

Lip Reconstruction After Mohs Micrographic Surgery: A Guide on Flaps

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PRACTICE POINTS

- Even with early detection, many skin cancers on the lips require surgical removal with subsequent reconstruction.
- There are several local flap reconstruction options available, and some may be used in combination for more complex defects.
- The most suitable technique should be chosen based on tumor location, tumor stage or depth of invasion (partial or full thickness), and preservation of function and aesthetics.

The lips are commonly affected by skin cancer because of increased sun exposure over time. Even with early detection, many of these skin cancers require surgical removal with subsequent reconstruction. Mohs micrographic surgery is the preferred method of treatment for nonmelanoma skin cancers of the lip, as it has the lowest recurrence rates and allows for the maximum preservation of healthy tissue. After surgery, the remaining lip defect often requires reconstruction with skin grafts or a local cutaneous or myocutaneous flap. There are several local flap reconstruction options available, and some may be used in combination for more complex defects. We provide a succinct review of commonly utilized flaps and outline their indications, risks, and benefits.

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The lip is commonly affected by skin cancer because of increased sun exposure and actinic damage, with basal cell carcinoma typically occurring on the upper lip and squamous cell carcinoma (SCC) on the lower lip. The risk for metastatic spread of SCC on the lip is higher than cutaneous SCC on other facial locations but lower than SCC of the oral mucosa.^{1,2} If the tumor

is operable and the patient has no contraindications to surgery, Mohs micrographic surgery is the preferred treatment, as it allows for maximal healthy tissue preservation and has the lowest recurrence rates.¹⁻³ Once the tumor is removed and margins are confirmed to be negative, one must consider the options for defect closure, including healing by secondary intention, primary/direct closure, full-thickness skin grafts, local flaps, or free flaps.⁴ Secondary intention may lead to wound contracture and suboptimal functional and cosmetic outcomes. Primary wedge closure can be utilized for optimal functional and cosmetic outcomes when the defect involves less than one-third of the horizontal width of the vermilion. For larger defects, the surgeon must consider a flap or graft. Skin grafts are less favorable than local flaps because they may have different skin color, texture, and hair-bearing properties than the recipient area.^{3,5} In addition, grafts require a separate donor site, which means more pain, recovery time, and risk for complications for the patient.³ Free flaps similarly utilize tissue and blood supply from a donor site to repair major tissue loss. Radial forearm free flaps commonly are used for large lip defects but are more extensive, risky, and costly compared to local flaps for smaller defects under local anesthesia or nerve blocks.^{6,7} With these considerations, a local lip flap often is the most ideal repair method.

When performing a local lip flap, it is important to consider the functional and aesthetic aspects of the lips. The lower face is more susceptible to distortion and wound contraction after defect repair because it lacks a substantial supportive fibrous network. The dynamics of opposing lip elevator and depressor muscles make the lips a visual focal point and a crucial structure for facial expression, mastication, oral continence, speech phonation, and mouth opening and closing.^{2,4,8,9} Aesthetics and

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symmetry of the lips also are a large part of facial recognition and self-image.⁹

Lip defects are classified as partial thickness involving skin and muscle or full thickness involving skin, muscle, and mucosa. Partial-thickness wounds less than one-third the width of the horizontal lip can be repaired with a primary wedge resection or left to heal by secondary intention if the defect only involves the superficial vermilion.² For defects larger than one-third the width of the horizontal lip, local flaps are favored to allow for closely matched skin and lip mucosa to fill in the defect.⁹ Full-thickness defects are further classified based on defect width compared to total lip width (ie, less than one-third, between one-third and two-thirds, and greater than two-thirds) as well as location (ie, medial, lateral, upper lip, lower lip).^{2,10}

There are several local lip flap reconstruction options available, and choosing one is based on defect size and location. We provide a succinct review of the indications, risks, and benefits of commonly utilized flaps (Table), as well as artist renderings of all of the flaps (Figure).

