Reconstructing the Extended Nasal Tip Defect

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Abstract

Reconstruction of large facial defects requires surgical skill, an understanding of engineering principles, an artistic eye, and patience to design the most elegant solution for each patient. Extended nasal tip defects, which may involve additional facial subunits, require even more thoughtful analysis and planning. Reconstructive surgeons need to be aware of the pros and cons of various options for flaps, the use of a delay stage, and sequencing and scheduling of staged operations to achieve an optimal outcome.

Keywords

- Mohs reconstruction
- paramedian forehead flap
- facial reconstruction
- skin cancer
- nasal tip defects

Perhaps nowhere else in surgery do the skills of artistry and engineering come into more harmonious integration and balance than when a surgeon is called upon to reconstruct a large nasal-facial defect. In the simplest of clinical scenarios, such as when less than 1.5 cm of skin is missing and the defect is nicely contained within the boundaries of a single esthetic subunit, the reconstructive surgeon has multiple options to achieve a final elegant solution. However, reconstruction of an extended nasal tip defect requires an increased commitment to thoughtful planning and patient counseling, strategic timing of surgical stages, and a more creative application of subunit reconstruction principles.

Defining the Problem: The Extended Nasal Tip Defect

For purposes of this article, an extended nasal tip defect is defined as a defect that is both:

1. Larger than 1.5 cm in diameter.
2. Full-thickness (through and through).

It may also have one or more of the following characteristics:

1. Multiple full subunits removed.
2. Other partial subunits involved.
3. Extends beyond the nose, involving also the lip and/or cheek.

When an extended nasal tip defect presents itself, the reconstruction plan must take into account the artistry needed to recreate the proper appearance of this facial feature using autologous grafts appropriately to ensure that both form and function will be restored. This is where reconstruction takes on a higher level of complexity, but solving this challenge can be immensely satisfying.

When reconstructing the extended nasal tip defect, surgeons should be inspired to follow an important engineering principle: an *elegant solution,* which provides directed and practical solutions to its challenge while efficiently balancing the demands of time, materials, and other constraints. Reconstructive surgeons must draw not only on the practical and scientific qualities of an engineer but also on the creativity of an artist to achieve these goals. Experienced surgeons can quickly identify challenges, craft-efficient solutions, and optimize reconstructive results with each surgery. In short, they reconstruct extended nasal tip defects with the most elegant of solutions (►**Fig. 1**).

Philosophy

A popular adage tells us that, "Good judgment comes from experience but experience often comes from bad judgment." Although obviously a cliché, this quote clearly illustrates that experienced surgeons are less likely to be faced with complications with complex nasal reconstruction, probably because they have dealt with those complications earlier in their careers. Even for experienced surgeons, however, extended nasal tip defects are often extremely challenging, not only for the surgeon, who must plan the needed stages, but also—and

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Fig. 1 (A–L) Elegant solutions in extended nasal tip defect repair.

especially—for the patient, who will have to endure weeks or even months of abnormal appearance before a final optimal outcome is achieved. However, with thoughtful planning, appropriate patient counseling, and experience about where pitfalls of reconstruction are most likely to occur—and how to prevent them—these cases can be some of the most rewarding reconstructive journeys for both surgeon and patient.

One of the goals of this work is to share my experiences gained from over a decade of reconstructing a great number of extended nasal tip defects to inform and educate other surgeons about some of the finer details in the planning and execution of these multistage reconstructive surgeries.

Initial Patient Counseling and Planning

Depending on each surgeon's practice setup and referral norms, the initial meeting of the surgeon and patient is often within hours of the patient having left the Mohs dermatologist's office. Although this cannot be avoided at times, it is preferable to have a preoperative visit before the Mohs extirpation to discuss reconstructive options. The number of surgeries that need to be planned out for extended nasal tip defects can be numerous, and this information is all the more difficult for patients to fully assimilate if they are still in the initial "shock" stage of having just left the dermatologist's office with a large facial defect. Surgeons should develop practice systems that permit face-to-face consultations prior to the defect being created. These preoperative meetings are less anxiety filled, and patients are not as overwhelmed as they learn about and come to terms with the number of operations that will be necessary for a final elegant reconstruction.

For extended nasal tip defects, I find it helpful to introduce the patient to the concept of two rounds of surgery. The first round of surgeries will involve a forehead flap, possibly folded, and the requisite stages to reconstruct both internal and external nasal lining. The first round of surgeries ends with the division and inset of the forehead flap. When counseling patients, I set the expectation that there will be approximately 2 months of waiting after the end of the first round of reconstruction and the commencement of the second (final) round of reconstructive surgeries. These 2 months of waiting are critical, during which the normal processes of scar contraction and consolidation occur, giving time for the reconstructed nose to take on a more stable and permanent form. This is not to say that this stable form is the final shape; rather, it is this more stable form that results after a few months of scar consolidation that allows for even more accurate nasal contouring in the second round of reconstructive stages.

There are also psychological benefits to allow 2 months of downtime between the two rounds of reconstructive surgeries. Going through the first round of reconstruction takes a definite mental and emotional toll on the patient. Time off from work, an irregular facial appearance, and the stresses of recovering from multiple surgeries scheduled rather tightly together all add up to a patient who welcomes a break in the reconstruction schedule.

In simplest terms, the goal of the first round of surgeries is to get the "hole closed" and to assemble a combination of forehead skin, autologous cartilage grafts, and other tissues that closely resemble the appearance of a human nose. It is not critical to end the first round with a perfectly shaped nose; that high goal will be achieved after the second round of surgeries.

First Round of Reconstruction of Extended Nasal Tip Defects

Preoperative scenario 1: *Patient with through-and-through nasal tip defect, weighing pros and cons of various donor tissues for internal vestibular lining.*

This extended nasal tip defect is a fairly straightforward case in that it is full-thickness and is confined to half of the nasal tip, not involving other facial units. There are many choices for replacing internal lining, as this case will illustrate. Much has been written about many of the excellent choices for donor materials for internal lining. Hinge flaps, "bucket-handle" flaps, contralateral septal mucosal flaps, and folded forehead flaps have all been well-described.[1–3] I have tried each of these flaps, and they all have clear pros and cons.

