# Current Concepts in Cheek Reconstruction

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The surgical reconstruction of facial defects is a critical skill for the facial plastic surgeon. The broadest subunit of the face, the cheek is formed by the hard and soft tissue contours of the bordering units: the forehead, eyelids, nose, lips, neck, and ear. The cheeks frame the central units of the face and at their periphery blend into their surrounding structures. Despite their close proximity, reconstructive considerations for the structures of the central face are different from those for the cheeks.

## Anatomy

A primary reason for the difference in reconstructive approaches for the cheek and central facial structures, such as the nose, is the difference in anatomy. In contrast to the complex three-dimensional contours of the nose, the cheek is broad and relatively two-dimensional. In women, the skin of the cheek is relatively homogeneous with fine matte hair, whereas in men, the preauricular and jaw line portions of the cheek are covered with thicker hair-bearing skin. The borders of the cheek subunit are composed of the nasofacial junction and nasolabial fold medially, the infraorbital rim superiorly, the temporal hairline and preauricular crease laterally, and the lower border of the mandible inferiorly. The relaxed skin tension lines (RSTLs) represent lines of intrinsic skin tension along which incisions experience the least tension and optimal healing [1]. In the cheek, the RSTLs are generally parallel to rhytids. In the midcheek, particularly in younger individuals, no visible lines or rhytids are apparent. The cheek subunit borders and the RSTLs provide the basis for proper orientation of excision and reconstruction to maximize eventual scar camouflage (Fig. 1).

The cheek is made up of epidermis, dermis, and subcutaneous tissues that overlie the fibrous superficial musculoaponeurotic system (SMAS). The SMAS layer is continuous with the platysma and extends to the zygomatic arch. The prevalence of sebaceous glands and skin appendages varies throughout the cheek skin; typically, the more sebaceous skin is located medially. Structures deep to the SMAS layer include the parotid gland, masseter muscle, and buccal fat. The facial nerve runs through the parotid gland to emerge anteriorly just superficial to the masseter muscle, becoming more superficial as it moves medially. Great care must be taken with dissection deep to the SMAS layer to avoid injury to branches of the facial nerve. In sub-SMAS dissection in the medial cheek, the masseteric fascia should be left intact to provide a protective layer over the facial nerve. Fibrous attachments connect the skin and SMAS to the deeper periosteum at the zygoma and the masseter. These zygomatico-cutaneous and masseteric-cutaneous ligaments serve to suspend the cheek soft tissue onto the facial skeleton. In extensive facial reconstruction, these ligaments may need to be divided to achieve adequate mobilization of facial soft tissue [2].

## General principles of cheek reconstruction

For all cutaneous malignancies, flaps should not be designed until all margins have been deemed to

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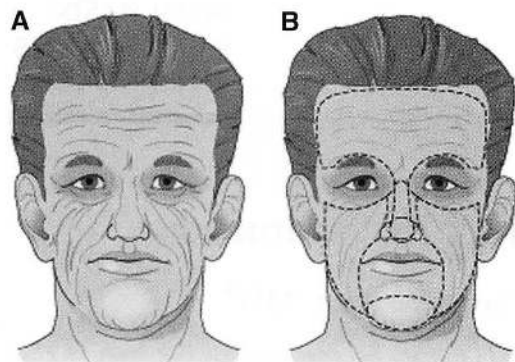*E-mail address:* dkim@ohns.ucsf.edu (D.W. Kim).

Fig. 1. (*A*) Relaxed skin tension lines in a middle-aged man. (*B*) Facial subunit boundaries.

be free of tumor. If undetected positive margins are present at the time of closure, there is risk of recruiting normal tissue into an area of malignancy. This event may lead to the tumor becoming masked by the flap, causing delayed definitive treatment. In addition, once the residual tumor is detected (by pathologic diagnosis or by gross regrowth of tumor), it will be difficult to determine how much additional resection is necessary. In such cases, because of the previous flap harvest, there is less surrounding skin, further limiting reconstructive options. Mohs' microsurgery is an excellent technique to ensure tumor removal while minimizing the degree of tissue loss. This method allows the surgeon to close the defect with reasonable confidence of oncologically clear margins. Alternatively, the defect may remain open and be treated temporarily with local wound care until permanent pathologic sections are completed before definitive closure.

The flat and expansive nature of the cheek makes it a relatively forgiving area for reconstruction. In contrast to the midline facial structures, the outline of only one cheek can be fully seen on any one view; therefore, recreating exact symmetry does not have the same importance as in the central facial subunits. Nevertheless, preserving the existing symmetry of the central subunits is critical in cheek reconstruction. Many reconstructions require the creation of tension that, if directed improperly, may distort esthetic subunits such as the lateral nasal ala or inferior eyelid, resulting in a "broken face" appearance. An essential principle of cheek reconstruction is to avoid undue tension and disfigurement of these regions.

Placement of scars within existing rhytids, in RSTLs, along or within hairbearing areas, or along subunit borders makes scars less conspicuous. The

human eye expects to see lines of shadow or contrast in these borders and curves; therefore, scars are less conspicuous when they are contained within them. Nevertheless, the avoidance of distortion to adjacent structures of the face should have priority over the desire to place scars in facial RSTLs or rhytids. For example, if an infraorbital defect is repaired so that the resultant scars lie in a predominantly horizontal orientation that parallels the RSTLs, downward tension of the lower lid and ectropion may ensue. In such a situation, the tension of closure should be oriented parallel to the lid to prevent ectropion, even if it means that the resulting scars overall will not lie in the RSTLs of the area.

Another essential principle of cheek reconstruction is to provide an accurate skin color and thickness match for the reconstruction. Although the expansive cheek subunit may be tolerant of slight asymmetry or contour changes, color mismatches in the cheek are conspicuous and result in a poor cosmetic outcome. Locally recruited tissue tends to provide a superior color match with improved cosmesis.

## Reconstruction techniques

### Secondary intention

Secondary intention represents the simplest form of facial reconstruction. This minimalist approach provides the opportunity to monitor for persistent or recurrent disease in defects created with the excision of malignant disease. Cosmetically, secondary intention provides the best results in concave areas with underlying bony support, such as the medial canthal area. The cheek is a convex structure with little osseous foundation. Although secondary intention may yield acceptable cosmesis for superficial defects, the results may be unpredictable. Another limitation with secondary intention is that scar contracture may result in distortion of the lip, nose, or eyelid. Secondary intention requires ongoing wound care, which not all patients may be able to provide. Despite its surgical simplicity, secondary intention is generally not the option of choice for reconstruction of cheek defects.

