Simplifying Lip Reconstruction: An Algorithmic Approach

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Abstract

The authors provide an overview of lip reconstruction after Mohs surgery based on the senior author's practice. Lip reconstruction offers unique challenges to preserve not only lip function but also aesthetics. Lip reconstruction must take into consideration the three anatomical layers that comprise the lip and defects that involve the mucosa, the muscle, the skin or more than one layer will help determine the modality of repair. The authors offer an algorithm based on defect location, tissue involvement, and severity of defect to simplify an often complex decision-making process.

Keywords

- Lip Reconstruction
- Mohs surgery
- primary closure
- full-thickness skin grafting
- Ergotrid flap
- V-Y advancement
- Karapandzic flap
- dermal matrices

As a central part of the face and prominently displayed in social interaction, the lip provides a myriad of functions from expressing emotion and articulation, to allowing for oral competence and swallowing. There is a wide array of reconstructive options for both the upper and lower lip.[1] While there are beautiful flap designs for reconstruction, the lip remains one of the stalwarts in adhering to the reconstructive ladder. Secondary healing and direct closure often offer a simple reconstruction with excellent aesthetic and functional results.

As with any reconstruction, the goal is to try and recreate like tissue with like tissue and each defect should be further delineated based on the size and depth of the defect. The location and functional implications of the lip defect must be thoroughly defined prior to any surgical intervention. The goal of lip reconstruction is to have both functional and aesthetic lips that allow for oral competence, movement, and facial expression.

A majority of our lip reconstructions are done in elderly patients with local sedation only. A wide range of these reconstructions can be safely performed with a general understanding of local blocks so as to not distort the remaining anatomy.

Anatomy

Any reconstruction of the lip requires a thorough understanding of the anatomy of the lip and the functional and aesthetic significance it plays in every day social situations and activities. The upper lip and the lower lip have different functional roles and need to be assessed differently. Additionally, the upper lip has numerous aesthetic features that are not present on the lower lip making for different reconstructive needs.

For reconstructive purposes, the lip is comprised of three layers: mucosa, muscle, and skin. The mucosal layer with distinct elements such as the red line separates the wet and dry vermillion. The mucosal layer is important in providing a watertight seal of the oral cavity. Inaccuracy in keeping the wet and dry vermillion separated can lead to wet vermillion that becomes exposed on the lip during repose, leading to a chronically irritated piece of tissue in the middle of the visible lip.

The muscle layer of the lip is mainly comprised of the orbicularis oris. This sphincter muscle allows for complete closure and prevents oral cavity contents from spilling out. It connects to the oral commissure at the lateral aspect of the mouth, which provides a key stabilizing point to allow the

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orbicularis to contract. The skin layer of the lip is critical from an aesthetic standpoint. The upper lip has distinct cutaneous features, including the white roll, philtral column, and Cupid's bow, and even a 1 to 2 mm discrepancy in the white roll can be noticeable in everyday conversations.[2]

Defect Evaluation

The treatment of lip defects is based on a thorough evaluation of what tissue is missing (mucosa, skin, and muscle) and where that tissue is in relation to the key lip anatomic structures. In the upper lip, a subunit analysis[3] is required for reconstructive planning of defects. Conversely, much of the lower lip does not have any distinctive features which often allow for simpler types of reconstruction that are more amenable to tensioned closure. The main functional goal of lower lip reconstruction is to recreate or maintain a "dam" effect with a competent muscle as opposed to an atonic reconstruction.

The wounds of the lip are separated into three different types based on the depth of defects and what needs to be reconstructed. These defects range from mucosal only defects, skin only defects, and then a combination of skin and mucosal defect (►**Fig. 1**).