Contralateral septal mucosal flaps: These can be more technically demanding to execute but they provide an excellent, supple, thin, mucosalized, and well-vascularized internal nasal lining. This internal lining choice can have higher utility when reconstructing a more petite (usually female) nose (►**Fig. 2**). Unfortunately, the highly technical design of this flap requires the creation of a small septal perforation. Although both the surgeon and patient will be satisfied initially with the results that are possible with this supple vascularized material, the iatrogenic perforation can, in some cases, slowly enlarge in the months and years following the initial reconstruction. The long-term consequences of an enlarging perforation can poison the initial positive reactions of both patient and surgeon to the donor material choice for internal lining. Septal perforations are by no means a minor inconvenience to patients and, in some cases, can result in significant long-term nasal morbidity. Adding to this problem, once a nose has been reconstructed with a forehead flap, the difficulty in opening the nose to repair the perforation is greatly increased.

Hinge flaps: Also known as trap door, turn-in, or turn-down flaps, hinge flaps provide alternative donor material for internal lining from the adjacent remaining skin of an esthetic nasal subunit. The thin nasal skin can be cut and turned over to create new internal lining. This donor material is most suitable for smaller defects of internal nasal lining—preferably less than 15 mm. Advantages of a hinge flap are that it allows the surgeon to control the new boundaries of the reconstruction so that final scars will be placed at esthetic subunit borders, whereas at the same time providing a nearby, well-vascularized, and thin piece of tissue to act as a new lining. Because hinge flaps end up being pedicled on a thin bridge of dermis with scant subdermal tissue, their blood supply is random and less robust. This is an excellent time to consider adding a delay stage 7 to 10 days prior to flap execution to provide a more robust vascular supply.[4–6]

Folded forehead flaps: Folded forehead flaps are the modern-day workhorse for full-thickness nasal reconstruction for all of the same reasons that paramedian forehead flaps (PMFF) are the mainstay for complex nasal reconstruction: potential for abundant skin and tissue, axial pattern blood supply, and ability to be shaped and thinned. The folded forehead flap, therefore, provides several advantages for internal lining reconstruction.

Like all donor material choices in reconstruction, folded forehead flaps come with their own set of challenges that (only partially) offset their utility. Most often, they result in hair-bearing skin replacing the internal nasal lining. However, because both men and women have nasal vestibular hair, this downside is minor and can usually be dealt in long term by use of a nasal hair–trimming device. Another downside of the folded forehead flap is that they are inherently bulky. The bulk can be dealt with via a few different strategies. I often perform a surgical delay stage prior to the actual flap inset stage. This delay stage allows a very think distal flap to be raised that will replace internal lining and still have a robust vascular supply relative to how thin it is.

When using a folded forehead flap, there will be too much tissue bulk at the time of initial flap inset, which will postpone requisite cartilage grafting by one stage. A predictable pattern of staged reconstruction using a folded forehead flap for through-and-through defects is:

- *Stage I: Surgical delay*. This stage is not always necessary and is based on surgeon judgment. This is a preparatory stage wherein the flap template is meticulously designed and the flap incised, raised out of the forehead (with the distal-most portion raised quite thinly), and immediately replaced. Around 7 to 10 days are allowed to pass.
- *Stage II: The folded forehead flap is brought down with the thinned distal skin paddle folded internally for new lining.* Flap thinning is performed again in this stage, as in the delay stage. The external skin paddle is attached to the native nose and also sewn to the folded portion of the new internal lining where appropriate. Cartilage grafts are not placed at this stage. There is simply too much bulk present, and grafts will be placed in more anatomically accurate positions in the next stage. Twenty-one days are allowed to pass.
- *Stage III: The internal flap is separated from the main PMFF.* By this stage, it has established its own blood supply from the native nose. Delayed primary cartilage grafts are placed. Often, these will replace previously resected tip cartilages and will begin to create a "gapless" cartilage

Fig. 2 (**A–D**) An example of a more petite female nose (**A**) where the choice of a contralateral septal flap was used (**B**). The final result is satisfactory with patent nares bilaterally (**C, D**). A small septal perforation initially ensued which slowly enlarged in the years following the initial repair, resulting in moderate patient morbidity in long term.

lattice on which to reconstruct the entire lateral nasal vestibular sidewall. Twenty-one days are allowed to pass.

- *Stage IV: The external skin paddle is detached superiorly from the main "trunk" of the PMFF.* The flap is partially thinned but left mostly attached to the reconstructed nose. Thinning and contour refinement are performed to the degree possible. The forehead donor "trunk" is excised and the forehead repaired. This concludes the first round of surgeries. Second round will commence in approximately 2 months.

In summary, folded forehead flaps for internal lining are thicker than hinge or contralateral septal grafts, but they have the significant advantage of axial rather than random-pattern blood supply, and they can be designed into just about any shape or size needed for internal lining reconstruction. They do require de-bulking, and they move hair to the inside of the nose. All in all, they provide many advantages for a variety of reconstructive scenarios, and their disadvantages are easily managed.

Preoperative scenario 2: *Patient missing part of the medial cheek.* Just as it would be unwise to start building a house on a concrete foundation that was still setting up and curing inside the concrete forms, it is illogical to try to build a nose onto an upper lip or medial cheek that is being reconstructed in the first surgical stage. For that reason, it is optimal to reconstruct the missing cheek tissue and/or upper lip tissue in what will be the "foundation preparation" stage. In cases where the patient is missing hemi-tip, medial cheek, and upper lip, there are simply too many different tissue movements, advancements, and placements required. To attempt to perform all of them in one setting will create far too many unpredictable