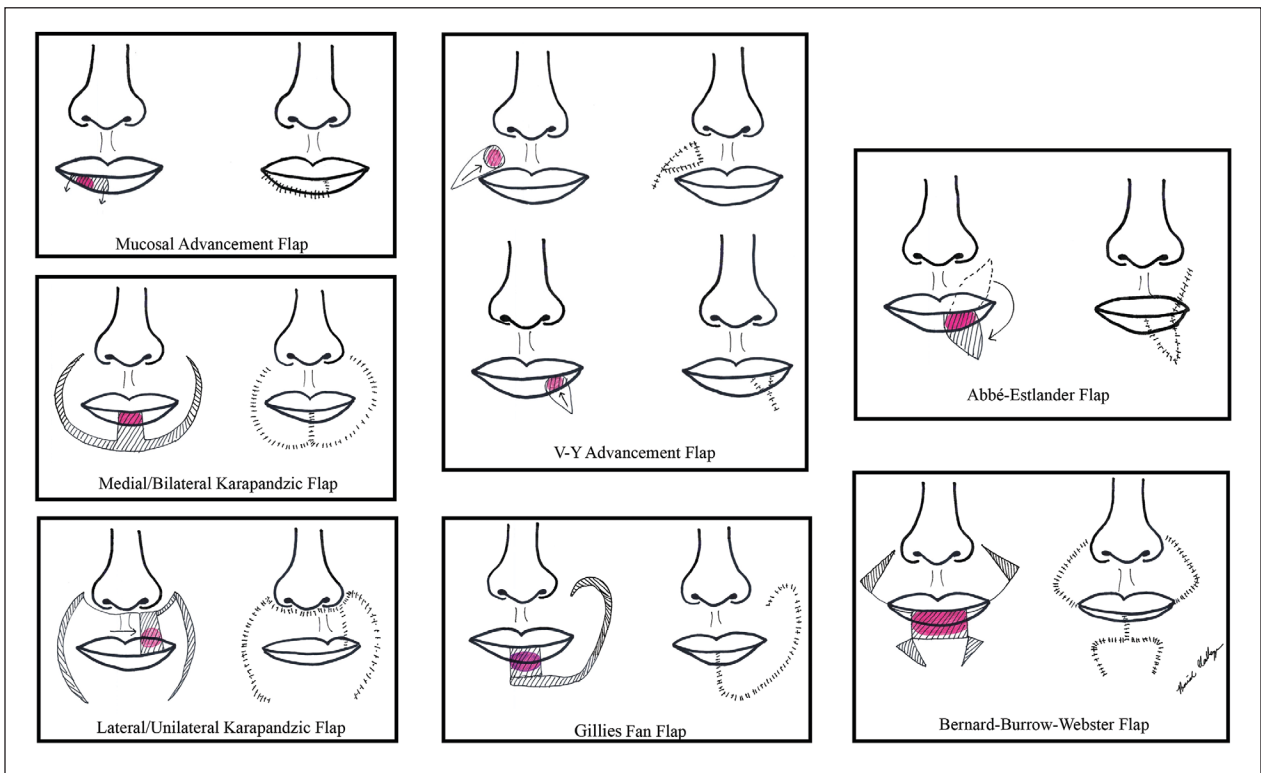
Vermilion Flaps

Vermilion flaps are used to close partial-thickness defects of the vermilion border, an area that poses unique obstacles of repair with blending distant tissues to match the surroundings.⁸ Goldstein¹¹ developed an adjacent ipsilateral vermilion flap utilizing an arterialized myocutaneous

flap for reconstruction of vermilion defects. Later, this technique was modified by Sawada et al¹² into a bilateral adjacent advancement flap for closure of central vermilion defects and may be preferred for defects 2 cm in size or larger. Bilateral flaps are smaller and therefore more viable than unilateral or larger flaps, allowing for a more aesthetic alignment of the vermilion border and preservation of muscle activity because muscle fibers are not cut. This technique also allows for more efficient stretching or medial advancement of the tissue while generating less tension on the distal flap portions. Burow triangles can be utilized if necessary for improved aesthetic outcome.¹

