

Various Modalities of Reconstruction of Nasal Defects

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Abstract

The nose represents the most important site for the esthetic face. The smallest loss of substance will create aesthetic and psychosocial concerns for patients; therefore, surgeons who perform nasal reconstruction should be strictly confident with the normal as well as abnormal surgical anatomy to execute perfectly the procedure for patient's condition. To achieve, the original shape is the end target of any reconstruction in terms of appropriate of three-dimensional geometry, proper establishment of symmetry, and good color and texture match to the adjacent structures that are paramount features. At present, we have multiple surgical options to re-establish normal or near normal function and anatomy; nevertheless, the management of nasal defects can be often challenging. The present goal is to highlight some of the more common techniques used to reconstruct cutaneous, cartilage or composite defects of the nose with a specific focus on decision-making based on the esthetic subunit and defect size. Our aim is to share common problems and offer practical suggestions that we have found helpful in their clinical experience.

Key words: Forehead flap, Local flap, Nasal defect, Nasal reconstruction, Naso labial flap, Subunit

INTRODUCTION

Nasal defects can be post-surgery, burns, and trauma. In this article, we aim on reconstruction of all nasal defect except post-onco surgical defect. This criteria can be effectively applied to traumatic issue, in the cases of burns and trauma.^[1] Initial management should be focused on removing any possible wound contamination before surgery. The nose and the periorcular region own a key position in the aesthetic face; its distinct anatomy combined with the functional, social, and esthetic concerns makes reconstruction challenging.^[2] We may come across patients with unrealistic expectations. In all cases, esthetics face is the main concern. Post-animal bite, road traffic accident, and post-burn defect cases remain main pool of patients with the nasal defect; one will come across in India.^[3] Nasal

defects can involve the skin, cartilage, bone, or the internal mucosal lining up to various degrees, and even the smallest loss of substance will create esthetic and psychosocial concerns for patients.^[4] Therefore, surgeons who perform nasal reconstruction should be strictly confident with the pertinent surgical anatomy to tailor the procedure to the patient's needs.^[5]

The first technical description of nasal reconstruction was made by Indian physicians thousands of years ago. Since then, many refinements have been made to these primitive procedures, and many novel techniques have been reported. Burget and Menick have further improved nasal reconstruction techniques by establishing the esthetic subunit principle.^[6] Loco regional flaps and skin grafts still play a significant role in the reconstruction of soft tissue and cutaneous defects; microsurgery can offer alternative options, especially for total or subtotal nasal reconstruction.^[7]

The present goal is to highlight some of the more common techniques used to reconstruct cutaneous defects of the nose with a specific focus on decision-making based on esthetic subunit and defect size.^[8]

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www.ijss-sn.com

Month of Submission : 01-2022
Month of Peer Review : 01-2022
Month of Acceptance : 02-2022
Month of Publishing : 03-2022

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Evaluation of Defect

Nasal tissue can be divided into cover (skin, subcutaneous tissue, and muscle), support (cartilage and bones), and internal lining (vestibular skin and nasal mucosa).^[9] The key for a successful nasal reconstruction is a careful evaluation of the defect and local tissue status. The most critical aspects to investigate are the size, depth, and location of the defect.^[10]

Small defects of <1.5 cm can be closed primarily or reconstructed with a flap (local tissue) or full thickness skin graft (FTSG). Medium defects of 1.5–2.5 cm can be reconstructed with a flap (regional or local tissue) or FTSG. When the defects are large, that is, >2.5 cm, a flap (regional tissue) or FTSG should be exploited.^[11] However, inconsistent recommendations for a general ranking are found in the literature, and disagreements exist about whether the cutoff for a primary closure should be 1 cm instead of 1.5 cm or whether a regional flap is mandatory for a medium-sized defect.^[12]

Variation 0.5 cm should be applied to any difference in size and skin mobility among patients; a pinch test has to be completed preoperatively, especially when performing a primary closure or a local flap.^[13] Healing by secondary intention not to be allowed considering the esthetic importance of face in that case, it is likely to be unacceptable. It requires weeks of careful wound care and, often, social segregation; surgical site infection.^[14] The literature is inconclusive about this matter. Indeed, the small scars that result from second intention healing located in natural concavities (i.e., alar grooves) are often less evident than the bulkiness of flaps and grafts; anyway, secondary healing is much more unpredictable than primary healing, and a subsequent alar elevation would be an esthetic disaster.^[15]

Microvascular free flaps are the gold standard in head-and-neck reconstruction and they have proven to be highly reliable and effective in total and subtotal nasal reconstruction. These patients should be counseled about their increased risk for complications.^[16]

