

Reconstructive Perspectives of Cutaneous Defects Involving the Nasal Tip

A Retrospective Review

Ryan M. Collar, MD; P. Daniel Ward, MD; Shan R. Baker, MD

Objectives: To create an algorithm that derives our preferred reconstruction technique for cutaneous defects involving the nasal tip and to review the management and outcomes of patients with nasal tip cutaneous defects after their initial reconstruction.

Methods: A retrospective review of patients undergoing repair of cutaneous defects involving the nasal tip between January 2006 and January 2009. After data compilation, a defect-based algorithm deriving our repair technique was created.

Results: Seventy-two patients were indentified: 57% underwent full-thickness skin graft repair (n=41), 19% underwent forehead flap repair (n=14), and 17% underwent bilobe flap repair(n=12). The remaining 7% underwent repair using nasal cutaneous flaps harvested adjacent to the defect (n=5). Nasal tip defect involvement of an adjacent nasal aesthetic unit was the most critical

factor in selecting a reconstruction technique. Further categorization by the presence of nasal ala involvement, cartilage exposure, and defect surface area allowed reliable prediction of our reconstruction technique. Dermabrasion was routinely performed early in the postoperative course (25% [18 of 72 patients]). Corticosteroid injection was commonly used for those undergoing forehead flap (71% [10 of 14 patients]) and bilobe flap (50% [6 of 12 patients]) repair. Aesthetic revision surgery was infrequently required (15% [11 of 72 patients]). All aesthetic outcomes were good or satisfactory.

Conclusion: The included algorithm offers a systematic approach for managing cutaneous defects involving the nasal tip and derives our preferred technique with high reliability.

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SUCCESSFUL REPAIR OF CUTANEOUS defects involving the nasal tip is of great consequence to the overall integrity of facial structure. Although the nasal tip is among the most prominent aspects of the face, the interplay of light and shadow across its complex contour also helps create and define essential nasal landmarks. Beyond this integral position and topography, varying skin thickness and texture add further complexity to reconstruction. With these critical characteristics in mind, a myriad of reconstructive strategies has been espoused for skin defects in this region.¹ Each sets out to match the natural skin texture, thickness, and color. Strategies also set out to restore normal topography of the nasal tip while respecting adjacent nasal aesthetic units.

The most commonly described techniques for nasal tip skin defect repair in-

clude bilobe flaps, full-thickness skin grafts (FTSGs), and interpolated flaps.²⁻⁴ Each technique is associated with distinct advantages and disadvantages relative to the goals of recreating natural skin texture and color and topography of the nasal tip while preserving aesthetic unit integrity.¹

Applying these reconstructive techniques to the nasal tip may be rewarding and challenging. Recreating a natural-appearing nasal tip restores facial balance and is of great value to patients. The challenge lies in choosing the proper reconstruction for a specified nasal defect. Herein, we present our experience with reconstruction of cutaneous defects involving the nasal tip over a consecutive 3-year interval. The objective was to identify those categorical factors that determine our approach to nasal tip defect repair and to organize these considerations into an algorithm that derives our preferred reconstruction with high reliability and repro-

Department of Otolaryngology, University of Michigan Medical School (Drs Collar and Ward), and Center for Facial Cosmetic Surgery (Dr Baker), University of Michigan, Ann Arbor.

ducibility. In addition, we review the management of patients with nasal tip cutaneous defects following their initial reconstruction.

METHODS

STUDY DESIGN

The University of Michigan Center for Facial Cosmetic Surgery maintains a patient registry of nasal tip defects repaired by one of us (S.R.B.). This registry was queried for those patients with defects involving the nasal tip between January 2006 and January 2009. Full-thickness defects requiring internal lining replacement were excluded.