### Primary closure

Primary closure with undermining of skin is the reconstructive option of choice for most small defects. This approach is simple and, when properly designed, provides excellent cosmesis. There are

several important considerations when designing a primary closure to achieve esthetic results. The size of the defect and the laxity of the patient's skin will determine whether primary closure is feasible. Elderly patients tend to have redundant skin, making this method advantageous. For younger patients, primary closure may result in excessive tension on skin wound edges or distortion of surrounding facial subunits despite undermining.

When executing a primary closure, every effort should be made to place the scar within, or parallel to, existing facial rhytids. In elderly patients, such rhytids are typically abundant, and a properly placed scar may be virtually unnoticeable. Although younger patients have fewer rhytids, incisions should be placed along RSTLs so that the scar will fall into the rhytids that will become prominent as the patient ages.

## Skin grafting

Skin grafting allows rapid coverage of large defects; however, several disadvantages limit this approach in the cheek. Obtaining a proper color match with a skin graft is difficult. Split-thickness skin grafts develop unpredictable color and a shiny appearance, producing a poor cosmetic result. Full-thickness skin grafts from the preauricular, postauricular, or supraclavicular region may result in a better color match, but the borders of such grafts tend to produce a conspicuous "patch" appearance.

Scar contracture may also limit the use of skin grafting. Split-thickness grafts experience significant contracture that may cause deformity of adjacent facial subunits. These grafts should be avoided in the repair of defects medial to the lateral canthus of the eyelids. Full-thickness grafts experience less contracture but still may result in ectropion if used inferior to the eyelid in patients without adequate skin laxity.

Some experts advocate skin grafting as an initial approach to reconstruct defects resulting from excision of malignant lesions. This approach allows observation of the tissue bed with early detection of recurrent disease. If no further lesions develop, a secondary reconstruction can be performed with removal of the initial skin graft. Although contracture of the graft may result in a smaller secondary defect, such contracture may also result in deformity of surrounding structures, complicating secondary reconstruction. In general, the low recurrence rates associated with the Mohs' micrographic surgical technique and the use of frozen sections obviate the need for initial grafting with secondary recon-

struction, except in patients at the highest risk for recurrence.

## Transposition flaps

Transposition flaps are versatile and may be used anywhere on the face. These flaps recruit tissue from adjacent sites, resulting in excellent color and texture matches. An abundance of skin in the neck and postauricular region makes the use of transposition flaps an attractive option in cheek reconstruction. Often, multiple designs are available, allowing the surgeon to customize the repair for a particular defect. A clear understanding of final scar patterns and areas of maximal tension is critical to minimize the visibility of the scar and the distortion of surrounding facial structures.

Several issues need to be addressed with all transposition flaps. The donor defect must be closed. Some transposition flaps are designed for primary closure of the donor site (rhombic flaps), whereas others recruit secondary flaps for reconstruction of the primary donor deformity (bilobed flaps). Often, a standing cone or "dog ear" deformity is created with this closure and is usually repaired at the time of reconstruction. The creation of a trapdoor deformity may also be seen with the use of transposition flaps. This deformity occurs when scar contracture at the undersurface and periphery of the flap causes the deep portion of the flap to contract more than the superficial and central portion, resulting in a bulging "pin cushion" appearance of the transposed tissue. Adequate undermining of soft tissue at the time of transposition and eversion of wound edges on closure minimize the occurrence of the trapdoor deformity. Typically, this deformity improves over time. Steroid injections may be given to hasten resolution. Deformities that persist beyond 1 year can be addressed with additional surgery to debulk the flap.

Many other types of transposition flaps exist, with various sizes and shapes of the primary flap. Rhombic and bilobed designs are discussed in more detail herein, because these represent the workhorse flaps in local cheek reconstruction.

## Rhombic flaps

Rhombic flaps use adjacent areas of loose skin to close defects. The classic flap addresses a rhombic defect (equilateral parallelogram) with 60- and 120-degree angles. For defects of other shapes, additional skin around the defect may be excised to approximate a rhombic. As seen in Fig. 2A, the flap is three sided, with one side shared with the defect.
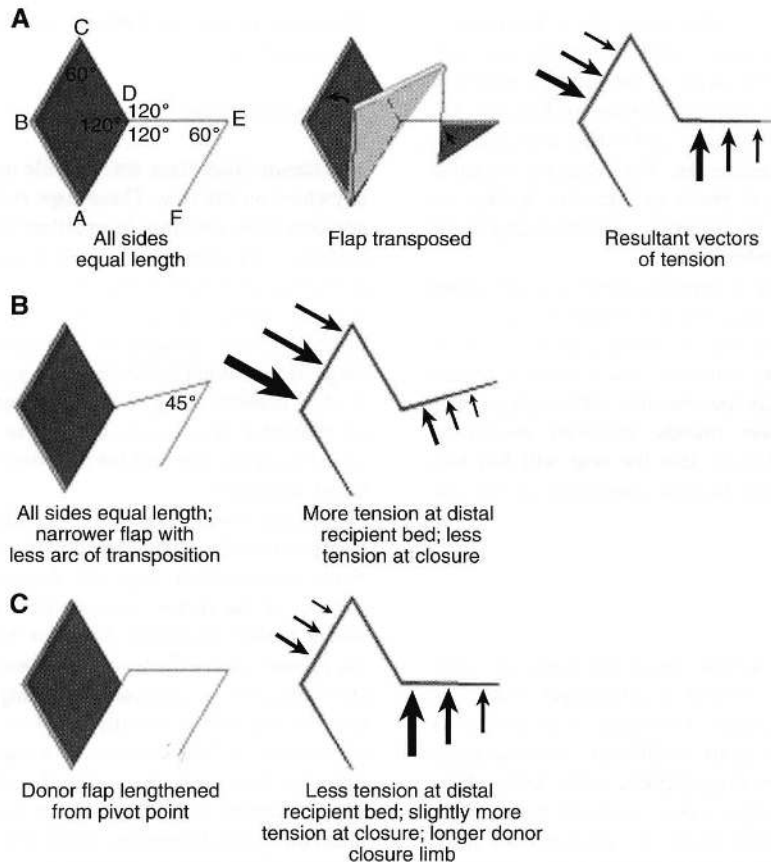
**A**



All sides
equal length

Flap transposed

Resultant vectors
of tension

**B**

All sides equal length;
narrower flap with
less arc of transposition

More tension at distal
recipient bed; less
tension at closure

**C**

Donor flap lengthened
from pivot point

Less tension at distal
recipient bed; slightly more
tension at closure; longer donor
closure limb

Fig. 2. (*A*) Example of a classic 60- to 120-degree rhombic flap. All sides of the flap are equal to the sides of the defect. As the flap is transposed into the defect, the main areas of tension are at the distal edge of the defect and the closure of the donor defect. (*B*) Modified design with a longer flap compensates for pivotal restraint on the flap as it is transposed, resulting in less tension and local distortion at the distal aspect of the defect. There may be slightly more tension at the closure of the donor defect if there is an increase of flap width at its base. (*C*) Modified design with a narrower flap with a decreased angle of transposition, allowing for a narrower donor defect and less tension of closure at the donor site. Although less pivotal restraint is experienced by the flap owing to a smaller arc of transposition, there may increased distal wound tension owing to the use of a flap narrower than the defect.

