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# Repair of Defects of the Nasal Tip After Mohs Surgery

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## ABSTRACT

**Introduction:** Mohs Micrographic Surgery (MMS) is a treatment option for high-risk facial nonmelanoma skin cancer with high cure rates. Especially on the nasal tip, the tissue sparing properties of MMS are appealing. The nasal tip is a common location of nonmelanoma skin cancer and can be a challenging anatomical structure for reconstructive surgery due to its prominent location in the face, the shortage of spare tissue, as well as the stiffness and composition of different skin types, cartilage and bone.

**Objectives:** The aim of the present paper is to review and demonstrate how reconstruction of the nasal tip can be done successfully to improve the care for patients undergoing MMS in this area.

**Methods:** Using selected literature on the area and the surgeons experience, each method of repair are described including their individual advantages and challenges. Pictures and consent were selected from one patient who underwent each repair method and three photos are presented in this paper: one after tumor resection, one immediately after repair, and one minimum 6 months post-surgery.

**Results:** We present eight surgical methods as well as pictures from previous surgeries.

**Conclusions:** The results demonstrate obtainable results using very different surgical methods and the importance of an individualized approach to repairing cutaneous defects of the nasal tip.

## Introduction

Mohs micrographic surgery (MMS) is the gold standard for treatment of high-risk facial nonmelanoma skin cancer (NMSC) in the United States and many countries in Europe [1-5] . The micrographic technique of MMS progressively examines the complete margin of surgically excised cancer -containing skin until only tumor-free tissue remains. MMS offers 99% cure rates in primary basal cell carcinoma (BCC) cases, in contrast to the 87%-90% rate provided by traditional excision with histopathological examination using vertical sectioning [6-12] . Besides high cure rates, MMS spares healthy tissue promoting optimal conditions for repair and cosmesis. Preservation of healthy tissue is particularly significant in maintaining important structures and their function in essential areas like the nose, where the majority of facial BCCs are located [13-15] . Therefore, knowledge related to different methods of repair is necessary.

## Objectives

The aim of this paper is to review and demonstrate how one-step reconstruction of the nasal tip (apex nasi) can be done successfully to improve the care for patients undergoing MMS in this area.

## Results

### Repair of Defects on the Nasal Tip

Reconstruction of surgical defects of the nose are challenging, in part due to the shortage of spare tissue, as well as the stiffness and composition of different skin types, cartilage and bone [16,17] . The nasal tip is part of the lower one-third of the nose, in conjunction with the soft triangles, columella and alar lobules. It's defined as being bordered by the nasal dorsum, nasal sidewalls, the soft triangles and the nasal alae [17]. The primary goals of the repair after MMS are to preserve anatomy, aesthetics and function of the nose, while preventing nostril size reduction, internal and external deformation, and nasal tip elevation. For optimal cosmetic results, careful selection of the reconstructive method is necessary taking into account the characteristics of the defect, nasal anatomy, patient expectations and the surgeon's experience [17]. There are four major wound closure options: second intention healing, primary closure, local or distant flaps and skin grafts [11,17] .

## Methods for One-step Repair of Nasal Tip Defects

### Direct Linear Closure

Direct linear closure (Figure 1) can be the best option for closure in certain cases. It is a simple one-stage procedure, which is less time consuming compared to more complex closure options such as flaps or grafts. Moreover, there is less risk of flap loss or hematomas. The aesthetic outcome is predictable and often excellent. Although direct linear closure probably is best used for defects involving the upper-two-thirds of the nose where the surrounding skin is more mobile, the method can also be applied on defects involving the nasal tip. It is a reasonable option for closure of smaller defects less than 10 mm, as well as for elderly patients, who commonly present with greater skin laxity. Vertically orientated closure is preferred to horizontal, as the latter carries a risk of tip elevation. Generally, horizontal closure should be restricted to patients with nasal tip ptosis or convexity of the nasal dorsum. Furthermore, retraction of the nasal ala is also a risk, but can be minimized by performing wide undermining