Mucosal Only Defects

In patients that have an isolated defect of the mucosa, primary closure is utilized only when the defect is small enough that closure will not distort the lip. If there is any distortion of the lip, the utilization of secondary intention healing with or without acellular matrix coverage is the method for coverage.[4,5] The lower lip does very well healing spontaneously without scarring or contracture that will distort the lip even on large defects.[5]

When initially evaluating a lower lip defect, even large defects $>$ 2cm, the utilization of acellular matrix powder with an overlying acellular dermis sheet is sewn in for coverage. The patients are then instructed on proper care with a water-based surgical ointment application. These have healed uniformly without any late contracture and with exceptional patient satisfaction scores.[5]

In defects that are larger than 3 to 4 cm where patients do not have the ability to perform local wound care or require healing faster than 4 to 5 weeks with secondary healing, we utilize a buccal advancement flap. The buccal advancement flap recruits extra tissue laterally and advances it into the defect.[6] While it may provide wound coverage, there is a risk that using the advancement flap can lead to a shortened lip that won't afford the patient oral competence. Additionally, recruiting wet vermillion to reconstruct dry vermilion will lead to visually perceptible differences in texture as well as a constantly irritated tissue.

Skin Only Defects

When evaluating patients with skin only defects, primary closure should remain the first line of treatment. We will primarily close upper lip defects up to 40% of the upper lip and lower lip defects upward of 50% of the lower lip or ~3cm.[7] Our approach has changed significantly over the course of our practice from full-thickness wedge excision including mucosa

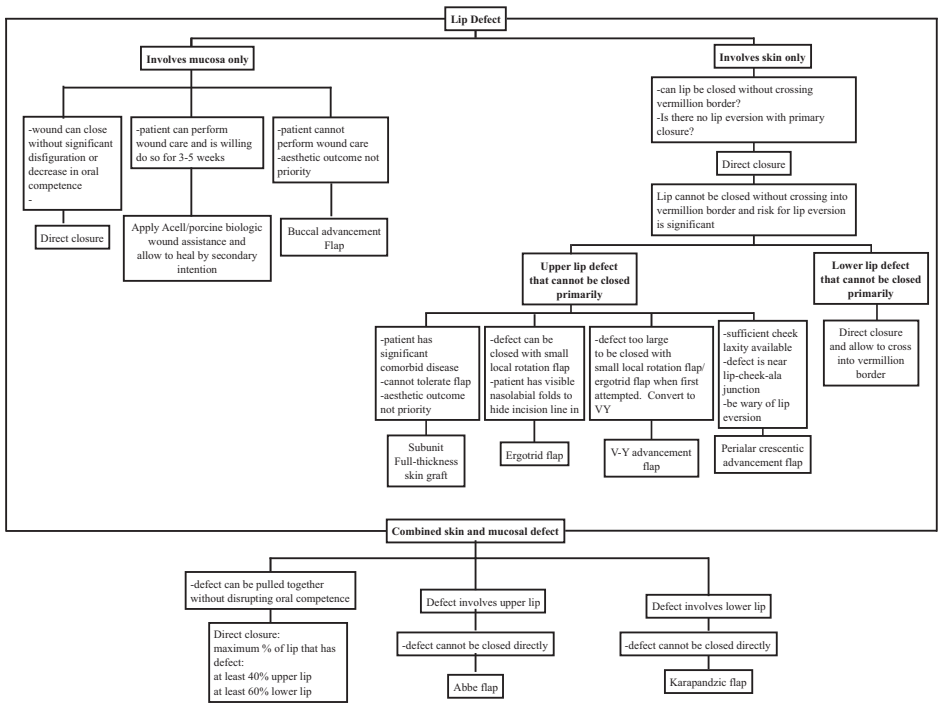

Fig. 1 Algorithm for lip reconstruction. (Reproduced with permission from Thornton J, Carboy J. Facial Reconstruction After Mohs Surgery. New York, NY: Thieme Publishers Inc.; 2018. www.thieme.com)

Fig. 2 Skin only lip defect closed primarily.

and then reclosure into a graduated approach of linear closure along skin tension lines with partial debulking of the orbicularis muscle as needed to ensure no superior or inferior dog ear deformity. The mucosa remains intact, which provides an impermeable watertight barrier from the oral cavity reducing late infection risk and quicker recovery (►**Fig. 2**).[8,9]

With the use of primary closure, we have been able to limit the number of grafts we have had to use. The use of full-thickness skin grafting to the lips is something that for the most part we removed from our reconstructive algorithm. In our hands, we have found that defect only reconstruction, with color matched skin, yielded less than aesthetically pleasing results.[10] We caution anyone using grafting for defect only reconstruction. The one stipulation where we will perform full-thickness grafting is for reconstruction of the entire upper lip subunit[3] or when reconstructing isolated philtral defects.[11,12]