Because four sides of the rhombic defect are present, four possible flaps may be designed. The second side of the flap (*DE*) is colinear with the short diagonal or equator of the rhombic defect. The distal two sides of the flap (*DE* and *EF*) should be of the same length as the distal sides of the defect (*BC* and *CD*). The sides that are approximated are of the same length. In the classic flap, the corresponding angles of the flap are the same as those of the defect. The flap is usually elevated in the subcutaneous plane and transposed to cover the defect. The donor site is then closed primarily. Primary closure of the donor site may be a limiting factor for rhombic flaps, and these flaps are best suited for small to medium-sized defects.

Rotation of the initial rhombic defect allows for virtually limitless options for scar placement and distribution of tension (Fig. 2A) [3].

*Bilobed flaps*

Bilobed flaps are essentially a double transposition flap, with the first flap designed to cover the original defect and a second flap designed for coverage of the donor defect. The secondary donor defect is closed primarily. An early design of the bilobed flap by Esser [4] called for a 90-degree angle between the defect and the primary lobe of the flap and another 90-degree angle between the primary and secondary lobes of the flap. In 1981 this design was

altered by McGregor and Soutar [5] to narrow the angles between the defect and flap lobes. In 1989 Zitelli [6] published his experience using the modified bilobed flap. He emphasized a total transposition over no more than 90 to 110 degrees (compared with the 180 degrees of the initial design). He noted fewer standing cutaneous (dog ear) deformities, as well as a reduction of the trapdoor deformity.

A disadvantage of the bilobed flap is that the resultant scar retains a bilobed pattern that is not easily camouflaged among the natural lines of the face. For smaller defects, primary closure or the use of a well-designed rhombic flap will likely give a better cosmetic result. For larger facial defects, the bilobed flap has the advantage of distributing the closure of the defect and the wound tension over two flaps and two donor sites. For example, for low lateral cheek defects, a bilobed flap can be used in which the preauricular skin serves as the primary flap and the postauricular or cervical skin as a secondary flap.

## Rotational flaps

Rotational flaps can be used to close medium or large facial defects. In the cheek, a curvilinear rotational pattern allows recruitment of skin and soft tissue from the preauricular and cervical regions. The cervical facial rotation flap uses preauricular and transverse cervical incisions with resulting scars along the preauricular border of the cheek subunit and within the RSTLs of the neck. The melolabial and alar-facial sulci form cosmetic medial flap borders, and the infraorbital rim region provides a satisfactory superior margin. More limited versions of this flap can be used for smaller defects. Closure of these flaps typically requires repair of a standing cone deformity at their base. In male patients, the location of hairbearing skin of the cheek must be considered to avoid the undesirable result of rotating hairbearing skin into the medial cheek.

## Advancement flaps

Advancement flaps involve a primary sliding action of an incised flap to close a defect. Multiple variations of advancement flaps exist with varied anatomic applications. Advancement flaps may have single or multiple pedicles and frequently require excisions of Burow's triangles to allow adequate sliding of tissue. Along with sliding of the flap, stretching of the flap and advancement and stretching of the surrounding tissues may aid in defect reconstruction. The underlying pliability and the use of undermining will determine the relative advancement of surrounding tissues.

Advancement flaps are best designed when the incisions fall into the natural lines of the face. Their use is limited by the skin laxity of patients; in younger patients, advancement flaps are only practical for small defects. To increase the reach of advancement flaps, Burow's triangles or Z-plasty may be used at their base. For larger defects, advancement may be combined with rotation, such as in the cervicofacial rotational flap.

## Regional flaps

Regional flaps may be considered in the reconstruction of large facial defects. Forehead and platysmal flaps can provide significant soft tissue with good color match for cheek reconstruction. Nevertheless, both flaps have significant potential donor morbidity, and in the authors' experience, rotation and transposition flaps provide more reliable and less morbid reconstruction.

## Paramedian forehead flap

The paramedian forehead flap is most frequently used in nasal reconstruction but can also be used for cheek reconstruction. The flap is based on the supratrochlear or supraorbital vasculature. Because this flap requires a staged approach and may leave undesirable scarring in the forehead, rotational or transposition flaps are typically preferred in cheek reconstruction.

## Platysmal flaps

Platysmal flaps can be designed as myocutaneous flaps with skin pedicles from the cervical skin. One advantage of the platysmal flap is the potential to bring hairbearing skin of the neck to defects of hearbearing facial skin in men. The blood supply to the muscle and skin comes from submental branches of the facial artery and branches of the transverse cervical artery. Following incision of the skin island, the flap is elevated in the subplatysmal plane and transposed or tunneled to the defect site. Elevation of the platysma should not proceed beyond the inferior border of the mandible so as not to compromise blood supply. Meticulous flap elevation is required to avoid transection of the platysma and compromise of the flap's blood supply. Care must also be taken to avoid injury to deep structures such as the marginal mandibular branch of the facial nerve. Because of these potential morbidities, platysmal flaps remain a secondary option for cheek reconstruction.

*Distant flaps*

Distant flaps provide virtually unlimited tissue bulk for reconstruction of large facial defects. Typically, these flaps provide a poor color and texture match for cheek skin and should be avoided when possible. Massive defects, such as through-and-through cheek defects, may require distant flaps for their extensive soft tissue, with acceptance of their cosmetic deficiencies.

**Selection of flaps and flap design**

Each defect presents unique challenges. Proper flap selection and design are dictated by the size and location of the defect, by neighboring structures, and by the patient's skin laxity and thickness. The primary goals of avoiding distortion of local structures (eyelid, nose, and lips) and providing an appropriate donor tissue match must be considered in all reconstructions. Because so many variables are at play in local flap repair, each case must be approached with a unique plan to fit the defect and patient. The results will be limited if one chooses the same type of flap for every defect at a particular site or rigidly traces geometric textbook designs for every case. Modification of the orientation, angles, and lengths of the classic design of established local flaps should be performed based on the unique characteristics of each case. For this reason, a rigid algorithm is not easily applied to flap repair of facial defects. Nonetheless, repair of defects in various anatomic locations invokes certain principles that may be anticipated with some level of predictability. Table 1 demonstrates common flap choices for cheek defects of variable size and location.

