Current Otorhinolaryngology Reports (2018) 6:129–139
https://doi.org/10.1007/s40136-018-0199-z

HEAD & NECK: NON-MELANOMA SKIN CANCER OF THE HEAD AND NECK (J MOYER, SECTION EDITOR)

Principles of Reconstruction After Mohs Surgery

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Published online: 10 May 2018

Abstract

Purpose of Review Reconstruction of cutaneous defects is a key component following completion of extirpative surgery, with a primary aim of restoring form and function to sensitive regions of the face and scalp. We review flap physiology, defect analysis, and reconstructive options in the reconstructive ladder, and describe key principles in unit reconstruction.

Recent Findings An overview of time-honored principles and techniques including healing by second intention, skin grafting, and local flaps is described. More contemporary techniques such as the use of perichondrium-cutaneous composite grafts, and multi-layered reconstruction of complex nasal defects including the use of forehead flaps are succinctly discussed.

Summary This concise review hopes to highlight key nuances in defect analysis, decision-making processes in choice of reconstruction, and considerations when performing reconstruction on various aesthetic units of the face and scalp.

Keywords Cutaneous malignancy · Defect analysis · Face · Scalp · Flaps · Grafts

Introduction

Reconstruction after Mohs surgery is a challenging process that aims to restore form and function to a patient. Disfiguring cutaneous defects offers to the reconstructive surgeon an opportunity to return a sense of normalcy to the patient. A thorough understanding of principles and mastery of techniques are prerequisites for providing this service to patients.

In this article, we review the physiology of skin flaps, describe our algorithmic analysis of defects, and run through the decision-making process when using the reconstructive ladder. We then provide an overview on the basics of grafts and flaps and examine key principles in unit reconstruction.

This article is part of the Topical Collection on *HEAD & NECK: Non-melanoma Skin Cancer of the Head and Neck*

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Flap Physiology and Biomechanics of Skin Flaps

A brief overview of the physiology and biomechanics of skin flaps allows us to understand the basics behind how incisions are planned, how wounds are closed, and how scars react and heal over time. Skin has the following three important characteristics—anistropy, non-linearity, and viscoelasticity.

Anistropy refers to the mechanical property of skin that varies with direction. This is reflected in the relaxed skin tension lines (RSTLs) of the face, where fusiform incisions made along RSTLs, and closed in the direction of lines of maximum extensibility (LME), afford the best scar under least tension. This is further elaborated in the section below related to facial lines.

Skin is also *non-linear*. This describes how increasing force is required as skin lengthens under stretch. Figure 1 illustrates this concept on a stress-strain curve graph [1].

The time-dependent property of skin is termed *viscoelasticity*. Skin held under tension over a period of time results in further lengthening and is defined by creep and stress relaxation. *Mechanical creep* describes the mechanics behind rapid intra-operative tissue expansion, where skin placed under high stress loads over a short period of time lengthens from the displacement of interstitial fluids and temporary realignment of collagen fibers in the dermis. When stress is prolonged over time (days and weeks), however, *biological creep* occurs where histologic

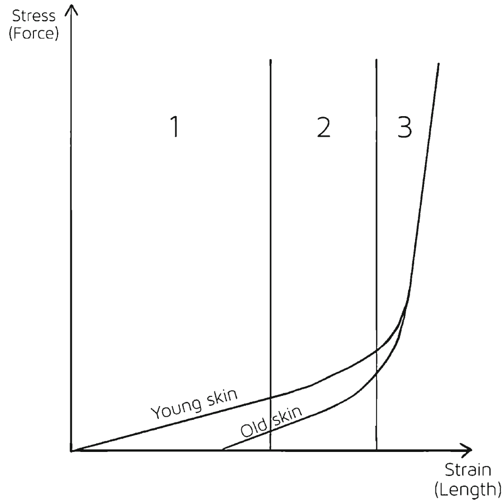

Fig. 1 Stress-strain curve graph. In *section one* of the curve, a small stress produces a large strain (length), due to the deformation of elastic fibers within the skin. With increasing age or sun damage, these fibers are damaged and results in a shift of the curve to the right. In *section two*, increasing force is required to lengthen the skin due to the need to reorient randomly arranged collagen fibers to lie parallel to the direction of pull. In *section three*, wound healing is compromised and such excessive forces should be avoided

changes and increase in skin surface area result in further lengthening. *Stress relaxation* refers to the reduction in stress on the skin when it is placed under tension at a constant strain over time.