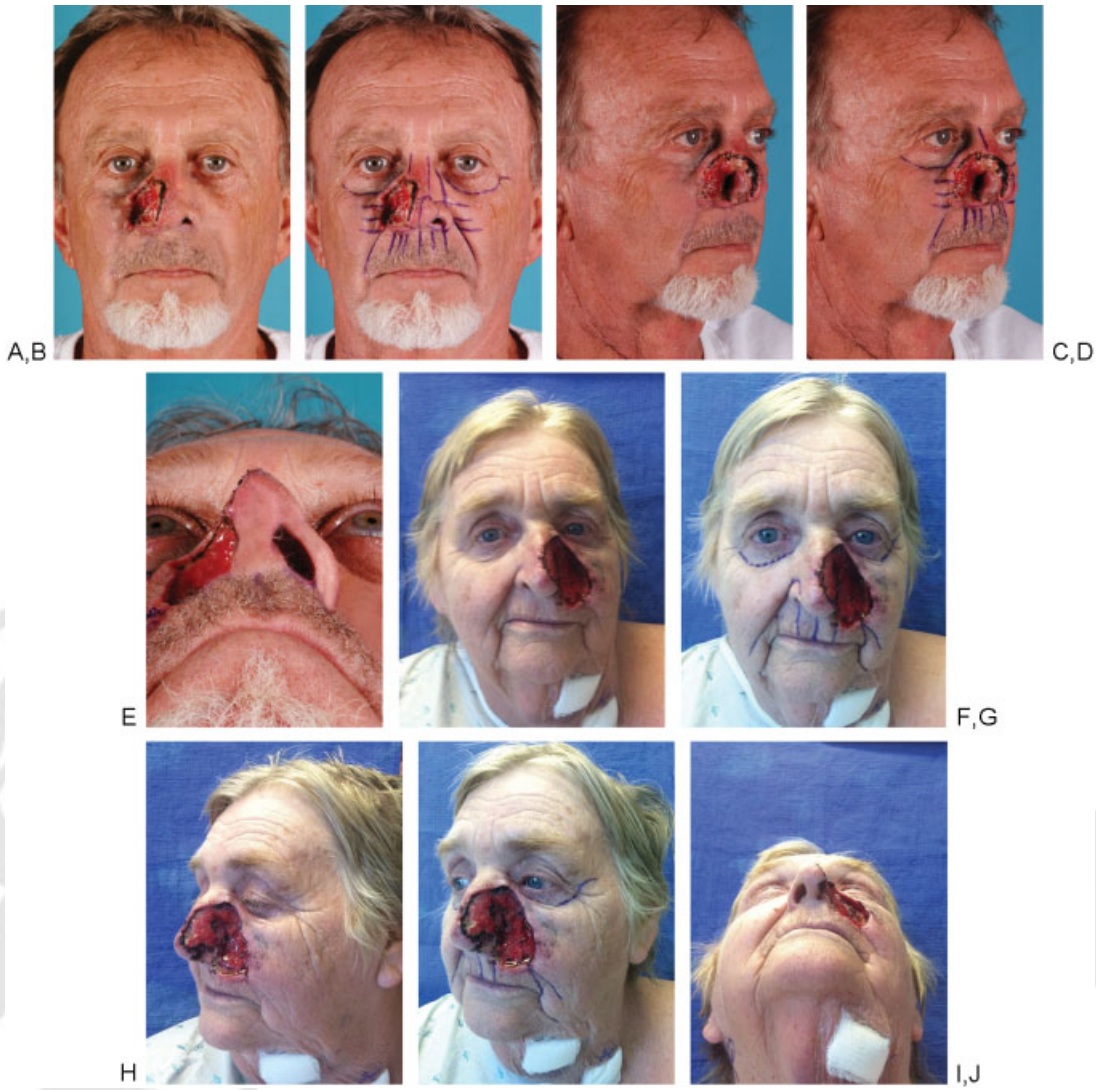

Fig. 3 (A–J) Extended nasal tip defects that involve the medial portion of the cheek, frontal, and profile views also shown with surgical markings that help define aesthetic subunits. Establishing a stable base on which to build a nose will be done with a preparatory advancement of the cheek that extends a few millimeters medial to the actual border of the nasal sidewall and cheek subunits.

forces of tension and scar contracture. For example, there is no point in putting a patient through a three- or four-stage full-thickness hemi-tip reconstruction if the nose does not end up perfectly positioned on the face/cheek and upper lip. It is a far more appropriate allocation of surgical priorities to make one's first priority establishing a stable foundation on which to build a nose. The missing medial cheek and/or upper lip are reconstructed first. Around 2 to 3 weeks later, after the "foundation has set," a paramedian forehead flap can be brought down and exactly positioned onto the proper location on the face. To put in another way, frame your house on a stable foundation and not on a concrete foundation that is still setting up and curing.

In this scenario, both patients are missing medial cheek along with approximately half the full thickness of the hemi-nose (►**Fig. 3**). The female patient is also missing a significant portion of the left upper lip. In both cases, it was determined that the patients would need to have their cheeks (and upper lip for the female patient) reconstructed. In this "foundation preparation" stage, the cheek was advanced to a point that was just slightly medial to the aesthetic subunit border of the cheek and lateral nasal sidewall. By slightly overcorrecting the amount of medial movement of the cheek, the surgeon will be able to come back and surgically define the medial border of the cheek exactly where it should be after 2 to 3 weeks of initial flap settling (►**Figs. 4**, **5**).

The forces of scar contracture never cease to humble the reconstructive surgeon, which is why it is advantageous to advance the cheek a few weeks before in-setting the forehead flap. If the cheek advancement and flap inset were to be done at the same time, then two structures—the advanced cheek and the inset forehead flap—would pull at each other. This can lead to subtle shifting of the entire nose laterally and a suboptimal final result.

After the folded forehead flap is inset the patient is left with a "blob" (for lack of a more descriptive medical term) of tissue resting on the face (►**Fig. 6**). A lot of hand-holding is needed at this step to reassure the patient that an elegant looking nose will be the final result of the reconstruction process. Most patients at this stage are not able to fully comprehend how the

Fig. 4 Following the preparatory advancement of the cheek, the cheek flap is advanced 3 mm medial to the cheek/nose aesthetic subunit border (**A, B**). In the subsequent stage, the surgeon can incise exactly on the aesthetic subunit border of the cheek and nose, setting the stage for ideal subunit reconstruction (**C, D**).

"blob" in the center of their faces will rapidly start transforming into the shape and function of a human nose. However, the surgeon should be confident that if the initial planning and template design were performed correctly, the final reconstruction will look realistic and optimal.

Preoperative scenario 3: *Patient's extended defect of tip crosses midline to contralateral side and/or involves midline*

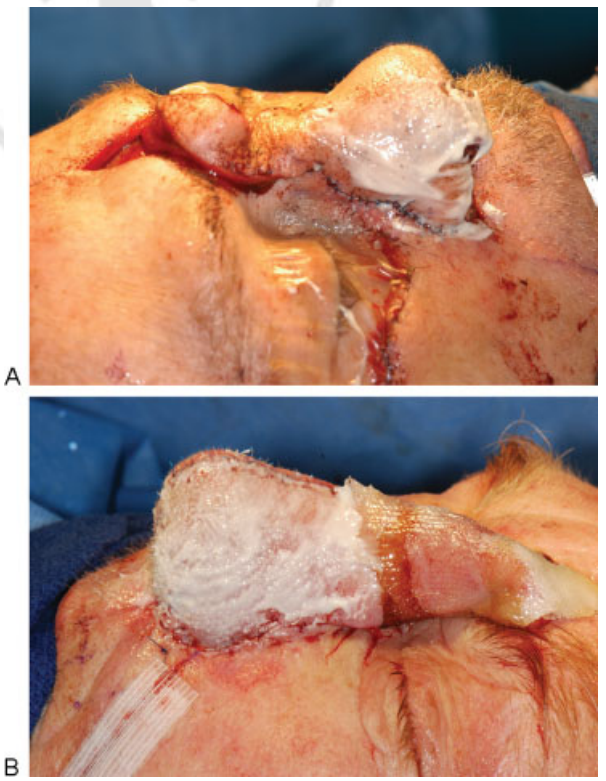

Fig. 5 (**A, B**) Flap in place. Note the use of nitroglycerin ointment on flap.

