Lower Third Nasal Reconstruction: When Is Skin Grafting an Appropriate Option?

Paul D. McCluskey, M.D.
Fadi C. Constantine, M.D.
James F. Thornton, M.D.

Dallas, Texas

Background: A full-thickness skin graft is generally not considered the ideal replacement for the thick, sebaceous skin of the nasal tip, ala, lower sidewalls, or dorsum. Instead, many clinicians prefer to reconstruct these defects with local or axial composite flaps that incorporate skin, subcutaneous tissue, and fat.
Methods: The authors conducted a retrospective analysis of 55 consecutive patients who underwent reconstruction of lower third nasal defects with full-thickness skin grafts between 2002 and 2007 performed by the senior author (J.F.T.). All of the patients in this review underwent skin cancer ablation by means of Mohs' micrographic surgery.
Results: Good aesthetic results, based on preoperative and postoperative photographic analysis of contour and pigmentation, have been achieved in both the recipient and donor sites in 52 of 55 patients. Three patients, all of whom were smokers, experienced loss of the skin graft requiring alternative reconstructive techniques.
Conclusions: Under certain conditions, skin grafting of defects of the caudal third of the nose offers a viable reconstructive option that yields good contour and color match. Careful analysis of defect size, location, and depth and consideration of donor-site skin thickness and pigmentation are vital for accurate replacement of the thick, pitted, sebaceous skin of the caudal nose. An evolution in technique has revealed that the forehead donor skin often provides a more consistent color and contour match in such reconstructions. Secondary dermabrasion of the graft provides a critical step for obtaining final aesthetic contour and color.   (*Plast. Reconstr. Surg.* 124: 826, 2009.)

Defects of the lower third of the nose present a special challenge to the reconstructive surgeon. The unique character of the lower third of the nose, with its interwoven concavities, convexities, and varying skin thicknesses, exacerbates the difficult reconstruction of this region.

Well-defined flap algorithms are available for reconstruction of full-subunit alar or full-subunit tip defects.[1] The lower third nasal defects or defects larger than 1.5 cm in diameter can be reliably reconstructed and repaired with nasolabial or forehead flaps using either a subunit or defect-only reconstruction.[2] These techniques require multiple stages and allow for the replacement of cartilage and lining if missing.

Paradoxically, acceptable results are more difficult to achieve with smaller defects, most notably those smaller than 1 cm. Local flaps applied for these defects often result in violation of aesthetic subunits, worsening of the defect by alar notching, and frequent or unpredictable pincushioning. Likewise, the misapplication of skin grafts to large or deep lower third defects often yields a depressed patchwork with unsuitable results.

In many cases of lower third nasal reconstruction, particularly those arising from excision of neoplasms by means of Mohs' micrographic surgery, the defects are shallow and measure less than 1 cm in diameter. These defects rarely encompass greater than 50 percent of aesthetic subunits and are best treated as defect-only reconstructions.[3]

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Such defects can be successfully and reliably treated with well-applied full-thickness skin grafting from the preauricular or more preferential forehead donor site.

The evolution of the demonstrated skin grafting techniques started with the recognition of the frustrating paradox in reconstructing small defects of the lower third. Larger defects could be easily and reliably reconstructed with the well-established algorithms (i.e., nasolabial or forehead flap reconstruction). Our institutional disappointment with use of bilobed flaps from the upper third of the nose to recreate defects on the lower third commonly results from the inherent design flaw of the bilobed flap (the design of the flap violates a second or third aesthetic unit and often completely distorts the alar groove) and the inherent unpredictability of the final result because of its tendency to pincushion. We also have an institutional reluctance to advance skin from the nasal sidewall to reconstruct lower third defects, as this destroys an aesthetic subunit that is very hard to reconstruct—the alar groove.

ANATOMICAL CONSIDERATIONS

The lower third of the nose is defined by its margins, which include the alar rims inferiorly, the nasolabial grooves laterally, and the alar groove, which forms the junction with the upper two-thirds of the nose.[4,5] Any distortion of the alar rim or obliteration of the nasolabial groove is exceedingly noticeable and difficult if not impossible to correct secondarily. Classically, the lower third of the nose is composed of six subunits: bilateral ala and soft triangles, the central tip, and columella[6] (Fig. 1). Importantly, the ala and tip are biconvex structures, and maintaining and restoring the contour of these structures is essential to aesthetic nasal reconstruction. The unique nature of the lower third skin, which is often thick and richly populated with sebaceous glands, complicates reconstructions, often rendering the skin stiff and difficult to rotate and form into local flaps.

