

# Nasolabial interpolation flap for alar reconstruction after Mohs micrographic surgery

*Retalho interpolado do sulco nasogeniano para reconstrução da asa nasal após cirurgia micrográfica de Mohs*

## ABSTRACT

**Introduction:** The nasolabial interpolation flap is an essential flap in nasal reconstruction. Its main indications are deep and extensive defects of the nasal ala.

**Objectives:** To evaluate the usefulness of the nasolabial fold interpolation flap for alar reconstruction after Mohs micrographic surgery—especially in an outpatient setting and under local anesthesia—as well as to discuss refinements in its design and execution.

**Methods:** Retrospective study of patients with nasal ala defects resulting from Mohs micrographic surgery repaired with nasolabial interpolation flap.

**Results:** Eighteen patients were included in the study; 7 (39%) had localized defects in the ala only and were reconstructed with an isolated nasolabial interpolation flap; however 11 (61%) had defects involving both the ala and some adjacent anatomical subunit. These patients underwent a combined reconstruction. Resection of the remaining portion of a subunit was performed in 14 (78%) cases. There were no complications or recurrence after an average follow up of 29 months. Excellent functional and aesthetic results were achieved in all patients.

**Conclusions:** The nasolabial interpolation flap is essential in the reconstruction of alar defects after Mohs micrographic surgery. If adjacent subunits are involved—such as the medial cheek or nasal sidewall—the nasolabial interpolation flap must be combined with another method of repair. The flap can be safely performed in an outpatient setting.

**Keywords:** Mohs surgery; surgical flaps; nose neoplasms.

## RESUMO

**Introdução:** O retalho interpolado do sulco nasogeniano é retalho essencial em reconstrução nasal. Suas principais indicações são defeitos extensos e profundos da asa nasal.

**Objetivos:** avaliar a utilidade do retalho interpolado do sulco nasogeniano para reconstrução alar após cirurgia micrográfica de Mohs, sobretudo em ambiente ambulatorial e sob anestesia local, bem como discutir refinamentos em seu design e execução.

**Métodos:** Estudo retrospectivo de pacientes com defeitos de asa nasal decorrentes de cirurgia micrográfica de Mohs reparados com retalho interpolado do sulco nasogeniano.

**Resultados:** 18 pacientes foram incluídos no estudo; sete (39%) tinham defeitos localizados apenas na asa e foram reconstruídos com retalho interpolado do sulco nasogeniano isoladamente; 11 (61%), entretanto, tinham defeitos envolvendo a asa e alguma subunidade anatômica adjacente. Esses pacientes foram submetidos a reconstrução combinada. Ressecção da porção remanescente de alguma subunidade foi realizada em 14 (78%) dos casos. Não houve complicações ou recorrência após seguimento médio de 29 meses. Ótimos resultados funcionais e estéticos foram alcançados em todos os pacientes.

**Conclusões:** O retalho interpolado do sulco nasogeniano é retalho fundamental na reconstrução de defeitos alares após cirurgia micrográfica de Mohs. Se subunidades adjacentes como bochecha medial ou parede nasal estiverem envolvidas, o retalho interpolado do sulco nasogeniano deve ser combinado com outro método de reparo. O retalho interpolado do sulco nasogeniano pode ser realizado com segurança em ambiente ambulatorial.

**Palavras-chave:** cirurgia de Mohs; retalhos cirúrgicos; neoplasias nasais.

## Original Articles

### Authors:

Felipe Bochnia Cerci<sup>1</sup>  
Tri H Nguyen<sup>2</sup>

<sup>1</sup> Dermatologist. Dermatology fellowship at Wake Forest University - North Carolina, USA. Dermatologic and Mohs surgery faculty at Santa Casa de Curitiba - Curitiba, PR, Brazil.

<sup>2</sup> Dermatologist in private practice. Previous Director of Mohs Surgery Fellowship at the MD Anderson Cancer Center - University of Texas, Houston (TX), USA.