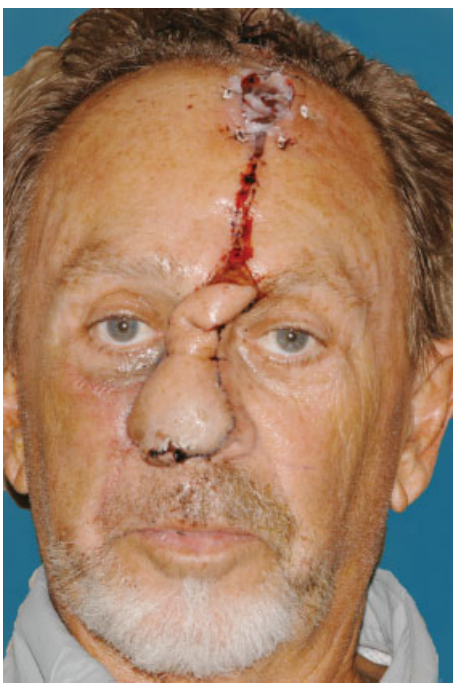

Fig. 6 Folded forehead flap the day after the operation. There is plenty of bulk and tissue but the general subunit borders have been respected and the patient is set on a good trajectory for an elegant outcome.

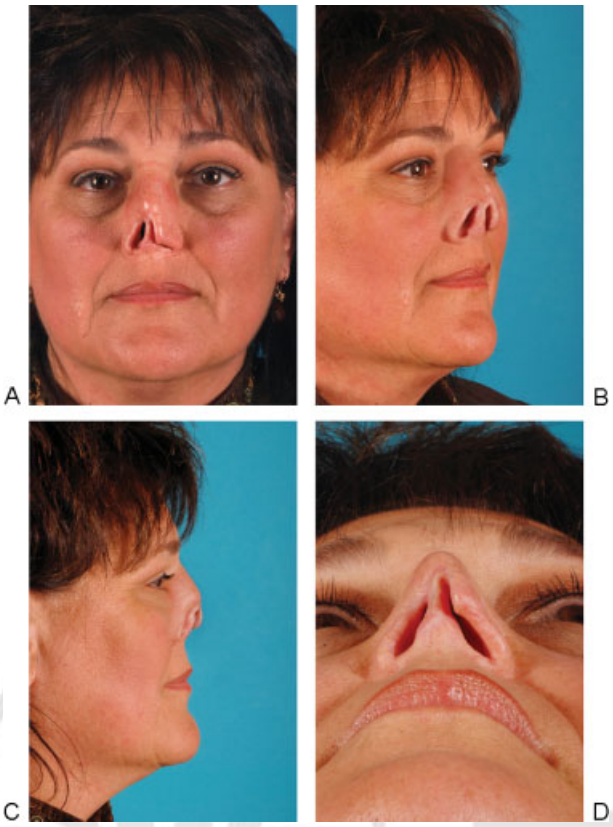

Fig. 7 (A–D) An extended tip defect that involves bilateral alar subunits as well as most of the columella.

Fig. 8 Design of hinge flap. Arrow indicates arc of rotation.

columella One of the key issues in extended tip defects reconstruction is knowing which tissues to remove, which to keep, and which may be kept but used to reconstruct a different aspect of the nasal anatomy. With careful thought and planning, elegant solutions for the most complex defects can be formulated but they may require the design of multiple templates until the most elegant solution presents itself. These types of decisions can be time consuming and are best done in a preoperative planning visit—not in the high-pressure atmosphere of the OR staff rushing to start the next case.

In this case, well over 50% of the left hemi-tip was still intact (►**Fig. 7**). However, the patient needed bilateral internal nasal linings. For that reason, it was determined that the external skin of the left hemi-tip could be incorporated into a hinge flap. The remaining hemi-tip subunit skin would be used to provide internal nasal lining for the left vestibule. This skin of the hinge flap was relatively thin and supple, and it decreased the overall bulk of her complex multisubunit reconstruction (►**Fig. 8**). Missing nasal units and autologous replacement tissues were identified as follows:

1. Left internal nasal lining: repaired with hinge flap from remaining left hemi-nasal tip subunit.
2. Right internal lining: repaired with extension "branch" off of the main "trunk" of folded forehead flap.
3. Bilateral nasal tip subunits: repaired with PMFF main "trunk" (axis).
4. Columella structural support: repaired with septal cartilage.
5. Columella skin: repaired with PMFF main axis.
6. Nasal bridge: repaired with PMFF "trunk."

The template used to design the flap for reconstruction of this patient's extended nasal tip defect took 45 to 60 minutes of drawing, cutting, planning, and most importantly, thinking. Designing the template was almost like a simple form of origami, as I had to determine the best way to replace the missing external skin including the columella, create a "branch" off the main PMFF "trunk" that would provide internal lining for the missing right nasal vestibule, and keep the majority of the flap at the best possible orientation so that an axial pattern blood supply was placed most optimally down the center of donor skin.

This type of decision making and planning of templates is crucial and is another excellent explanation for why it is preferable to have a preoperative consult with the patient more than a day in advance of the repair. Not only does this allow the patient to begin to come to terms with the reconstructive journey on which they are about to embark but it also gives the surgeon sufficient time to ponder various ways of designing the donor flap. A key thought to bear in mind is:

> *Spending a disproportionate amount of time on initial template design will pay dividends several times over when everything comes together with beauty, elegance, and a safe, robust blood supply.*

The combination of flaps strongly influenced the decision to surgically delay both the paramedian forehead flap as well

Fig. 9 A, Delay of donor flap with (A) the proximal course of the supratrochlear artery, (B) the distal part of the extension "branch" that will become the new right internal vestibular lining, (C1) the proximal part of the extension "branch" that will become the right external hemi-tip , (C2) the proximal part of the flap that will become the left external hemi-tip, and (D) the distal part of the flap that will become the external lining of the columella. **B**, Delayed recipient hinge flap from left hemi-tip and right alar base. **C**, 3/4 view of delayed hinge flap that will become left internal lining.

as the left hemi-tip hinge flap (►**Fig. 9**). This delay was performed 7 to 10 days prior to the first stage of the repair (►**Fig. 10**).