Nose-union of Subunits

The nose is one of the esthetic units of the face and is subdivided into its nine esthetic subunits.^[17] They are identified by distinctive convex or concave surfaces, more specifically, from above downward as dorsum and paired sidewalls, nasal tip and paired alae, columella, and paired soft-tissue facets. Cutaneous nasal defect reconstruction should be considered in light of nasal esthetic subunit principles. If most of the surface area (>50%) of a convex subunit (tip or ala) is excised, reconstructing the whole subunit is usually preferable: The safe part of the

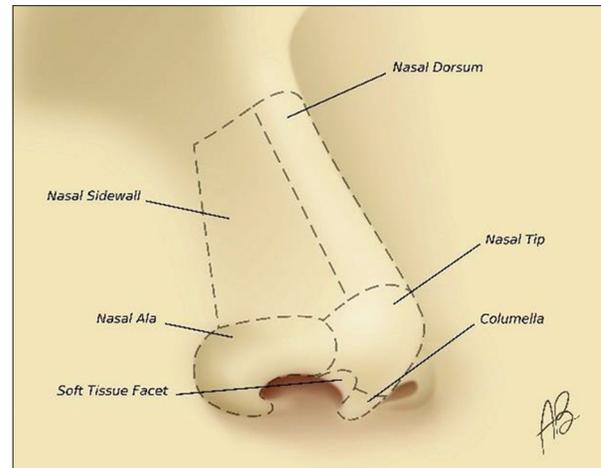


Figure 1: Esthetic subunits of the nose

subunit should be excised and the whole subunit should be reconstructed [Figure 1].^[18]

The subunits differ in skin quality and shape and the latter is determined by the size and contour of the underlying structural framework. The nasal tip, nasal ala, and cranial dorsum (radix) have the thickest skin with more pilosebaceous units.^[19] Conversely, the skin of the mid-lower dorsum and the upper nasal sidewall is usually the thinnest.^[20] Reconstructive surgeons should be conscious of these differences because the recruitment of skin with a thickness that differs from that of the recipient area may lead to suboptimal results; moreover, a thick and non-elastic skin interferes with flap transposition by increasing wound tension and developing conspicuous standing cutaneous deformities.^[21]

MATERIALS AND METHODS

All the patients signed an informed consent form and a photo release form. Peri-operative antibiotics such as amoxicillin with clavulanic acid were administered in all nasal reconstruction cases. We inject bupivacaine and with epinephrine in flap donor area with the aim of preventing bleeding during surgery. When facing a nasal cutaneous defect, we never choose healing by secondary intention because the outcomes are unpredictable in terms of cosmetic results. Local flap reconstruction is generally chosen over skin grafts, although the latter can be beneficial in following patients: (1) Patients who reject any staged procedure and/or multiple flap harvest, (2) patients with superficial defects, and (3) patients with significant medical comorbidities; anyway, a higher necrosis rate should be taken into account if compared to local flap surgery, and a suboptimal result should be expected in terms of contour and color match.

Defects and reconstructive strategies	
Esthetic Subunit	Technique
Dorsum and Sidewalls Cm	
<1.5	Primary closure Transposition flap (sidewall) Glabella flap
1.5–2.5	Glabellar flap (cranial defect) Bi lobed flap Dorsal nasal flap
>2.5	Para medial Forehead Flap Dorsal Nasal Flap Cheek advancement Flap
Tip, cm	
<0.5	Primary Closure
<1.5	Bi lobed Flap V-Y Island Pedicle Advancement Flap
1.5–2.5	Dorsal Nasal Flap Para medial Forehead Flap
>2.5	Para medial Forehead Flap Nasolabial Flap
Ala	Nasolabial Interpolated Flap Paramedial Forehead Flap

Management of Defects

Following table shows that different modalities were categorized as per size of defect so as to standardized it.

Skin Grafting

Grafting is be giving suboptimal result. Full-thickness skin grafts are suitable for reconstruction most superficial defects; however, the color-blending could be often disappointing, especially in sun-damaged reddish skin, where the FTSG will appear as a pale patch. When facing a large multi-subunit defect, the surgeon should be encouraged to adopt the well-recognized concept of reconstructing the nose in esthetic subunits. Using the subunit, principle is often ideal [Figure 2].



Figure 2: (a) Pre-operative, (b) Intra-operative, (c) Post-operative

An FTSG was planned and harvested from the retroauricular area (The 2-month post-operative picture shows an acceptable result in terms of color and contour match).