After obtaining University of Michigan Institutional Review Board approval, medical records were reviewed. The following data were extracted: patient age, maximal defect diameter, tumor biologic findings, adjacent aesthetic units involved (if any), depth (superficial vs cartilage exposure vs cartilage transgression), repair technique (primary closure, bilobe flap, FTSG, forehead flap, or adjacent tissue transfer[ATT]), cartilage graft use (yes vs no), number and rate of required aesthetic revision procedures (excluding forehead flap inset, corticosteroid injection, or dermabrasion), number of dermabrasions performed, time to first dermabrasion, corticosteroid injection (yes vs no), time to corticosteroid injection, primary surgical site complication rate, donor site morbidity rate, aesthetic outcome, and follow-up period.

The primary surgical site complication variable was defined as any undesired nonaesthetic outcome requiring therapy (ie, hematoma, infection, and graft necrosis, defined as <90% graft survival). The donor site morbidity variable was defined as an unacceptable aesthetic or nonaesthetic (ie, infection or hematoma) outcome for which treatment was rendered.

The aesthetic outcome variable was defined as follows: (1) A good outcome was a pleasing outcome whereby no further treatment was recommended by the senior author (S.R.B) or desired by the patient at the final consultation (this includes patients who had received revision treatment before the final consultation). (2) A satisfactory outcome was an outcome whereby the senior author recommended further revision treatment that the patient did not deem necessary (this also includes patients who had received revision treatment before the final consultation). (3) A poor outcome was an unsatisfactory outcome that could not be corrected despite additional revision treatment.

Pearson product moment χ^2 and linear regression statistics were generated to measure the effect of surgical technique on relevant dependent variables. After data compilation, we created a defect-based algorithm that derives our most commonly used repair technique with high reliability.

SELECTED TECHNIQUES

All patients undergo skin cancer resection by our dermatology colleagues using Mohs micrographic technique. Resultant defects are repaired within 48 hours of tumor extirpation by one of us (S.R.B.). The procedures are performed with intravenous sedation and local anesthesia.

Full-Thickness Skin Graft

A template of the defect is created and used to mark the amount of tissue required from the donor site. The supraclavicular skin is most commonly used as a donor, but other sites such as the postauricular skin may be used. The graft is designed to be 10%

to 15% larger than the defect size to account for skin graft contracture. The FTSG is removed and the donor defect closed. All subcutaneous fat is removed from the deep surface of the graft. The skin graft is then positioned into the nasal tip defect and secured with interrupted absorbable suture. A bolster dressing is then applied and secured by tying opposing sutures spaced evenly around the periphery of the graft. The bolster is left in place for 5 days.

Bilobe Flap

Bilobe flaps require accurate geometric measurements. The radius of the defect is first measured. This distance is used to mark a point in the alar groove measured from the lateral border of the defect. From this point, 2 arcs are designed, one passing through the center of the defect and the other passing tangentially along the border of the defect most distal to the point. The bases of the 2 lobes of the bilobe flap are placed along the arc that passes through the defect center. The height of the first lobe is the distance between the 2 arcs; its width is equivalent to the defect width. The height of the second lobe is 1.5 to 2 times the height of the first lobe; its width is the same or slightly narrower than the first lobe. As measured from the initial alar groove point, the axes of the defect and the first lobe are 45° apart, and the axes of the first lobe and second lobe are approximately 45° apart. A triangle of skin lateral to the defect (the eventual standing cutaneous deformity) is marked with one border of the triangle parallel to the alar groove. Once precisely designed, the flap is elevated to a depth that matches the depth of the tip defect. Wide undermining of all nasal aesthetic units is performed in the subfascial tissue plane to decrease tension along closure lines. The donor site of the second lobe is closed first, followed by transfer of the first lobe into the defect and removal of the standing cutaneous deformity. We use precise layered suturing technique to further diminish tension and to optimally evert wound edges. A compression dressing is applied, and sutures are removed in 5 to 7 days.