Initial Template Design as It Relates to Final Alar Rim Symmetry

Achieving symmetrical alar rims is made all the more difficult when one must repair a full-thickness defect that involves the alar rim. The traditional technique of PMFF nasal subunit reconstruction has been to create a flap that exactly replaces the tissue and/or subunit that has been removed. However, I prefer to use a folded PMFF for most full-thickness alar subunit reconstructions and have learned that it is often very advantageous to leave an additional 2 to 3 mm of tissue at what will eventually be the alar rim. My reasoning is that, during the course of a multistage full-thickness alar subunit reconstruction, the distal part of the flap, which will become the new alar rim, is the part of the flap most vulnerable to distal ischemia and poor wound healing. If traditional design of the skin paddle is followed, and only an exact amount of replacement skin is brought from the forehead to the missing alar subunit, the symmetry of the final reconstruction will be

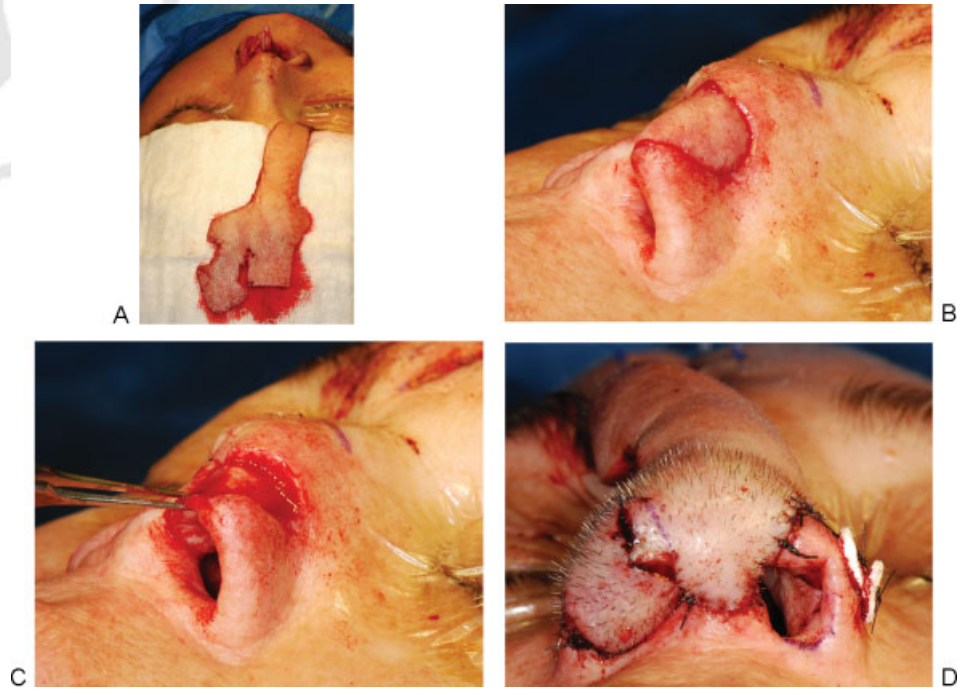

Fig. 10 The surgical delay phenomenon. (**A**) The portion of the forehead flap, which is not in direct alignment of the supratrochlear vessel, was delayed to increase its vascularity and to permit the raising of a thinner flap. (**B, C**) The left hemi-tip skin has been surgically delayed to provide a more robust blood supply to this thin and supple tissue used to create a left nasal vestibular lining with a hinge flap. (**D**) Composite reconstruction of delayed folded forehead flap along with delayed native nose hinge flap.

Fig. 11 (A–D) Examples of how flap necrosis almost always occurs at the distal margin of the flap—the future alar rim.

in serious jeopardy if there is any distal flap necrosis resulting in a paucity of tissue at the alar rim (►**Fig. 11**).

A more elegant solution, however, is to purposefully leave 2 to 3 mm of tissue in the skin paddle in the area that will eventually become the alar rim. One can always debulk the alar rim to create near-perfect symmetry, but it is another matter altogether to build it up if there is tissue loss and the rim retracts, and it would require multiple additional operations in an effort to reconstruct the missing tissue at the alar rim.

A Sidebar on Bridge Skin Replacement

Although the bridge is sometimes minimally involved in extended nasal tip defects, the amount of reconstruction that is needed at the tip is likely to end up looking more like a "ball" stuck onto the end of the nose unless the entire bridge is replaced along with the tip. By adding the bridge subunit to the final design of the forehead flap, the patient will have less "patchwork" appearance of skin (►**Fig. 12**).

Structural Issues: Choice of Cartilage Donor Material(s)

Defects involving midline columella can present a particular challenge to the reconstructive surgeon. Borrowing again from engineering principles, the caudal septum and midline columella (with the cartilaginous medial crura cartilages) are critical support structures for the entire nose. Much like a center stabilizing beam supports the roof and structural integrity of an A-frame house, if the central support system of the reconstructed nose is not solidly engineered, the entire nasal tip reconstruction will be at risk for asymmetry, slanting, and decreased functional support of the vestibular inlet. Making things even more difficult is the fact that a normal (functional) columella is a relatively thin nasal subunit. A thick columella may provide the required structural integrity and strength but if it is too bulky it will result in bilateral narrowing of the external nasal valves medially. Engineers do not build things just to be strong; they build them to be both strong and light. Surgeons must remember this general principle as it relates to forehead flap reconstruction: It is

Fig. 12 (A–D) Examples of nasal tip and bridge reconstruction where the final result looks less "patchwork" when the entire bridge subunit is replaced along with the tip subunit(s). The skin thicknesses and texture blend together into a much more uniform visual appearance.

not enough to take a large rib graft to create central support to the nose unless that support has also been engineered to be both strong and of acceptable minimal bulk.

Remembering that "experience comes from bad judgment," I urge reconstructive surgeons to avoid the temptation to overly thin down this external skin during earlier stages. The goals of the initial reconstructive stages as they pertain to this important area of central support should focus on a symmetrical and structurally sound "central beam" on which the rest of the nose will eventually be cantilevered. Thinning can be delayed until later stages when the nose has contracted into its final shape. This contracture also makes the reconstructed nose more rigid and strong. In most cases, septal cartilage will prove to be of adequate strength and quantity to provide rigid central cartilaginous support.

One pearl with regard to septal cartilage as a donor material when utilizing a folded forehead flap to repair a full-thickness defect: When folded forehead flaps are used, the cartilage grafts are placed in a delayed stage that is one stage after the bulky folded forehead flap is brought down. If the surgeon anticipates needing septal cartilage as an autologous graft material, it is critical that this septal cartilage be harvested in the same stage as the insetting of the folded forehead flap. Otherwise, it is very difficult to have sufficient visual access to perform a septoplasty if a bulky folded forehead flap is already sewn in place. The harvested septal cartilage can be easily banked in the forehead and retrieved 3 weeks later.