Defect Analysis

Defect reconstruction first starts with an algorithmic analysis of the defect. The following five considerations should be deliberated.

Immobile Surrounding Landmarks to Preserve

Flaps exert a vector of pull directed back towards their point of origin. The recipient tissue and its surrounding structures resist this pull. This secondary tissue movement can result in distortion of important facial structures such as the eyelids, lips, nostril, hairline, and oral commissure.

Facial Lines

Relaxed skin tension lines (RSTL) reflect the molecular orientation at the dermal level. They follow furrows which form when the skin is relaxed, and can be simulated when skin is pinched. These lines correspond to directional pull when skin is not under tension, which is determined by protrusion of underlying bone, cartilage, or tissue bulk over which the skin stretches. While independent of muscle orientation, they often run perpendicular to the muscle fibers beneath them. Perpendicular to RSLTs are *lines of maximum extensibility (LME)*. A fusiform incision made along the RSTL and closed in the direction of LME affords the best scar under least tension. *Wrinkles* or *facial creases*, also known as *lines of minimum tension*, are lines created from repeated contraction of muscle fibers beneath the skin. They become increasing visible with age. While wrinkle lines often correspond with RSTLs, there are three areas of conflict. These occur at the glabella, lateral canthus, and nasal supratip. At these areas, it is often more favorable to orient incisions along the wrinkle lines rather than the RSTLs (Fig. 2).

Aesthetic Units and Subunits

The face is divided into aesthetic units (forehead, eyelids, cheeks, nose, lips, mentum, and auricles) and further divided into subunits (Fig. 3). Boundaries between units and subunits are determined by skin thickness, color, elasticity, degree of adherence to underlying fascia, and the interfaces between concave and convex surfaces. These boundaries represent borders which the human eye and mind expect to see when scanning a face. The preferred flap design often places the flap edges along the borders of aesthetic units for maximum camouflage. This is often achieved by enlarging a defect to reach the edge of a unit, or to occupy the entire aesthetic unit. Small trapdoor effects and subtle bulging may even simulate normal contours such as on the nasal tip or alar lobule [3•].

Fig. 2 Relaxed skin tension lines (RSTL) often correspond with lines of minimum tension (wrinkle lines). However, at the three areas of conflict—glabella, lateral canthus, and nasal supratip—it is more favorable to orient incisions along wrinkle lines [2•]

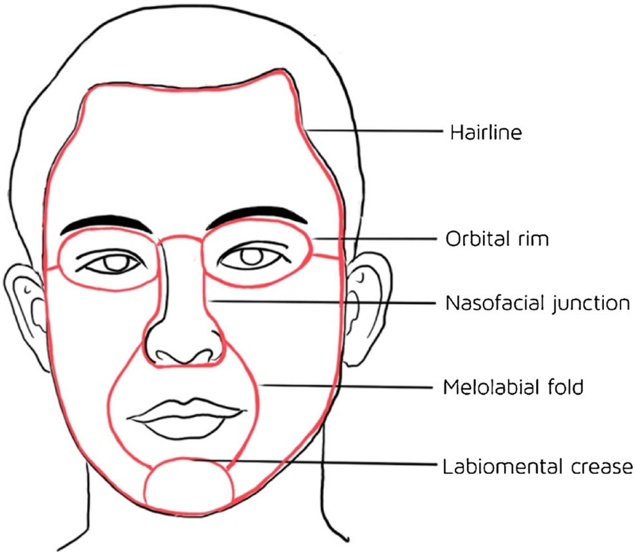

Fig. 3 The face is divided into aesthetic units of the forehead, eyelids, cheeks, nose, lips, mentum, and auricles

Area of Recruitment

Skin that is recruited should be considered for its accessibility and extensibility. Extensibility refers to the lengthening of skin under tension due to stretching of elastic fibers.

Resultant Scar

The sequel to each reconstruction is a scar, which must be anticipated beforehand and designed to respect the facial lines, aesthetic units, and immobile landmarks.

When to Use What?

The reconstructive ladder is an organization of reconstructive options in order of increasing complexity (Fig. 4).

In choosing which rung of the reconstructive ladder to utilize, one should progress sequentially from simple to complex, analyzing morbidity, risk, and inconvenience against patient expectations and outcomes.

