Introduction:

Dermatologic surgeons often perform nasal reconstructive procedures following the extirpation of cutaneous malignancies. The nose occupies a prominent place in the center of the face, making it a structure of obvious aesthetic significance. The delicate reconstruction of this facial structure following tumor removal procedures cannot be overemphasized. With thoughtful attention to surgical planning and use of proper surgical technique, the dermatologic surgeon can restore both the form and the function of the nose.

History of the Procedure:

The reconstruction of the nose goes back thousands of years. The ancient Hindus are credited with the first nasal reconstruction attempts. In ancient India, punishment involved having one’s nose cut off, and such a defect was reportedly first repaired by transposing a cheek flap. The Italians also used reconstructive techniques for the nose during the Renaissance. The Branca family and Tagliacozzi experimented with flaps and rhinoplasty techniques. However, the British documented the Indian techniques of reconstruction they saw during their time in the subcontinent. Gillies, of England, formulated rules and techniques for nasal reconstruction. These efforts were passed on, expanded, and refined to form the multitude of reconstructive options available today.

Problem:

Planning an operation involves not only the examination of the operative defect but also a discussion concerning the patient’s wishes for reconstruction. Several important aspects must be developed in the reconstructed nose. As described by Burget, contour, color, texture, and function are all important aspects in the reconstructed nose.1,2,3

Before determining how to properly perform nasal reconstruction, the aesthetic and anatomical breakdown of the nose must be understood. Anatomically, the nose is made up of a vascular lining, alar tip cartilages (sculptured cartilage), bone braces that buttress the dorsum and sidewalls of the nose, and thin skin that matches the rest of the face. Thus, when a deformity is present, the actual tissue missing must be delineated, whether it be the cover (skin), lining (mucosal lining, septal mucosa), or framework (septal hard
tissue, alar cartilages, upper lateral cartilages, nasal bones, alar fibrofatty tissue). Also, the anatomical location of the defect and the surface extent of the defect must be examined.

**Presentation:**

Initially, attention to the wound or wounds created by trauma or neoplasm excision is necessary. Determining the location, breadth, and depth of the wound or wounds is critical. Some small wounds may not require surgical intervention (eg, small defects of the medial canthus that may heal successfully by secondary intention), while other larger wounds may require extensive planning with a multistaged approach. The quality of surrounding skin and any indication of compromised vascular supply, such as scarring due to prior surgery or radiation therapy, should be considered. Identification of adjacent tissue with similar texture, color, and sebaceous gland density improves the aesthetic outcome. These factors often dictate the type of flap or graft needed for reconstruction.

Functional deficiencies such as airway patency should be identified and addressed prior to graft or flap placement. Prior existing asymmetry, functional deficiencies, and the possibility of skin mismatch are a few of the issues that need to be discussed with the patient prior to surgery.

**Relevant Anatomy:**

The anatomy of the nose is complicated because of the intricate arrangement of shadowing concavities and light-reflecting convexities. The surgeon should be aware of both the topographic anatomy and the internal anatomy of the nose before proceeding with any nasal reconstructive procedure. A review of nasal topography should be undertaken, and the surgeon should be acquainted with the concept of facial aesthetic units.

Most dermatologic surgeons are confronted with small-to-medium–sized nasal wounds; therefore, the concept of nasal skin types (as espoused by Dr Gary Burget) is perhaps more relevant than the concept of nasal aesthetic subunits. In brief, this concept states that the nose has areas of thin, loose, and compliant skin. These largely forgiving areas are typically located on the nasal dorsum and sidewalls. After a transition zone, the nasal skin of the supratip, the tip, the infratip lobule, and the alae becomes thick, sebaceous, noncompliant, and unforgiving. The differences in skin types can be appreciated with an examining hand, and an accurate assessment of nasal skin types and transition zones is critical to the aesthetic success of any nasal reconstructive procedure.