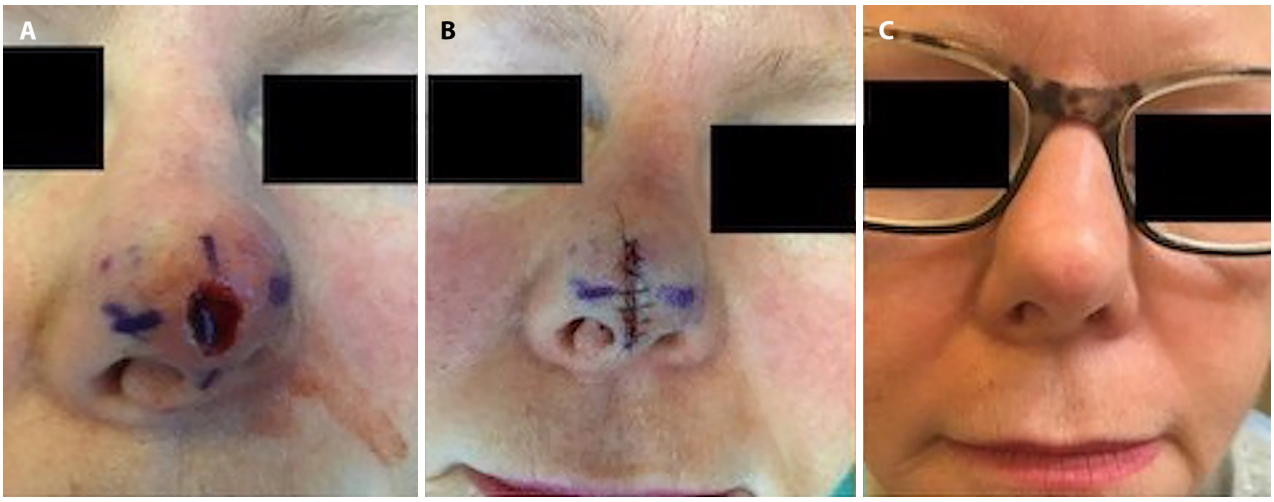


**Figure 1.** Side-to-side repair of defect on the nasal tip. Pictures of a) defect after Moh's surgery, b) suture, and c) result post-surgery.

extending on both sides [17]. Removal of standing cones is necessary so that margins are readily approximated under minimal tension. The resulting scar after direct linear closure is often longer than patients anticipate and must therefore be explained. The surgical defect can be closed with 4-0 or 5-0 absorbable sutures buried deep in the reticular dermis and subcutaneous tissue, followed by 5-0 or 6-0 non-absorbable, running or interrupted cutaneous sutures.

### *East-West Flap*

The horizontal advancement flap, also known as the East-West flap (Figure 2) or Burrow wedge advancement flap, is a simple technique in repairing even larger, full-thickness defects on the nasal tip after Mohs surgery [18]. The horizontal advancement flap is conceptually equivalent to the vertical primary closure, in the need of removal of two standing cones. The superior cone, as it would be in a primary closure, is adjacent to the defect and parallel to the long axis of the nose. The inferior cone, however, is shifted medially to the exact center of the nasal tip and/or the columella, in order to avoid excision of the alar rim and the soft triangle. Both standing cones are then removed. Wide undermining above the perichondrium is necessary for tissue advancement into the original defect without tension. The flap is best for dermal defects of the lateral nasal supra-tip that do not exceed 15 mm in size. Vascular supply is excellent and cosmetically, the risk of lifting of the alar rim or distortion of the nasal tip is minimal [19]. Caution should be taken for defects approaching the alar crease or moving down the nasal sidewall, as decreasing tissue laxity increases the risk of nasal asymmetry. It should also be noted that sebaceous nasal tips are at risk for dehiscence. The surgical defect can be closed with 4-0 or 5-0 absorbable subcutaneous sutures and 5-0 or 6-0 running or interrupted non-absorbable cutaneous sutures.

### *Bilobed Flap*

The bilobed transposition flap (Figure 3) is widely used for nasal reconstruction [16], though with many variations upon the original design. The flap was initially described as a tissue transposition over two arcs of 90° each, but subsequently a modified flap designed by Zitelli limited the arc of rotation to 45-50° for each lobe [20]. The double transposition flap design allows for greater distribution of tension compared to a single transposition flap (the rhombic or note flap). Also, it permits harvesting the lax and matching skin of the nasal dorsum to transpose and rotate into defects of the nasal tip [17]. The base of the bilobed flap is preferably located laterally, where the angular artery provides solid vascular supply to the flap. The pivot point of the laterally based flap is placed one defect radius away from the edge of the defect preferable in or towards the alar groove allowing for the standing cone to be removed with optimal cosmesis. Then, two lines are drawn from the pivot point directed 45° and 90° from the axis of the wound, marking the central axis of the first and second lobe, respectively. Two arcs are then drawn going through the center and the edge of the defect to guide shaping of the two transposition flaps. The first lobe should be nearly the same size and width as the defect, whereas the size of the second lobe can be somewhat undersized (75%-80% of the defect size) to avoid pincushioning. Importantly, if the tertiary defect is not vertically placed on the dorsum it can lead to secondary tip distortion. Wide undermining is performed at the submuscular level. Primary closure of the secondary lobe donor site is preceded by excision of a standing cone deformity. Then follows closure of the secondary and primary defects before the standing cone of the pivot point is trimmed and sutured. 4-0 or 5-0 absorbable subcutaneous and 5-0 or 6-0 running or interrupted non-absorbable cutaneous sutures are suitable. A superiorly based bilobed flap has been described, where the standing