In cases where there is inadequate septal cartilage and a strong piece autologous cartilage is needed, rib cartilage makes an excellent second choice. The piece required is usually only 2 to 3 cm in length and can be easily obtained with only modest donor site morbidity (►**Fig. 13**). Basic principles of handling and carving rib cartilage should be applied. It is optimal to harvest the rib early and allow it to sit submerged in NS for 30 to 60 minutes to allow initial warping to occur.[7] The central "core" of rib is then carved to remove approximately equal amounts of excess cartilage from each side of the core. By evenly carving away the lateral/external portions of the rib, chances of further warping and distortion are reduced significantly. I have not found it necessary to use K wire, although this technique does have a history of reliability when borrowing from the reconstructive rhinoplasty literature.[8]

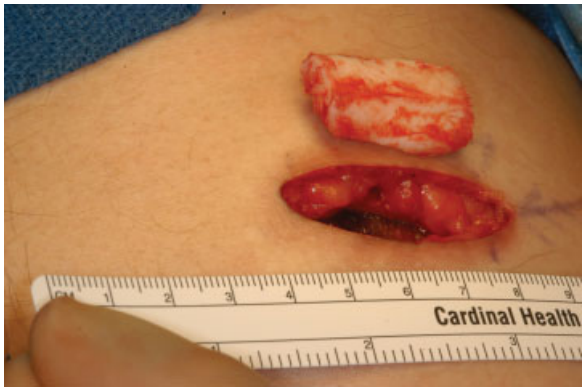

Fig. 13 Rib cartilage has been harvested.

End of First Round

After placement of delayed primary cartilage grafts, another 3 weeks will pass before moving onto division and inset of the forehead flap. Patients should be educated that this represents the end of the first round of reconstructive stages. Most patients will want further reconstruction that focuses on improving external contour in areas such as the supra-alar crease as well as widening the vestibular inlet through thinning and debulking. Patients with significant medical comorbidities or a lower esthetic standard may consider their reconstructions done after this first round. The next section is devoted toward the techniques necessary to get the patient to a state of maximal reconstructive outcome, both esthetically and functionally.

Interim Treatment Options

During the 2 months separating the first and second rounds of reconstruction, in-office soft tissue treatments with triamcinolone injections can be performed to create subtle but important improvements in tissue contour, bulk, and what is often referred to as areas of "stubborn edema." I usually begin with triamcinolone at a final concentration of 2.5 mg/mL (mixed with lidocaine and bicarbonate for patient comfort) in 0.1 mL aliquot injections from a 1-cc tuberculin-type syringe for each approximately 5 mm^2 of edema. Typically, the first injection is performed 3 weeks postoperative and will be administered to the deep dermis or top layer of subcutaneous fat. When injected intradermally, the surgeon should see skin blanching (►**Fig. 14**). The patient will follow-up in 4 weeks. If no appreciable effect is noticed, an increased triamcinolone concentration of 5 mg/mL will be injected, continuing with 0.1 mL aliquots per approximate 5 mm^2 of persistent tissue edema.

Fig. 14 The diluted triamcinolone injections are classically injected intradermally or in the most superficial subcutaneous fat. Soft tissue atrophy will occur focally in the areas injected, with results visible 2 to 4 weeks after injection.

There is a definite art to this technique, and the learning surgeon is advised to proceed slowly, spreading treatments over longer intervals, perhaps 6 weeks initially, until familiarity is gained with how much edema will resolve with a given injection. Keep in mind that one can always inject more triamcinolone at a later time. If significant progress in contour is being achieved with these triamcinolone injections, it can be advantageous to delay the second round of reconstructive surgeries by a few weeks to allow time for one or two additional sessions of injections.

Second Round Two of Reconstruction of Extended Nasal Tip Defects

Completing the first round of reconstruction is a significant accomplishment. At this point, patients have something that closely resembles a human nose. However, depending on exact planning details, the future nose may still require additional surgical stages until an optimal result is achieved. In my practice, after the first round of surgeries, I can expect the reconstructed nose's appearance to have some or all of the following characteristics (►**Fig. 15**):

1. The alar margin will be very close to where it should be with a purposeful few extra millimeters of tissue present.
2. If an internal nasal lining was also reconstructed, it is expected that the vestibular opening will be stenotic yet hold the potential for good patency if the autologous cartilage grafts were properly positioned and placed in the preceding first round of surgeries.
3. The supra-alar crease will almost always be a bit too full and will need definition and "deepening" to resemble the normal contralateral side.
4. If the apical triangle was involved, it may need to be recreated as well.[9]
5. If the upper lip was involved, the amount of "pink lip" show may need to be refined.

The following question now arises: In which order should these remaining face and nose elements be reconstructed? My advice is not to hold slavishly to a set sequence of stages for this second round of surgeries. Rather, study each patient closely before embarking on the second round of surgeries, and let surgical experience and good soft tissue analysis be your guide—not some "ordained" order of surgical sequencing. With that being understood, I usually prefer to surgically define the alar margin as the first stage of the second round of reconstructive surgeries.

Surgically Defining the Alar Rim

There are several reasons that I normally choose to define the alar rim margin as the first stage of the second round of surgeries. After this stage, when the alar margins are almost

Fig. 15 (A–D) Examples of several patients after the first round of surgeries. Each patient has slightly excessive tissue at the alar rim margin. This sets the stage to return to surgery and surgically define a (near-perfect) symmetrical alar rim after 2 months of scar contracture and consolidation has been allowed to occur.

Fig. 16 (A–D) Examples of several patients about to embark on the second round of surgeries. The reconstructed nose has some purposefully created extra tissue along the area that will be the alar rim margin. Careful surgical markings done prior to the first stage of the second round of surgeries will help the surgeon create an alar rim margin almost exactly where it should be.

perfectly symmetrical, the reconstructed nose has a subjective A+ appearance, and both surgeon and patient are often very satisfied with the appearance of the nose. Also, surgical defining of the alar rim allows access to the nasal vestibular opening, making this one stage the single surgery, which results in nearly perfectly symmetrical bilateral alar rims as well as improvement in nasal function by restoring patency to the stenotic nasal vestibule. The details of creating a patent vestibular inlet have been described in detail elsewhere.[10]

The surgery to create alar rim symmetry begins approximately 2 months after the first round of surgeries. The patient is seen preoperatively, and the unaffected side's alar rim is carefully studied and marked. I find it helpful to mark the lowest visual border of the alar rim just where the shadow is cast and the internal nasal vestibular lining begins (►**Fig. 16**). After the unaffected side is marked, the reconstructed side is carefully marked. This is done with the patient sitting upright and the surgeon looking straight at the patient while slowly moving the patient's head from side to side to make sure the entire course of the alar rim is accurately marked on the reconstructed side.