For the dermatologic surgeon, the internal anatomy of the nose is also relevant to surgical success. Nasal musculature is not terribly important for functional purposes; however, this musculature can dilate the nares in times of extreme inspiratory need, and it can serve a purpose in defining the nasal valve mechanism. More importantly perhaps, the nasal musculature provides a luxurious source of perfusion for random pattern cutaneous flaps.

Fortunately, the arterial supply of nasal skin is redundant. The nose has an arterial supply from both the external carotid system (facial/angular artery) and the internal carotid system (ophthalmic artery branches in the area of the medial canthus). The underlying cartilaginous framework of the nose should also be reviewed prior to initiating any reconstructive procedure. This review has particular importance in the area of the middle/lateral nasal alae, since cartilaginous bolsters do not support potentially mobile alar margins. The lateral nasal alae can frequently be deformed during surgical reconstructive procedures that place even modest wound-closure tensions in directions that are not exactly parallel to the alar margins.
Indications:

The first step in any surgical procedure for skin cancer occurring on the nose is to ensure adequate tumor removal. The Mohs micrographic surgical technique has been documented to have unparalleled success in the treatment of nonmelanoma skin cancer of the nose. On the nose, subclinical tumor extension is often dramatic, and this extension can make excision with traditional surgical margins inadequate. The Mohs technique allows accurate identification of clinically inapparent tumor spread because the technique is a systematic examination of all lateral and deep surgical margins.

If access to Mohs micrographic surgery is not possible, every effort should be made to document the adequacy of surgical excision prior to contemplating reconstructive procedures. The surgeon should assess the need for a reconstructive procedure after adequate tumor removal. Reconstructive procedures are typically offered when the wound is deemed unsuitable for secondary intention healing.

Even on a delicate nose, secondary intention healing can result in aesthetically acceptable results when the wound is small and shallow. Areas of the nose that heal well by secondary intention include the concavity of the nasal root in the area of the medial canthus and the concavity of the alar groove. Secondary healing typically produces acceptable results when the wound is less than 1 cm in diameter, less than 4-5 mm in depth, and greater than 5-6 mm in distance from the mobile alar margin. A reconstructive procedure should be considered if these wound criteria are not satisfied. Reconstructive procedures have the opportunity to increase the speed of healing, to prevent disastrous wound contraction that produces functionally significant deformity, and to produce aesthetically optimal results.

Contraindications:

Nasal reconstruction methods have few contraindications. If the patient tolerates tumor extirpation well, a nasal reconstructive procedure will likely be tolerated. Care should be exercised when previous surgical procedures or radiation therapy have altered the nose because perfusion of nasal tissues then becomes highly unpredictable. Care should also be exercised in patients who use tobacco heavily; however, the influence of cigarette smoking on the survival of small nasal flaps is likely limited unless tobacco use is extreme. Other medical conditions that may have a negative impact on the success of nasal reconstruction (as with any surgical procedure) include bleeding diatheses, chronic malnutrition, underlying severe disease/general debility, and unrealistic patient expectations.

Technique:

Before beginning any reconstructive procedure, the physician should adequately assess the surgical wound that has resulted from tumor extirpation. Particular attention should be directed toward determining the breadth, depth, and anatomical location of the wound because these factors have a dramatic influence on the selection of the most appropriate reconstructive technique. The quantity and quality of tissue surrounding the wound should also be noted.

Importantly, the surgeon should attempt to locate areas of adjacent tissue that share similar characteristics of skin color, sebaceous density, texture, and porosity with nasal skin. The presence of old surgical scars and radiation therapy stigmata should be identified on the nose because these factors may predict inadequate cutaneous perfusion of adjacent tissue. A careful, prospective examination of the nose must also determine any functional deficiencies prior to the initiation of a reconstructive procedure. Failure to correct functional problems before covering the nasal wound with a flap or a graft may produce problems that are difficult to surgically correct later.
The surgeon should evaluate the symmetry of the alar margins before beginning any reconstructive procedure. Although some minor degree of alar asymmetry is common, the patient may not have recognized this prior to the surgical procedure. With the increased visual attention placed on the nose during the postoperative period, the patient may inappropriately blame the surgeon for slight degrees of asymmetry.