Mucosal Advancement and Split Myomucosal Advancement Flap

The mucosal advancement technique can be considered for tumors that do not involve the adjacent cutaneous skin or the orbicularis oris muscle; thus, the reconstruction involves only the superficial vermilion area.^{7,13} Mucosal incisions are made at the gingivobuccal sulcus, and the mucosal flap is elevated off the orbicularis oris muscle and advanced into the defect.¹⁰ A plane of dissection is maintained while preserving the labial artery. Undermining effectively advances wet mucosa into the dry mucosal lip to create a neovermilion. However, the reconstructed lip often appears thinner and will possibly be a different shade compared to the adjacent native lip. These discrepancies become more evident with deeper defects.⁷



Illustrations of flaps for lip reconstruction. Courtesy of Brinda Chellappan, MD (Galveston, Texas).

There is a risk for cosmetic distortion and scar contraction with advancing the entire mucosa. Eirís et al¹³ described a solution—a bilateral mucosal rotation flap in which the primary incision is made along the entire vermilion border and tissue is undermined to allow advancement of the mucosa. Because the wound closure tension lays across the entire lip, there is less risk for scar contraction, even if the flap movement is unequal on either side of the defect.¹³

Although mucosal advancement flaps are a classic choice for reconstruction following a vermilion defect, other techniques, such as primary closure, should be considered in elderly patients and patients taking anticoagulants because of the risks for flap necrosis, swelling, bruising, hematoma, and dysesthesia, as well as a decrease in the anterior-posterior dimension of the lip. These risks can be attributed to trauma of surrounding tissue and stress secondary to longer overall operating times.¹⁴

Split myomucosal advancement flaps are used in similar scenarios as myomucosal advancement flaps but for larger red lip defects that are less than 50% the length of the upper or lower lip. Split myomucosal advancement flaps utilize an axial flap based on the labial artery, which provides robust vascular supply to the reconstructed area. This vascularity, along with lateral motor innervation of the orbicularis oris, allows for split myomucosal advancement flaps to restore the resected volume, preserve lip function, and minimize postoperative microstomia.⁷

V-Y Advancement Flaps

V-Y advancement flaps are based on a subcutaneous tissue pedicle and are optimal for partial- and full-thickness defects larger than 1 cm on the lateral upper lips, whereas bilateral V-Y advancement flaps are recommended for central lip defects.¹⁵⁻¹⁷ Advantages of V-Y advancement flaps are preserved facial symmetry and maintenance of the oral sphincter and facial nerve function. The undermining portions allow for advancement of a skin flap of similar thickness and contour into the upper or lower lip.¹⁵ Disadvantages include facial asymmetry with larger defects involving the melolabial fold as well as paresthesia after closure. However, in one study, no paresthesia was reported more than 12 months postprocedure.⁴ The biggest disadvantage of the V-Y advancement flap is the kite-shaped scar and possible trapdoor deformity.^{5,15} When working medially, the addition of the pincer modification helps avoid blunting of the philtrum and recreates a Cupid's bow by curling the lateral flap edges medially to resemble a teardrop shape.¹⁷ V-Y advancement flaps for defects of skin and adipose tissue less than 5 mm in size have the highest need for revision surgery; thus, defects of this small size should be repaired primarily.⁴

When using a V-Y advancement flap to correct large defects, there are 3 common complications that may arise: fullness medial to the commissure, a depressed vermilion lip, and a standing cutaneous deformity along

the trailing edge of the flap where the Y is formed upon closure of the donor site. To decrease the fullness, a skin excision from the inferior border of the flap along the vermiliocutaneous border can be made to debulk the area. A vermilion advancement can be used to optimize the vermiliocutaneous junction. Potential standing cutaneous deformity is addressed by excising a small ellipse of skin oriented along the axis of the relaxed skin tension lines.¹⁵