Once the entire alar rim new border is marked on the affected side, the patient should then be viewed from the base. In most cases, the well-marked alar rim will also define how much tissue must be removed (from the base view perspective) to maximally restore vestibular patency (►**Fig. 17**).

During the surgery, the incision is initiated exactly at the line that was marked and determined preoperatively (►**Fig. 18**). This access provides excellent exposure to the thickened scar and subdermal tissue that is contributing to the vestibular stenosis. Time is taken in this dissection to remove this obstructing tissue without button-hole violation of the neo-internal nasal vestibular lining. An internal lining flap is raised very thinly, and this access provides an excellent opportunity to debulk tissue and increase the patency of the vestibular inlet (►**Fig. 19**). It is critical to remove subdermal tissues only and not cartilage grafts placed to reconstruct the alar sidewall. If auricular cartilage is excised, the skin will contract around this solid tissue void, and an alar notch will likely develop. The incision is closed with fine interrupted (not running) sutures (►**Fig. 20**). If the surgeon believes that not too much stress was placed on the blood supply to the alar region, the supra-alar crease reconstruction can be performed in the same setting.

If the surgeon judges that the creation of the alar rim margin and increasing of vestibular patency was enough "vascular stress" on the tissues for one surgical stage, the patient can be brought back to surgery for the supra-alar

Fig. 17 (**A**, **B**) Once the alar rim margin is drawn on the patient from their frontal view (seen in Fig. 16B), the same markings will most often define exactly where the incision needs be placed to also open up the vestibular inlet from the base view.

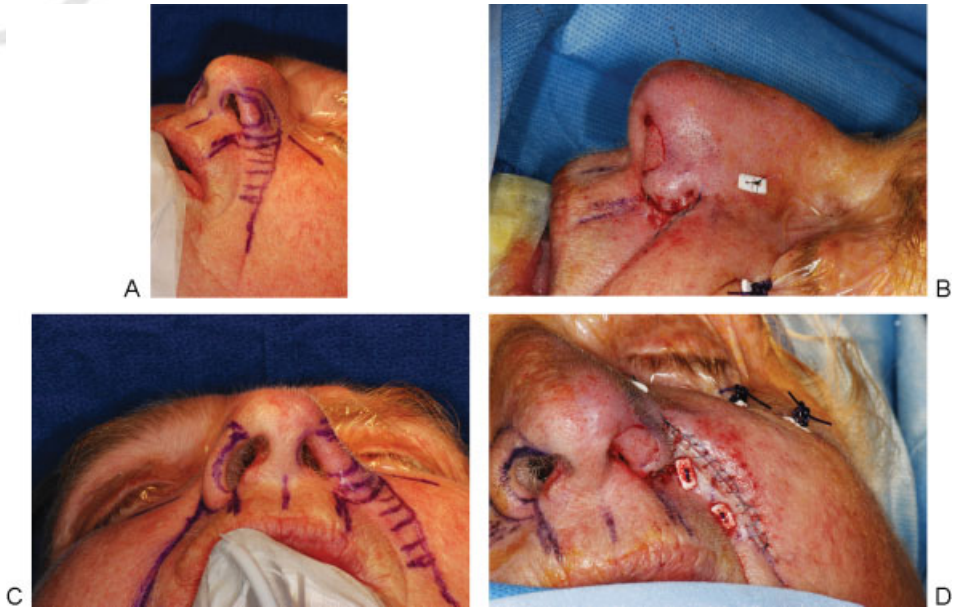

Fig. 18 (**A**, **C**) Preoperative markings that exactly define the alar rim margin as well as other contour features of the ala. (**B**, **D**) Incision is made exactly where the future alar rim margin will be.

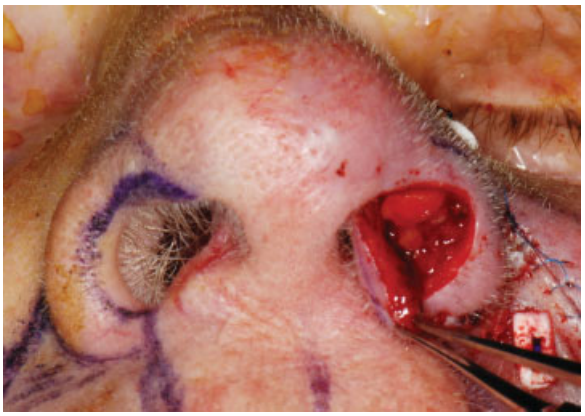

Fig. 19 The internal lining flap is raised very thinly to provide excellent access to define the alar rim margin and to debulk tissue contributing to stenosis.

crease reconstruction 2 to 3 weeks after the alar margin stage. The surgeon should always bear in mind the potentially devastating consequences of combining too many incisions and "too much" surgery into a given stage. Each case is unique, and the surgeon must consciously decide if it

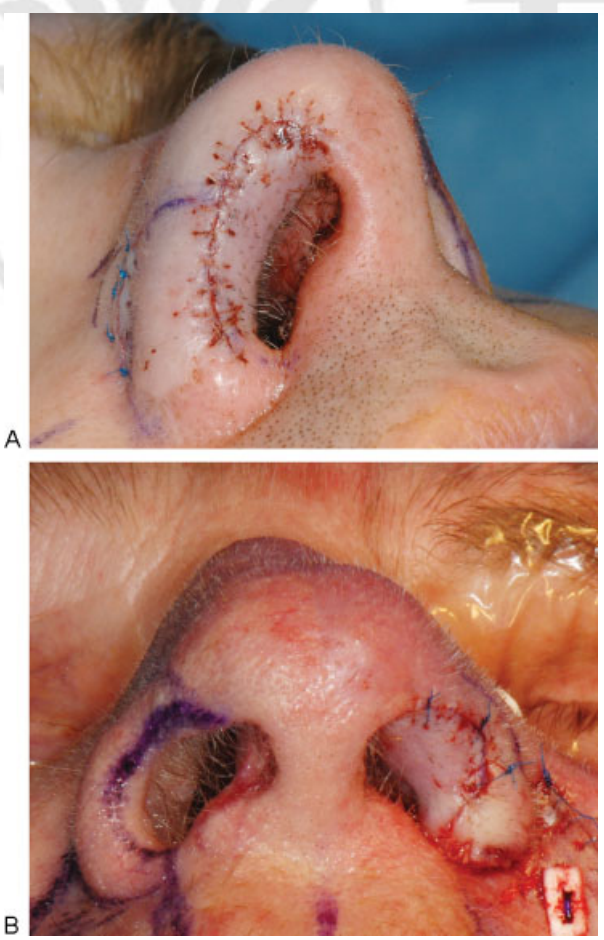

Fig. 20 (A, B) Examples of the alar rim incision near the end of the operation, closed with fine interrupted sutures.