Intraoperative details

Linear repair

Small wounds on the nose can often be repaired in a simple linear (side to side) manner, which is often advantageous because the complexity of the operative procedure is low; therefore, the patient’s morbidity is diminished. The linear closure produces a predictably simple scar that is often aesthetically ideal. Unfortunately, many areas of the nose are not suitable for linear repairs because of the unavailability of mobile tissue, particularly in areas of the nasal tip and the alae. Therefore, linear repairs are often limited to areas of the lateral nasal sidewalls and the central nasal dorsum.

Tissue redundancies (dog ears) on the nose are permanent and visually distracting; therefore, their creation should carefully be avoided. In the area of the upper lateral nasal sidewall, linear closures should be oriented to point toward the medial canthus, following the relaxed skin tension lines in that area.

Nasal soft tissue wounds on the central dorsum, the nasal supratip, and the nasal tip can also be considered for linear repair when they are small (ie, <1 cm in diameter). A surgical ellipse created around these circular wounds should extend to a length-to-width ratio of at least 4:1, eliminating the potential for a distracting dog-ear deformity. The distal part of the nose does not have any identifiable relaxed skin tension lines; therefore, closures in this area should be oriented vertically to prevent alar asymmetry. As with all linear closures on the nose, the tissue should be undermined at the level of the perichondrium. The wound is approximated by using buried vertical mattress sutures following meticulous hemostasis. Particular attention is paid to wound-edge eversion on the sebaceous areas of the nose because surgical scars tend to invert in thickly skinned areas.

Although the linear closure on the nasal tip can be satisfying (see images below), it unfortunately is only available for small wounds (<1 cm). Larger linear closures on the nasal tip produce unacceptably high wound-closure tension, which promotes wound-edge ischemia and more visible scarring in the nasal tip area. Such higher wound-closure tensions also produce an artificially flared appearance to the nasal ala. An interesting variant of the linear closure for wounds located off-center in the area of the supratip is the recently described Burow-type advancement flap, which can serve to close smaller wounds while maintaining alar symmetry.
Split-thickness skin graft

Split-thickness skin grafting can occasionally be considered in the repair of nasal wounds; however, more aesthetically appropriate alternatives are almost always available. Although split-thickness skin grafts can be used to cover large wounds on the nose, the aesthetic success of the grafts is often compromised by the propensity of the graft to significantly contract and to develop unsightly hyperpigmentation. While the graft offers little hope for aesthetic success, split-thickness skin grafts should be considered to provide only
biological/functional coverage of the nasal wound. Therefore, split-thickness skin grafting plays a role in nasal reconstruction only in the patient who can tolerate surgery or in the case of a particularly virulent neoplasm when a more involved reconstruction is delayed to observe the potential of the tumor's persistence.

**Full-thickness skin graft**

In nasal reconstruction, full-thickness skin grafting is typically a better aesthetic option than split-thickness skin grafting. Full-thickness skin grafts contract much less than split-thickness skin grafts, thereby minimizing the risk of aesthetically significant alar distortion. Full-thickness skin grafts typically retain a more natural color, and they can often maintain textural characteristics (eg, visible pores) that reflect the quality of donor sites. Full-thickness skin grafts are an important nasal reconstructive modality, but the author believes that well-designed and executed random pattern cutaneous flaps often exceed full-thickness skin grafts in the final aesthetic results. Therefore, the author relies on full-thickness skin grafting as a repair technique in only 20-30% of nasal wounds encountered.

The author selects full-thickness skin grafting as a reconstructive modality when secondary intention healing, linear repairs, and uncomplicated flap repairs are not suitable. Typically, full-thickness skin grafting is selected for large wounds of the nose. The author believes that full-thickness skin grafting has an important role in the reconstruction of the nasal tip and the ala because flaps moved into these areas can cause tremendous nasal distortion if not carefully designed and executed. Full-thickness skin grafts are most appropriate in reconstructing shallow nasal wounds. Because full-thickness skin grafts need to be thinned prior to grafting, the grafts should be relied on to
The early result (8 wk) of the repair is acceptable. The slight amount of hyperpigmentation of the skin graft will likely resolve without further surgical intervention.