PATIENTS AND METHODS

This is a retrospective review of 55 patients who underwent reconstruction of lower third nasal defects with full-thickness skin grafts between 2002 and 2007, all performed by the senior author (J.F.T.). Only those patients with defects of the lower third, defined as the bilateral ala and soft triangles, tip, columella, lower dorsum, and nasal sidewalls were included in the review. All patients had defects resulting from skin cancer ablation
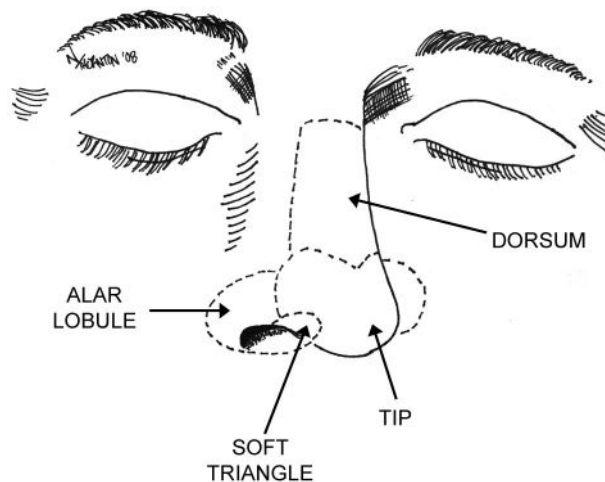

Fig. 1. Illustration of the nasal subunits of the lower third. The dorsum, tip, and paired soft triangles and alar lobules are shown. Note that the columella is not labeled.

using Mohs' micrographic surgery performed by a dermatologist. The reconstructions took place within 48 hours of excision, with the vast majority occurring on the same day as the Mohs' procedure. All procedures were performed in an operating room setting with either sedation supplementing local anesthetic or local anesthesia alone.

Forehead or preauricular skin donor sites were used in all cases, with primary closure of the donor sites. The percentage of forehead skin grafts was greater in the later patients secondary to the perception that these provided superior results. Forehead skin was used in 65 percent, with the remainder being preauricular skin. As a rule, the thicker nasal defects in younger patients were reconstructed with forehead skin, as this was an evolving technique. As the senior author began to use forehead skin more frequently as opposed to preauricular skin, a more consistent result was achieved with regard to a normal appearing reconstruction, with less irregularity in contour and color match.

RESULTS

Average defect size among all 55 patients was 8 mm, with a range of 5 to 17 mm. Sixty-eight percent of the patients had greater than 3-month follow-up. Sixty-two percent underwent one dermabrasion treatment, and 26 percent underwent two or more treatments. An aesthetic standard of not simply a healed wound but rather a normal appearance with good contour and color match as endpoints was used (Figs. 2 through 7). Patients were evaluated for contour irregularities and hypopigmentation or hyperpigmentation. Based on

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Fig. 2. A 64-year-old man presented with an 8-mm nasal tip defect following Mohs' excision of a basal cell carcinoma (*left*). There was exposed perichondrium in the base of the wound, although it was a relatively thin defect. The patient underwent two rounds of postoperative dermabrasion after skin graft placement (forehead donor site). (*Right*) Appearance at 3-month follow-up.

Fig. 3. A 43-year-old woman presented with a 7-mm alar defect, abutting but not crossing the alar rim. (*Left*) Appearance of the patient 1 week after skin grafting from a forehead donor site. Note the dusky appearance of the graft despite good take. (*Right*) The patient 3 months postoperatively. She has undergone two dermabrasion treatments.

postoperative photographs, 14 percent had minor contour or color defects, with 8 percent having more pronounced color/contour changes (Figs. 8 and 9). Of the 55 patients, there were only three cases (5 percent) of graft loss. All of these occurred in smokers [11 of 55 patients (20 percent) were active smokers], and among active smokers, the rate of graft failure was 27 percent (Fig. 10). There were no donor-site morbidities in this series; however, most of the harvested grafts measured less than or equal to 1 cm. There were no primary failures of the bolster technique, and all bolsters were removed at 3 to 7 days postopera-

tively, with day 5 being the preferred time for bolster removal.

