Published in final edited form as:

Plast Reconstr Surg. 2013 January ; 131(1): 28e–36e. doi:10.1097/PRS.0b013e3182729e22.

The V-Y Advancement Flap Is Equivalent to the Mustardé Flap for Ectropion Prevention in the Reconstruction of Moderate-Size Lid-Cheek Junction Defects

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Abstract

Background—Lid-cheek junction defects represent a reconstructive challenge because of the susceptibility of the lower eyelid to ectropion. To minimize the inferior tension placed on the lid margin, classic teaching advocates for the use of cervicofacial rotation-advancement flaps as popularized by Mustardé. Despite this approach, ectropion can still be problematic, and elevation of the cheek poses its own set of potential complications. An inferior-to-superior V-Y advancement flap has also been described, but its use is often limited because of the perceived increased risk of ectropion. This study attempts to define this risk by investigating the incidence of postoperative ectropion between cervicofacial and V-Y flaps for the reconstruction of lid-cheek junction defects.

Methods—All patients who underwent reconstruction of lid-cheek junction defects performed by the senior author (D.L.B.) between January of 2002 and March of 2009 were reviewed retrospectively. Only cervicofacial ($n = 11$) and V-Y flaps ($n = 23$) were included in the analysis. Patient demographics, defect size, operative time, hospital stay, and postoperative complications were extracted from the clinical record.

Results—Nine patients in the cervicofacial group (82 percent) and three patients in the V-Y group (13 percent) experienced a postoperative complication ($p = 0.0002$). Three cases of ectropion were observed, including two patients in the cervicofacial group (18 percent) and one in the V-Y group (4 percent, $p = 0.24$). All cases resolved with conservative management.

Conclusions—No difference in ectropion rate was found between the cervicofacial and V-Y groups. The versatility of the V-Y advancement flap is perhaps underestimated in this clinical context.

CLINICAL QUESTION/LEVEL OF EVIDENCE—Therapeutic, III.

As the general population continues to age, the incidence of skin cancer is increasing, with approximately 1 million new cases per year.¹ Direct exposure to sunlight is the leading

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Presented in part at the 21st Annual Reed O. Dingman Research Symposium, in Ann Arbor, Michigan, June 5, 2009.

Disclosure: The authors have no financial interests to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

cause of malignant transformation, accounting for the significant proportion of skin cancers that occur on the face. The lid-cheek junction is especially prone because of its more horizontal contour. When a tumor is located in a sensitive reconstructive area such as the lid-cheek junction, Mohs' micrographic surgery is the extirpative procedure of choice to ensure absolute histologic margin control and to maximize conservation of uninvolved tissues.² The resultant defect is often large enough to preclude primary closure, thus necessitating a skin graft, local flap, or regional flap for reconstruction.

When planning the reconstruction of lid-cheek junction defects, the susceptibility of the lower eyelid to ectropion warrants special consideration. The overall risk of ectropion depends on many variables, including preexisting laxity; position of the maxilla in relation to the orbit; defect size and depth; type of reconstructive procedure performed; and the use of adjunctive measures such as the periosteal anchor stitch,³⁻⁷ Frost stitch,^{8,9} or Mitek anchoring system (DePuy Mitek, Inc., Raynham, Mass.).^{10,11} In the immediate postoperative period, any downward traction on the lower eyelid is the result of tension and edema. Scar contracture often worsens the condition but is usually a late finding and is primarily attributed to poor surgical planning. Likewise, skin grafts are universally avoided around the lower eyelid because of their natural predilection for both primary and secondary contracture, with an ectropion rate recently reported as high as 14.2 percent in a large case series.¹²

The preferred choice for reconstruction of lid-cheek junction defects has traditionally been the cervicofacial rotation-advancement flap, which borrows tissue lateral to the defect rather than below it. Multiple variations have been described in the literature,¹³⁻²⁶ but they all share the common trait of rearranging local tissue to reconstruct "like with like," and rotation-advancement to minimize the inferior tension placed on the lid margin. These flaps are relatively large reconstructive procedures often requiring an overnight hospital stay, and are fraught with the potential complications of hematoma, hypertrophic scarring, and distal flap necrosis. For these reasons, the inferior-to-superior V-Y advancement flap has been purported as an alternative solution,²⁷ offering a less invasive operation while still using cheek tissue of similar color, thickness, and texture. Nonetheless, the vertical trajectory of this flap remains a major point of concern for most plastic surgeons when operating in the superomedial cheek. It is believed to contribute to the perceived increased risk of ectropion, although no study has proven this. The purpose of this study was to demonstrate that a properly designed and well-executed V-Y flap is a safe alternative to the cervicofacial flap for reconstruction of moderate-size lid-cheek junction defects and, more importantly, does not increase the risk of postoperative ectropion.

