

Comment on “Full-Thickness Skin Grafts and Quilting Sutures for Reconstruction of Internal Nasal Lining”

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Skin graft “take” requires that it lie immobilized and in contact with a well-vascularized recipient bed. The paper by Gostian et al outlines their experience with a simple method to improve the vascularization of skin grafts when used to line full-thickness nasal defects.

Neck or groin full-thickness skin grafts (described as both “free skin flaps” and “free skin grafts”) were sutured to the margins of the lining defect in 16 patients. A full-thickness *nonexpanded* forehead flap was transferred to replace missing overlying external skin. Multiple percutaneous full-thickness quilting sutures were passed through the external surface of the forehead flap to fix the skin graft to the raw surface of the forehead flap. No support was placed initially. Later, during an intermediate operation, delayed primary grafts were placed to support the skin graft. At a third stage, the pedicle was divided. The skin graft take was excellent and the forehead flap suffered no serious sequelae. Complications were minimal and results were good.

Unfortunately, the dimensions of the external skin and lining defects, the size of the lining skin grafts, and the duration of quilting suture placement are not specified. They emphasize that skin graft lining must be “supported” but do not describe the design or position of the cartilage grafts. They do not address when, how, or if associated cartilage injuries were repaired in the neighboring areas of the external wound where the lining remained intact.

Although the case descriptions are confusing, the technique seems to have been applied to repair small to moderate full-thickness defects of part or all of the ala and sidewall, as well as central defects of the tip and septal angle when significant residual central septal support remained intact.

So how should we incorporate lining skin grafts and percutaneous suture fixation into the repair of full-thickness nasal defects?¹

The Lining Defect

Available lining options for small to moderate defects of the ala and sidewall (when the central septal partition remains intact to provide midline support) include skin grafts, a folded forehead flap, and hinge over flaps.

Because the smooth, highly vascular, “dry” underlying surface of a full-thickness forehead flap is an ideal vascular bed, *skin grafts* survive. “Take” is expected and may be improved with through and through percutaneous quilting sutures.

I routinely fix the skin graft to the soft tissues of the overlying frontalis muscle with multiple 6–0 plain sutures passed intranasally through the nostril aperture. I place a small sponge within the alar vestibule for 24 hours. These absorbable sutures fall out spontaneously or can be removed in 5 to 7 days. I will now consider using percutaneous full-thickness quilting sutures to augment or replace these fine absorbable sutures—probably using a 5–0 Prolene on a taper needle to minimize bleeding and ease removal.

The skin graft technique is most often applied to small to moderate lining defects along the nostril margin. The larger the lining defect, the larger the required skin graft, the greater risk of skin graft loss with possible infection and graft contraction, and difficulty of restoring support. So I prefer to use vascularized lining flaps for especially large defects—often a combination of local tissue, a folded forehead flap, a second forehead flap for lining, or a microvascular flap.

I am concerned about full-thickness quilting sutures causing forehead flap necrosis and permanent suture scarring. To minimize this risk (and my own anxiety), I will evaluate these percutaneous, through and through, quilting sutures on the second and fourth day postoperatively, release/remove tight sutures as needed, and eliminate all through and through skin graft fixation sutures by day 4 or 5 to minimize the risk of forehead flap necrosis and external skin scarring. I will consider placing a small soft lubricated sponge within the airway

intermittently to provide light pressure and additional protection for the first week of healing.

(Note: Although I routinely use quilting sutures to fix the forehead flap to the underlying sculpted recipient bed after intermediate operations, but these quilting sutures do not enter the nasal airway. They pass through the covering forehead flap, into the recipient bed, and back outward through covering flap. They are always removed at 48 hours to prevent permanent suture marks.)

Forehead flaps are highly vascular but do not tolerate tension. So a short or too small a flap or tight sutures may cause necrosis. I perform all procedures under general anesthesia without local anesthetic injection to better evaluate flap color and capillary refill during flap inset and when applying quilting sutures. It is difficult to rule out excessive suture tension if the flap is swollen due to local anesthesia or white due to epinephrine.

As an alternative, a skin extension can be added to the distal end of a full-thickness forehead flap and turned inward to line small to moderate full-thickness defects—*folded forehead flap lining*. The extension lies under the hairline within the area of excess skin discarded during donor closure. If supple and easily turned inward, the flap is not thinned. However, if stiff, frontalis and subcutaneous fat can be safely excised to thin the lining extension and ease its folding.

This folded extension easily lines a defect which extends from the nostril margin to the border of the nasal bones. If the defect extends more superiorly, the upper aspect of the defect, toward the medial canthus, is more easily lined with local hinge over flaps, a contralateral septal mucosal flap, or occasionally a skin graft. The authors' percutaneous quilting sutures would be especially advantageous to fix a skin graft superiorly in the area of nasal bones, if employed. The inferior 2 to 2.5 cm of the defect is lined with folded lining.