Technique

All procedures were performed under local anesthesia with or without intravenous sedation in an operating room setting. A 1:1 mixture of 0.25% Marcaine (Hospira, Inc., Lake Forest, Ill.) with 1% lidocaine with epinephrine (mixed 1:1000 in 30 cc of lidocaine) was used for local anesthesia, vasoconstriction, and postoperative analgesia. This mixture is injected subdermally at the site of the

Fig. 4. A 57-year-old man with thin nasal skin underwent Mohs' excision of a basal cell carcinoma on his nasal tip (*left*). (*Right*) Patient 3-month follow-up after full-thickness skin grafting from forehead skin and one in-office dermabrasion treatment.

Fig. 5. A 54-year-old man had a 7-mm alar defect after excision of a basal cell carcinoma (*left*). (*Right*) Patient at the 3-month follow-up visit following preauricular skin grafting. He received one dermabrasion treatment.

defect and the graft donor site. The operative approach to each defect followed a similar cadence beginning with reverticalization of the wound edges and sharp débridement of any fibrinous tissue or debris in the base of the defect. This initial step is critical for normalizing any contour abnormalities in the defect and is performed under loupe magnification with a straight, double-edged beaver blade. Further excisions were performed if required to place the borders within aesthetic subunits; however, there was not strict adherence to aesthetic subunit reconstruction, and these cases should be considered as defect-only reconstructions.

After reverticalization of the wound edges and normalization of the contour, a foil pattern template was used. This template should be treated as a three-dimensional construct, accounting for the relative concavity or convexity of the tissue surrounding the defect. Based on the template, a full-thickness skin graft, either from the preauricular or preferentially from the forehead donor

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Fig. 6. A 1-cm superficial alar defect was reconstructed with a full-thickness skin graft from a forehead donor site in this 37-year-old woman (*left*). After two dermabrasion treatments, her contour and pigmentation at 3 months are very good (*right*).

Fig. 7. This 6-mm alar rim defect was reconstructed with a full-thickness skin graft using preauricular skin (*left*). (*Center*) Photograph demonstrates the degree of healing at 1 month postoperatively. After two dermabrasion treatments, no contour or color irregularities are visible (*right*).

site, is harvested. The donor sites were all closed in a multilayer fashion with buried interrupted and continuous suture. The donor sites were frequently placed at the junction of the hair-bearing and non–hair-bearing scalp following the relaxed skin tension lines. Great care was taken to ensure that the grafts harvested were identical size matched to the donor site. This was accomplished by using the foil pattern template and sharply scoring the harvested graft within the ellipse of the donor site to accurately reflect the size before graft harvest. This eliminates the distortion caused by blurry ink lines while harvesting the graft. Therefore, scoring the template before harvest repre-

sents a critical step in accurately designing the graft to be the exact size of the defect. Care was taken to handle the graft atraumatically throughout its harvest and inset.

In the initial 10 consecutive patients included in this review, the skin grafts were sewn into the defect with 4-0 or 5-0 chromic gut suture; however, secondary to an unsatisfactory inflammatory response from the chromic suture, the suture material has been changed to 5-0 fast-absorbing gut, which was used for the remainder of the cases. The grafts are precisely sewn into place with continuous opposing 4-0 or 5-0 plain gut sutures that run in a continuous fashion in opposite directions

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Fig. 8. A patient with a hypopigmented scar after full-thickness skin grafting from preauricular skin to the nasal tip with postoperative dermabrasion.

Fig. 10. An example of a failed alar graft from forehead skin in a smoker. This was successfully regrafted after the wound was débrided.

Fig. 9. This patient received a full-thickness skin graft from a preauricular donor site to his ala with postoperative dermabrasion. He has a persistent contour defect at this site.

Fig. 11. An example of the fast-absorbing running suture at the graft margin, and four-corner bolster sutures.

around the graft and are tied at the opposite side. This precisely insets the graft, providing a stable inset with no bunching or distortion, and is very time saving (Fig. 11).