### Correspondence:

Hospital Santa Casa de Misericórdia de Curitiba  
Departamento de Dermatologia  
A/C. Dr. Felipe Bochnia Cerci  
Praça Rui Barbosa, 245 - Centro  
Cep: 80010-030 - Curitiba - PR, Brazil  
E-mail: cercihc@hotmail.com

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## INTRODUCTION

The nasolabial fold interpolated flap or *cheek to nose interpolation flap* (CNIF) is an instrumental flap in nasal reconstruction. The skin of the donor area (medial cheek) is very similar to that of the nasal ala.<sup>1</sup> Its main indications are extensive and profound defects of the nasal ala and, less often, small defects of the lower portion of the nasal tip and columella.<sup>2</sup> Proper training, good surgical technique, and careful planning are necessary to achieve optimal results.

The CNIF is classified as an interpolated flap done in stages due to the following characteristics: vascular pedicle based on a specific artery and/or on its tributaries, distant donor area and not contiguous to the defect, and more than one stage to complete implementation.<sup>3</sup> Other interpolated flaps, such as the paramedian frontal flap (PFF), are capable of repairing distal nasal defects.<sup>4</sup>

Chart 1 compares CNIF's and PFF's characteristics in nasal reconstruction. One of the CNIF's advantages as compared to other flaps employed in alar reconstruction is the preservation of the alar groove, for which restoration is challenging when it is eliminated by single stage flaps (transposition of nasolabial fold), resulting in asymmetry of the alar grooves and an unfavorable outcome.<sup>5</sup> The disadvantages are related to the fact that it needs two stages to be implemented, the post-operative care required for the exposed pedicle and, in men, the potential transfer of facial hairs to the nasal ala.<sup>2</sup> The scar in the donor area is usually imperceptible. However, asymmetry of nasolabial folds may occur.<sup>6</sup>

The purpose of the present study is to evaluate CNIF's usefulness in alar reconstruction after Mohs micrographic surgery, especially in an outpatient setting under local anesthesia, as well as to discuss refinements in its design and implementation.

## METHODS

### Patients

A retrospective study was carried out with 18 patients whose alar defects resulting from Mohs micrographic surgery were repaired with CNIF. The cases were selected from a private practice Mohs clinic in the period 2010–2013. Through the review and analysis of medical records and extensive photographic documentation, the following demographic and surgical data was evaluated: age, gender, tumor type, size of defect and involved subunits, number of Mohs stages, additional measures for the patient's comfort, cartilage grafts, pedicle design, post-operative complications, smoking habits, and follow-up and outcomes.

Prior to the surgery, all patients signed a Free and Informed Term of Consent allowing the publication of photographs in scientific journals. All procedures (Mohs surgery to remove the tumor and subsequent reconstruction) occurred in an outpatient setting. Nerve blocks (infraorbital) supplemented local anesthesia in some cases. Before the procedure, patients were given analgesics, benzodiazepines or oral antibiotics, as necessary. Most of the reconstructions occurred on the same day after Mohs surgery. Typically, the second stage was performed at three to four weeks after the first.

### Design and implementation of the flap

CNIF requires significant knowledge of anatomy, surgical planning, and surgical skills in order to achieve a correct

design and successful implementation. The pedicle is marked close to the lateral portion of the alar groove. Unlike the pedicle of the PFF, which contains the supratrochlear artery, CNIF depends on the angular artery's myocutaneous perforators and tributaries for its viability, making it a random flap. As a result, its vascularization is lower than that of the PFF.<sup>3</sup> Charts 2 and 3 describe the design and implementation of the flap step-by-step. (Figures 1–5) A variation of the traditional design is an option for patients whose terminal hairs might be transferred from the medial cheek. In this case, the pedicle is based inferiorly in order to recruit tissue from the upper and medial portions of the cheek, adjacent to the nasal wall.