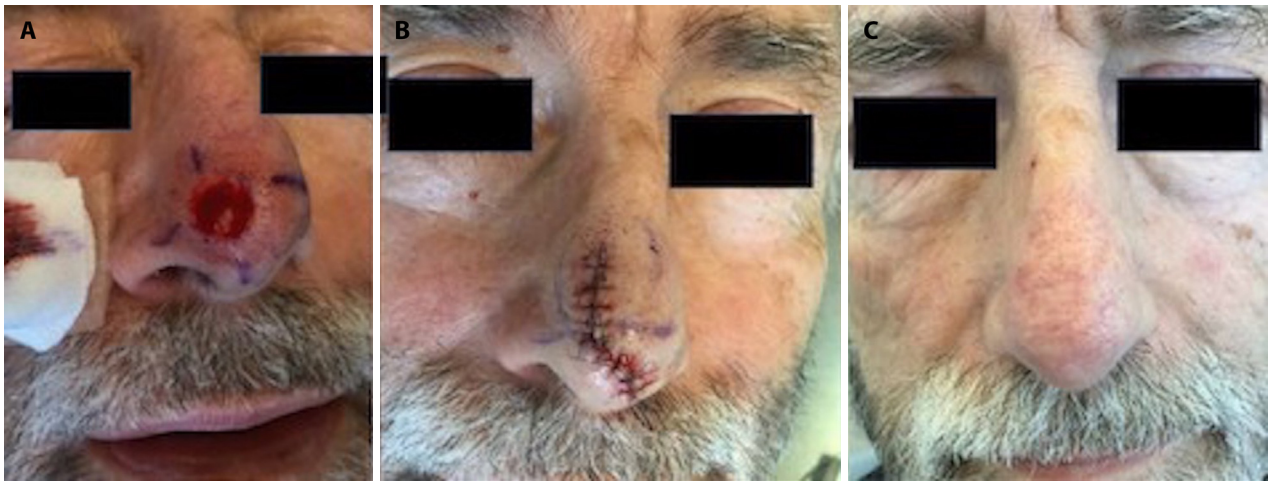


**Figure 2.** East-West flap. Pictures of a) defect after Moh's surgery, b) suture, and c) result post-surgery.

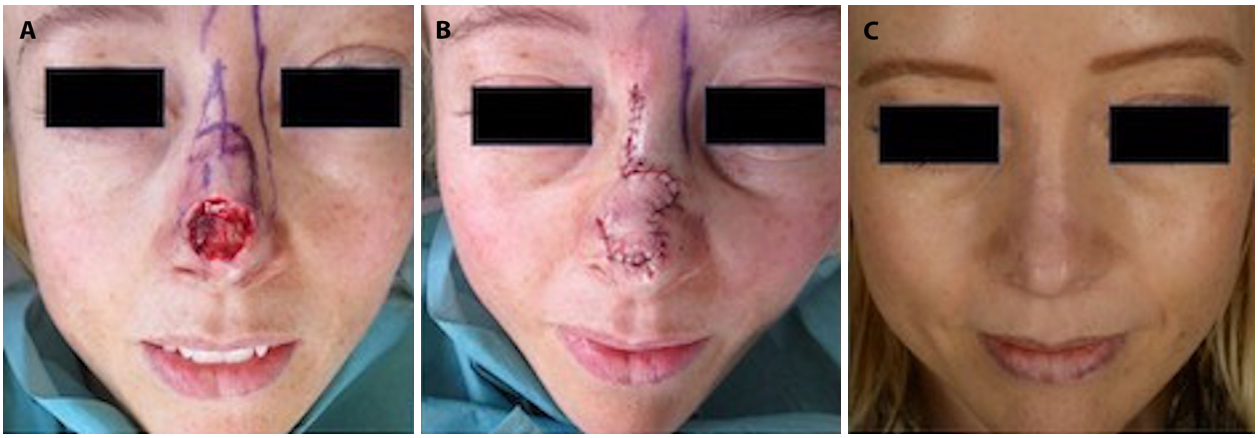


**Figure 3.** Biloped flap. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

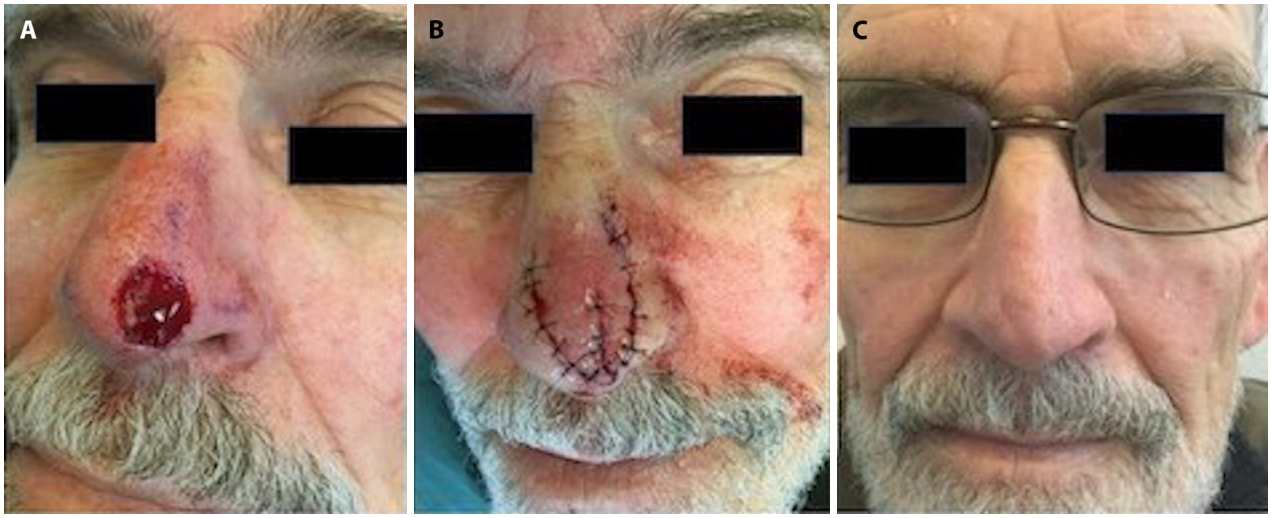


**Figure 4.** The Peng flap. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

cone of the secondary lobe is placed within or close to the nasolabial fold whereas the pivot point is directed toward the medial canthus. This design could be advantageous in larger defects of the nasal tip. The cosmetic result following closure with the bilobed flap is often satisfactory. However, pincushioning can be a problem and should be managed by injection of Triamcinolone or simple surgical revision if it occurs. Nasal valve problems due to pressure of the soft tissue or weak underlying structures of the ala nasi can also occur. Finally, it is should also be observed that this bilobed flap creates a linear and two sequential curvilinear scars.

*Peng Flap*

The Peng flap (Figure 4) is a double rotation flap originally designed for repair of midline surgical defect of the distal nose [21]. Since its introduction in the late eighties, modifications of the flap design have improved the applicability to include even larger and eccentrically located surgical defects of the distal nose [22]. The flap seems best suitable for defects contained within a cosmetic unit no larger than 20 mm in diameter. For midline defects, incision of the rotation arms of the flap begins at the distal portion of the defect, continues laterally into the alar grooves until the junction between the cheek and nasal sidewall is reached. Incisions are then directed towards the medial canthus area running between these two cosmetic units. Both flaps are raised from the submuscular level and followed by wide undermining of surrounding areas. Both flaps are then rotated centrally into the defect and sutured with buried sutures starting centrally. The secondary defects along the nasal sidewall are closed before the standing cone at the center of the flap is removed, preferably as a 30° vertical midline wedge. The superficial layer is closed using 5-0 or 6-0 interrupted non-absorbable cutaneous sutures. Basically, closure of eccentrically located defects are designed similarly, but the standing cone would then become a 30° wedge into the wider of the two arms. Vascular supply from branches of the angular and infratrochlear arteries is excellent. The cosmetic result of this flap

is often excellent, partly due to the perfect tissue match for sebaceous nasal skin as well as the fact that scar lines can be placed in the junctions of cosmetic units. The flap is quite mobile and can reach even large defects of the distal nose without much tension. A drawback of this flap is nasal tip- or bilateral alar elevation, resulting in distortion of the shape of the nostrils [17].