The most important predictor of graft success is the quality of the recipient bed. Therefore, the use of electrocautery is minimized carefully during the tumor removal procedure to adequately preserve the perfusion of the recipient site. The recipient site should be shallow, and the presence of a perichondrium is typically required in areas of the nasal tip to promote graft viability. A number of donor sites are easily accessible to the surgeon. The author favors a conchal bowl donor site for the reconstruction of small-to-medium-sized nasal defects. The skin in the conchal bowl tends to be thicker, and the presence of visible
pores makes it more closely resemble the nasal tip skin. In addition, studies have suggested that the adnexal/sebaceous gland density of the conchal bowl skin most closely approximates that of the nasal tip tissue; therefore, conchal skin grafts should be expected to be more aesthetically appropriate than grafts from other donor sites.1

Although full-thickness skin grafts are visually most appropriate when used in the nasal sidewall areas, the author often finds that the sidewall areas are often more easily reconstructed with other surgical techniques. Therefore, the author largely limits the use of skin grafts to areas of the nasal tip and the alae. After a graft has been harvested from an appropriate donor area, the skin graft is attached to the recipient site by using nonabsorbable sutures. The suturing technique is performed such that the skin graft is adequately anchored to the recipient bed, producing a visible concavity of the skin graft at the conclusion of the procedure. Central basting sutures are loosely tied in the skin graft to prevent lateral traction on the graft. If the sutures are tied too tightly, the resulting pleats of the graft become permanent. The author believes that the use of bolster sutures is not necessary. Sutures should be removed within 1 week.

**Random and axial pattern cutaneous flaps**

Random and axial pattern cutaneous flaps are particularly important in nasal reconstruction. Cutaneous flaps offer the surgeon the ability to replace missing nasal tissue with tissue of a similar color, texture, and porosity. These flaps are often 1-step procedures, and the aesthetic results typically exceed those of secondary intention healing and full-thickness skin grafting when appropriate surgical design and technique are used.

With experience, flap reconstructions of the nose are predictable; however, the procedure has several disadvantages. Because significant undermining is associated with flap reconstructions on the nose, the patient's morbidity may be increased. Additional incision lines on the central part of the face need to be made to create cutaneous flaps. The aesthetic outcome can be disastrous in the absence of surgical expertise. If the surgeon lacks a complete understanding of flap biomechanics, flap necrosis and nasal distortion can occur. Necrosis particularly is an unfortunate complication because it introduces a larger surgical defect on the nose.

Nonetheless, with proper experience, flap repairs of the nose offer significant advantages. Therefore, flaps constitute a large percentage of nasal reconstructive procedures performed by the author. Although a full discussion of the various flaps relevant in nasal reconstruction is beyond the scope of this article, some general comments are appropriate regarding the flap techniques that are more commonly used. In selecting a flap with which to perform reconstruction, the surgeon should pay particular attention to tissue availability on the nose. The skin of the nasal tip and the ala is sebaceous, noncompliant, and thick; therefore, flaps raised within this skin can commonly cause permanent iatrogenic asymmetry of the distal part of the nose. Particularly in men with sebaceous/rhinophymatous skin, the performance of flap surgery on the distal part of the nose can be problematic.

The surgeon should also assess the architectural stability of the lateral nasal ala before any flap repair on the distal part of the nose is performed. If the lateral ala is unsupported, additional flap bulk moved into this area will likely cause alar collapse and permanent functional compromise.

**Rhombic transposition flap**

The primary advantage of a rhombic transposition flap is the ability to move tissue from an area in which it is more readily available to an anatomical area that lacks sufficient tissue availability. The rhombic flap also reorients wound-closure tension vectors, which can be particularly important in minimizing alar...
distortion. Although rhombic flaps are frequently used on the nasal tip, the author tends to avoid them in this area because of their tendency to produce unattractive nasal tip and alar distortion. Most of the rhombic transposition flaps that the author uses on the nose are located along the lateral nasal sidewall and the glabellar areas. These flaps can donate more proximal nasal skin to distal areas that lack sufficient tissue availability.