## RESULTS

Eighteen patients were included in the study. Demographic and surgical data is shown in Table 1. Patients ranged in age from 46 to 82 years (mean = 69 years), with no differences by gender (9 men X 9 women). Basal cell carcinoma was the most common cancer found (n = 16), followed by squamous cell carcinoma (n = 2). The number of Mohs stages required to obtain free margins ranged from 1 to 6 (average = 2.55). The size of the surgical defect ranged from 1.5 cm X 1.0 cm to 2.0 cm X 1.8 cm (average = 1.8 X 1.4 cm). Data concerning additional measures for greater patient comfort were available in 14 patients. Six (33%) patients received anxiolytics or oral analgesics as adjuvants to local anesthesia. Infraorbital block was performed in 8 (57%) patients. Only one participant was a smoker.

Seven patients (39%) had defects located only in the nasal wing, having been reconstructed with CNIF alone. However, 11 patients (61%), had defects involving the nasal wing and some adjacent anatomical subunit. Those patients underwent combined reconstruction, most commonly secondary intention (n = 7), due to the favorable location and small size of the non-alar defect. For the remaining patients, primary closure (n = 2), advancement of the cheek (n = 1), and bovine dermal collagen (n = 1) were combined with CNIF. The most frequently affected adjacent subunit was the nasal wall (n = 7), followed by the medial cheek (n = 3). Resection of the remaining portion of any subunit was performed in 14 (78%) of cases.

Structural support provided by auricular cartilage was necessary in 17 (94%) patients. The cartilage graft was removed from the scaphoid fossa/antihelix (n = 16) or concha (n = 1), through posterior incision in 15 (83%) patients. Bovine dermal collagen was used in three (17%) patients to cover the exposed surface of the pedicle.

There were no complications, such as post-operative bleeding, infection, or necrosis. No recurrence was observed after the follow-up, which ranged from 5 to 49 months (mean = 29 months). Optimal functional and aesthetic results were achieved in all patients.

## DISCUSSION

The nasal ala is a common site for the occurrence of skin cancer and often presents challenging surgical defects following Mohs micrographic surgery.<sup>7</sup> Repair options should be individ-

CHART 1: Comparison between CNIF and PFF

Parameters	Nasal Fold Interpolated Flap (CNIF)	Paramedian Frontal Flap (PFF)
Indications	Nasal ala. Less frequently: nasal tip, columella, and root. Minor defects. Reduced complexity.	Nasal tip, wing. Less frequently: nasal wall and dorsum, periorbital. Larger defects, multiple subunits.
Vascularization and pedicle preparation	Random: angular artery's tributaries and muscular perforators. Preparation of the pedicle may be more difficult. Less reliable vascularity. Flap at higher risk in smokers.	Axial pattern: contains the supratrochlear artery and its tributaries. Dorsal nasal artery as secondary blood supply. Predictable identification of the vessel and easier maintenance. Robust vascularization, allowing revisions in intermediate stages and repair of the nasal lining with skin grafts.
Post-operative morbidity	Less pain, usually related to the cartilage donor area. Rare nausea, headache and vomiting. Patients can wear glasses to drive. Generally, it is possible to work.	Pain is variable, usually related to the cartilage donor area. Rare, but more frequent than in CNIF. Difficult to wear glasses without customized devices. Continued working can be difficult (after the 1st stage).
Cartilage graft	Patency of the nasal valve should be preserved. Cartilage is required in most cases to balance the contraction forces of healing.	Patency of the nasal valve should be preserved. Need for cartilage is variable.
Limitations (patients)	Young patients with less prominent nasolabial folds can develop more visible scars. Transfer of facial hairs is more likely (originally from the beard area in men).	Forehead's vertical extent determines the reach of the flap, which is quite variable. Transfer of hairs varies according to the PFF's length and hair density in the frontal part of scalp.

ualized according to each patient and surgical defect. For extensive and profound defects of the nasal wing, however, options that promote good functional and aesthetic results are limited. Although other options could be considered for such defects, CNIF has the advantage of preserving the alar groove and concealing the donor scar in the melolabial fold.<sup>5</sup> The “soft” and fibrofatty nature of the donor area of the cheek is an additional advantage of the CNIF. The tissue of the cheek tends to contract and trapdoor. While this might be unfavorable in other places, it can effectively recreate the alar lobule's convexity. PFF is thicker and more rigid, and less capable of simulating the smooth and convex contour of the wing.<sup>8</sup>

The principle of anatomical subunits is a key concept in reconstruction. If a defect involves more than half of the subunit, excising the remaining portion and repairing it as a whole can provide better results.<sup>9</sup> (Figure 1) In the present study, 14 (78%) patients had their remaining alar subunit resected with excellent results. This principle, however, is not absolute.<sup>10</sup> Through careful selection, some defects can be repaired without the complete resection of the subunit.