Often times, the optimal solution is a combination of flaps and grafts that are simple and predictable yet yield aesthetic and functional results. For instance, a defect along the tip or dorsum of the nose can often be closed by converting the defect into a vertical fusiform, using bilateral advancement flaps for partial closure and then utilizing the skin of the standing cutaneous deformity (which would otherwise be discarded) as a full-thickness skin graft for the remaining defect.

Delaying the repair also has certain advantages. The defect will begin to heal with granulation tissue and neovascularization. This process can be favorable as it improves vascularity and fills in the contour defect. A delayed flap, on the other hand, describes partially harvesting a flap without transposition. This process is

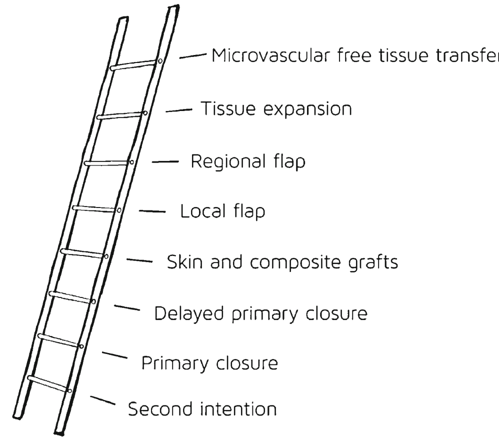

Fig. 4 The reconstructive ladder

known to improve vascularity and viability through a number of different proposed mechanisms.

Additional considerations include the pathophysiology of the malignancy. In cases at high risk of recurrence, such as cases with multiple previous recurrences, invasive subtypes, or malignancies with perineural invasion, the use of skin grafts instead of flaps may be prudent in order to maximize future surveillance.

In cases requiring post-operative adjuvant radiotherapy, one may consider the speed of recovery and avoid multiple-staged reconstructive efforts. Following completion of adjuvant treatment, further reconstruction can be pursued.

Communication between the extirpative surgeon and reconstructive surgeon is essential to ensure that these issues are considered.

Patients should be actively involved in the decision-making process. Their concerns and expectations regarding form and function should be elicited. Post-operative care of wounds may be a tedious and highly complex process; ensuring adequate provisions and support can prove imperative.

In the following section, we review key techniques frequently used in Mohs reconstruction, namely healing by second intention, skin and composite grafts, and local flaps.

Second Intention

Healing by second intent can be the repair of choice, particularly in superficial defects of concave surfaces. Some examples include the triangular fossa of the ear, medial canthus of the eye, philtrum, supra-alar crease, and temporal region of the forehead. Larger wounds undergo more contracture but can be reasonably employed over convex bony surfaces such as the scalp or forehead. Deeper wounds with significant soft tissue deficit often leave a contour depression. Proximity to “immobile structures” must be considered. Second intent healing may cause wound contracture around the periphery and distort critical landmarks, such as the vermillion border or alar rim. Additionally, collapse of the nasal sidewall should be anticipated and may create iatrogenic nasal obstruction. The time-dependent nature of healing by second intention implies that patients will have to care for the wound over an extended period—generally keeping the wound clean and moist.

Skin and Composite Grafts

Skin grafts can be classified based on their thickness into *split-thickness skin grafts* (STSGs) and *full-thickness skin grafts* (FTSGs). Their differences are reviewed in Table 1.

Composite grafts describe grafts which contain more than one tissue content. Examples include skin-subcutaneous fat grafts from the forehead, composite skin-cartilage grafts, and composite perichondrium-cutaneous grafts (PCCG) harvested from the ear. Composite skin-cartilage grafts are often utilized for reconstruction of alar rim defects and can aid in resisting contracture that results in alar notching. PCCG grafts, when compared to FTSGs, better withstand contracture, grow with maturity (in children), and possibly improve revascularization due to its perichondrial plexus despite its thicker composition [4].

Technique

The ideal recipient bed for a skin graft is vascular and does not contain bare bone or cartilage. Grafts survive well on muscle or granulation tissue, and also do well on perichondrium or periosteum. In cases of bare bone, as seen on some scalp defects, the cranial bone can be drilled down to its diploic space, or a separate pericranial flap mobilized to cover the defect. Exposed cartilage devoid of perichondrium can be prepared by making multiple punch excisions to allow granulation ingrowth from deep surfaces to provide for a vascularized bed.