Interpolated Paramedian Forehead Flap

A template of the skin defect is created to design the interpolated paramedian forehead flap based on the supratrochlear blood vessels. After designing the flap, it is elevated from superior to inferior superficial to periosteum of the frontal bone to the level of the brow. Wide subgaleal undermining usually allows wound closure of the donor site. This is performed using interrupted 2-0 polyglactin suture to approximate the muscle layer and running 5-0 polypropylene suture to repair the skin. The frontalis muscle and a portion of subcutaneous fat are removed from the distal aspect of the forehead flap. The flap is then transferred to the nose and sutured to the recipient site with a combination of vertical mattress 5-0 polypropylene suture and running 5-0 fast gut suture. Sutures are removed in 5 to 7 days. The pedicle of the forehead flap is detached, and the flap is inset 3 weeks later. If there is concern about the vascularity of the flap (eg, in smokers), the flap is not inset for 4 to 6 weeks.

RESULTS

Seventy-two patients with nasal defects involving the nasal tip skin underwent repair between January 2006 and January 2009. The mean age of patients was 64.2 years; 90% of defects resulted from removal of basal cell carcinomas.

Most cutaneous nasal defects (41 of 72 patients [57%]) were repaired using FTSGs (**Figure 1**). Nineteen per-

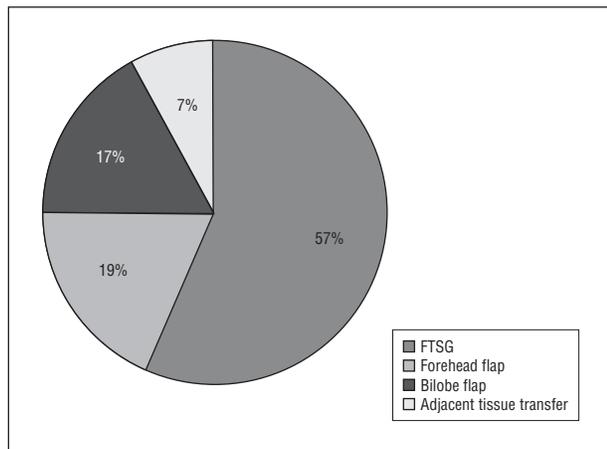


Figure 1. Percentages of patients in the series undergoing adjacent tissue transfer, bilobe flap, full-thickness skin graft (FTSG), and forehead flap repairs.

cent of patients underwent interpolated paramedian forehead flap repair, and 17% of patients underwent bilobe flap repair. The remaining 7% underwent repair using nasal cutaneous flaps harvested adjacent to the defect (ie, ATT). The ATT procedures included V-Y advancement flaps and bilateral advancement flaps.

The mean follow-up period was 7 months (range, 1-40 months). Patients undergoing forehead flap repair required a longer mean follow-up period (12 months) than those undergoing ATT (3 months), bilobe flap (5 months), or FTSG (8 months) repairs.

The mean maximal nasal tip defect diameter was greatest among patients receiving forehead flap repair (2.8 cm). The mean maximal defect diameter was greater among those who underwent repair with FTSGs (1.7 cm) than among those who underwent reconstruction with bilobe flap (1.3 cm) or ATT (1.0 cm).

Most defects were confined to the nasal tip (51 of 72 patients [71%]). Of the remaining patients with additional adjacent nasal aesthetic unit involvement, 48% included the ala, and 33% involved the nasal sidewall, nasal dorsum, or both. Twenty-four of 51 patients (47%) had defects with cartilage exposure. The remaining patients had superficial defects. No defect transgressed the cartilage (**Figure 2**).

All patients with isolated nasal tip defects with depth to cartilage and diameter exceeding 2 cm underwent forehead flap repair (3 of 3 patients) (**Figure 3**). Eight of 11 patients (73%) with isolated nasal tip defects with depth to cartilage and diameter between 1 and 2 cm underwent bilobe flap repair. All patients with isolated nasal tip defects with depth to cartilage and diameter less than 1 cm underwent ATT repair (3 of 3 patients). Most patients (28 of 34 [82%]) with isolated nasal tip defects of superficial depth underwent FTSG repair.