### *Dorsal Rotation With Back-cut*

The dorsal nasal flap (Figure 5), also known as the Rieger flap, is a rotational flap that allows for reconstruction of intermediate to large defects (≤ 25 mm), affecting several areas of the nose including the apex. The flap is generated by starting at the medial part of the defect or alternatively, at the base of the defect. From there, the arc of the rotation flap is drawn towards the glabella. If possible, incisions are placed at the border between the nasal dorsum and sidewall subunits. A back-cut at the end of the incision line removes the Burow triangle that often occurs during rotation and reduces pedicle tension. The flap should then be elevated at the submuscular plane with proper undermining of the pivot point. Closure is made using 2-layered closures starting with the glabellar portion of the flap thereby forcing the flap into position. Subsequently, the primary defect is closed. Cosmetically, the outcome is good, as tissue match is perfect, and scars are located in less noticeable anatomical areas [17]. However, extending the flap too inferiorly can result in elevation of the tip or cause alar retraction and asymmetry.

### *Island Flap*

The island flap (Figure 6) differs from the other flaps mentioned by the pedicle of the island flap solely consisting of subcutaneous tissue or an artery and vein. It can be either rotation or advancement flaps, with the first being most common for closure of nasal defects with the cheeks or the forehead as donor areas [23]. The design of island flaps