Considerations in choosing a donor site include the size, thickness and grade of sun exposure of the donor and recipient site skin, and the resultant cosmetic deformity/easy concealment of the donor site. Preferred donor sites include pre-auricular, post-auricular, and supraclavicular, and inner arm area; this site is more concealable than the supraclavicular area. FTSG exploited for tip reconstruction should be thinned minimally due to the characteristics of caudal nose skin.

Dorsal Nasal Flap

This flap can be used for large-sized defects of >2.5 cm located on the caudal dorsum–tip of the nose. However, in those cases, a paramedian forehead flap should be preferred to obtain a more acceptable esthetic outcome [Figure 3].

If a direct closure is planned, a careful and extensive undermining should be always accomplished to avoid any standing cutaneous deformity (SCD) and wound closure tension. In the caudal dorsum, a transverse fusiform excision should be reserved for the elderly to obtain a pleasing tip rotation (balancing nasal tip ptosis); if otherwise exploited, such direct closure could cause a tip distortion. If a thickness mismatch is present (i.e., glabellar skin moved to the inner canthus), thinning of the flap is mandatory to obtain a pleasing result.

The dorsum and sidewalls are treated together because these two esthetic subunits are similar in terms of skin characteristics and reconstructive options. The dorsal and sidewall skin is usually mobile and less sebaceous. Local tissue can be easily mobilized to reconstruct small-to-medium-sized defects; instead, flaps from adjacent areas are exploited for large defects.

Small defects of <1.5 cm could be closed primarily due to the slight redundancy of cutaneous tissues. In the dorsum, the decision of whether to orient direct closure in the transverse or craniocaudal dimension should be made according to the shape and size of the defect.

Medium defects of 1.5–2.5 cm are not suitable for a primary closure. A local flap reconstruction is mandatory. In the cephalic dorsum (and sidewalls), a glabellar flap can mobilize a conspicuous amount of skin and cover a defect extending to the canthus. The flap can be harvested as a V-Y advancement flap or a more typical glabellar rotation flap.

Bilobed Flap [Figure 4]

Small defects of <1.5 cm could be treated with a bi-lobed flap. A bi-lobed flap (a double transposition flap with a



Figure 3: Dorsal nasal flap, pre-operative markings. A “V” shape was designed in an upside-down fashion over the glabella; then, a curvilinear line was drawn on the nasal–cheek junction till reaching the defect site. Pre-operative, (b) Intra-operative, (c) Post-operative



Figure 4: (a and b) Bilobed flap. Preoperative picture. A laterally based bilobed flap was planned to repair the skin defect (1.4 cm). The surface area and the width of the first lobe should be the same as the defect. The second lobe was designed in a triangular shape; the width was slightly less and the height was approximately 1.5 times greater than the first lobe

single base) with its geometrical features recruits elastic skin from contiguous subunits and minimizes the wound closure tension and standing cutaneous deformities. The bilobed flap can be based laterally or medially. The first lobe (curvilinear) is designed immediately adjacent to the defect. The surface area and the width of the first lobe should be the same as the defect. The second lobe should have a surface area smaller than that of the defect and should be designed in a triangular shape; the width should be slightly less and the height should be approximately 1.5 times greater than the first lobe. The straight axes passing through the center of each lobe and defect are placed at about 45° from each other. The dissection is carried out below the muscular plane and above the perichondrium/periosteum. As for any other transposition flap, the donor site of the second lobe is closed first. Then, the first lobe is transferred to reconstruct the nasal defect. Finally, the second lobe is trimmed and stitched in the donor defect of the first lobe and the SCD is excised.

Forehead Flap [Figure 5]

The forehead flap is based on the supra trochlear vessels that pierce the orbital bone at about 2 cm lateral to the midline. It is commonly used for total resurfacing of the tip, nasal dorsum, and sidewalls or ala. The procedure can



Figure 5: Pre-operative, (b) Post-operative, (c) Follow-up

also be used for reconstruction of multiple subunits. It is a staged operation; two-stage reconstruction is more commonly performed, but it also can be performed in three stages to reduce complications and enhance the esthetic outcomes. A paramedian forehead flap (PFF) will usually give a more natural result because the entire esthetic unit can be restored and the scars can be concealed in natural boundaries.

Large defects of >2.5 cm are commonly reconstructed with a PFF.