*Infraorbital region*

The primary concern in repair of the infraorbital region is avoidance of inferior tension on the eyelid with resulting ectropion. It is critical to design flaps in which tension is distributed parallel to the eyelid margin rather than perpendicular to it. The versatility of the rhombic flap allows the surgeon to design a flap that minimizes vertical tension on the eyelid. Fig. 3 demonstrates properly and improperly designed rhombic flaps used in the treatment of lateral infraorbital defects.

For large infraorbital defects, particularly those on the medial aspect of the cheek, the cervicofacial rotational flap is a dependable technique. The flap is designed to recruit tissue over the expanse of the cheek and, if necessary, the neck. Incisions are extended laterally from the defect along the infraorbital rim, to the temporal hairline, and then inferiorly along a preauricular rhytidectomy incision. The incision may be extended inferiorly into the neck if additional skin is necessary. Another incision may be made starting from the medial aspect of the defect, following the nasal-facial border and nasolabial groove inferiorly. These flaps are elevated in the subcutaneous plane and then rotated and advanced to close the wound. This design, which employs incisions along subunit margins, allows for a predominately horizontal tension vector beneath the eye and a vertical tension vector along the nose (Fig. 4).

*Nasolabial region*

Within the nasolabial region, avoiding distortion of the lips and nose is critical. Horizontal tension near the nasal ala or vertical tension along the lips

Table 1
Flap considerations for cheek reconstruction

| Location | Size of defect | | |
| --- | --- | --- | --- |
| | Small | Medium | Large |
| Central cheek | Primary closure | Rhombic flap Bilobed flap Cervicofacial rotation flap | Bilobed flap Cervicofacial rotation flap |
| Preauricular | Primary closure | Cheek advancement flap | Bilobed flap Cervicofacial rotation flap |
| Nasolabial region | Primary closure | Rhombic flap Advancement flap | Cervicofacial rotation flap |
| Infraorbital region | Primary closure (vertical ellipse) | Rhombic flap Advancement flap Cervicofacial rotation flap | Cervicofacial rotation flap |
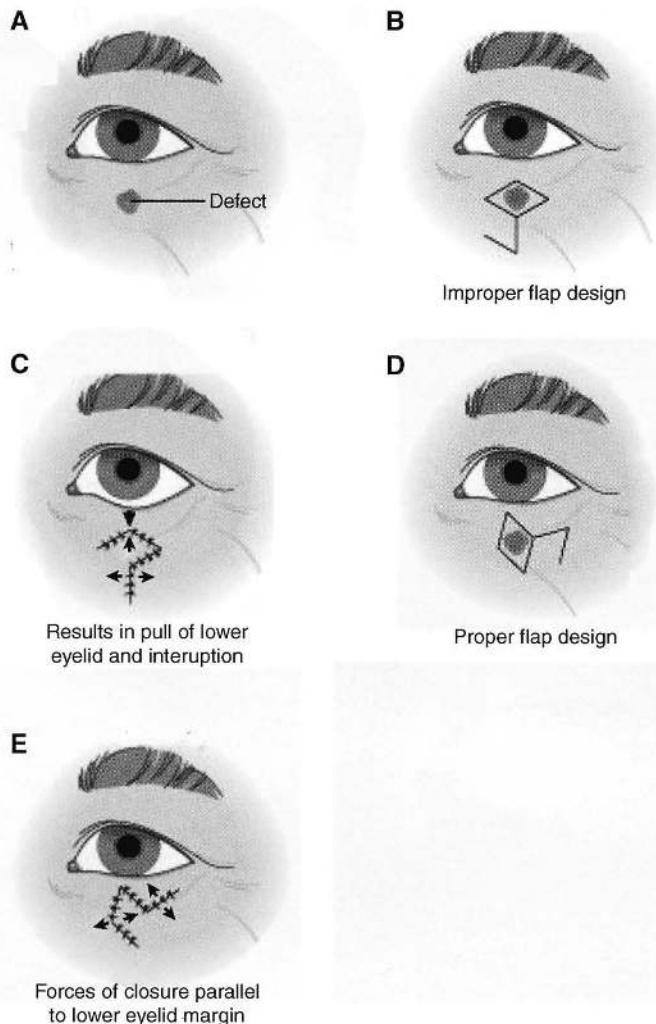
Fig. 3. (A) Small defect just below the lower eyelid margin. (B) Improper flap design. (C) Closure leads to majority of scars in an overall horizontal orientation along RSTLs; however, wound tension at the distal defect pulls the lower eyelid down, causing ectropion. (D) Correct flap design. (E) Although most of the scars violate the direction of the RSTLs, the vectors of tension are parallel to the eyelid margin. Eyelid distortion and ectropion are avoided.

may lead to undesirable cosmetic results. Within this region, the nasolabial fold provides an anatomic camouflage while separating facial subunits. Although simple elliptical incision and primary closure within the nasolabial fold serves well for small defects along the fold, larger defects require reconstructions that are more complex. Small or moderate-sized defects in or near the alar groove may be closed effectively with VY advancement flaps, placing most of the scar within the nasolabial groove. This technique uses a deep subcutaneous pedicle after skin incisions are made circumferentially around the flap. Typically, the flap is designed just above or below the defect. The numerous arterial perforators from the facial artery provide an adequate blood supply to support this deep pedicle. The flap is advanced into the defect, with the resulting donor site closed primarily. When properly designed, the donor site closure scar should lie within the nasolabial fold.