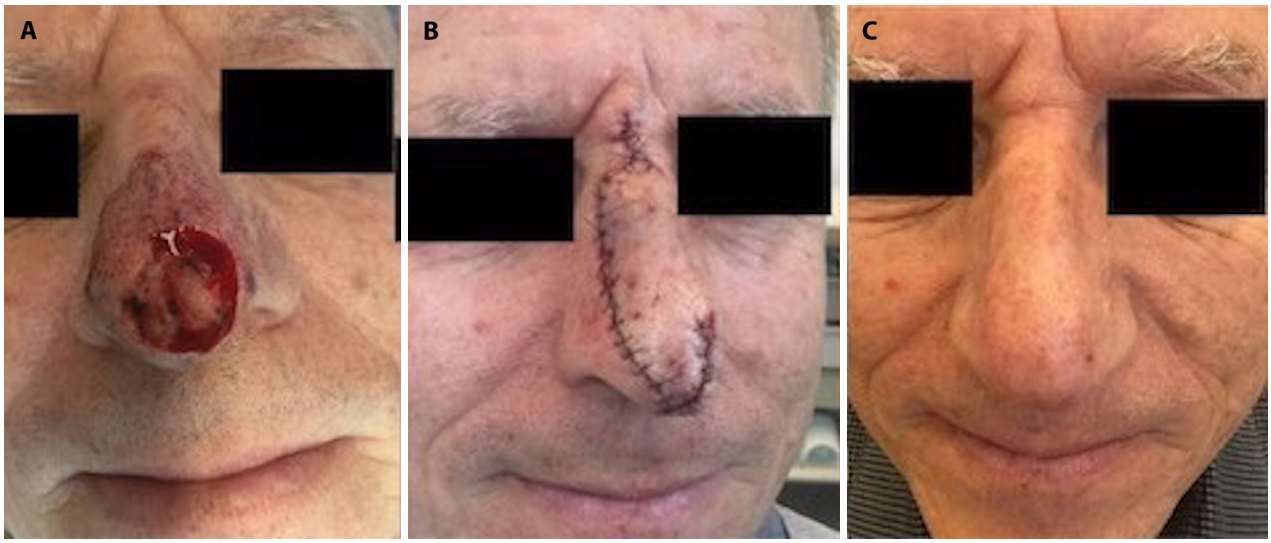


**Figure 5.** Dorsal Rotation With Back-Cut. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

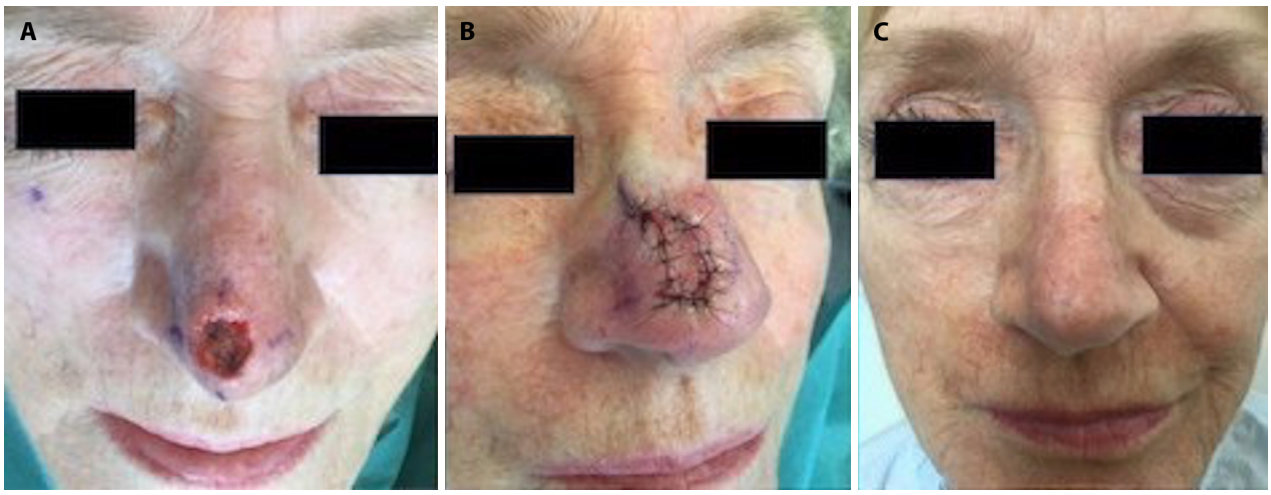


**Figure 6.** Island Flap. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

varies. The present island flap is a flap hinged on the nasalis muscle. In general, the flap is designed by marking a triangle from the defect towards the nasal dorsum or laterally onto the nasal sidewall. The width of the island should be equal to the defect. The flap is incised at the submuscular plane creating an island from the surrounding areas. The underlaying subcutaneous tissue is carefully loosened with scissors. Next, the leading and lagging part of the flap is undermined leaving the middle one-third part intact as a deep pedicle. Undermining around the defect is performed before setting the first absorbable buried suture that pulls together the leading edge across the defect. A second buried suture can be used to close the secondary defect. Then interrupted non-absorbable cutaneous sutures are placed. The Island flap is ideal for smaller defects and locations with well vascularized and elastic subcutaneous tissue. Advantages of this flap are great viability and mobility of the flap [16]. Drawbacks are the risk of pincushioning, nasal tip elevation and a triangular shaped scar difficult to place in a less visible anatomical area.

### *Advancement and Inferior Rotation of the Nasal Sidewalls (AIRNS) Flap*

This random pattern, single-stage flap uses principles of advancement and rotation with a primary rotation arc and pivot point similar to the bilobed flap in addition to an added advancement limb (Figure 7). Some authors consider the design of the flap and its execution to be simpler than that of the bilobed flap. The AIRNS is best suited for defects of the distal nose sized ≤15 mm, preferably with horizontal orientation. An arc is drawn from the superior edge of the surgical defect towards the medial canthus. The arc must be as long or longer than the height of the defect to be able to cover it. Reaching the junction between the nasal sidewall and the cheek, the arc is linked to an advancement limb. Importantly, the width of this limb must match the vertical height of the surgical defect. The flap is incised at the submuscular layer followed by wide undermining laterally on the cheek. Flap advancement is achieved by orienting the primary stich (an absorbable, buried suture) parallel to the free margin of the lower eyelid. The following movement of the flap is an inferior rotation, in which the primary defect can be reached without tension. A standing cone along the alar groove is produced during flap rotation. Upon cone removal, 5-0 or 6-0 running- or interrupted non-absorbable cutaneous sutures are placed in standard fashion. The curvilinear scar associated with the AIRNS flap might be more visible than the alternating scar line of the bilobed flap.

### *Skin Graft*

Full thickness skin grafting (FTSG) (Figure 8) in nasal reconstruction, especially for defects located at the lower third of the nose, is commonly used. Although many still consider this closure method inferior, the outcome of a FTSG, when appropriately applied, can be acceptable for the patient. Proper patient selection and donor sites are imperative to obtain optimal results [12]. The skin texture of the nasal tip is thick and composed of sebaceous glands. For defects of the lower third, the lateral lower forehead is an ideal location to harvest a graft since the skin is structurally similar to that of the nasal tip, and the scar can be hidden in the junction of the hair-bearing and nonhair-bearing scalp. Other possible donor sites could be the preauricular or postauricular