The defect size can be minimized by placing a purse-string suture around the defect if appropriate. Circular defects can be converted to one with angled sharp edges to better camouflage the appearance of the graft. Delaying the application of grafting can further improve vascularity of the wound bed and result in a shallower defect.

STSGs are generally harvested from the inner thigh with a power-driven dermatome set between 0.010 and 0.016 in. The donor site is covered with a porous dressing. FTSGs are harvested sharply with a blade and elevated in the immediate subdermal plane within subcutaneous tissue. It can be further thinned to remove the deeper subcutaneous elements and trimmed to fit. The donor site is closed primarily with standing cones excised as needed.

Grafts can be pie-crusted to prevent seroma or hematoma formation. However, these perforations can leave noticeable scars or texture discrepancies. Close apposition between the graft and recipient bed is paramount. This can be accomplished with tacking sutures and/or bolster bandages.

Local Flaps

All flaps, by definition, have a defined blood supply from the patient. This is in contrast to a graft, which is entirely separated from the patient and relies on neovascularization from the recipient bed. Table 2 reviews how flaps can be classified and described.

Table 1 Comparison between split-thickness and full-thickness skin grafts

		Split-thickness skin grafts	Full-thickness skin graft
Definition		Skin is harvested within the dermal layer, leaving behind upper dermal elements	Skin is harvested in the subcutaneous plane, immediately below the dermal elements
Differences	Immediate contracture	Less immediate contracture	More immediate contracture due to elastic fibers within the dermis which are harvested together with the epithelium. This can be counteracted by stretching and pie-crusting
	Delayed contracture	More delayed contracture	Less delayed contracture
	Vascular viability	Lower vascular requirement, higher survivability	Higher vascular requirement, lower survivability
	Color and texture match	Poorer	Better. This is an important consideration in facial reconstruction, and a reason why FTSGs are more often employed over STSGs, which tend to have a less favorable pale and satin appearance
	Availability of graft for harvest	Large amounts can be harvested	Relatively limited
	Donor site closure	Primary reepithelization occurs from the upper dermal elements left behind after harvest	Secondary procedure to close the donor site

Table 2 Description and classification of flaps

Flap description
1. Blood supply
a. Random—no named vessel, based on dermal plexus of the skin
b. Axial—named vessel usually running parallel to the linear axis of the flap within subcutaneous fat. Most axial patterns have a degree of random pattern vascularity to the distal portion
2. Tissue content
a. Cutaneous
b. Fasciocutaneous
c. Musculocutaneous
d. Composite
3. Area of recruitment
a. Local
b. Regional
c. Distant
4. Method of transfer
a. Advancement
i. Unipedicle/bipedicle
ii. V-Y
iii. East-West
b. Rotation
c. Rotation-advancement
i. O-T or A-T
ii. Cheek flap
d. Transposition
i. Rhombic
ii. Bilobe
iii. Z-plasty
e. Hinge
f. Interpolated
i. Forehead
ii. Melolabial

Technique

Mohs surgery usually results in defects with circular shapes and inward-beveled edges. Flap designs often require the removal of some normal tissue to convert the defect into a more optimal design. Edges of the defect and flaps should be outward-beveled when possible to aid in eversion of skin edges.

After the flap has been transferred to the recipient site, key sutures which hold maximal tension should first be placed. Additional tacking sutures may be required to either recreate deep contours (such as along the nasofacial sulcus), or to carry the weight and tension of the flap (such as at the leading edge of a cheek flap) to avoid tension along "immobile structures."

Standing cone deformities should be thoroughly excised. Generally speaking, an increase in length of scar is better tolerated than a contour irregularity. Even small dimples or protrusions can cast small shadows that draw attention to them.

Unit Reconstruction [2•, 3•, 5•]

1. Scalp
2. Forehead
3. Eyelid
4. Nose
5. Cheek
6. Lip
7. Auricle

Scalp [6, 7]

The scalp is a five-layered structure, commonly described using the mnemonic SCALP (skin, subcutaneous tissue, galea aponeurosis, loose areolar tissue, and pericraneum). The galea is a strong fibrous layer with tight attachments to the skin, significantly reducing tissue mobility and extensibility.

Incisions made in the scalp should be made parallel to the hair follicles to preserve them. At the pretrichal region, incisions are made beveled tangential to the direction of hair follicles to allow hair growth through the scar.

Undermining is usually performed in the sub-galea plane. This plane is easy to raise and avascular, and provides a strong layer for subsequent closure. Undermining in the supra-galea plane is possible; however, injury to hair follicles and excessive bleeding make this plane of dissection more tedious.