Transposition flaps can also be considered for small or medium-sized defects in this region. Flaps should be designed so that most of the resulting scars fall within or parallel to the nasolabial fold and do not distort the lips or nasal ala. Large defects in this region can be reconstructed with cervicofacial rotational flaps as described previously.
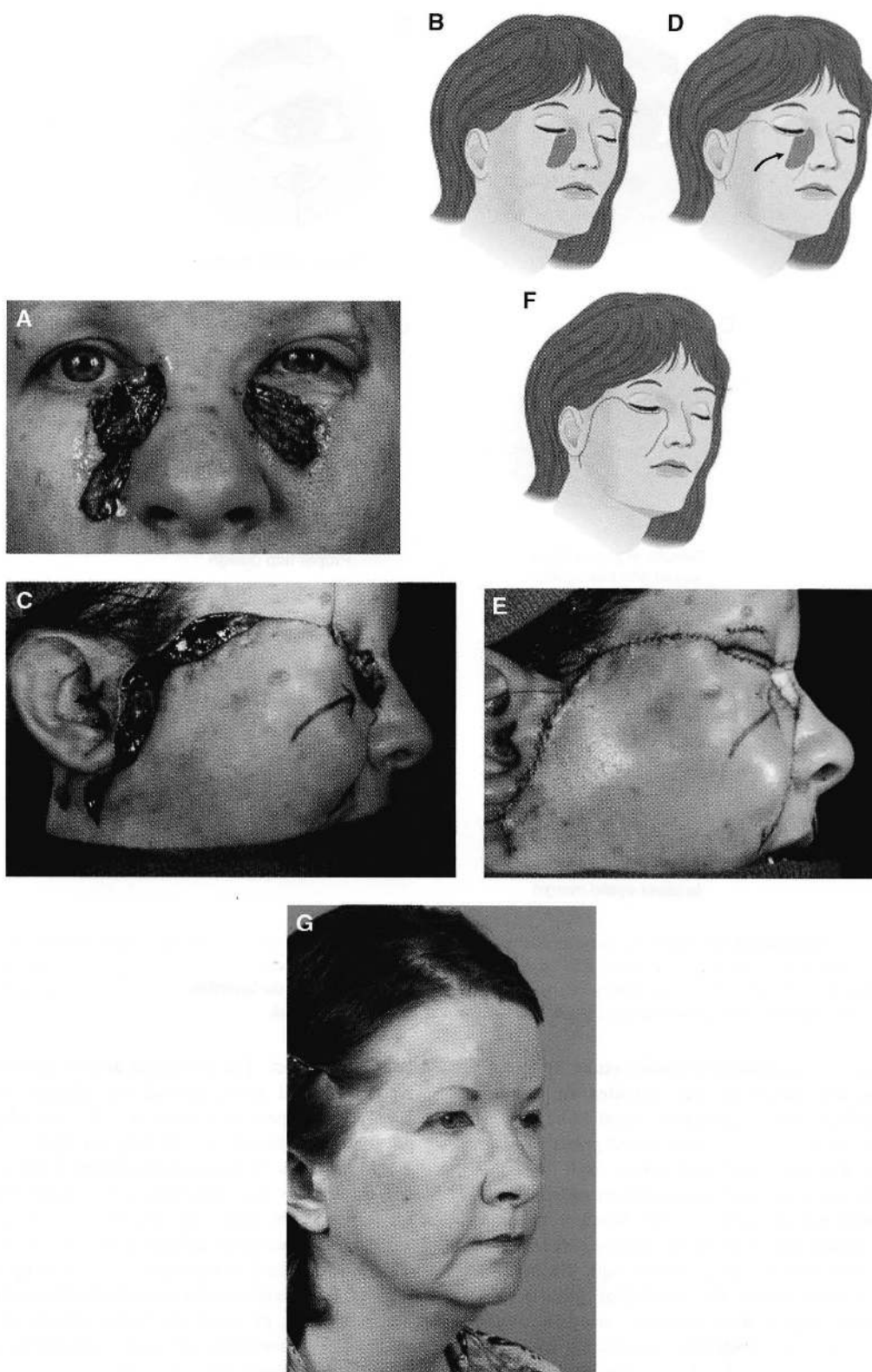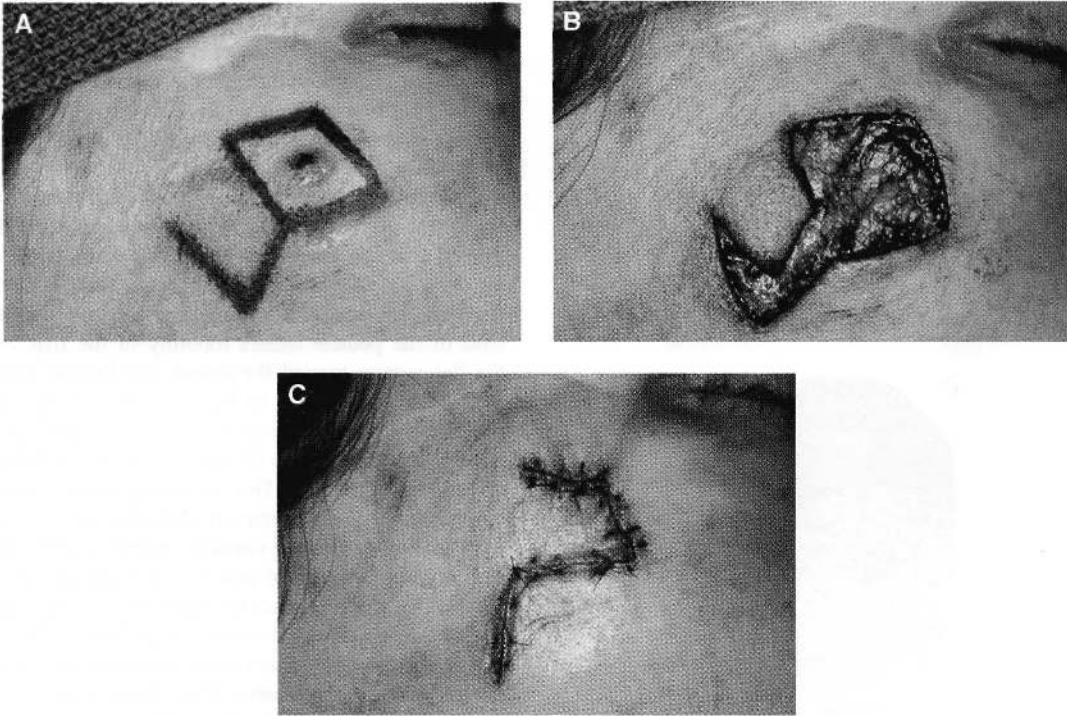
Fig. 5. (*A*) A 1-cm midcheek basal cell carcinoma. (*B*) Rhombic flap design after excision and clear margins. (*C*) Closure under minimal tension. (Courtesy of Dean Toriumi, MD.)

*The midcheek region*

Defects in the midcheek are amenable to a variety of closure techniques. For small defects with adequate skin laxity, primary closure is the method of choice. Within the midcheek region, rhytids are frequently inconspicuous, particularly in younger patients. Although closure along an RSTL is desirable, if such a closure requires a significant increase in the length or tension of closure, a smaller scar not orientated along RSTLs may be preferable. For larger defects, rhombic flaps or cervicofacial rotation flaps can be used. With larger defects in this region, the principle of avoiding tension and distortion of midface structures is critical to achieving good cosmesis. Fig. 5 demonstrates closure of a midcheek defect using a rhombic flap.

*The preauricular region*

Anatomic considerations limit flap choices in reconstruction of the preauricular lesion. The skin at the lateral border of the cheek in the region of the tragus is relatively fixed, with little potential for medial advancement for flap closure. Recruitment of superior tissue may change the temporal hairline, resulting in noticeable deformity; therefore, medial, inferior, and, occasionally, postauricular recruitment of tissue is typically necessary for closure of preauricular defects.