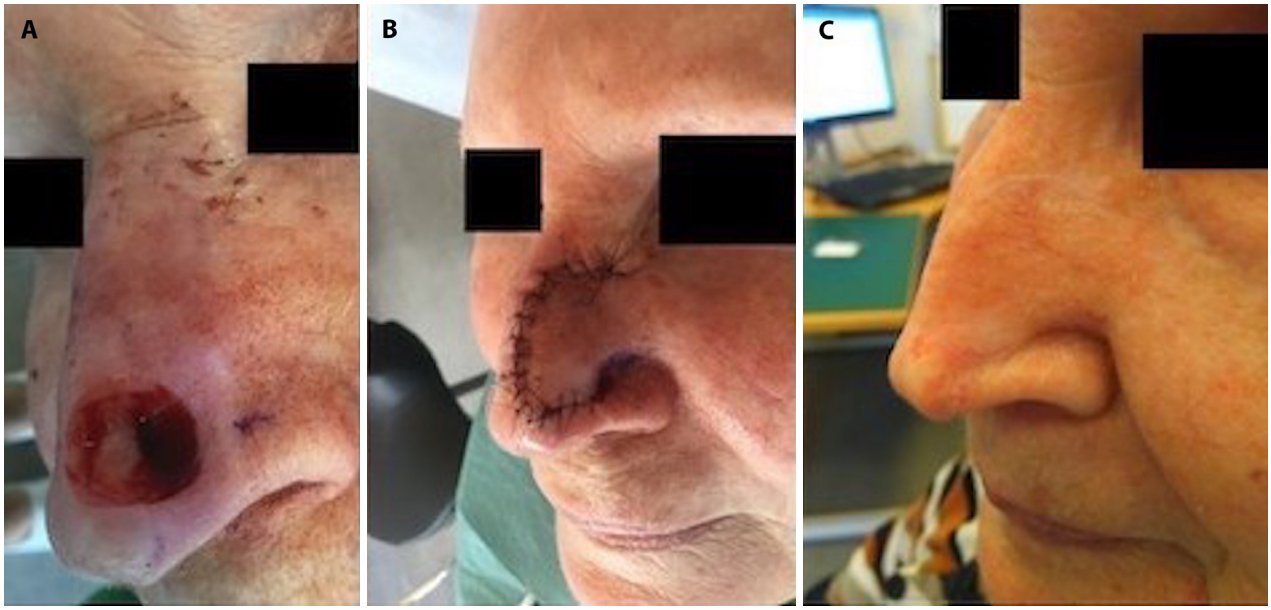


**Figure 7.** Advancement and Inferior Rotation of the Nasal Sidewalls (AIRNS) flap. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

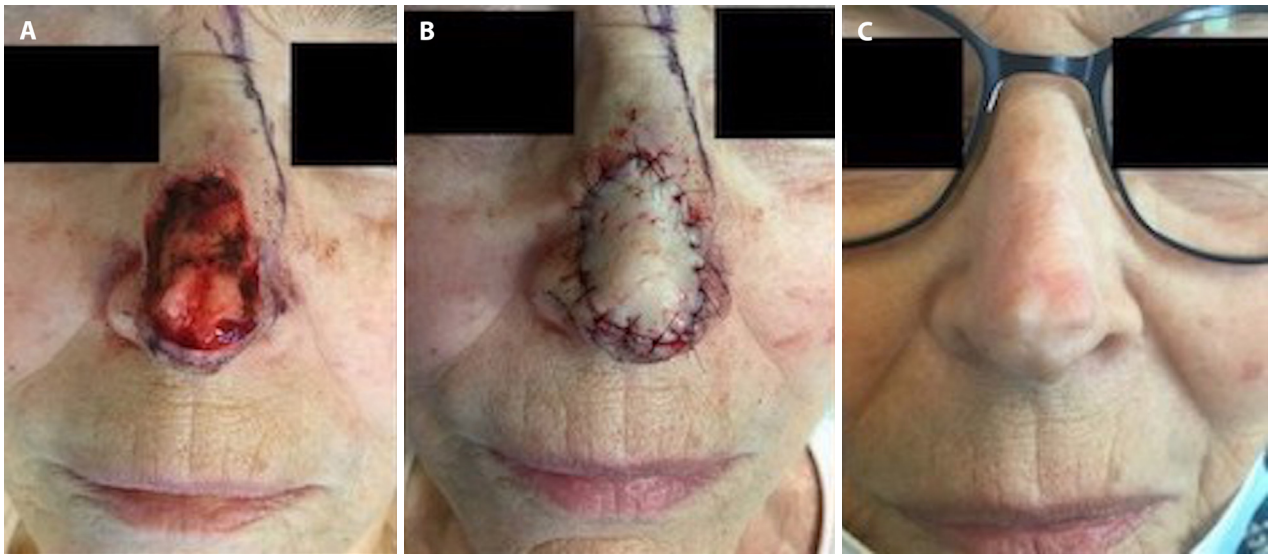


**Figure 8.** Full thickness king graft. Pictures of a) defect after Moh's surgery, b) suture, c) result post-surgery.

regions. Specifically, the conchal bowl is often chosen as a suitable donor site due to its's thickness and sebaceous similarity to the nasal tip. It is desirable to select the donor site from a location with minimal actinic damage to minimize the potential for another skin cancer at the site.