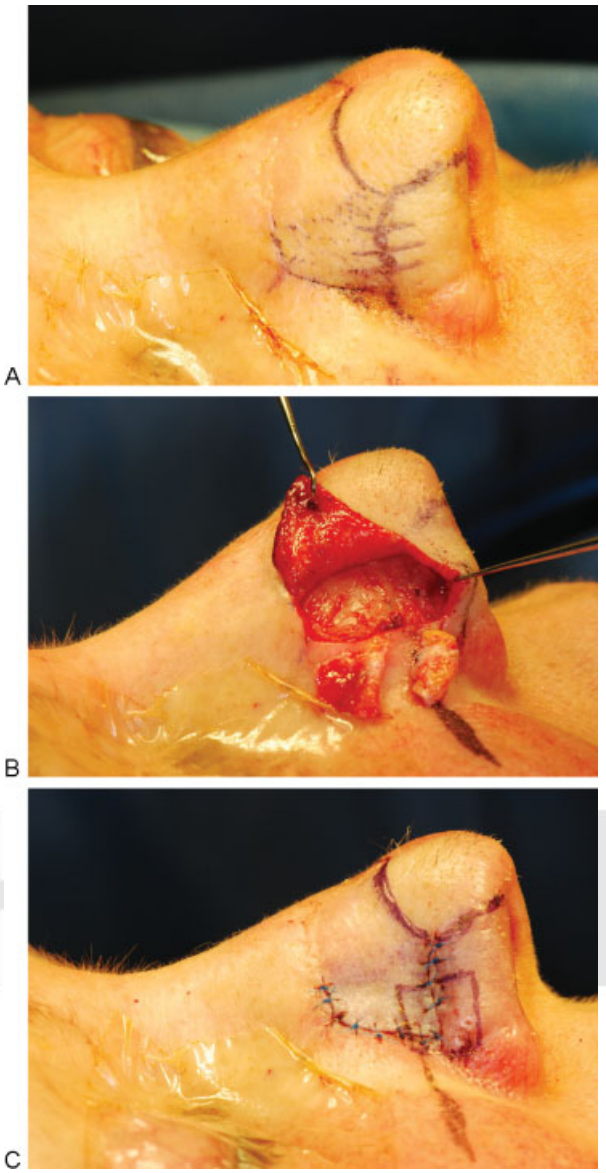

Fig. 21 (A) Horizontal lines mark areas of needed concavity to accurately mimic the supra-alar crease. (B) Superior and inferior flaps raised. Note that tissue that was debulked is seen in photo. (C) Incision closed with fine interrupted monofilament sutures. Area of needed maximal concavity marked with a fine black square.

is prudent to divide these two operative goals into distinct surgical days or if it is safe to combine them. If they are to be combined, the surgeon must always consider whether or not the risk of a partial necrosis of the reconstructed nose is too high. Whether to combine or separate these steps is at the surgeon's discretion and is always guided by prudent judgment on the basis of experience that will increase with time and the number of reconstruction cases performed increases.

Recreating the Supra-Alar Crease

A curved incision is placed, which closely replicates the natural semilunar crease of the unaffected side. Here, the surgeon must rely on an artistic eye to judge exactly how

Fig. 22 (A) PTFE pledgets (commonly used in vascular surgery). (B) Two PTFE pledgets placed exactly over the area of needed concavity as marked in Fig. 21C. PTFE pledgets sutured securely in place with through-and-through 5–0 nylon sutures.

much subdermal tissue to remove superiorly and inferiorly from this incision point. The subdermal tissue is removed with the surgeon's sharp instrument(s) of choice, with my preference being the 6900 Beaver blade (Becton, Dickinson and Company, Waltham, MA), which works well in tight places, cuts on all three edges, and allows for precise artistic control as if holding a pencil or paintbrush. Removal of subdermal tissue, in my mind, is a step that is the perfect blend of art and engineering: The artistic eye judges how much tissue to remove to create a realistic supra-alar crease, and the engineering brain carefully removes just enough tissue with well-chosen instrumentation and technique (►**Fig. 21**). To add gentle and even soft tissue compression without the "cheese-wire cutting" effect of the suture placed directly against the skin, tie 5–0 nylon suture over PTFE pledgets (Covidien, Mansfield, MA) (►**Fig. 22**).

Dermabrasion: The Final Stage

Once all of the above stages are combined into an elegant reconstruction solution, partial dermabrasion is offered to the patient as a final stage. In the majority of cases, this procedure is well indicated. It provides further reconstructive refinement of the incision edges and can also "smooth out" minor surface contour abnormalities. Another positive reconstructive benefit that I have personally observed but is not extensively discussed in the literature is that dermabrasion often provides better long-term color-matching of the reconstructed tissues. In many cases, the skin of the forehead will have been exposed to less sun than the nose, making the reconstructed nose appear paler than the native nose. During dermabrasion, the entire nose, reconstructed as well as unaffected portions, is dermabraded down to an endpoint just below the junction of the papillary and reticular dermis.[11] During the weeks that follow the dermabrasion, the entire nose will take on the slightly pink hue that is typical of resurfaced skin. For reasons that are not completely clear to me, this pink hue seems to impart a long-lasting "color difference mellowing" between the forehead skin and that of the native nose. The two skin types simply appear more closely matched in color in the majority of patients and skin types, and the effect persists in long term.

Conclusion

Extended nasal tip defects can be initially psychologically devastating to patients and provide a robust surgical challenge to even the most experienced reconstructive facial surgeons. These defects require a surgeon who has the qualities of both an engineer and an artist and may even demand those of a psychologist.

The extended nasal tip defect is best approached by adhering to the principle of two rounds of surgery. The first round is to reconstruct missing internal and external lining, provide a structurally stable middle layer, and leave the patient with a small amount of excessive tissue along the alar rim margin. The second round of surgeries, performed approximately 2 months after the first round, will define the alar rim margin perfectly, improve nasal vestibular stenosis, and create a natural contour to the supra-alar crease.

Spending an appropriately extensive amount of time thinking, drawing and cutting various templates, and strategizing the order and timing of reconstructive stages, rather than jumping right into surgery, will, in the end, provide the most elegant of solutions to our patients.

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