Cheek advancement flaps with recruitment of medial soft tissue provide the opportunity to close significant soft tissue defects while camouflaging the scar in the preauricular creases. Vertically oriented defects are particularly amenable to this type of

Fig. 4. (*A,B*) Patient with defect following multiple skin cancer excisions. Large right medial infraorbital cheek defect is pictured. (*C,D*) Large facial rotation-advancement flap is designed. A lateral incision is made along the inferior orbital rim, temporal hairline, and preauricular crease. A medial incision follows the nasofacial junction and nasolabial fold. Flaps are widely elevated in a subcutaneous plane. (*E,F*) Lines of closure lie within facial subunit borders. A full-thickness skin graft was used to repair the small nasal sidewall component of the defect, preserving the distinction between the cheek and nose units. (*G*) Six-month postoperative result. (Courtesy of Dean Toriumi, MD.)
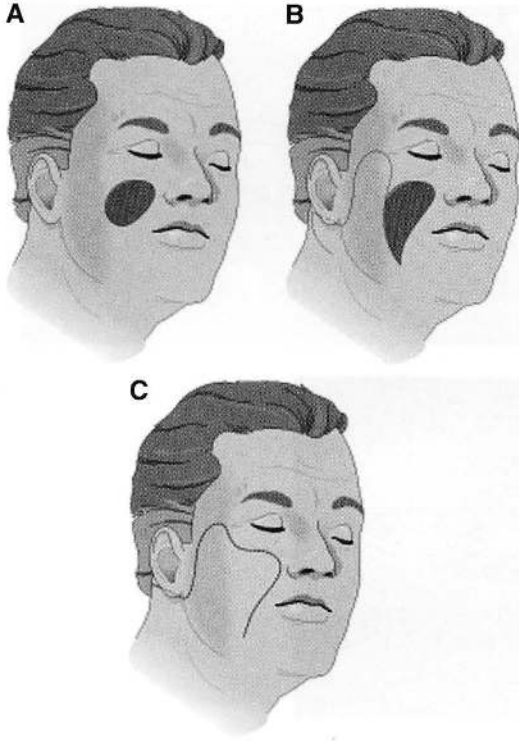
Fig. 6. (*A*) Large inferior preauricular midcheek defect. (*B*) Bilobed flap design allows for recruitment of post-auricular and mastoid skin to close primary donor site. (*C*) By distributing closure over two flaps, wound tension is reduced.

closure. In women, the scar may be hidden on the medial aspect of the tragus; in men, this approach recruits hairbearing skin over the tragus, an undesirable outcome. Bilobed flaps recruiting soft tissue from the postauricular region may also be used for reconstruction of medium and large defects of the preauricular region. The postauricular donor site is well hidden by the auricle with this approach. Fig. 6 demonstrates the use of a bilobed flap for closure of a preauricular defect. A cervicofacial rotation flap may also be used for larger defects with a significant horizontal component.

## Modifications to flap design to reduce wound tension and local tissue distortion

Despite the surgeon's best efforts, tension on the edge of the reconstruction may cause distortion of surrounding landmarks. In general, large defects, defects close to central facial landmarks, and defects in patients with poor skin compliance are more likely

to lead to distortion to key landmarks. An understanding of several key concepts and modifications to classic flaps may minimize this distortion.

### Flap lengthening to reduce distal defect tension

One consideration in the design of local cutaneous flaps that use a rotation or transposition type of motion is the concept of pivotal restraint as described by Dzubow [7]. This principle states that, as such flaps are transposed or rotated from a donor site, the base of the pedicle tethers mobility of the flap. As the flap rotates toward the defect, the distance from the original pivot point to the distal part of the flap decreases. This effective shortening of the flap causes a gap to remain between the distal aspect of the defect and the tip of the flap. This remaining distance must be spanned by a combination of further stretch and mobilization of the flap (usually requiring additional undermining around the pedicle base) and advancement of the distal edge of the defect toward the flap. In some cases, the advancement of the distal edge of the defect may cause unwanted distortion of neighboring anatomic landmarks. One example of this is alar retraction caused by advancement of the distal defect in bilobed flap repair of a nasal alar defect. Dzubow's principle reminds us that "textbook" flap design may fail to perform as expected when based on two-dimensional geometric principles.

One method that may be used to compensate for this phenomenon is intentional overlengthening of the flap in the initial design. One may consider this when there are structures distal to the defect that would be prone to cosmetic or functional complications should they be distorted after reconstruction. The degree to which the flap length should be increased depends on the elasticity and thickness of the soft tissue. In general, less mobile thicker skin may need further lengthening to compensate for pivotal restraint [7,8].

### Changing the flap angle and width to reduce donor site closure tension

Just as tension at the distal defect edge may cause local tissue distortion, the tension of donor site closure may lead to deformity of neighboring landmarks. For example, the side-to-side closure of the donor site for a rhombic flap will lead to tissue pull on both sides of the donor site closure. If an anatomic landmark resides in the path of these vectors of pull, functional or cosmetic distortion may ensue. Narrowing the width of the flap and reducing the angle of rotation or transposition of the flap to the

defect may reduce this type of distortion. The narrower donor defect results in less tension needed for closure, and the smaller angle of rotation results in less pivotal restraint on the distal flap. Overall, there is less local distortion caused by closure of the secondary defect. Despite the reduction in pivotal restraint, there may actually be an increase in distal defect tension and distortion owing to the flap being undersized in relation to the defect. The surgeon must be thoughtful in deciding where around the flap it is most important to avoid tension and where it is acceptable to have higher tension. This decision requires careful assessment of the surrounding structures and skin around the defect. The concepts of flap lengthening and flap narrowing are illustrated with a rhombic flap in Fig. 2B and C.
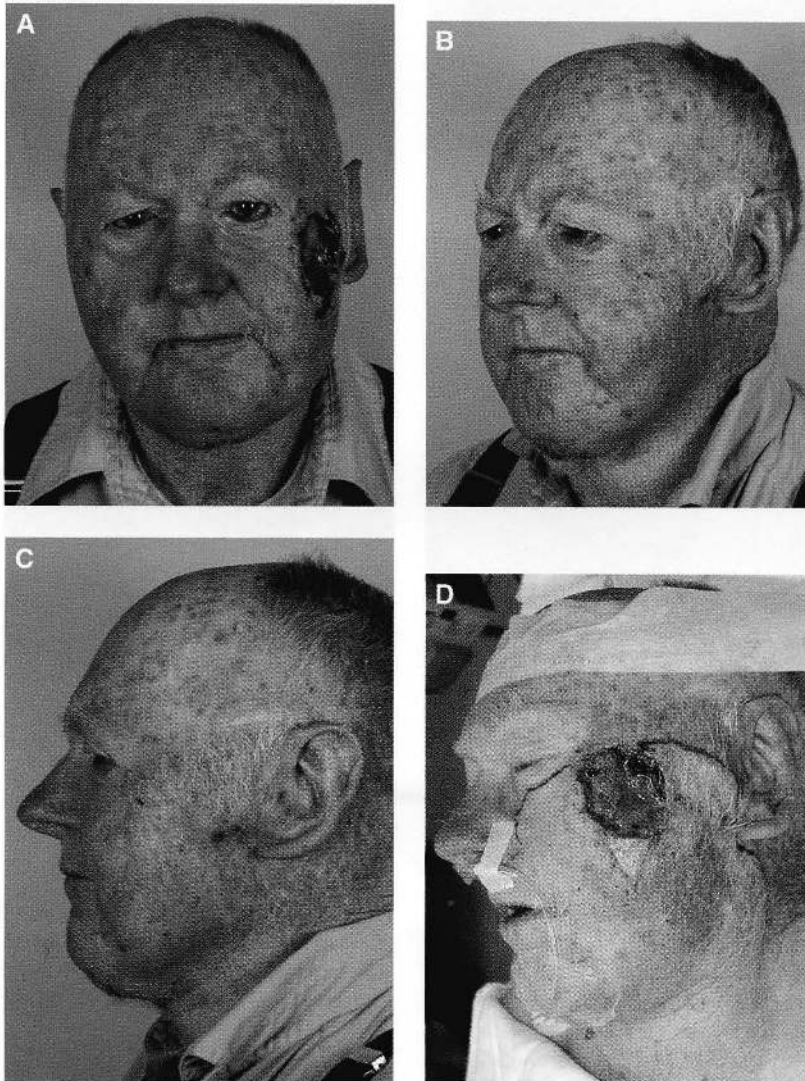