A full-thickness forehead flap with its intact frontalis muscle is highly vascular and necrosis of the lining extension is very unusual. This folded lining technique has many advantages—minimal or no additional donor injury, maximal vascularity, and the ability to place support grafts primarily or in a delayed primary fashion, as required.

Hinge over lining flaps use available local tissue but are relatively avascular and prone to necrosis. Although simple, the border of the defect must first heal cover to lining to create a vascular hinge at the point of turnover. This precludes their use for immediate reconstruction. Although they increase the requirement for external skin replacement, the proximal forehead flap pedicle easily resurfaces any additional skin deficiency caused by the hinge over flap. They are best employed to line small full-thickness defects when adjacent external surface skin is unscarred. Borderline vascularity limits their useful length to approximately 1 cm.

Support Replacement

The size, projection, and shape of the nose are determined by its mid-layer cartilage framework. If missing, it must be

replaced. Although not normally present, cartilage must also be placed along the nostril margin to support, position, and shape the reconstructed ala. Sidewall grafts are less commonly applied because most nasal defects are limited to the inferior and most projecting parts of the nose. Sufficient sidewall support is usually provided by alar margin battens alone.

Typically, when a *nonexpanded* flap is folded or a skin graft is used for lining, primary nostril margin support is not placed. The forehead flap is simply folded for lining or the skin graft is fixed to the covering flap's deep surface.

If the flap has not been expanded, it is simpler and unnecessary to place primary cartilage support within folded lining. In contrast, primary cartilage grafts are precluded if skin graft lining is planned because the skin graft will not survive if separated from its overlying vascular bed. Delayed primary alar support is positioned later during an intermediate operation with either technique.

However, the external nasal injury is often significantly greater than the lining loss. So adjacent cartilage may be injured or absent within the more superficial, neighboring areas of the larger wound. In such cases, although primary cartilage grafts cannot be positioned over a lining skin graft and may be unnecessary within folded lining, other cartilage injuries should be repaired at the time of flap transfer to maintain nasal projection and contour, if needed.

For example, in the authors' Fig. 2, the external skin of the tip, soft triangles, and medial ala and the underlying tip cartilages and septal angle were excised. Postoperatively, the result is good but the reconstructed nasal tip is flat, wide, poorly projecting, and the nose is short, strongly suggesting that the central support loss was not addressed at the time of flap transfer or was not adequately addressed during the intermediate operation.

In such cases, I believe that the central support should be restored at the time of forehead flap transfer. The residual septal angle is exposed, as in an open rhinoplasty, septal cartilage harvested, and tip support, definition, and projection restored with primary extended lateral spreader grafts and a columellar strut (or a septocolumellar graft) and tip grafts. The lining defect is then replaced with a skin graft or folded lining. The nose is resurfaced with a full-thickness forehead flap of adequate dimension and outline. During the subsequent intermediate operation, delayed primary alar battens are placed to support the nostril margin and the reconstructed lining. If such adjacent cartilage injuries are not repaired initially, you are effectively resurfacing a “short, small” nose with a flap which is too small. It is difficult or impossible to build a larger, longer nose later. Although you can re-elevate the flap during the intermediate operation and try to place additional delayed primary cartilage grafts, excessive closure tension will limit the result or cause flap necrosis. In other words, although primary cartilage grafts cannot be placed over skin graft lining and may or may not be required within folded lining to support the nostril margin, missing cartilage within adjacent areas of the defect should be repaired when the forehead flap is transferred.

Nasal Resurfacing

Because of its maximal blood supply, a full-thickness forehead flap is well suited to either folded or skin graft lining. However, the forehead donor may be inadequate in height or width due to a low hairline or previous scarring. Preliminary forehead expansion is frequently necessary to permit harvest of sufficient skin to reach the defect and/or avoid transferring hair to its external surface. Once transferred to the nose, hair is difficult or impossible to permanently eliminate. And scalp is thicker and stiffer than glabrous forehead skin, making ideal nasal contouring more difficult. If the forehead is short or scarred, it should be pre-expanded as needed to provide the skin with sufficient length and width to resurface the defect.

However, forehead expansion significantly impacts the timing of support placement. Expanded forehead flaps shrink immediately on elevation and must be rigidly supported to prevent massive elastic recoil, soft tissue retraction, and permanent cover and lining contraction. They cannot be re-expanded during the intermediate operation. So if the flap must be expanded, you cannot use the skin graft lining technique. Fortunately, you can place a primary cartilage graft within the vascular skin envelope of a folded forehead flap, fixing it to an intact or rebuilt central support, medially, and into a soft tissue pocket at the alar base, laterally. The rigid primary alar batten controls the rim position by maintaining skin stretching and preventing flap recoil. Although suturing folded lining around a rim graft is awkward, it just takes a little more time when the flap is inset.