In larger defects that are not able to be closed primarily, we use a local rotation advancement flap continuum from ergotrid to a V-Y advancement flap (►**Fig. 3**). The ergotrid flap[13] rotates tissue from lateral lip to fill more central defects. It allows the advancement limb to be placed along the nasolabial fold, and in patient with prominent folds can be extended quite far to cover large skin defects (►**Figs. 4** and **5**). In larger defects, we will mark the patient for an ergotrid flap, and then will use Doppler to mark out a single perforator in superior to this marking in the event we need to transition the ergotrid into a V-Y advancement. The superior portion to the ergotrid flap is started and if enough advancement to get tension free closure isn't possible, it will transition to a V-Y advancement by making

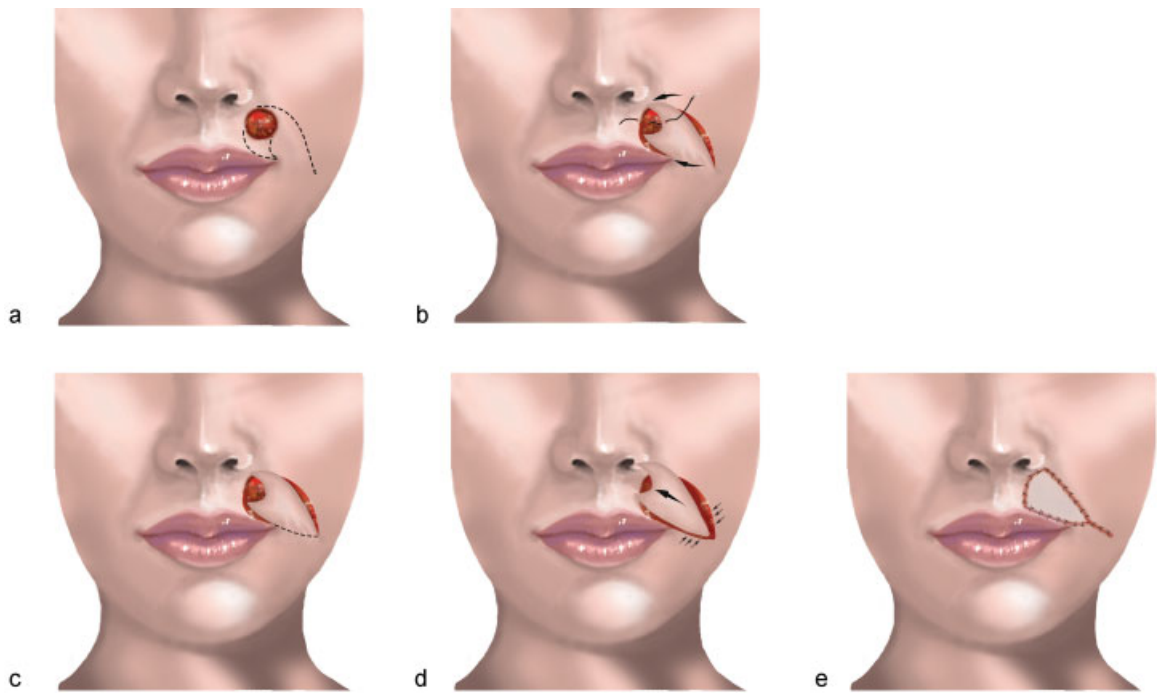

Fig. 3 Illustration of ergotrid to V-Y advancement flap continuum. (**A**) Defect in lateral third of lip with ergotrid flap markings. (**B**) Incision and rotation of an ergotrid flap to close defect with temporary suture to evaluate if tension free closure is possible. (**C**) Marking of the inferior incision to transition from an ergotrid rotation flap to a V-Y advancement flap if the defect is too large for an ergotrid flap to allow for tension free closure. (**D**) Inferior aspect of V-Y flap incised and advanced. (**E**) Closed incision demonstrating the V-Y advancement flap to cover the defect.