Rhombic transposition flaps can minimize the addition of incision lines to sebaceous distal nasal skin. Although a multitude of rhombic flap designs are available to the surgeon, the author prefers a modified Dufourmentel design. This design allows easy closure of a circular wound while minimizing any dog-ear redundancies at the origin of the flap.
At 8 weeks, the aesthetic result from the repair is excellent.

**Bilobed transposition flaps**

The bilobed transposition flap is a workhorse flap for nasal reconstruction. In the author’s opinion, the bilobed transposition flap is the reconstructive modality of choice for soft tissue wounds located on the distal aspect of the nose. Unfortunately, the use of the flap is typically limited to nasal wounds that are less than approximately 1.5 cm in diameter. The Zitelli modification of the bilobed flap's design has further
improved the usefulness of this flap. The bilobed flap offers the ability to replace missing skin on the distal aspect of the nose with skin of a similar quality obtained from more proximally located nasal areas. When designed and executed properly, the bilobed flap almost always excels in reconstructing the distal part of the nose.

At 8 weeks after flap repair, the nose has healed nicely without additional intervention. The surgeon should prospectively determine the amount and the direction of tissue availability to minimize distortion of the nose. A proper flap design should then be selected. The Zitelli modification offers distinct advantages over the traditional Esser flap design touted in many plastic surgery textbooks. The flap should be appropriately sized to prevent secondary motion at the recipient sites of the flap. To minimize distortion, both the primary lobe and the secondary lobe of the flap should be equally sized to the recipient sites. When possible, the donor site of the secondary lobe should be placed perpendicular to the alar margin to prevent unanticipated alar elevation. Once the design factors have been considered appropriately, the flap should be definitively incised. The incision should be carried to the depth of the perichondrium or the periosteum.

Wide undermining is critical in properly executing the bilobed flap because it dramatically improves the mobility of the flap, minimizes the likelihood of nasal distortion, and diminishes the likelihood of the flap undergoing pincushioning. Because the undermining is performed at the level of the perichondrium or the periosteum, the nasal musculature, replete with highly anastomotic blood vessels, is included in the flap's base. Hemostasis is achieved, and the flap is transposed to fill the primary and secondary surgical defects. Because the dog-ear redundancy is prospectively removed at the edge of the primary defect, the flap is easily transposed to fill the surgical defect.

To minimize the likelihood of alar displacement, the tertiary defect is closed initially. Buried vertical mattress sutures are used, and the retracted muscle is again reapproximated to diminish the appearance of the incision lines. After the tertiary defect is closed, the primary and secondary lobes of the flap are subsequently positioned. Vertical mattress buried sutures are used to align the flap, and the epidermal closure can then be performed rapidly with a running suture. Intraoperative flap modifications should be performed if alar displacement is identified. Undermining the inferior margin of the primary defects along the alar rim is among the most useful of the modifications.

**Dorsal nasal rotation flap**

The dorsal nasal flap offers particular advantages for reconstructing nasal surgical wounds that are greater than 1.5 cm in diameter. When properly designed and executed, the dorsal nasal flap excels in the repair of large distal nasal defects. Similar to the bilobed transposition flap, the dorsal nasal flap offers the ability to replace missing nasal tissue with tissue of a similar color and texture; however, the dorsal nasal flap is a much more involved reconstructive procedure than that of the bilobed transposition flap. Incision lines are long, and the aesthetic result can be undesirable if expert technique is not used. More importantly, dramatic distortion of the nose is likely if proper modifications of the flap are not undertaken. If modifications are not appropriately designed, the vascular input of the flap can become precarious. If the blood supply is compromised, a necrotic flap on the nose produces a greatly enlarged surgical defect.