Twenty-one of 72 patients (29%) had nasal tip defects with adjacent aesthetic unit involvement (Figure 3). Eight of 10 patients (80%) with nasal tip defects exceeding 2 cm involving the ala underwent forehead flap repair. Four of 5 patients (80%) with nasal tip defects 2 cm or less involving the ala underwent FTSG repair. Four of 6 patients (67%) with tip defects involving nonala adjacent aesthetic units underwent FTSG repair.

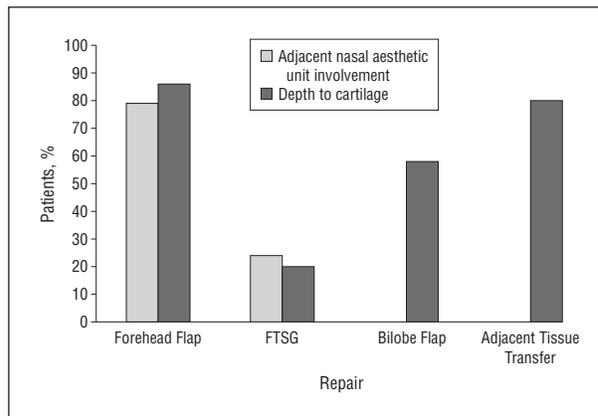


Figure 2. Nasal aesthetic unit involvement and defect depth among patients undergoing forehead flap, full-thickness skin graft (FTSG), bilobe flap, and adjacent tissue transfer repairs.

The primary surgical site complication rate (as already defined) among all patients was 6% (4 of 72 patients). Complications included partial FTSG necrosis requiring conservative management, hematoma accumulation beneath the forehead flap managed with drainage in the office, external nasal valve collapse after forehead flap repair that required flap debulking to relieve the nasal obstruction, and nostril collapse after FTSG repair of a large tip and ala defect requiring graft resection and forehead flap reconstruction with auricular cartilage support. No primary surgical site complications occurred in patients undergoing bilobe flap or ATT repair.

The overall donor site morbidity rate (as already defined) was 7% (5 of 72 patients). All instances occurred in patients undergoing forehead flap repairs. Four of 14 patients with forehead flaps (29%) required a return to the operating room for forehead scar revision, while 1 patient needed office-based treatment for localized infection.

Nasal aesthetic revision surgery was performed in few patients (11 of 72 [15%]). Of 11 patients returning to the operating room for revision, 2 had undergone repair with a bilobe flap (7% of 12 patients undergoing bilobe flap repair), 3 with an FTSG (7% of 41 patients undergoing FTSG repair), and 6 with a forehead flap (43% of 14 patients undergoing forehead flap repair) (**Figure 4**). Operative revisions included 6 flap debulking (contouring) procedures, 3 auricular cartilage graft placements for dome augmentation or external valve collapse, 2 temporalis fascia grafts for contour deformity, and 2 Z-plasty procedures for nostril margin notching or trap-door deformity.

Among all patients in the data set, the mean number of procedures required to achieve an acceptable aesthetic outcome was 1.4 (range, 0-3). The group undergoing forehead flap repair averaged more total procedures (mean, 2.4) than the groups undergoing other repair techniques. This trend is anticipated because all patients with forehead flap repair undergo inset procedures.

Dermabrasion was performed in 25% of patients (Figure 4). There was no difference in dermabrasion rates among groups undergoing the various repair techniques ($P = .48$). The mean and median times to first derm-