Fabrication of the skin graft bolster completes the procedure. In the majority of cases, a double-armed 3-0 or 4-0 Prolene suture (Ethicon, Inc., Somerville, N.J.) is placed at the center through the underlying tissue and then through the center of the graft. Both arms of the suture are placed in a similar fashion and then left untied and sewn directly into the bolster (Fig. 12). All bolsters in this review were fashioned from dry surgical preparation sponges that had been preoperatively gas

sterilized. The surgical preparation sponge material provides adequate rebound and support. The sponge bolsters are all coated with antibiotic ointment away from the operative field and the through-and-through 3-0 Prolene sutures are then placed in juxtaposition through the bolster and tied in place (Fig. 13). This technique obliterates central dead space and optimizes graft adherence. The remainder of the bolster was then secured with 5-0 silk bolster sutures placed through the graft and native skin edge, then tied at four to eight points around the graft, depending on graft size. The closed donor-site incision and the edges

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Fig. 12. The through-and-through monofilament suture used to provide additional stability and compression to the skin graft bolster. Both needles on the double-ended suture are then passed through the center of a piece of surgical sponge and tied down.
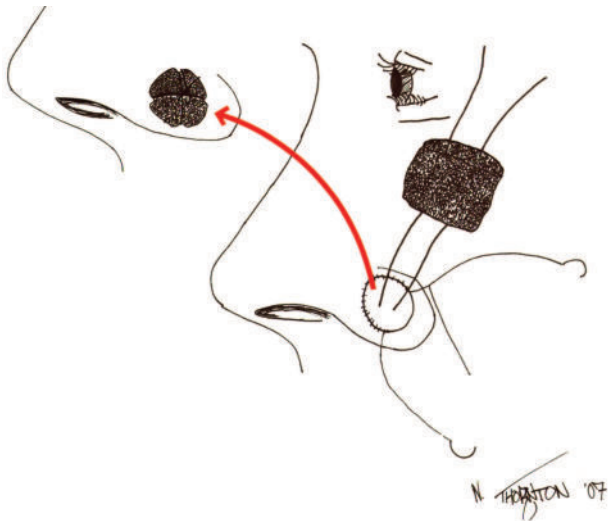

Fig. 13. Illustration of the bolster technique used by the senior author. Through-and-through 3-0 Prolene sutures are placed in juxtaposition through the bolster and tied in place. This technique obliterates central dead space and optimizes graft adherence.

and exterior of the bolster were coated with antibiotic ointment.

Donor sites were dressed with Xeroform gauze (Sherwood Medical, St. Louis, Mo.), and the patients were each given a set of written wound care instructions. The patients are instructed to begin

showering on the second postoperative day with the provision that they cover the graft bolsters with a vigorous coating of antibiotic ointment before showering. The bolsters and the graft material were very well tolerated, as mentioned earlier, with no bolster failures.

Given the thickness of the forehead skin, it is not unusual for the most superficial portion of the graft to initially undergo a period of partial slough. This was treated with continued application of antibiotic ointment and patient reassurance. Patients were seen at weekly intervals until full graft survival was ensured. At this point, daily application of antibiotic ointment was discontinued and patients were offered the opportunity to begin topical scar cream therapy with Mederma (Merz Pharmaceuticals, Greensboro, N.C.), Scar Zone (CCA Industries, East Rutherford, N.J.), or more recently, Transdermis scar therapy (NFI Consumer Products, Fayetteville, N.C.). No clinical science supports the use of one scar cream over another; however, it has been our experience that the patients strongly prefer applying a scar care product, and subjectively the Transdermis scar therapy resulted in a fairly rapid reduction in inflammatory response. We also currently offer patients the opportunity to apply silicone sheeting to both the skin graft and donor-site areas.

It should be noted that the postoperative recommendations for scar therapy are based not on science but on an evolving clinical practice with lessons learned from failures in scar therapy from the beginning of the practice. All of the patients were offered dermabrasion beginning at 6 weeks after grafting. Based on the behavior and appearance of the scar, up to three postoperative dermabrasion treatments were offered at 6-week intervals. The dermabrasion itself was performed in the office setting, with only topical tetracaine cream for anesthetic. The dermabrasion was performed with a rotary dermabrader using the diamond cylinder wheel, and the endpoint was deep punctate bleeding. The goal of the dermabrasion procedure was to both improve the graft color and to blur or diminish the patch effect of the graft on the surrounding nasal skin by essentially improving the appearance of the surrounding scar. The procedure was confined to the graft and immediate surrounding skin. Although dermabrading entire subunits has been advocated to provide an even contour over the subunit, we have found this practice largely unnecessary for smaller defects.[7] Entire subunit dermabrasion was not frequently offered except for larger defects that encompassed a majority of the subunit. An illustration of

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the effects of dermabrasion is provided in sequential photographs in Figure 6.[8]

DISCUSSION

Historically, and often correctly, skin grafting of defects of the lower third of the nose has been considered to yield an inferior aesthetic result. The inappropriate placement of large, poorly color-matched supraclavicular or postauricular skin grafts to replace the thick, often convex defects of the lower third can yield results that are poor and frequently impossible to correct.