Flap design will require consideration of mobility of tissue by palpation. In general, defects less than 3–5 cm can be closed with either unilateral or bilateral rotation flaps. Rotation flaps are typically designed with their lengths four times the defect diameter. In the scalp, this may be extended to six times the diameter in order to allow sufficient mobilization. Bilateral rotation flaps distribute closing tension across a larger area. The two limbs do not need to be equal in length.

The inelasticity of scalp tissue can further be partially overcome with galeal-releasing incisions (galeotomies) as well as tissue expansion (Fig. 5).

Forehead [8, 9]

The forehead is divided into central, lateral, and brow subunits. The central region is generally thicker, less elastic, and adherent to underlying frontalis muscle. Lateral subunits are generally more elastic and concave.

Small defects are often closed in a fusiform fashion, usually horizontally along wrinkle lines. Care however must be exercised to ensure the brow is not elevated inappropriately. Defects above the brow or anterior to the hairline can be

Fig. 5 Rotation flaps. A rotation flap in its purest form pivots about a single point at its base without stretching or advancement. In general, the arc of the flap is four times the diameter of the defect, and the radius 2.5 times. The inability to stretch the scalp often requires a design with six times the arc. The tip of the flap may be an acute angle with less vascularity, so excessive tension should be avoided. Galeotomies can help with flap mobilization

closed in an O-T fashion (Fig. 6). Midline defects medial to the brow are closed well in a vertical fashion with wide undermining. Additional M-plasty can be utilized to avoid transgressing into the brow or nasal subunit, and can be nicely incorporate into glabella rhytids.

The lateral forehead or temple area is challenging due to the immobile landmarks above and below, i.e., brow and hairline. Often a rhombic or bilobe flap is useful in this area.

Healing by second intent is often a reasonable option for defects in the concave temporal region, anterior to the hairline.

Eyelid [10, 11]

The periocular region is divided into the lower eyelid, upper eyelid, medial, and lateral canthal subunits.

Fig. 6 Rotation-advancement flaps. Most rotation flaps of the face have an element of advancement as well. The O-T flap is useful to position the horizontal limbs in natural creases or into aesthetic boundaries, such as in the lip, where defects of the white lip can be closed without crossing the vermilion into the red lip. In the forehead, it can allow closure along the brow or the hairline. The main disadvantage of this technique is when large (> 2 cm) O-T defects heal with contracture of the vertical scar, it may result in a distortion of the horizontal limb

The medial canthal region is concave and contains the medial canthal tendon and the lacrimal system, which must be considered. Small defects can be closed primarily or by second intention. Larger defects can utilize FTSGs, rotation flaps, glabellar flaps, or even forehead flaps, with care to avoid webbing in this concave region.

The lateral canthal region is slightly concave, contains the lateral canthal tendon, and can be closely related to the frontal branch of the facial nerve. Reconstruction of these defects often involves rotation/advancement flaps from the temple or cheek.

The upper and lower eyelids are divided into the anterior lamella which is made up of skin and orbicularis oris, while the posterior lamella is made up of tarsus and conjunctiva. Further from the lid margin is the middle lamella made up of septum, preaponeurotic fat, and lid retractors. Key considerations for lid repair include ensuring full closure for corneal protection, adequate mobility for full peripheral vision, and aesthetics.

Defects of the upper and lower eyelid can be classified as anterior lamella or full-thickness defects. Small anterior lamella defects less than 0.5 cm of the upper and lower eyelid heal well by second intent. Larger defects can be closed by conversion of the defect into a fusiform shape for linear closure, or by rectangular advancement flaps. Flaps should comprise of skin and muscle. Closure should be without excessive tension, and care taken to prevent lagophthalmos or ectropion formation. When this occurs, additional tissue will have to be brought in. FTSGs from the opposite eyelid or post-auricular region, or a laterally based transposition flap from the upper lid to the lower lid are common examples.

Full-thickness defects of the upper and lower eyelid will require multi-layered reconstruction to reform the anterior and posterior lamella. Small defects less than 25% of the eyelid width can be closed primarily, taking care to reapproximate the tarsal plate accurately and avoid notching at the lid margin. Larger defects bring in tissue either laterally, such as the tenzel semicircular flap, or from the opposing lid in the form of various conjunctival and/or tarsal flaps for posterior lamella reconstruction.