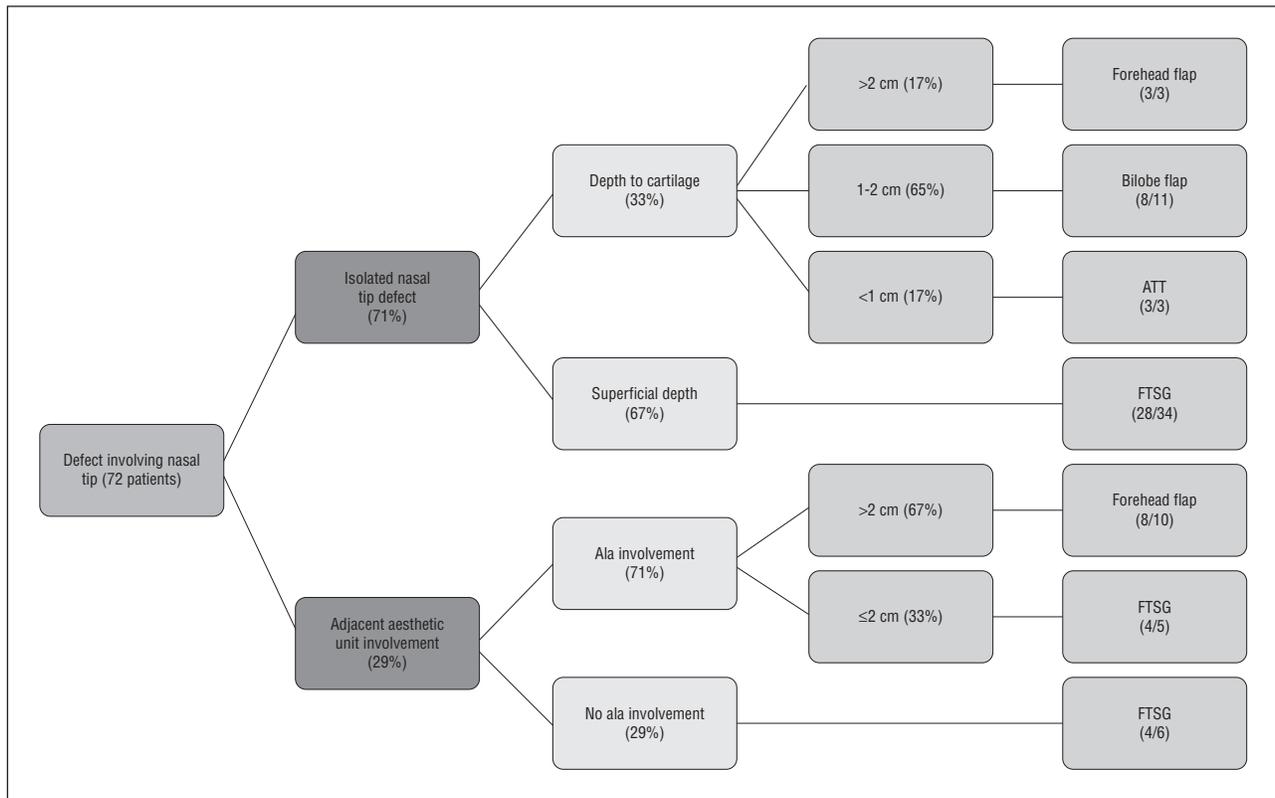


Figure 3. Algorithm deriving the preferred reconstructive technique of one of us (S.R.B.). FTSG indicates full-thickness skin graft.

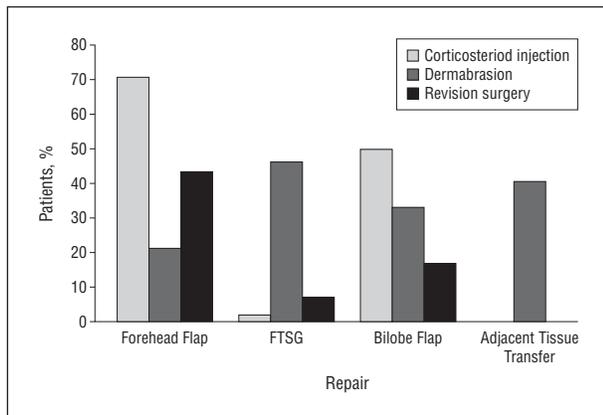


Figure 4. Rates of secondary procedure requirement among patients undergoing forehead flap, full-thickness skin graft (FTSG), bilobe flap, and adjacent tissue transfer repairs.

abrasion treatment were 5 and 4 months, respectively (range, 2-15 months). Among patients receiving dermabrasion therapy, the mean number of treatments was 1.1 (range, 1-2).