The dorsal nasal rotation flap demonstrates many of the nuances of rotation flap reconstruction of the face. Care should be taken to elongate the arc of the rotation flap so that the secondary defect created when the flap is moved is narrow at any one point. This maneuver minimizes the likelihood of distortion of the alar margin or the medial canthus. Equally important in the design of the dorsal nasal flap is extension of the leading edge along the primary defect, which is distinct from a traditional rotation flap design. The
modification minimizes the influence of pivotal restraint on the flap. The mobility of the flap is dramatically enhanced, with a significant back cut in the area of the glabella. The back cut can be extended to the area of the medial canthus, and it produces a flap that is mobile because of a narrow pedicle.

After the flap has been incised, the entire nasal surface should be undermined at the level of the periosteum or the perichondrium. Particular attention should be paid toward gently undermining the area of the medial canthus because the vascular supply of the flap originates in this area. With the appropriate flap design and undermining, the flap can be easily rotated to fill the primary defect under minimal tension. Alar distortion is not produced because the tension is minimized and the perfusion of the flap is ensured.
At 3 months, the flap has provided an aesthetic appearance that exceeds the typical appearance of a graft repair.

**Nasolabial transposition flap**

The nasolabial transposition flap is a 1-step transposition/advancement flap that is useful in the reconstruction of lateral ala defects. The flap is advantageous because it offers a 1-step repair of the lateral ala. Its donor site is skillfully hidden in the melolabial crease; however, the nasolabial transposition flap has several distinct disadvantages. The flap is capable of anatomical distortion if it is not widely undermined. The alar groove is necessarily blunted, and the flap is particularly prone to development of a trapdoor deformity.

This author selects nasolabial flaps when a surgical defect is located on the lateral ala or in the area of the alar groove. The incision line of the flap is made directly into the melolabial fold. The flap undergoes predictable shortening as it transposes (illustrating pivotal restraint); therefore, the flap should be elongated at its donor site on the medial cheek. Dog ears in the area of the melolabial fold and immediately superior to the surgical defect on the nose are removed generously. This maneuver minimizes the risk of developing unsightly tissue protuberances in the postoperative period.

After the flap is incised, it is widely undermined in the area of the central part of the cheek. Hemostasis is achieved, and adequate flap mobility is ensured prior to suturing. The placement of deep tacking sutures is of particular importance in creating the nasolabial transposition flap. After sufficient flap mobility has been achieved with wide undermining, a deep suture is placed in the piriform aperture area in the region of the alar base. This suture serves to anchor the flap in the nasofacial sulcus area and the nasolabial fold area. Additional tacking sutures are placed from the recipient bed along the lateral nasal sidewall into the flap, but tacking sutures need to be carefully placed in this area to minimize the risk of inducing flap ischemia.

When the primary lobe of the flap is placed into the surgical defect, care is taken not to oversize the flap. Oversizing dramatically increases the risk of developing a trapdoor deformity. The entire nasolabial flap is carefully anchored with buried sutures, and the epidermal closure is achieved with a running stitch. To restore the alar groove, a secondary procedure can be performed at a later date to improve the final aesthetic outcome of the repair.

An interesting variant of the nasolabial flap is the turn-over flap, initially described by Spear et al. This nasolabial flap is flipped upon itself so that the skin of the medial cheek’s donor site serves as both the internal nasal lining and the external nasal coverage. By repairing full-thickness wounds of the lateral ala in a single operative procedure, this flap makes an attractive alternative to the traditional staged repairs used for difficult full-thickness wounds in this area.

**Island pedicle flap**

The island pedicle flap is a V-Y advancement flap that is useful in the closure of deep surgical defects located in the lateral nasal sidewall area and in the closure of smaller wounds located in the nasal tip area. The base of the flap has predictably luxurious vascular input; therefore, a thick, easily mobile flap can be generated. When the flaps are used to reconstruct nasal wounds, attention should be directed toward the tapering area of the flap. If the flap tapers too rapidly, the secondary motion at the flap's donor site produces distracting vertical alar displacement.