Fig. 7. (*A*−*C*) A 4 × 2 cm elliptical defect following excision of squamous cell carcinoma. (*D*) Rotation-advancement flap design would require recruitment of tissue from the more cosmetically visible central face. (*E*) Unilobe transposition design poses difficulty in closing the donor defect given the proximity of the auricle. (*F*) Rhombic flap design. The distal flap is increased in length and the arc of transposition is decreased to decrease pivotal restraint and distal defect tension near the lower eyelid and lateral canthus. (*G,H*) Flaps transposed. (*I*) SMAS suspension suture from the undersurface of the flap to the inferior orbital rim periosteum. (*J*) Final closure. (*K*−*M*) Two-month postoperative result.
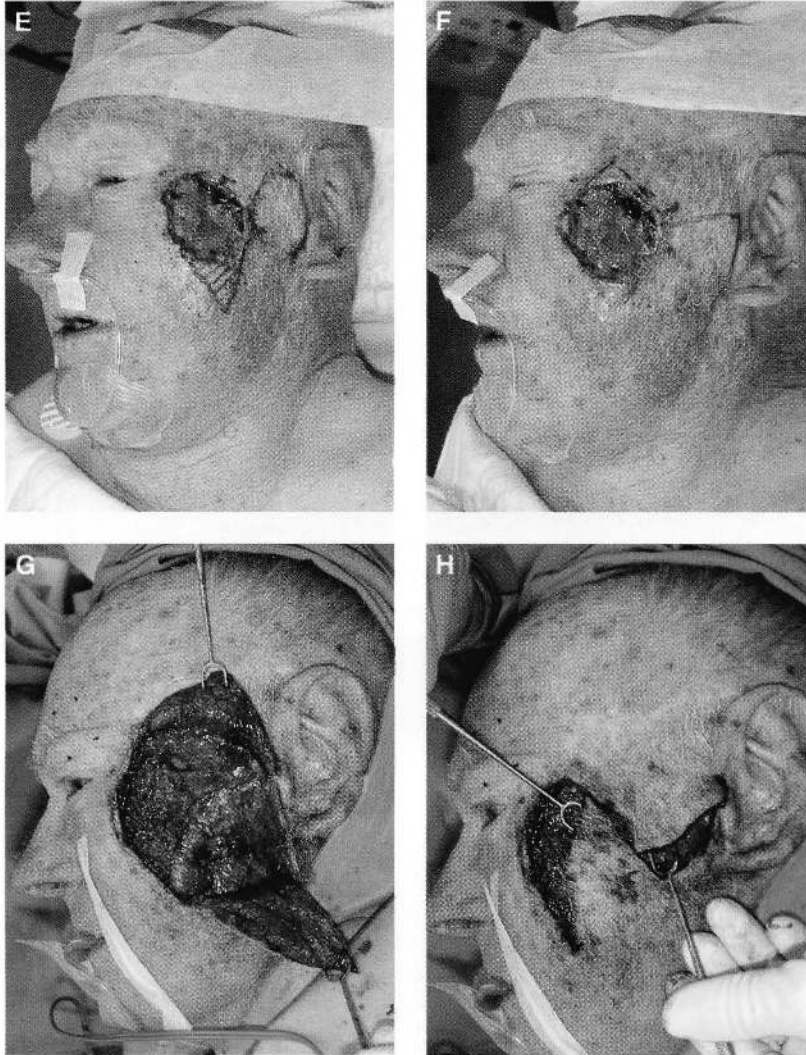
Fig. 7 (*continued*).

*Superficial musculoaponeurotic system suspension*

In the area of the cheek, another method to reduce tension is the use of SMAS fixation to deeper stable structures. In this technique, elevation of the flap is undertaken deep to the SMAS so that this tough layer may be used as an anchor for fixation. Great care must be taken during flap elevation to avoid disturbance of deep tissue and possible facial nerve injury. The level of undermining around the flap may be done in the supra-SMAS subcutaneous level. The SMAS of the flap is then suture fixated to deeper fixed structures, such as periosteum. Ten-

sion of the closure is borne by the SMAS fixation rather than by the subcutaneous or cutaneous tissues. Decreased distortion of adjacent facial structures and superior healing of the skin are likely to ensue.