Twenty-two percent (16 of 72) of patients underwent corticosteroid injection (Figure 4). The mean time to first corticosteroid injection was 2.4 months (range, 1-5 months). This treatment was more commonly used for patients undergoing bilobe flap (6 of 12 patients [50%]) and forehead flap (10 of 14 patients [71%]) repairs.

Forty-six percent of patients (n=33) had a good aesthetic result. The remaining 54% (n=39) had a satisfactory result. No patient had a poor result. No statistically

significant difference in aesthetic outcomes was noted among groups undergoing the various repair techniques ($P = .56$).

COMMENT

Analysis of our data set suggests that adjacent aesthetic unit involvement, defect depth, and defect surface area represent the most important factors in our selection of a reconstructive technique for repair of cutaneous defects involving the nasal tip. From these findings, we constructed an algorithm that derives the preferred technique of one of us (S.R.B.) with considerable reliability (Figure 3). This algorithm is not intended to serve as a strict guideline. However, we contend that it offers a valuable systematic approach to management of skin defects involving the nasal tip. The algorithm divides defects into those that are isolated to the nasal tip and those that involve adjacent nasal skin.

For superficial defects isolated to the nasal tip, our strong tendency is to perform FTSG repair. In our data set, defects meeting these criteria that were reconstructed using FTSG ranged from 0.7 to 2.5 cm in greatest diameter. In such situations, we preserve all remaining nasal tip skin, even when defects involve greater than 50% of the tip aesthetic unit. Postoperative dermabrasion (required in 46% of patients undergoing FTSG) reduces conspicuous skin color and texture gradients at the graft margin, and aesthetic outcomes are usually favorable (Figure 5).

For isolated nasal tip defects with depth to cartilage, our choice for repair is determined by the defect surface



Figure 5. Patient undergoing full-thickness skin graft repair. A, A 2×2-cm superficial cutaneous defect of the lateral nasal tip. B, At 9 months after repair with a supraclavicular full-thickness skin graft. The graft was dermabraded.

area. For smaller isolated nasal tip defects (<1 cm) with depth to cartilage, we favor ATT repair. This typically entails V-Y advancement or bilateral advancement flap techniques. These repairs are favored over FTSG reconstruction because the latter is likely to result in contour irregularity due to the placement of a thin free graft into a small deep defect. The nasal skin used for ATT more favorably matches the color, texture, and thickness of the missing skin of the defect. Furthermore, because the defect surface area is limited, the degree of soft tissue recruitment afforded by bilobe flap or interpolated flap techniques is unnecessary.

When the surface area of an isolated nasal tip defect with depth to cartilage exceeds that which can be easily addressed with local advancement flaps and does not require interpolated paramedian forehead flap for repair, our practice is to use bilobe flap repair. Specifically, for intermediate-sized deep isolated nasal tip defects (diameter, 1-2 cm), our data set demonstrates a strong propensity to select a bilobe flap. Although this technique requires corticosteroid injection treatment in 50% of cases to deter trapdoor deformity, it provides a sufficient amount of nasal skin surface area to repair defects (**Figure 6**).

For large deep isolated nasal tip defects (diameter, >2 cm), an interpolated paramedian forehead flap repair is our clear preference. For these defects, we routinely resect any remaining tip aesthetic unit skin to propitiously place suture lines along aesthetic unit boundaries.

Despite the need for additional procedures (data set mean, 1.4 procedures [including inset]), the requirement of auricular cartilage harvest in 57% of cases, and the small added risk of donor morbidity, we favor the paramedian forehead flap for repair of large deep isolated nasal tip defects because it confers distinct aesthetic advantages. It offers ample flap thickness to deter contour irregularity, surface area surpassing that provided by local flap techniques, and favorable color match with native nasal skin relative to FTSG repair (**Figure 7**).

