Nasal defects on convex surfaces often result in depressed and irregular scars, especially if the defect has a larger depth or if cartilage is involved.^{18,19}

Primary Closure

Direct linear closure of a wound is often overlooked as a suitable option for nasal defect repair. The indications for direct linear closure on the nose are more limited than other anatomical areas on the face due to the relative paucity of skin laxity and the risk of subunit distortion. However, primary closure can actually be the best option in certain cases usually involving the upper two-thirds of the nose. It is a simple one-stage procedure recruiting adjacent color and thickness-matched skin. Either transverse or horizontal closure can be performed. The resulting scars can be hidden in the relaxed tension lines, leaving minimal visible stigma of Mohr reconstruction.²⁰ Cook often points out the primary closure works best for midline defects because of the resulting symmetrical tension to the subunit.²¹ Additionally, it is a very reasonable option in areas or patients with greater skin laxity. This is most commonly present in older patients and procedures on the upper two-thirds of the nose, where the subunits typically have lax skin. In elderly patients with minor tip descent transverse closure may be suitable, as some tip elevation is tolerable (→Fig. 2). In all cases, meticulous dog-ear excision and aggressive scar treatment are required to accomplish the best result. The use of primary closure should always be considered, but it should be compared and contrasted with other options in obtaining the optimal aesthetic outcome.

Conceptually, primary closure has potential downsides. To prevent skin tenting near the end of the closure, dog-ear excisions are often required and can result in a longer scar than the original defect. More importantly, the tension from primary closure on the lower nose often causes retraction of the nasal ala. However, the benefits of linear closure when compared with more complex geometric flaps, are that it can be performed expediently, in one-stage, with virtually no risk of hematomas or flap loss.²² In addition, it should be pointed out that linear closure generally does not prevent subsequent reconstructive options.²²

Full-Thickness Skin Graft

Many surgeons have regarded full thickness skin grafts as the most useful tool for reconstruction of small superficial defects.^{23–26} Skin grafts are different than flaps in that skin grafts are ischemic when first inset. New blood supply to the graft has to be established through the stages of imbibition (first 24 hours), vascular inosculation (24–48 hours), and revascularization (4–7 days). Counting on simple diffusion to re-establish blood supply, as written by Hubbard, often causes the center of the grafts to form an eschar, or in worse

Fig. 2 Linear closure. (A) A 1-cm defect of the tip and dorsum. (B) Transverse linear closure. (C) 3-months postop—note there is little to no tip elevation.

cases—necrosis—that results in some permanent damage to the graft.²⁶ This concern is mitigated in the repair of small defects, as the size of the wound does not require a long time to regain perfusion.

Individual characteristics of skin graft donor and recipient sites must be considered when choosing the correct graft donor site. The nasal defect needs to be analyzed for texture, thickness, color, and tendency toward hyperpigmentation or hypopigmentation.²⁵ This information will aid the surgeon in the selection of a donor site with similar skin characteristics. The current medical literature has established that certain areas of the face, mainly the preauricular and lateral forehead, match well in thickness and color to the nose.^{1,27,28} Small defects, involving a single subunit on the lower third of the nose, are best repaired with color- and thickness-matched skin grafts harvested from the lateral forehead.

We have obtained favorable outcomes with these grafts in restoring skin color, contour, and volume. Dermabrasion is a mandatory adjunct for optimizing aesthetic results and reducing the appearance of scars. It is worth noting that some hypopigmentation of the graft, often theorized to be caused by the relative redness from vasodilation of the surrounding healthy tissue, can occur in the early stages.²⁹ Along with erythema and eschar, the hypopigmentation often spontaneously resolves with time. Graft survival is unpredictable with concomitant vascular disease and smoking. Vascular disease predisposes the patient to poor perfusion, and smoking has been cited as one of the most common causes of graft failure or center necrosis.^{25,26,30–33}

Defects deeper than a full-thickness skin graft may require a short period of healing by secondary intention (7–14 days) prior to placing the skin graft. Following granulation of the defect, a delayed skin graft can be placed without risk of a subsequent contour deformity.¹⁶

Local Flaps

Local nasal flaps have many advantages that help provide adequate wound closure and an aesthetically pleasing result. Local flaps can provide closure with minimal tissue resection and contour deformity.^{5,34–40} Additionally, they provide adjacent color-matched skin to repair the defect, carry their own blood supply, and are not dependent on the recipient site for a

vascular blood supply. When carefully planned, local flaps provide very good cosmetic results, with scars hidden within natural creases. Literally, dozens of flaps are described; however, the serious practitioner would do better mastering a relatively few number of flaps.

Banner Flap

The banner flap, first described by Elliot in 1969, consists of a transverse triangular flap, often designed superior to the defect from the nasal dorsum (►Fig. 3).⁴¹ The transverse incision allows the scar to be hidden in the relaxed tension lines of the face.^{4,20} Theoretically, the reach of the transverse incision of the banner flap could reach across the entire width of the nose, which allows the surgeon comfortable leeway for the length of the flap. Longer reaching flaps also allow symmetrical retraction of both sides of the nose, which aids in achieving symmetry of the subunits.

In the senior author's experience, it is best to limit the use of the banner flap to defects of 8 mm and below the alar borders. The use of this flap near the rim should be treated with care as irreversible retraction of the ala can occur. Alar retraction is a very noticeable and often difficult complication to treat.