When different subunits are affected, independent closure options should be considered. This is especially true for subunits separated by concavities, such as the alar crease. The attempt to repair the nasal ala and medial cheek/nasal wall with CNIF can result in an enlarged nasal ala besides eliminating the alar groove. Small defects in these adjacent areas should be left to heal by secondary intention, which helps in recreating the alar groove's concavity. For medium to large defects, cheek advancement flaps are a sensible option. Following that principle, all patients with defects that extended into the medial cheek or nasal wall were reconstructed with combined options. (Figure 1)

The CNIF provides thickness of soft tissue, however it does not provide structural support. The nasal mucosa (nasal lining) and cartilage are the infrastructures that must be intact or be supplemented or repaired prior to the implementation of CNIF.<sup>11</sup> Given that the CNIF is most often used for partial thickness alar defects, the repair of the nasal lining will not be discussed in the present article.

Cartilage grafts can be structural (native cartilage is present however there is need for additional cartilage for support) or

CHART 2: CNIF Stage 1 – Steps and Comments

STEPS	comments
1 - Mark the natural limits before anesthetizing	Mark the nasolabial folds and the nasal subunit. Consider resecting the remaining portion of the alar subunit, except for 1 mm adjacent to the borders of the alar base and rhyme (Figure 1).
2 – Create a template of the repair (defect + / - adjacent subunits) beforehand	Create the template before excising any subunit in order to avoid artificially larger dimensions due to the contraction of the defect. Use the packaging of the suture as the material for the template. The template can be based on the unaffected contralateral half.
3 - Transfer the model to the cheek	Place it with its longer extent on the line of the oral commissure (Figure 2). The flap's movement is counterclockwise when the defect is on the right nasal ala (and clockwise, when on the left). Position the flap anticipating the movement it will cause. Confirm the flap's reach using a suture or gauze.
4 - Draw the pedicle	Draw triangles medially and laterally to the flap creating an ellipse. The proximal triangle must be at least 0.5 cm below the alar groove in order to keep it from being deleted. Although the medial triangle has a narrow drawing, the underlying pedicle is wide and deep so as to maximize the blood supply (myosubcutaneous pedicle) (Figure 2).
5 – Anesthesia	Local anesthesia with nerve block (infraorbital nerve). Consider benzodiazepines or oral analgesics for patient comfort. Avoid anesthetizing all areas at the same time. Set the order of the local anesthesia aiming at maximizing patient comfort. First, anesthetize the cartilage donor area, then the cheek. Remove the cartilage and start to detach the flap. Only after the flap has been partly detached, anesthetize the nose. Regarding the nose, consider supplementing with bupivacaine for longer lasting action.
6 (#) - Repair of nasal overlay	The CNIF is more effective when the nasal overlay is untouched.
7 (*) – Removal of the cartilage graft	The antihelix and concha are ideal areas. The cartilage of the antihelix (Figure 3A) is most often used in CNIF. However, where more rigidity is required, the concha's cartilage can be used. The grafts must be longer than the horizontal lengths of the defects in order to be properly fixed. If necessary, sculpt the cartilage in order to avoid sharp edges. Apply temporary pressure on the donor areas.
8 (*) – Closing/Closure of the ear	The ear is a common site of hematoma after the removal of the cartilage graft. Suture it first by placing a brown bandage before incising the cheek.
9 (*) - Suture the cartilage to the nose	Create “pockets” on each side of the defect with the scalpel blade. The cartilage must be inserted in these pockets (Figure 3B). Carry out a figure eight suture, which helps to stabilize the free end of the cartilage. “U” suture or simple suture help to stabilize the cartilage over the underlying cartilage or to stabilize the cartilage in the nasal free margin.
10 - Incise the flap	At the flap's upper border, tilt the incision inwards in order to create a delicate border (better fit for the alar free border). In the other borders, incise vertically.
11 – Detach the flap	The flap is elevated in two different planes. At the distal margin, raise it to the superficial subcutaneous tissue (subdermal, 3 mm). In the pedicle's margin, elevate it to a deeper plane in a way that includes the deep subcutaneous and fibers of the elevator of the upper lip and nasal ala (Figure 4). Partial inclusion of the muscle is essential to preserve the perforating arteries in order to supply the flap.
12 - Prepare the defect	Trim the edges in a way that they become perpendicular, except for the nasal free border, which must have an inwards slanted border, in order to allow a better fit of the inclined border of the flap. The remaining portion of the alar subunit must not be resected up to the pedicle's division (unless it is the ala's medial portion).
13 – “Thin out” in the distal part of the flap	When necessary, remove excess subcutaneous tissue of the distal part of the flap, leaving a thin layer of subdermal fat. Evaluate the vascularization (bleeding at the flap's borders) as it becomes thinner.
14 - Suture the donor area	Suture the cheek primarily, directing the vector supero and obliquely, in two layers. This will gradually move the flap to the defect.
15 - Suture the flap to the nose	Start at the medial portion of the ala with superficial interrupted sutures aiming at aligning and inserting the flap. Once aligned, the remaining must be sutured in two planes in order to minimize the incision lines.
16 - Cover the pedicle	Unlike the PFF's pedicle, the CNIF's pedicle is less likely to bleed in post-operatively. If necessary, the exposed pedicle may be coated with bovine dermal collagen or Surgicel R in order to reduce the possibility of bleeding.
17 – Apply the dressing to the pedicle	Wrap the pedicle with a gauze impregnated with Vaseline, without excessive pressure.