Abbé-Estlander Flap

The Abbé-Estlander flap (also known as a transoral cross-lip flap) is a full-thickness myocutaneous interpolation flap with blood supply from the labial artery. It is used for lower lip tumors that have deep invasion into muscle and are 30% to 60% of the horizontal lip.^{8,9} Abbé transposition flaps are used for defects medial to the oral commissure and are best suited for philtrum reconstruction, whereas Estlander flaps are for defects that involve the oral commissure.^{9,18} Interpolation flaps usually are performed in 2 stages, but some dermatologic surgeons have reported success with single-stage procedures.¹ The second-stage division usually is performed 2 to 3 weeks after flap inset to allow time for neovascularization, which is crucial for pedicle survival.^{8,9,19}

Advantages of this type of flap are the preservation of orbicularis oris strength and a functional and aesthetic result with minimal change in appearance for defects sized from one-third to two-thirds the width of the lip.²⁰ This aesthetic effect is particularly notable when the donor flap is taken from the mediolateral upper lip, allowing the scarred area to blend into the nasolabial fold.⁸ Disadvantages of this flap are a risk for microstomia, lip vermilion misalignment, and lip adhesion.²¹ It is important that patients are educated on the need for multiple surgeries when using this type of flap, as patients favor single-step procedures.¹ The Abbé flap requires 2 surgeries, whereas the Estlander flap requires only 1. However, patients commonly require commissuroplasty with the Estlander flap alone.²¹

Gillies Fan Flap, Karapandzic Flap, Bernard-Webster Flap, and Bernard-Burrow-Webster Flap

The Gillies fan flap, Karapandzic flap, Bernard-Webster (BW) flap, and modified Bernard-Burrow-Webster flap are the likely choices for repair of lip defects that encompass more than two-thirds of the lip.^{9,10,22} The Karapandzic and BW flaps are the 2 most frequently used for reconstruction of larger lower lip defects and only require 1 surgery.

Upper lip full-thickness defects that are too big for an Abbé-Estlander flap are closed with the Gillies fan flap.¹⁸ These defects involve 70% to 80% of the horizontal lip.⁹ The Gillies fan flap design redistributes the remaining lip to provide similar tissue quality and texture to fill the large defects.^{9,23} Compared to Karapandzic and

Bernard flaps, Gillies fan incision closures are hidden well in the nasolabial folds, and the degree of microstomy is decreased because of the rotation of the flaps. However, rotation of medial cheek flaps can distort the orbicular muscular fibers and the anatomy of the commissure, which may require repair with commissurotomy. Drawbacks include a risk for denervation that can result in temporary oral sphincter incompetence.²³ The bilateral Gillies fan flap carries a risk for microstomy as well as misalignment of the lip vermilion and round commissures.²¹

The Karapandzic flap is similar to the Gillies fan flap but only involves the skin and mucosa.⁹ This flap can be used for lateral or medial upper lip defects greater than one-third the width of the entire lip. This single-procedure flap allows for labial continuity, preserved sensation, and motor function; however, microstomia and misalignment of the oral commissure are common.^{1,18,21} In a retrospective study by Nicholas et al,⁴ the only flap reported to have a poor functional outcome was the Karapandzic flap, with 3 patients reporting altered sensation and 1 patient reporting persistent stiffness while smiling.