**Case presentation**

A 70-year-old man presented with a history of multiple facial skin squamous cell carcinomas and melanoma. He previously underwent local excision of a left temple squamous cell carcinoma with primary closure and left parotidectomy and neck
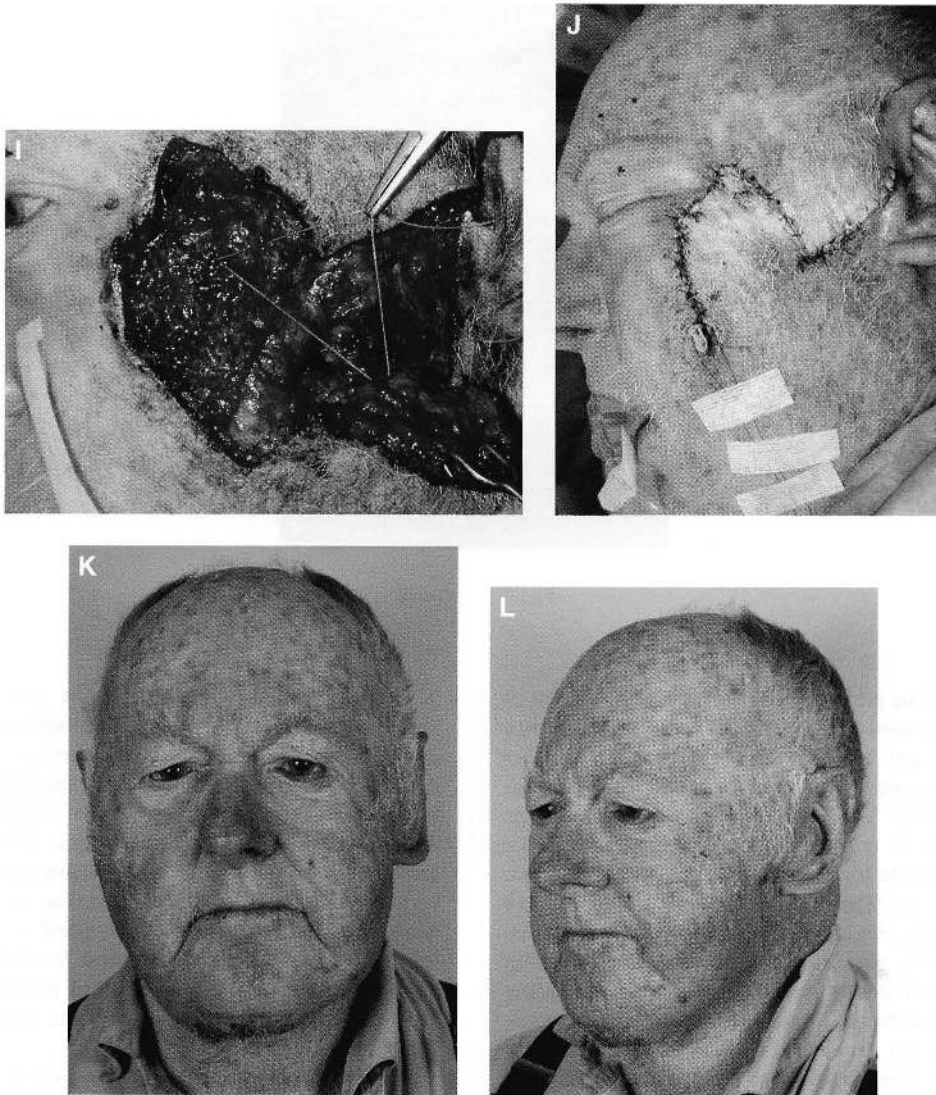
Fig. 7 (*continued*).

dissection for melanoma. He was referred to the senior author (DWK) by an otolaryngologist after an additional resection of a new squamous cell carcinoma of the left cheek. The defect measured 5 cm in vertical dimension and 3 cm in horizontal dimension. The superomedial aspect of the defect was 2 cm from the lateral canthus of the left eye. The superior border of the defect was at a level just inferior to the lower eyelid margin. Complicating this case was the previous temple excision and parotidectomy, which decreased the pliability and mobility of local skin. In addition, the patient had a long-standing lower eyelid ectropion, which was previously scheduled to be repaired by an oculoplastic surgeon after the cheek reconstruction (Fig. 7A–C).

In planning for this reconstruction, several options were considered. Healing by secondary intention would lead to significant contracture, the possibility of infection, a delay in healing, and, inevitably, a poor cosmetic result. The defect was too large for primary closure, and a skin graft would cause poor tissue match with the risk of contracture. Local flap reconstruction was deemed the best choice. Three designs were considered. A rotation-advancement
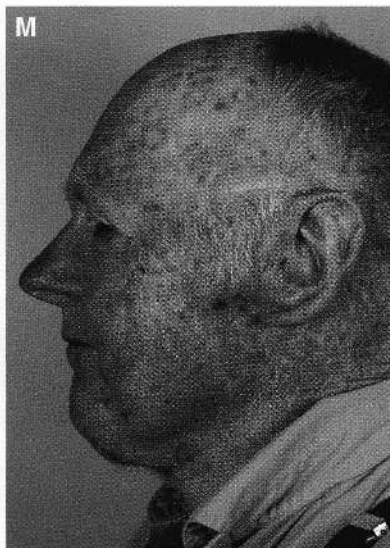
Fig. 7 (*continued*).

flap could be performed, but the size and location of the defect would require recruitment of donor tissue medially and laterally. This approach would also require a more extensive incision and result in scars in the more visible central portion of the face (Fig. 7D). A unilobe transposition flap with donor tissue from the preauricular area was also considered; however, the large preauricular donor defect would need to be closed in an anteroposterior direction. Because the auricle is a relatively fixed structure, this type of closure would be difficult. If the defect had been of the same size and orientation, but positioned a few centimeters inferior, a second postauricular lobe could have been incorporated into such a flap design to allow for acceptable closure (Fig. 7E).

In the end, a rhombic transposition flap was chosen. The defect was roughly an oblong shape, requiring minimal additional excision to create a rhombic defect. Unlike in the unilobe flap, the donor tissue of the rhombic flap would come from inferolateral to the defect, allowing for a more oblique direction of closure of the donor defect. This flap would allow for downward recruitment of skin in the temporal area to achieve closure of the donor site. This direction of closure of the secondary defect would also minimize distortion to the auricle. The main vector of tension of the flap closure on the defect would be in a horizontal direction, minimizing any downward pull on the already abnormal left lower eyelid. Because of the patient's history of

numerous previous operations in the area, it was believed that the skin would be less elastic and more prone to tension and distortion; therefore, the flap design was modified from the classic rhombic design in two ways. First, the flap was angled slightly above the horizontal bisection of the rhombic defect. This change allowed for less pivotal restraint on the flap, because less distance of transposition would be needed. Second, the flap was designed to be 15% longer than the defect as measured from the pivot point. This extra length compensated for the reduction of flap length caused by pivotal restraint on the transposed flap (Fig. 7F–H).

Because of the pre-existing ectropion of the left lower eyelid, it was imperative that no downward tension was placed on the lid. Although the forces of closure were mainly horizontal, an additional measure was undertaken to ensure no adverse pull would occur. By elevating the SMAS layer along with the flap, a sturdy anchoring structure was available that could be used to fixate the flap onto a fixed deeper structure. Two 3-0 Prolene mattress sutures were used to stabilize the undersurface of the SMAS in the flap to the periosteum of the inferolateral orbital rim. After this SMAS fixation, tension on the skin closure was at a minimum (Fig. 7I). Buried subcutaneous 5-0 polydioxanone sutures were followed with 6-0 vertical mattress skin sutures (Fig. 7J). The skin sutures were removed at 6 days and replaced with Steri-strips. The patient recovered uneventfully with satisfactory healing of the area (Fig. 7K–M).

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