Step # 6: necessary for full-thickness defects.

\* Steps 7, 8, and 9: cases requiring cartilage graft. The cartilage graft in the cheek to nose interpolation flap is structural and non-repairing since there is no cartilage in most of the nasal ala's fibrofatty tissue.

CHART 3: CNIF Stage 2 – Steps and Comments

Steps	Comments
1 - Division of the pedicle	Incise the pedicle near the base in the shape of a “V”.
2 - Suture the base of the pedicle	Primary closure or in the shape of a “V” using the proximal portion of the pedicle.
3 - Excise the remaining portion of the subunit	Excise the remainder of the subunit, except for 12 mm from the base of the ala, which serves to anchor the flap and preserve the lateral alar groove. If a cartilage graft was inserted, extra care must be taken.
4 - Trim and “thin out” the flap	Carefully lift the flap’s lateral portion incising the suture lines from Stage 1 (Figure 5). Mark the excess skin to be excised. “Thin out” and trim the flap as needed.
5 - Suture the flap	Carefully move the borders closer to each other, in two planes.



FIGURE 1: Defect involving more than 50% of the left nasal ala. The remaining portion of the ala has been removed. The portion involving the inferior nasal wall (dotted) was allowed to heal by second intention.



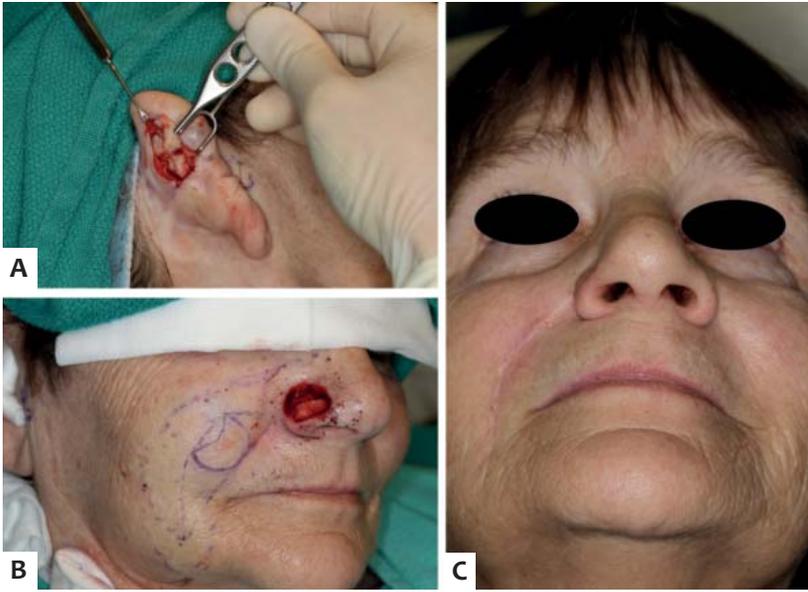
FIGURE 2: Design of the flap with the wider part positioned above the lip commissure. The proximal triangle (arrow) is purposefully smaller on the surface for better mobility of the pedicle. The distal triangle must be large enough to allow the resection of the excess tissue.

restorative (replacement of removed cartilage). Cartilage grafts for CNIF are usually structural and not restorative, since there is no cartilage in most of the nasal ala, but only adipose and fibrous tissue. The structural functions of cartilage include: 1) preventing tissue contraction and distortion, 2) supporting “heavy” flaps, 3) maintaining nasal patency and widening the internal nasal valve, and 4) providing support for the contour.<sup>3</sup> Donor areas of cartilage include the scaphoid fossa/anti-helix and auricular concha.<sup>12,13</sup>