Skin Graft versus Folded Flap Lining

The choice ultimately depends on the defect, surgeon, and the desired result.

In my experience, the folded lining technique is more reliable due to its inherent vascularity and adaptability, more widely applicable to both simple and extremely difficult repairs, and produces excellent results. It gives me options. I can use primary or delayed primary cartilage support or unexpanded or expanded forehead flaps. During the intermediate operation, I can divide the covering aspect of the flap from its distal lining extension along the nostril margin which allows me to thin both the lining and cover, place a delayed primary cartilage graft to support the nostril margin, modify a previous rim graft placed at the time of flap transfer, and correct imperfections in the nostril position. The incidence of folded lining necrosis approaches zero. I prefer postauricular skin grafts for lining because of their minimal morbidity, thin quality, location within the operative field, and hidden scar.

But skin graft lining, however, is an option especially for small to moderate (1–2 cm) lining replacement. If all goes well, both techniques can produce good results. Disregarding the need for a late revision (which, in my opinion, is required to adequately repair most full-thickness defects), both the folded flap and skin graft techniques require three operations over 2 months to transfer the flap, support the repair, and divide the pedicle.

Folded lining almost always survives and the patient is ready for the upcoming intermediate operation. Good skin graft “take” is expected but skin graft necrosis occurs infrequently. The authors clearly indicate that, with attention to detail, the risk of skin graft lining loss can be as little as 6%. Fortunately, because of forehead flap vascularity and the absence of overlying cartilage grafts over a skin graft, the necrotic skin graft can be debrided at 5 to 10 days postoperatively and replaced with a second skin graft, often sutured through the nostril aperture and not requiring re-elevation of overlying forehead flap. Usually the second graft heals well and delayed primary support is placed a month later during an intermediate operation. Unfortunately, this complication turns a three-stage operation over 2 months into a four-stage operation over 3 months and, although not disastrous, leaves the forehead pedicle hanging from the brow for an additional month. I prefer to avoid the occasional hassle and use a folded forehead flap for lining.

However, the skin graft lining is an invaluable option to salvage complications. Occasionally, a limited area of nasal lining dies postoperatively after transfer of the forehead flap. As an example, if 1 or 2 cm of microvascular lining is lost at the time of forehead flap resurfacing, the forehead flap can be minimally re-elevated, the area of necrotic lining excised, the overlying primary cartilage graft removed and banked, and the limited lining defect reconstructed with a skin graft, revascularized by the overlying full-thickness forehead flap. After skin graft healing, the banked rib cartilage is replaced later during the intermediate operation.

Surgical Staging, Surgeon Choices, and Quality of the Result

Success is determined by the dimension, bulk, projection, symmetry, skin quality, border outline, and three-dimensional contour of the result. I take nasal reconstruction very seriously. I believe patients do not care what you do or how you do it, they just want to look normal. We cannot build a “nose.” We are rebuilding a “facsimile” by altering “unlike” nonnasal tissues—local, regional, or distant skin, cartilage, etc.—until the assembled pieces “look like” a nose, but are not.

In actuality, many small defects can be left unrepaired or simply covered with a Band-Aid, if the patient does not care how they look or wishes to avoid surgery. Let’s face it. It is awfully simple and patients do it all the time. Certainly, many defects can be “filled” with a patch of flap. D. Ralph Millard described this as “O-filling” or hole filling. Some patients may be “satisfied,” even if they always draw attention and appear deformed or a little “odd” looking to the passerby.

But I believe most patients, if informed about options, choose to look normal. I “choose” that my patients look normal because they reflect on me and my training. I want to look normal and I want my friends and family to look normal. Why not my patients! So I do not hesitate to expand the short forehead to avoid transferring scalp onto the nasal surface or to obtain sufficient skin to resurface the more challenging defect. And I routinely plan a late revision, after pedicle division, to correct inevitable nostril margin asymmetries, a thick rim, a small nostril, poor scars, place a secondary tip cartilage graft, or

recreate missing nasal landmarks, such as the alar crease (which can only be recreated secondarily during a late revision.)

Defects vary. Methods and materials vary. The surgeon must understand the implications of his or her choices—timing, staging, combining, etc. I will use skin grafts for lining when it seems best and will add this quilting method of graft fixation to my armamentarium.

I thank the authors for expanding my technical options.

Conflict of Interest

The author reports royalties for his book *Aesthetic Nasal Reconstruction Principles and Practice*, outside the submitted work.

References

- 1 Menick FJ. *Aesthetic Nasal Reconstruction: Principles and Practice*. Phoenix, AZ: Aesthetic Nasal Reconstruction Press; 2018