For nasal tip defects that involve adjacent aesthetic units, our data set included only FTSG and forehead flap repairs. The presence of ala involvement partitioned these multiple aesthetic unit defects into 2 categories with predictable strategies for reconstruction.



Figure 6. Patient undergoing bilobe flap repair. A and B, A 1.5×1.5-cm deep cutaneous and soft tissue defect of the lateral nasal tip. C and D, At 4 months after repair with a bilobe cutaneous flap. No revision surgery was performed.



Figure 7. Patient undergoing forehead flap repair. A, A 3.5×2.5-cm deep cutaneous and soft tissue defect of the nasal tip with extension to the nasal dorsum. B, At 1 year after repair with an interpolated paramedian forehead flap. A contouring procedure was performed.

For superficial cutaneous tip defects with sidewall or dorsum (nonala) aesthetic unit involvement, we tend to use FTSG repair. Sidewall and dorsum skin is thin and is comparable to the thickness of a skin graft harvested from the supraclavicular fossa. Therefore, superficial skin defects located in these areas adjacent to the tip can be treated with FTSG repair without adverse depression irregularities. Furthermore, because these defects are typically removed from the nostril margin, FTSG may be safely used without sig-

nificant risk for scar contraction and subsequent nostril notching.

In contrast, when a tip defect involves the ala, we consider FTSG repair only for smaller defects (≤ 2 cm). For larger (> 2 cm) nasal tip defects involving the ala, we routinely reconstruct the nose using an interpolated paramedian forehead flap. Because alar skin is thick, FTSG repair of defects involving the ala results in untoward depressed contour irregularities. In addition, larger defects that involve the ala encroach on the nostril margin. When repaired with FTSGs, such reconstructions are prone to notching deformities with graft contraction.

Our data set findings suggest that, for a subset of patients, adjunctive procedures are essential for achieving favorable aesthetic results. Secondary procedures included dermabrasion, corticosteroid injection, scar revisions, and contouring techniques (Figure 4). Dermabrasion was performed in 25% of all cases. Intervening at an early postoperative time point (median, 4 months) permits optimal resurfacing efficacy but does not jeopardize flap viability. Corticosteroid injection was used in 22% of cases (16 of 72) but was more commonly required for patients undergoing bilobe flap (50%) or forehead flap (71%) repair. We recommend frequent and preemptive use of corticosteroid injection in these cases to prevent trap-door deformity and to deter scar contracture that would potentially require revision surgery, hence our high rate of corticosteroid injection and low rate of trap-door development. The first corticosteroid injection occurs on average 2.4 months after reconstruction. Forehead scar revision is more commonly required for patients with forehead wounds closed under significant tension. This can occur when large nasal defects require a wide forehead flap.

Aesthetic revision surgery was required in few study patients (11 of 72 [15%]). These procedures were typically aimed to improve tip contour (contouring procedures for forehead and bilobe flaps or temporalis fascia insertion beneath grafts for FTSG). With frequent use of corticosteroid injection treatments in the early postoperative healing stage, only 1 patient (with a forehead flap) required Z-plasty to address trap-door deformity. By avoidance of FTSG repair for defects abutting the nostril margin, only 1 patient (with a forehead flap) required revision

surgery to correct notching of the nostril margin. No patient underwent more than 2 revision surgical procedures for aesthetic concerns.

In conclusion, a myriad of options exist for the repair of cutaneous defects involving the nasal tip. By categorizing defects based on depth, surface area, and the presence of adjacent nasal aesthetic unit involvement, we have demonstrated considerable consistency in our selection of reconstructive techniques. Although not intended to serve as stringent guidelines, the included algorithm offers a systematic approach for managing cutaneous defects involving the nasal tip and derives our preferred technique with high reliability.

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Correspondence: Ryan M. Collar, MD, Department of Otolaryngology, University of Michigan Medical School, 1500 E Medical Center Dr, Ann Arbor, MI 48109-5212 (ryancoll@med.umich.edu).

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