Nasolabial Flap [Figure 6]

A nasolabial transposition flap is a viable option for alar reconstruction; anyway, this single-stage option results in a deformation of the alar facial sulcus (if left intact after tumor removal) and loss of symmetry that has to be restored with subsequent poor cosmetic result. An interpolated melolabial flap does not retain such downsides and it is a recommended option if the alar facial sulcus. This two-stage procedure leaves the alar facial sulcus untouched without the need for subsequent reconstruction. The main drawback of this flap is a cosmetic deformity that lasts 3 weeks; a second procedure is necessary to divide the flap pedicle and inset the flap. Defects also affecting the alar facial sulcus and/or alar groove often require a third stage during which these natural boundaries are accurately recreated.

Post-operative Care and Complications

- Peri-operative antibiotics
- Head elevated
- Proper wound dressing is mandatory to avoid bleeding and infection
- In case, a hematoma is noticed, it should be promptly



Figure 6: Nasolabial folded flap. (a) Preoperative picture. A 22-year-old patient defect of the nasal ala. A nasolabial folded flap was planned to repair the full-thickness defect in two stages. (b) A nasolabial flap was folded to reconstruct the lining and external coverage after being thinned. Stage I: Immediate post-operative picture. A povidone iodine impregnated gauze was positioned. The donor site was sutured primarily. (d) The 3-month post-operative (Stage II) picture shows an optimal result; the nasal ala regained a good contour and alar facial sulcus was restored. Pre-operative, (b) Intra-operative, (c) Post-operative, (d) Post-operative

treated to avoid any compromise

- Trap-door deformity
- Lymphedema.

RESULTS

Out of the 20 patients, 14 were men and six were women, with ages ranging from 5 years to 60 years. Road traffic accidents accounted for six cases; post-human bite defects account for one cases; seven cases were due to post-animal bite, one case was due to Kite string injury, one case was congenital defect, one case was post-burn nasal defect, and 3 cases were post-surgical defect.

Full thickness defect was in 18 patients. In two patients, there was only cover defect. Defect of dorsum of the nose was there for two patients. Defect of the ala alone was there for two patients. Defect of ala and dorsum was presented for eight patients. Both the alae with tip present were found defective for one patients. Dorsum with ala, tip, and columella was present for five patient. Defect of tip alone presents for two patients.

All the post-traumatic and post-excision cases underwent secondary reconstruction. All the post-excision defects were reconstructed primarily. Reconstruction with PFF was performed in 10 patients. Dorsal nasal flap was done for one patients. Four cases underwent reconstruction with nasolabial flap. Two defects were resurfaced with FTSG and the graft take was 100% in all cases. One patient reconstruction with bilobed flap for nasal defect. One patient reconstructed with free radial forearm flap. One patient underwent only SSG because of poor general condition later prosthesis was applied to him.

Two patients had associated eye injury. Two patients had associated upper lip injury. Two patients had pre-operative nostril stenosis which was cleared postoperatively. Five patients required only one operative stage. Thirteen patients had two stages of surgery. Two patients had three stages of surgery.

All the pedicled flaps survived completely. In our study, none of the patients underwent reconstruction for support. Midline forehead flap based on the supra-trochlear vessels was used in the majority of patients with dorsal and tip nasal defects which is comparable to other studies. The maximum size of the defect was 43×39 mm and the minimum was 12×8 mm.

None of our patients had any significant complications. The results were evaluated as follows: Regarding the color, small-to-moderate nasal defects were reconstructed quite well with the midline forehead flap. The forehead flap had the same color and a superb texture match with the facial skin.

In our study, at 3–6 month follow-up, the contour of the reconstructive nose was found to be satisfactory and retained the good shape of the nose and projection of the tip. There was no need for reconstruction of the support. All the pedicled flaps survived completely. The two nasolabial flaps needed thinning as a second stage surgery.

CONCLUSIONS

Nasal reconstruction is deeply founded on the nasal subunit principle and the physician must bear in mind the various tissue quality among the subunits when outlining a reconstructive strategy. Primary targets of nasal reconstruction were satisfactory cosmetic and functional result. PFF is very versatile flap which can be used for almost type of nasal subunit defect. Forehead flap with inner lining by FTG, STG, and cheek flap can be used. Nasolabial and cheek flap can be used for only alar defect undoubtedly. Reconstructive surgeons should treat each patient as a distinct individual with a peculiar defect and the procedure should be customized according to the clinical conditions and the demands and wishes of our patients.

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How to cite this article: Sachde JP, Kachhadiya N, Rana H, Suri MP, Mistry K, Ganpathy N, Nakka A. Various Modalities of Reconstruction of Nasal Defects. *Int J Sci Stud* 2022;9(12):101-106.

Source of Support: Nil, **Conflicts of Interest:** None declared.