The incisions for the harvesting of cartilage can be either anterior or posterior. Anterior incisions are easier to access, however result in more visible scars. Cartilage of the anti-helix is ideal for long, flexible, and straight segments (Figure 3), while that of the concha is ideal for grafts that require more curvature, substance, and rigidity. Concha’s grafts are more suitable for avoiding the collapse of the nasal valve and lobe. Anti-helix’s grafts are more suitable for preventing the contraction of the free nasal border.<sup>12,13</sup> It is often necessary to sculpt the graft in order to obtain the desired thickness, shape, borders, and contour. This must be done carefully as the cartilage is a fragile structure and may fracture during the process.

Traditionally, a scalpel blade n. 15 is used to sculpt, however a shaving blade allows a more gentle sculpting of the graft’s contours. Cartilage grafts can be removed safely under local anesthesia and with a low complication rate.<sup>14,15</sup> Post-operative pain is variable. Nonetheless, if cartilage grafts were performed, the auricular donor region is likely to be more painful than that of the cheek. For patient comfort, injection of a long duration anesthetic (bupivacaine) is recommended, after suturing the auricular donor area, in addition to administering post-operative analgesia (combined anti-inflammatory/narcotic combination).

The pedicle of the CNIF can be myocutaneous (skin portion of the pedicle connected) or myosubcutaneous (epidermis and dermis are completely incised proximally and released).<sup>3</sup> (Figure 6) myosubcutaneous design is preferable since it makes the flap island flap release the restriction of the epidermis and dermis, and reduces tension and twists the pedicle. Furthermore, the



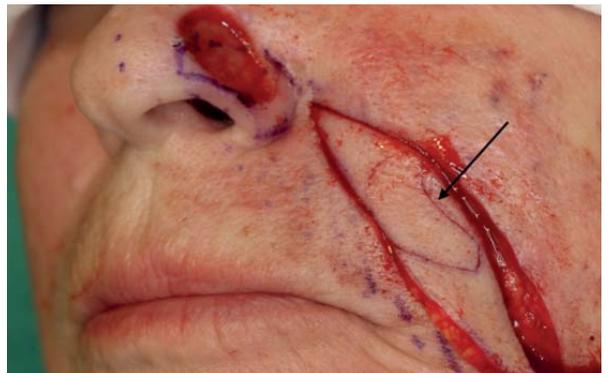
**FIGURE 3:** A) Cartilage graft taken from the scaphoid fossa through a posterior incision. B) Fixed graft cartilage. C) Four months post-operatively. Preserved alar contour without compromise of the nasal vestibule.