Nose [12]

Nasal reconstruction is challenging because of the complex contours, central position on the face, bony-cartilaginous framework, and critical functional role. The nose is made up of three distinct layers—skin and soft tissue envelop, bony and cartilaginous framework, and internal mucosa lining—which will need to be reconstructed individually when involved.

The nose is divided into nine aesthetic subunits—two sidewalls, a dorsum, two alar, a tip, two soft triangles, and a columella. When possible, flap design should allow for scars to fall along junctions between these subunits to remain inconspicuous. Areas of concavity such as the supra-alar region may heal well by second intention. Areas of convexity such as the ala can capitalize on pin-cushioning seen with many flaps. When defects take up a significant proportion of the subunit, it may be better to expand the defect and reconstruct the entire subunit. When defects span across more than one subunit, it may be possible to reconstruct individual subunits with different grafts or flaps.

Most small- to medium-size nasal cutaneous defects are repaired with local flaps (bilateral advancement, East-West, bilobe) and/or skin grafts (Fig. 7). The interpolated melolabial flap is well suited for repair of the alar lobule or columellar. The forehead flap is a workhorse flap for larger defects of the nose, providing excellent color and texture match, with sufficient availability to provide cover to the nose from alar to alar [13]. The paramedian forehead flap design has become more popular over the median forehead flap due to its more axial

Fig. 7 Bilobe flap. The *bilobe flap* is a double transposition flap that shares a single base, commonly utilized in smaller defects (< 1.5 cm) of the nose. The primary benefit of the flap is moving the tension for closure to further away from the primary defect. This can be critical for defects of the lower 1/3 of the nose. Usually, the first flap adjacent to the defect is designed to be approximately the same size as the defect, thus avoiding tension and distortion along the alar base. The second lobe is slightly smaller and the final defect is closed primarily. The secondary defect can be further converted into a triangle to accommodate the triangular secondary flap, allowing for straight lines and an acute angle instead of a curvilinear one. Wide undermining and aggressive thinning of the primary lobe can help reduce pin-cushioning

design capturing the supratrochlear artery, narrower base, greater effective length, and the ability to raise bilateral forehead flaps when required. Its pedicle is located around the medial brow, usually around 1.7 cm from the midline, and its base around 1.2 cm wide, but can be further narrowed to 1.0 cm and extended into the brow to improve flap mobilization (Fig. 8).

Nasal airway patency is a premium and must be maintained. Occasionally patients have unrecognized pre-existing nasal obstruction that will be noticed and bothersome after repair. It is best to address this concomitantly, be it through a septoplasty or nasal valve repair. Prophylactic non-anatomical grafting is often used for defects of the nasal sidewall, especially the alar lobule and supra-alar crease. This is to avoid collapse and alar retraction.

Full-thickness defects require internal lining reconstruction, which can be designed from intranasal mucosal flaps, external local cutaneous flaps, or grafts (composite or skin) [14].

Fig. 8 Forehead flaps. A complex full-thickness nasal alar defect involving deficiencies of both cartilage and internal nasal lining. Each of these components were separately reconstructed—bipedicled lateral wall mucosal flaps for internal lining, conchal cartilage graft for framework support, and a cheek advancement flap with left paramedian forehead flap for external reconstruction

Fig. 9 Rhombic flap. The *Dufourmental modification of the rhombic flap*, when compared with the classic Limberg flap, allows for a lesser arc of rotation, creates less SCD at the base of the flap, and sacrifices less normal tissue in this design. The site of greatest wound closure is at the donor site closure. This modification, however, distributes more tension around the perimeter of the flap. Disadvantages of the rhombic flap are that the four lines which make up the scar run in differing directions and cannot all lie within RSTLs

Cheek [15, 16]

The cheek is divided into the medial, zygomatic, buccal, and lateral subunits. Skin over the medial and buccal subunits is comparatively thicker and more mobile over its underlying fat. Incisions on the cheek are best placed along its unit's borders with the ear, lid, nose, or lip when possible; hence, advancement-rotation flaps are frequently utilized. When defects are not close to these borders, local transposition flaps are used (Fig. 9). It is important to preserve landmarks such as the lower lid, nasofacial junction, or melolabial fold.