Achieving a well-contoured, aesthetically pleasing result begins with meticulous preoperative analysis of the nasal defect. Criteria for selecting lower third nasal defects that can be acceptably treated with full-thickness grafts include defect location; size smaller than 1 cm; and a partial-thickness defect with underlying dermis, subcutaneous tissue, or perichondrium.

The basic concern with using a full-thickness skin graft is the resultant patchwork appearance caused by color mismatch and contour defects. Adhering to the concept of subunit reconstruction alleviates concerns for a resultant patchwork appearance, regardless of the reconstructive method. The senior author, however, prefers a defect-only approach to nasal reconstruction when using full-thickness skin grafts. Acceptable results were achieved in this study using full-thickness skin grafts to reconstruct lower third defects smaller than 1 cm in diameter, with each case performed without excising an entire subunit. The decision to limit described reconstructions to less than 1 cm is not based on the inability to reconstruct larger defects; however, defects larger than 1 cm, we feel, are reconstructed more successfully with entire subunit reconstructions using more standard reconstruction techniques (local or adjacent flap techniques). Contrasting defect-only versus subunit nasal reconstruction is beyond the scope of this study; however, these concepts are an important component of defect analysis and must always be considered. Again, a principle-based reconstruction, beginning with careful and meticulous defect analysis and selection, will yield an acceptable result regardless of the reconstructive method.[9]

Adhering to the concept of replacing like with like, the individual characteristics of skin graft donor sites must be considered. After analyzing the defect and creating a like-sized template, the appropriate donor site must be selected based on texture, thickness, color, and tendency toward hyperpigmentation or hypopigmentation. Much of our current knowledge of donor-site characteristics comes from the dermatology literature. The senior author prefers preauricular and more preferably forehead skin for lower third nasal reconstruction. Forehead sites offer thicker skin, with a relatively sebaceous, oily texture, and they suffer the same degree of daily sun exposure and actinic damage as the lower third of the nose. Other donor sites available to the reconstructive surgeon include the nasolabial fold, postauricular skin, and supraclavicular skin. Postauricular donor sites suffer very little (if any) daily sun exposure and have much thinner skin than the nasal lobule. Therefore, they are prone to pigmentation changes and do not provide a good contour match for reconstructing the lower third of the nose. Likewise, the skin of the supraclavicular region contains very few sebaceous elements and is often hyperpigmented before harvest. The preauricular and forehead donor site grafts should be harvested without including terminal hairs and designed along relaxed skin tension lines, allowing for primary closure. Good results can be achieved without distorting the anterior hairline or sideburn.

Hubbard wrote a provocative article describing 33 patients who had lower third defects reconstructed with nasolabial fat and/or partially defatted skin grafts harvested from the nasolabial fold.[10] The illustrated results demonstrated perfectly acceptable reconstructions, and his work serves as a useful description of a different technique using the nasolabial donor site. Although a departure from commonly preferred techniques, his results are a testament to the concept that a skin graft can survive without being completely defatted. Although his results are aesthetically acceptable and associated with very few graft losses, most authors argue that leaving this fat impedes the processes of imbibition and inosculation necessary for graft survival, thereby risking high rates of graft loss. Contact between the graft dermis and the recipient bed is of vital importance for establishment of neovascularization. Therefore, we regard careful defatting of the graft and use of a bolster indispensable technical components to ensure survival or "take" of the full-thickness graft.

If a defect is of sufficient depth to require a graft that includes subcutaneous fat, using a full-thickness skin graft for such a defect represents a break from principle-based reconstruction. Likewise, when considering defects along or near the alar rim, one must carefully account for the potential for alar notching. Given appropriate defect analysis, reconstructing a superficial alar defect with a full-thickness skin graft may yield an ac-

ceptable result without resultant notching. Skin grafting for defects that abut the alar rim were used with great caution in this series. Preferentially, skin grafts on the posterior aspect of the ala or defects in male patients with very thick sebaceous skin could be grafted more safely without the risk of alar retraction secondary to the inherent stability of anatomical position on the ala.[9] Deeper defects that extend into the subcutaneous tissue or to the perichondrium of the lateral crura demand a local flap or nasolabial flap with a nonanatomical alar contour graft.