Although the incision lines of the island pedicle flap can appear complicated, they are usually easily camouflaged within the naturally occurring anatomical landmarks if expert surgical technique is used. The island pedicle flap has a thick muscular base; therefore, the flap is predisposed to developing a
pincushion deformity. To minimize the risk of developing this complication, the author typically sutures the flap carefully so that a central flap concavity is produced at the termination of the procedure. The author routinely uses the island pedicle flap to close deep surgical wounds of the lateral sidewall or the nasal tip, particularly if mobile proximal nasal skin is not available.

**Pedicled nasolabial transposition flap**

When the surgical defect is located closer to the nasal tip, reconstruction of the defect with a 1-step nasolabial transposition flap is not easily accomplished. Additionally, if the surgical wound on the distal nose is too large for a bilobed transposition flap or is not well suited for a dorsal nasal rotation flap, a pedicled flap can be considered. Pedicled flaps offer distinct advantages in the reconstruction of the distal part of the nose. The perfusion of the flaps is predictable because of their pedicled nature. The flaps can be thinned appropriately to match the contour of the nasal tip. Surgical predictability is the primary advantage
of pedicled flap reconstructions. The disadvantages of pedicled flaps include the introduction of significant scarring at the donor site and the necessity to do at least 2 surgical procedures (creation and separation/insertion of the flap).

The pedicled nasolabial flap and the paramedian forehead flap are the 2 pedicled flaps that excel in the reconstruction of the distal part of the nose.

The pedicled nasolabial flap (see images below) is often advantageous because the donor's morbidity is considerably lower than that associated with the paramedian forehead flap. The donor scar is placed within the melolabial fold, rendering it nearly imperceptible. An appropriate donor site is selected within the melolabial fold area of the medial part of the cheek. The flap design is analogous to that of a 1-step nasolabial transposition flap. As the flap is undermined, it is aggressively thinned at its tip to the level of the dermis. At the pedicled flap's origin area on the lateral part of the nose, undermining is carried much more deeply. This maneuver produces a highly vascular and thick muscular pedicle that ensures flap viability.
A thorough understanding of pivotal restraint is vital if the flap is used to cover wounds on the nasal tip. The flap undergoes significant shortening; therefore, the donor site in the melolabial fold must be longer than typically anticipated. The donor site is sutured appropriately after wide undermining, and the flap tip is thinned and placed onto the nasal tip. At 3 weeks, the pedicle is severed and inserted into the area of the medial part of the cheek. Then, the flap can be lifted gently and thinned to an appropriate contour. Careful intra-operative observations of the fullness of the nasal tip should be performed during the flap-thinning procedure. The author often slightly thins the flap more during this second procedure because of the nearly universal development of some pincushioning with this flap.
**Paramedian forehead flap**

The paramedian forehead flap is an axial pattern flap that relies on perfusion from the supratrochlear artery. The flap has a predictable and luxurious vascular supply, rendering it highly useful in reconstructing large defects on the distal part of the nose. Aesthetically, the nose is more important than the forehead; therefore, most physicians do not hesitate to place donor scars on the forehead to surgically reconstruct the more delicate distal part of the nose.

The paramedian forehead flap is a 2-step procedure that is commonly and safely performed as an outpatient intervention. It provides excellent results in the reconstruction of the aesthetic subunits of the nose. The forehead has a large reservoir of donor tissue, and its skin has a close aesthetic match to the skin of the nasal tip. Therefore, the forehead flap offers unparalleled opportunities for successful nasal reconstruction; however, several distinct disadvantages are associated with the flap. This is a more involved surgical procedure; therefore, the patient's surgical morbidity is significantly increased.

The procedure is a 2-step procedure, and the patient's desire to undergo a staged procedure should be prospectively assessed. The donor scar on the forehead is often inconspicuous, but the patient needs to be counseled regarding the visibility of the scar and the slight medial migration of the brows, which are inherent to the flap.

The author uses the paramedian forehead flap to reconstruct large wounds on the distal part of the nose. If the wound encompasses greater than 60-70% of the nasal aesthetic subunits, the author considers enlarging the surgical defect to fit the normal aesthetic unit boundaries. A 3-dimensional template of the surgical defect is made by using a foil suture package. The template is transposed to the forehead, on which a careful outline is made.