The BW flap can be applied for extensive full-thickness defects greater than one-third the lower lip and for defects with limited residual lip. This flap also can be used in cases where only skin is excised, as the flap does not depend on reminiscent lip tissue for reconstruction of the new lower lip. Sensory function is maintained given adequate visualization and preservation of the local vascular, nervous, and muscular systems. Disadvantages of the BW flap include an incision notch in the region of the lower lip; blunting of the alveolobuccal sulcus; and functional deficits, such as lip incontinence to liquids during the postoperative period.²¹

The Bernard-Burrow-Webster flap is used for large lower lip defects and preserves the oral commissures by advancing adjacent cheek tissue and remaining lip tissue medially.¹⁰ It allows for larger site mobilization, but it is possible to see some resulting oral incontinence.^{1,10} The Burow wedge flap is a variant of the advancement flap, with the Burow triangle located lateral to the oral commissure. Caution must be taken to avoid intraoperative bleeding from the labial and angular arteries. In addition, there also may be downward displacement of the vermilion border.⁵

Overview of Flaps for Lip Reconstruction

Type of flap	Lip location	Size ^a	Risk for sensation loss	Risk for oral incompetence	Risk for discontinuity of vermilion border	Risk for microstomia	No. of surgeries	Aesthetic concerns
Abbé-Estlander	Medial upper or lower	1/2–2/3	N	N	Y	Y	2	No significant concerns
Bernard-Burrow-Webster/ Bernard-Webster	Lower	>2/3	N	Y	N	N	1	Pigmentation change
Gillies fan	Any	>2/3	Y	N	Y	Y	1	Round commissure
Karapandzic (unilateral or bilateral)	Any	Unilateral: lateral defects 1/3–2/3; bilateral: central defects >1/2	N	N	Y	Y	1	Altered sensation
Mucosal advancement	Lateral lower	Approximately 1/3	N	N	Y	N	1	Pigmentation change
Vermilion	Vermilion border	≥2 cm	N	N	N	N	1	No significant concerns
V-Y advancement	Lateral upper	>1 cm	Y	N	N	N	1	No significant concerns

Abbreviations: N, no; Y, yes.

^aWidth of entire lip.

How to Choose a Flap

The orbicularis oris is a circular muscle that surrounds both the upper and lower lips. It is pulled into an oval, allowing for sphincter function by radially oriented muscles, all of which are innervated by the facial nerve. Other key anatomical structures of the lips include the tubercle (vermilion prominence), Cupid's bow and philtrum, nasolabial folds, white roll, hair-bearing area, and vermilion border. The lips are divided into cutaneous, mucosal, and vermilion parts, with the vermilion area divided into dry/external and wet/internal areas. Sensation to the upper lip is provided by the maxillary division of the trigeminal nerve via the infraorbital nerve. The lower lip is innervated by the mandibular division of the trigeminal nerve via the inferior alveolar nerve. The labial artery, a branch of the facial artery, is responsible for blood supply to the lips.^{3,9} Because of the complex anatomy of the lips, careful reconstruction is crucial for functional and aesthetic preservation.

There are a variety of lip defect repairs, but all local flaps aim to preserve aesthetics and function. The Table summarizes the key risks and benefits of each flap. Local flap techniques can be used in combination for more complex defects.³ For example, Nadiminti et al¹⁹ described the combination of the Abbé flap and V-Y advancement flap to restore function and create a new symmetric nasolabial fold. Dermatologic surgeons will determine the most suitable technique based on tumor location, tumor stage or depth of invasion (partial or full thickness), and preservation of function and aesthetics.¹

Other factors to consider when choosing a local flap are the patient's age, tissue laxity, dentition/need for dentures, and any prior treatments.⁷ Scar revision surgery may be needed after reconstruction, especially with longer vertical scars in areas without other rhytides. In addition, paresthesia is common after Mohs micrographic surgery of the face; however, new neural networks are created postoperatively, and most paresthesia resolves within 1 year of the repair.⁴ Dermabrasion and Z-plasty also may be considered, as they have been shown to be successful in improving final outcomes.⁹ Overall, local flaps have risks for infection, flap necrosis, and bleeding, though the incidence is low in reconstructions of the face.

Final Thoughts

There are several mechanisms to repair upper and lower lip defects resulting from surgical removal of cutaneous cancers. This review of specific flaps used in lip reconstruction provides a comprehensive overview of indications, advantages, and disadvantages of available lip flaps.

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