It is frequently debated in both the dermatologic and plastic surgery literature whether to harvest a graft of identical size to the defect, or to correct for anticipated contraction and harvest a larger graft. The senior author's technique involves creation of a template of equal size to the defect. As discussed previously, this template is designed in three dimensions, taking concavity or convexity into consideration. Full-thickness skin grafts primarily contract 10 to 15 percent after excision; however, insetting the graft under appropriate tension readily resolves this problem. All of the defects presented in this study were reconstructed with grafts of equal size. Harvesting a larger graft to account for primary contraction presents a number of issues. First, the donor site must be larger, and in keeping with an elliptical design, increasing the diameter of the donor site necessitates an extension of its axial length. The larger donor graft, which represents an estimation of size to account for contraction, often requires trimming before inset; this leads to an inexact size and shape that no longer resembles the template or the defect. Harvesting a larger graft does not improve these results but instead presents the confounding morbidity of a larger donor site.

Graft loss is always a concern, and although results are improved by careful defatting and bolster placement with through-and-through buttress sutures, other factors such as a history of smoking come into play. All of the graft losses in this series were in smoking patients. It is impossible to develop and maintain a comprehensive reconstructive practice without operating on smokers; however, these patients must understand that they are at significantly higher risk of graft loss or flap necrosis, and may ultimately be left with an unacceptable result. The effects of nicotine are well documented as a potent vasoconstrictor that reduces blood flow, leading to a hypoxic cascade that impairs healing and increases platelet aggregation and adhesion. In the multicenter study of recipient-site complications of full-thickness skin grafts, authors of the Australian Mohs Database showed that "although the number of smokers was small, they had a mean graft survival of 2% on the second visit compared with 75.9% in the nonsmoking group." If the patients are seen preoperatively, substantial benefit has been shown in people who are able to abstain from smoking for at least 4 weeks before reconstruction.

Patients are typically well informed and understand the possibility of graft loss. They are highly attuned to changes in graft appearance and will often present in the early postoperative period with concerns over a pale or overly dark graft. Indeed, full-thickness skin grafts are less predictable than nasolabial or local flaps. The healing period involves color and texture changes that can raise alarm before arriving at the final, aesthetically acceptable result. The graft is initially ischemic, appearing white and pale. As it evolves through the stages of revascularization, it will become edematous and then darken, resulting in a cyanotic or hyperemic appearance. These color changes vary among patients and among graft sites and sizes in an unpredictable manner, but over weeks to months, the living graft will approximate a normal color. In some cases, especially with a thick graft, the epidermis will turn dark and slough. This tissue will reepithelialize, given the presence of dermal appendages, but both the patient and physician will have a justified concern that the graft has failed. Patients should be counseled to anticipate these changes in color and texture.

In keeping with the principles asserted by Rohrich et al., good contour is the aesthetic endpoint to all nasal reconstructions.[9] To achieve this, the authors describe "complementary ablative procedures" to enhance final results. These procedures include dermabrasion, thinning of flaps, breaking up trapdoor scar lines, and steroid injections at sites of pincushioning. Primary dermabrasion is not typically performed for full-thickness skin grafts because of the risk of trauma to the delicate graft and because of the unpredictable course of healing that the graft will follow. Dermabrasion of skin grafts is instead performed at approximately 6 weeks postoperatively. Depending on the size of the graft, dermabrasion can be limited to the graft margins or can include an entire subunit(s).

CONCLUSIONS

The following principles make skin grafting of lower third subunits a viable reconstruction option. Provided that these constraints are followed, skin grafting of the lower third of the nose is an appropriate part of the reconstructive algorithm.

1. Rigorous defect selection to include only superficial defects, and size-limited defects. Defects larger than 1 cm will be better treated with alternative reconstructions. Defects that involve cartilage or deeper are by definition complex nasal defects that will require onlay cartilage grafting for satisfactory reconstruction. Skin grafting is not offered for these defects.
2. Caution in skin grafting defects abutting the alar rim.
3. Meticulous graft donor-site selection using the thicker and better color-matched forehead skin in the majority of cases.
4. Meticulous size matching of the graft, using a foil pattern template, and development of a bolster material from a surgical sponge that provides ideal compression and handling qualities used in conjunction with a through-and-through central Prolene suture to minimize graft dead space.
5. Liberal use of postoperative dermabrasion to optimize the final color match.

James F. Thornton, M.D.
Department of Plastic Surgery
University of Texas Southwestern Medical School
1801 Inwood Road, 4th Floor
Dallas, Texas 75390-9132
james.thornton@utsouthwestern.edu

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