The supratrochlear artery can be located by using a Doppler examination; however, its reliable positioning near the corrugator fold is almost always certain. The flap's pedicle is designed to have a width of 1.3-1.5 cm. The flap is raised from the forehead, and the vascular pedicle is protected during wide undermining. The supratrochlear artery typically lies between the frontalis and the corrugator musculature. Dissection of the flap's pedicle near the orbital rim should be carefully performed. The flap's donor site is closed in a linear fashion. Occasionally, the wound-closure tension on the forehead is so great that the entire wound cannot be closed in a linear manner.

The author favors secondary healing of the remaining defect; in the author's opinion, skin grafts or local flaps are aesthetically inferior compared with secondary intention healing on the superior aspect of the forehead. The flap is transposed to cover the nasal defect. The flap should be sewn under minimal-to-no wound-closure tension to prevent anatomical distortion of the nose and to preserve the flap's vascular supply. The flap is separated and inserted at 3 weeks. At that time, the flap can also be appropriately thinned. Alternatively, the flap can also be aggressively thinned at this 3-week intervention, while keeping the axial, superior vascular input and the distal connection to the alar rim or tip intact. Several months after the initial procedure, a subsequent procedure can be performed to further thin the flap and to reintroduce the alar grooves, if required.

Using folded forehead flaps to replace both the nasal lining and the external skin of complicated, full-thickness nasal wounds has gained renewed popularity. The forehead flap can be folded upon itself to line the nasal vestibule, and architecturally important cartilage grafts can be added at an interim step several weeks after the creation of the flap's pedicle. Folded forehead flaps can remove the requirement to line nasal defects with difficult intranasal mucosal flaps, and the predictable perfusion of the forehead flap improves its versatility in the repair of deep and difficult nasal wounds.
DISCUSSION:

Reconstruction of Mohs Surgical Defects – Vicente Resto, MD, PhD

That was a very nice presentation of how to manage facial defects most often associated with Mohs surgery as well as surgical defects that can result from other surgical treatments of skin lesions. Perhaps the one thing to expand on is the use of intranasal coverage approaches which is critical to avoid contracture deformity secondary to exposed intranasal tissues from externally transferred flaps as well to insure perfect vascular cover of avascular tissues as used for support. The use of septal flaps and the bucket handle flap from the squamous portion of the vestibule are certainly the more common ones, however one can get quite creative if need be transposition tissue from the contralateral nasal airway usually from the septum by making a septal hole which would allow you to then transfer a flap to the other side.

In selective cases where there has been absolutely no tissue available from the septum I have also used tissue from the inferior turbinate and in one particular case I was able to successfully use a rotation perioveal flap from the maxillary face where I used the perioveal surface as the intranasal lining surface. That eventually supported a mucosalization very well and resisted contracture. Although my experience is not extensive, this case was very successful and I would not hesitate using this again in the future in cases where the more standard full-thickness epithelial covered donor sites are not available.

(Dr. Quinn raised the question of healing by secondary intention in selected Mohs defects.)

Secondary intention works and when you think about these defects, the reconstruction ladder approach holds- rather the reconstruction priorities hold. First and formative are wound healing followed by function and lastly you try to achieve the best cosmetic results. From the wound healing perspective, secondary intention will always work assuming good nutrition and good wound care. The problem is that secondary intention often involves a significant contraction component and depending on where the defect lies, it may cause a subsequent deformity either immediately associated with the wound or secondarily such as would be associated with an upper cheek defect in close association with the lower eyelid where ectropion could be a resulting problem. That said, sites with good underlying structure such as the nasal bones, the nasal dorsum and wounds that are not necessarily too large in size will do very well from a functional and cosmetic perspective by secondary intention. The same can be said in other portions of the face. Perhaps the main issue raised with that approach is that the patient has to handle an open wound for an extended period of time, something that can be challenging to some but more often than not it is something that is mostly to be concerned with. When given an option for direct closure and faster healing, the patients often opt for it, but it is certainly within the repertoire and can be managed with very acceptable results in selected cases and selected sites.

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