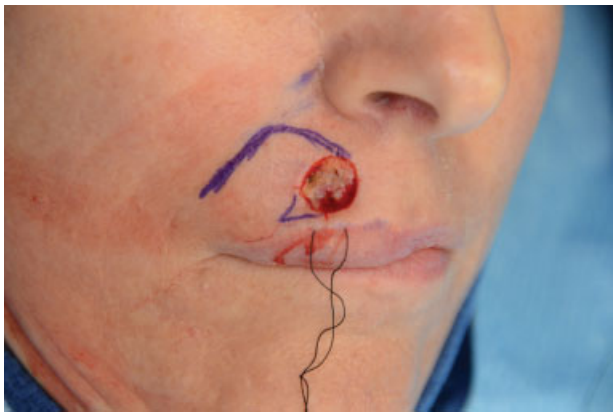

Fig. 4 Patient marking for ergotrid flap.

our lower limb incision and basing the flap off of the perforator we previously marked with the Doppler. This practice has significantly simplified our reconstruction of these defects and provides a measure of comfort to novice and expert surgeons alike as it prevents a misadventure of the ergotrid flap being too short for a unilateral lip element as this can be transitioned to a V-Y advancement flap with can easily repair an entire subunit.[14,15]

In defects that are too large to be closed with a V-Y advancement, the use of a perialar crescentic advancement flap to cover the upper lip is used. This flap takes advantage of laxity of the superior cheek with a planned excision of standing cone deformities at the nasolabial fold and around the alar base.[15,16] This is a very useful flap for reconstructing these defects, but care must be utilized to prevent upper lip retraction, eversion, and a nearly impossible deformity to correct for long term.

Combined Skin and Mucosa Defects

When reconstructing a combined defect of skin and mucosa, our algorithm focuses mostly on direct primary closure with or without wedge excision (►**Fig. 6**). The goal is to approximate the lip and the lip defining structures. Identification of the vermillion border, the white roll, and red line is paramount to getting a satisfactory reconstruction. Often, if resection is performed with immediate reconstruction, the anesthetic infiltration can alter the anatomy. In this situation, we will reschedule patients to the next day to allow the effects of infiltration to wear off so as to not compromise alignment of the vermillion or will collaborate with the resecting surgeon to have them mark the vermillion border before infiltration.

When marking the vermillion border, our technique has evolved from methylene blue tattooing of the cardinal points, to placing a 5–0 silk suture at the vermillion border and at the red line. Once this is done, a local anesthetic can be infiltrated ad lib without any concern for hindering alignment. The suture is left in place and prepped into the field. The effect of a step-off or even minor malalignment of the vermillion border is visible, requires secondary correction, and limits chance of a successful lip reconstruction.

Direct closure of the lip is based on the laxity present in the upper and lower lip. It is important to note that there is a different amount of laxity present and affects the size of the defects that can be reconstructed primarily. In elderly patients with laxity, defects up to 60% of the lower lip can be primarily closed with intact oral competence. Microstomia, if encountered, is managed with postoperative physical therapy and lip stretching that restore normal function.[17] In large defect of 60% of the lip, in addition to a vertical wedge

Fig. 5 Different patient, who underwent ergotrid flap.

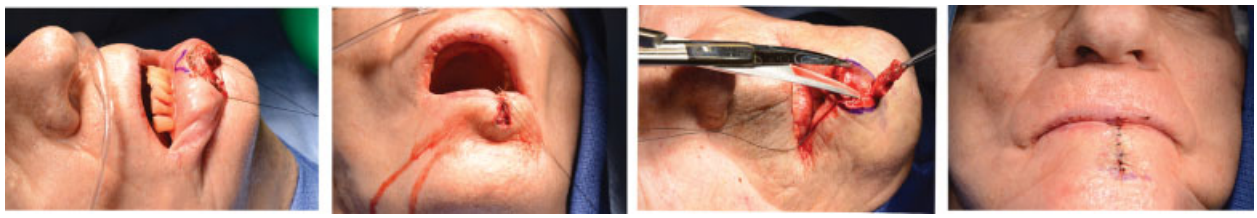

Fig. 6 Patient who underwent primary closure with wedge excision of full-thickness defect. Note that the vermillion is marked with a silk stitch prior to injection of local anesthetic.

resection, it is often necessary to perform a horizontal wedge excision in the mucosa to get mucosal sides to approximate during the inset.[18]

The upper lip is not as forgiving, and while it may still have laxity, the lateral retraction of the philtral columns is an instant indicator of a reconstructed lip, and will result in a long-term deformity. With this in mind, primary closure with wedge excision can be utilized with defects up to 40% of the upper lip.[7] A minimal amount of retraction on the philtral columns will relax over time and return to their natural midline anatomic position, but greater amounts of retraction will lead to prolonged distortion that is nearly impossible to correct.