Note Flap

The note flap, described by Walike et al in 1985, is another type of rotational flap.⁴² Appropriately named, the design of the flap looks like a musical eighth note with the defect being the note head (►Fig. 4). The use of the note flap on the upper two-thirds of the nose is very well indicated, as there is enough skin laxity for the closure of the donor site and inset of the flap. One can easily design this flap with relationship to the relaxed skin tension lines.⁴² Care should be taken when using this on the lower one-third of the nose. Any tension from closure and inset of the wound could cause unilateral distortion of the ala, which often yields an unacceptable cosmetic result. Additionally, some judgment needs to be used during the design and execution of this flap for a successful result. If necessary, an extra cut, back at the top of the note flap, can be used to facilitate rotation and closure (►Fig. 5). Remember that the note flap requires contribution and laxity from the inset region, which limits its use in lower third defects.

Fig. 3 Banner flap. (A) Subcentimeter defect of the ala and sidewall with flap design. (B) Immediate postop.

Fig. 4 Note flap. (A) Small defect of the sidewall with flap design. (B) Immediate postop.

Fig. 5 Note flap with additional cutback to aid with rotation.

Bilobed Flap

Although the banner and note flap each allow one lobe to be donated into the defect, the bilobed flap employs the use of two lobes. The original design of the flap was attributed to Esser⁴³ around World War I. The modern version employs a revision produced by Zitelli, published in 1989.⁴⁴ The Zitelli version of the bilobed flap reduced the amount of rotation required for each flap, therefore minimizing the degree of skin tenting and the rotational torque of each skin flap.

Many upsides come from the use of the bilobed flap. The most obvious one is the use of adjacent color-matched and thickness-matched skin with small defect (►Fig. 6). The amount of flexibility in both the lobe size and placement of the defect created by the primary and secondary lobes allow the surgeon almost total control in distributing the tension of closure and secondary movement of the wound. However, with these benefits of design there are some potential drawbacks. At the very core of the design, the bilobed flap aims to first alter otherwise untouched nasal subunits. Many surgeons feel that the violation of multiple subunits is an unacceptable side effect. Also, innate to the design of the bilobed flap is the necessity of the zigzagging scars. No matter how the surgeon orients each lobe, there will always be scars perpendicular to the relaxed tension lines of the face.²⁰ Overstuffing of the defect with an oversized flap could result in pincushioning or even unilateral alar distortion. During the execution of the bilobed flap, the second lobe donor site is closed first. Therefore, placement and design of the second lobe proves to be crucial to the execution of the bilobed flap.

Four key principles are fundamental in the design and implantation of the flap.

Fig. 6 Bilobed flap. (A) Defect of the ala and tip with flap design. (B) Immediate postop. (C) 4-months postop.

1. The lobes must be designed in an area of relative skin laxity.
 - Often, the lobes are best fitted on the dorsum of the nose.
2. The plane of dissection must be chosen (submuscular vs. subdermal).
 - Submuscular dissection is relatively avascular and results in less pincushioning.
 - Either plane is suitable. The final choice should be at the discretion of the surgeon.
3. Postoperative care should be aggressive with silicone sheeting and scar therapy.
 - Scar therapy and dermabrasion should be offered at 6 and 12 weeks postoperation to minimize the flap scar.
4. Alar positioning is the foremost concern of the surgeon.
 - The entire design of the bilobed flap must be thought out before the incision and undermining. Improvisation

during the surgery very rarely results in acceptable outcomes. Furthermore, the distortion of ala is often irreversible or extremely difficult to correct.

At best, the bilobed flap is a compromise, but often the best compromise and choice in small-defect nasal reconstruction.

V-Y Advancement Flap

If transpositional flaps are not appropriate for the defect, a V-Y advancement flap can be used. Some authors use this flap instead of a nasolabial flap as the primary technique to fix alar defects.⁴⁵ The primary use for the V-Y advancement flap by the senior author occurs for nasal sidewall defects (►Fig. 7). The flap borrows from the cheek, where skin laxity is abundant relative to the nose. Unlike alar defects, where the re-establishment of the alar groove remains the primary concern, the advancement of a flap onto the nasal sidewall does not greatly disturb the borders

Fig. 7 V-Y advancement flap. (A) Defect of the tip with flap design. (B) Immediate postop. (C) 3-months postop.

of the nasal sidewall and allows ideal incision-scar placement.

The surgeon should take care to make sure the extension of the flap is superior. Great care should be taken to make sure the tension from the cheek closure does not result in ectropion of the lower eyelid. Avoiding the distortion of other nasal subunits, particularly the ala, should also be taken into account in the planning and design of the advancement flap.

Complementary Procedures

Dermabrasion, flap thinning, and aggressive scar management can dramatically enhance the final results. Good contour is essential to the aesthetic result of nasal reconstruction.¹ Dermabrasion is necessary in most Mohs reconstruction with few exceptions. Primary dermabrasion is typically not performed on healing full-thickness skin grafts due to the unpredictable healing course and fragile state of a graft. Therefore, dermabrasion is generally postponed until 6 weeks postoperatively.

Although dermabrasion has greatly improved aesthetic outcomes of small defect reconstruction, it will not mask an uneven closure of a wound or abnormal scar formation. A meticulously planned and executed repair is necessary.

Conclusion

When performing correction of a small tissue defect of the nose, many options are available. The surgeon should take into account the qualities of the defect, the various reconstructive options, and their own surgical strengths to determine the optimal technique for their patient. A delicate balance between the classic triad of form, function, and safety should be considered.

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