**FIGURE 4:** Flap elevated in the superficial subcutaneous in its distal half (white arrow) and deep subcutaneous in its proximal half. Notice the wide myocutaneous pedicle with fibers of the elevator muscle of the upper lip and nasal ala (yellow arrow)



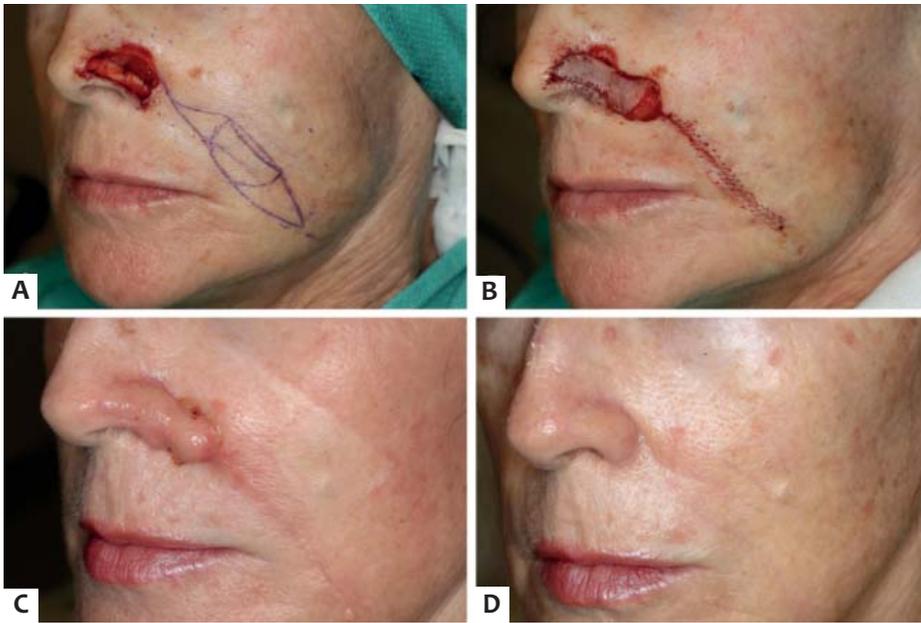
**FIGURE 5:** Flap elevated for “thinning out” during the 2nd stage. The hook is used to pull gently.



**FIGURE 6:** Myocutaneous pedicle. Epidermis and dermis are completely incised in the portion that is close to the alar groove. The flap is incised superficially (arrow), prior to its mobilization.

design in the shape of an “island”, allows dissection of a wider pedicle, with a smaller proximal triangle, increasing mobility.

Regardless of design, both pedicles should contain muscle fibers of the elevator of the upper lip and nasal ala. In this study, all pedicles were myosubcutaneous. Potential complications include CNIF post-operative bleeding, improper healing, infection, dehiscence, distortion-free margins, and necrosis.<sup>16</sup> In a recent study by Newlove and Cook,<sup>17</sup> the CNIF complication rate when performed by dermatologic surgeons in an outpatient setting under local anesthesia, was equal to or lower than in studies of other surgical specialties. In this study there were no complications, possibly due to the smaller number of patients.



**FIGURE 7:** A) Defect with cartilage fixed. B) Sutured flap. The inferior nasal wall was allowed to heal by second intention. C) Flap before the division of the pedicle. D) Seven-months post-operatively with repair of the alar convexity and preservation of the alar groove.



**FIGURE 8:** A) Flap's design. B) Flap's movement (clockwise for defects on the left hand side - arrow). C) Flap after the division of the pedicle. D) Three-months post-operatively.

**CONCLUSION**

The CNIF is crucial in reconstructing alar defects after Mohs micrographic surgery. If adjacent subunits such as the medial cheek or nasal wall are involved, the CNIF must be com-

bined with another repair method for best results. With proper planning and meticulous surgical technique, the CNIF can be safely performed in an outpatient setting. (Figures 7 and 8) ●

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