FTSG is suitable for small, shallow defects (< 10 mm) on the nose tip. However, it could also be applied on complete subunit reconstruction. When the donor site has been chosen, the graft is designed to match the exact defect dimensions or oversized by 10%-20%. The donor-site markings are extended beyond the template to form an ellipse along relaxed skin tension lines in order to remove dog ears from the donor site incision. The donor site is then closed appropriately. Once harvested, the graft tissue is trimmed from fat and in some cases fenestrated to allow for blood and lymph drainage. Next, skin edges of the graft and wound are carefully apposed using continuous 5-0 or 6-0 fast-absorbing sutures. To ensure that the base does not lift, tie-over dressings and/or basting sutures can be added. FTSG complications include full or partial graft loss. In such cases, new skin will eventually appear below the necrotized graft, although cosmesis could be less acceptable. Additionally, the risk of color and texture mismatch can yield a patch-like appearance.

## Conclusions

Nasal tip reconstruction is challenging due to the complex anatomical structure of this subunit. In order to obtain optimal functional and cosmetic results, the surgeon must take several aspects into consideration in choosing the best closure method. Attention to immobile landmarks is imperative, since alar retraction or twisting of the nasal tip usually is unacceptable, both for the patient and the surgeon. As surrounding tissue of the nasal tip is sparse, one should identify areas of maximal laxity with potential for tissue recruitment. Facial lines and borders of subunits are well-suited for placing scars. In addition, general skin condition is important. Often in older patients, skin laxity is more pronounced than in younger patients. In patients with nasal ptosis, some tip elevation is acceptable. Skin diseases such as severe rosacea, should prompt conversations with the patient about suboptimal healing conditions as well as an increased risk of unsatisfactory cosmetic outcomes.

The size of the lesion, and to a lesser extent, the location of the defect (i.e. whether its mid-tip or more eccentric) is equally important when choosing the optimal technique. Excessive advancement of flaps will result in alar retraction or nostril obstruction. If required, advancement of flaps with partial wound closure with minimum tension and distortion can be aimed for followed by a FTSG (either a Burow graft or harvested). FTSG used alone is seldom the first choice, but in difficult areas such as the soft triangle or in full subunit defects it can be used with acceptable outcomes.

Reconstructive algorithms for closure of nasal defects have been proposed in which the size of the defect is decisive. Defects after tumor extirpation of the nasal tip are classified as small (<10 mm), medium (between 10-30 mm) and large (>30 mm) [17]. For a small defect, direct closure or the East-West flap is often the best and simplest choice. An island flap could be a wise alternative if defects are deep. Secondary intention healing (granulation) also provides good cosmetic results but may entail more discomfort for the patient and takes a longer time to heal than other options. For medium-sized defects <15 mm, the bilobed flap is the flap of choice in many circumstances. However, the Peng flap is a good alternative in central and distally located defects. The AIRNS flap is another flap well-suited for the eccentrically located defect. In larger defects, the dorsal rotation flap with

back-cut is superior. Skin grafts could to some extent be used in combination with all the above-mentioned flaps. It should be noted, however, that regardless of the defect size, the abovementioned considerations and guidelines on reconstructive approaches must not be viewed as definitive rules.

Additional methods not included in the present review can be superior options for certain defects and patients. The present review focuses solely on outpatient surgery using one-stage procedures and local anesthesia, which is particularly suitable for older patients or those who are not candidates for general anesthesia. An example of a two-stage procedure not included in the present review is the nasolabial flap which is commonly used for lateral defects and very suitable for nasal tip defects due to its ideal scar placement in the nasolabial fold as well as the similar tissue structure and often similar amount of sun exposure of the skin flap compared to the nose [24].

The nose is a prominent and distinguishing point of the face, and even minor irregularities after repair can alter the patient's appearance. Consequently, the site is a source of concern for both patient and surgeon. For surgeons, it's important to have an individualized approach to repairing the cutaneous defect. A similarly sized defect in an identical anatomical location in two different patients should not necessarily be handled the same way. Treatment priorities for each patient should be taken into consideration along with individual health factors (age, concomitant medication and diseases). Also, patients are entitled to a full understanding of the rationale behind the choice of closure method, especially when the risk of suboptimal cosmetic outcome is foreseeable.

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