When closing a full-thickness defect, it is important to close the mucosal side first. We utilize a running and then simple suture of 4–0 or 5–0 chromic gut to allow for a watertight seal. This is then irrigated out once more to minimize any pre-existing oral flora. Then the orbicularis muscle is approximated to take tension off of the skin and vermillion repair. Then the vermillion is precisely approximated using the preplaced silk suture. Once satisfactory approximation of the vermillion is achieved, the remainder of the lip is closed.

In larger defects that cannot be closed primarily, the use of local rotation flaps is the mainstay depending on the location of the defect. A mainstay for significant central defects of the upper lip in our experience is the Abbe flap. There have been no instances of using an Abbe flap to reconstruct the lower lip in the past decade in our practice.[19]

In our experience, the flap is designed to be undersized, and smaller than the defect it will be used to reconstruct. It is rotated into position and inset. There is no temporary suture placed between the upper and lower lip. The flap is divided at 14 to 21 days. The Abbe flap provides a safe and reliable result for the reconstruction of central lip defects.[19]

In defects of the lateral commissure, reconstruction should focus on recreating the commissure in the proper anatomic location in the midpoint of the patient's pupils and equidistant to the contralateral side. Many of these combined cheek and lip commissure defects are successfully reconstructed with simple advancement closure, provided the damage commissure is reapproximated in the proper anatomic location.[16] It is our belief that an Estlander flap[20] should be a rarity if ever used, as reconstruction of the commissure with this flap typically results in suboptimal results.[21]

For large defects of the upper and lower lip, a Karapandzic flap is our last option.[22] This flap provides reconstruction of defects from commissure to commissure. As a circumoral innervated myocutaneous flap, it maintains nerve and intact mucosa to provide a functional reconstruction. The patients will require postoperative therapy for microstomia, but even 90% defects can have satisfactory restoration of microstomia.

Institutionally, we have not had reliable long-term postoperative results with the use of free tissue transfer to reconstruct the lower lip. The atonic tissue stretches over the long term as the orbicularis muscle that was excised is reconstructed only with soft tissue and static support.[23] Over time, this stretch limits oral competence. The use of a composite radial forearm free flap with a tendon graft to reapproximate the lower lip sling is utilized, though the functionality of the reconstruction is at best suboptimal. However, in composite defects from extensive resections, often getting coverage to close the defect comes at the expense of oral competence.

Postop

In all our lip reconstructions, the patients are allowed to eat and speak the day of surgery without any limitations. They only receive intraoperative antibiotics and do not receive any prophylactic antibiotics. All patients use a nonalcohol-based mouthwash and brush teeth four times a day to reduce infection risk and decrease bacterial flora.

Adjuncts

Even the best functional reconstructions often require additional adjunctive procedures to optimize the patient's aesthetic results. For patients who have a significant size discrepancy between the upper and lower lip, we utilize an acellular dermal matrix that is rolled and placed in the mucosa of the deficient lip with a tendon passer as has been described in the literature[24] Subtle differences can be improved with filler or fat grafting to the upper lip, but in our practice the use of fat or a long dermal fat graft is often subpar as a volumizer compared with the dermal matrices, as it seems to get resorbed at a higher rate.

We instruct the patient to use a moisturizer and a sunscreen daily and to cover the incision with a bandage to limit sun exposure and pigment changes. The routine use of bio-oil and silicone sheeting is offered to patients once incisions are healed and sutures are removed.[25] In scars that are raised or pigmented after the initial healing phase, several sessions of laser treatment or dermabrasion are utilized to improve scar appearance.

Conclusion

Reconstruction of the lower lip requires the surgeon to focus both on a functional and aesthetic result. A thorough understanding of anatomy and function of the lip is required. As with most reconstructions, the reconstructive ladder is utilized and simpler options often provide exceptional results even in large defects. The use of primary closure, wedge excision, and local advancement with postoperative adjuncts like scar massage, laser therapy and dermabrasion, has allowed us to reconstruct a large majority of our lip defects.

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