In the medial cheek, small defects can be closed utilizing the nasofacial junction or melolabial fold, in the form of fusiform incisions or V-Y subcutaneous pedicled island flaps. Cheek rotation-advancement flap or cervicofacial flaps are the workhorse flaps for larger medial cheek defects. In these flaps, it is essential to avoid inferior tension on the lower lid and place resultant scars strategically.

In the lateral cheek, defects can be closed with small advancement flaps, V-Y flaps, or larger cheek flaps with a direction of pull similar to a facelift. Any dissection over the zygomatic arch must be done with extreme caution since inadvertently dropping a plane into the deep subcutaneous plane will jeopardize the frontal branch of the facial nerve.

Lip [17]

The foremost two goals of perioral reconstruction include sufficient oral access and oral competency. Other goals include adequate mobility and restoration of aesthetic proportions. The lips are composed of three layers: skin, orbicularis oris muscle, and mucosa. Its blood supply is from the superior and inferior labial arteries, which rest between intraoral mucosa and the orbicularis oris muscle. The upper lip is divided into two lateral subunits and one medial philtral subunit. The lower lip is made up of a single subunit, separated from the chin by the mental crease. The superior and inferior mucosal (red) lips are each a separate subunit.

Defects can be classified as partial or full thickness. Partial-thickness defects are closed respecting the vermillion border, melolabial crease, alar base, philtral border, mental crease, and orientation of the perioral rhytids. O-T flaps or M-plasties are used to avoid extending what would otherwise be fusiform incisions that cross subunit boundaries. Converting to a full-thickness wedge defect is very usual. Rotation and advancement flaps are usually laterally based, with perialar crescentic excisions or incisions along the mental crease or vermillion border (Fig. 10). FTSGs can be effectively used in the concave philtrum.

Full-thickness defects when small (< 1/3) can be closed as a primary wedge closure. Up to ½ lip defects can be closed by bilateral advancement flaps, or Abbe lip-switch flap if oral commissure is spared, and Estlander lip-switch flap if the oral commissure is involved. Larger defects up to 2/3 may utilize the Karapandzic flap, which is a perioral rotating flap that maintains neurovascular supply to the lip, but is limited by resultant microstomia. Larger defects require either recruitment of cheek tissue, or the use of free flaps.

Fig. 10 Subcutaneous pedicled V-Y island advancement flap. A partial-thickness upper lateral cutaneous lip and medial cheek defect crossing the melolabial fold. The flap is designed as an island flap with no skin attachments, pedicled on its subcutaneous fat. This allows the flap to slide and advance medially and to be closed in a V-Y fashion. To avoid excessive tension, a small full-thickness skin graft (FTSG) was utilized adjacent to the alar, secured with a Xeroform bolster. The lateral aspect of this flap recreates the melolabial fold. These island advancement flaps are most easily advanced in areas with abundant subcutaneous fat, and thus most easily utilized in the lower medial cheek and lateral upper lip

Auricle [18]

The ear is characterized by its complex cartilaginous framework covered laterally by adherent thin inelastic skin and medially by relatively less adherent skin with subcutaneous fat. The regions of the ear relevant for reconstruction can be divided into the helical rim, scapha, antihelix, concha, triangular fossa, and lobule.

Regions of concavity such as the concha and triangular fossa heal well by second intent, or by FTSGs. In the concha, skin and cartilage defects, or full-thickness defects can be reconstructed by revolving door or post-auricular island pedicle flaps.

Defects involving the helical rim less than 2 cm can be closed by helical advancement flaps. Additional excision of the scapha in the form of wedge or star excisions will reduce the height of the pinna. The angle at the apex of the wedge should not exceed 30°. In general, up to 10 to 15% auricular height asymmetry can be tolerated [18]. Defects beyond 2 cm require additional tissue brought into the defect. Tubed post-auricular pedicle flaps, or posteriorly based post-auricular flaps, combined with cartilaginous grafts are staged procedures which prevent reduction of ear size.

Small defects of the ear lobe can be closed primarily, while larger ones may require the recruitment of skin from the post-auricular region. This can be further augmented with non-anatomical cartilaginous grafting to resist contracture.

Conclusion

In reconstruction of a cutaneous malignancy following Mohs surgery, it is essential to first understanding the physiology of skin flaps, before performing an algorithmic analysis of the defect. Next, one should consider the options as we ascend the reconstructive ladder, anticipating the surgical risks, challenges, and outcome while weighing in patient expectations. Each aesthetic unit presents its own unique challenges and deserves individual review.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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