PATIENTS AND METHODS

Study Design

After institutional review board approval, a database search was performed to identify all patients who underwent reconstruction of lid-cheek junction defects performed by the senior author (D.L.B.) between January of 2002 and March of 2009. Only cases involving cervicofacial or V-Y flaps were included in the analysis. All reconstructions were performed only after the margins were declared negative for residual tumor on final pathologic

evaluation. Patients who required multiple reconstructive procedures, patients with a history of prior surgery in the periorbital region, or patients with preexisting ectropion were excluded. Patient demographics, defect size, operative time, hospital stay, and postoperative complications were extracted from the clinical record. Postoperative complications were defined as any untoward event occurring within 30 days of the procedure requiring either medical or surgical intervention. Ectropion was defined as (1) the eversion, or rolling outward of the lid margin such that the bulbar and palpebral conjunctiva were no longer intimately juxtaposed; or (2) a change in the position of the lid margin to a level below the inferior limbus, or a difference greater than 1 mm compared with the contralateral nonoperated side. Dryness, foreign body sensation, and epiphora usually accompanied these findings, but the absence of symptomatology did not rule out the diagnosis.

Operative Technique

Our preferred approach to the cervicofacial rotation-advancement flap is an inferomedially based design similar to that originally described by Mustardé.^{26,28} The incision starts at the superolateral edge of the defect and extends just beyond the lateral canthus, where it continues superiorly into the temporal region above the zygomatic arch. It then proceeds in the preauricular crease, follows the caudal edge of the earlobe, and gently arcs into the mastoid region, remaining pretrichial before curving inferiorly and anteriorly onto the neck as needed. Although deeper planes of dissection have been advocated,^{16,20–23} our experience has been with the subcutaneous plane because of its relative ease, safety, and reproducible results.¹⁴ The flap is widely undermined in the cheek, over the mandible, and into the neck to allow enough rotation-advancement for a tension-free closure along the free margin of the defect. As a general rule, the larger the defect, the more that undermining, rotation, and advancement are required. The flap is suspended from the deep temporal fascia above the level of the lateral canthus to minimize the inferior tension placed on the lid margin. The remainder of the flap is then draped over the defect and trimmed to size. A standing cutaneous deformity is excised along the superomedial portion of the nasolabial fold. A closed-suction drain is inserted through a separate stab incision at the discretion of the surgeon.

The design of the V-Y advancement flap is straightforward (Fig. 1).²⁹ The inferior margin of the defect becomes the leading edge of the flap. Limbs of the V are drawn such that the medial limb is oriented immediately adjacent to and in parallel with the nasolabial fold. To ensure an adequate volume of tissue is advanced into the defect, the limbs are not tapered toward each other until after several centimeters. The superior width of the flap should be equal to the greatest diameter of the defect. The skin is incised and dissection is continued through the subcutaneous tissue to the superficial musculoaponeurotic system. Beveling the subcutaneous dissection slightly outward at approximately 30 degrees is strongly recommended to capture as many direct cutaneous perforators to the flap as possible. Fibrous attachments both laterally and inferiorly are released with a discontinuous spreading-scissor maneuver, and both the leading and trailing edges of the flap are minimally undermined, allowing the flap to be freely mobile on its subcutaneous pedicle. Rather than “hanging” the leading edge of the flap from the superior margin of the defect, the flap is “pushed” along a vertical trajectory during inset. This is accomplished by first

closing the inferior portion of the donor site forming the base of the Y. A stairstep pattern of deep dermal suturing is then performed along both limbs of the flap, where each bite of the suture must be precisely positioned from a point more inferior on the flap edge to a point more superior on the adjacent cheek tissue. This equally distributes all of the tension along both limbs of the flap rather than at the superior margin of the defect, which is finally closed to the leading edge of the flap. The flap is not anchored to the periosteum of the infraorbital rim, and closed-suction drains are not routinely required.

Statistical Analysis

Data were analyzed using a commercially available statistical software package (SPSS V19; SPSS, Inc., Chicago, Ill.). A two-tailed Fisher's exact test was used to determine the relationship between categorical variables including type of reconstructive procedure performed and postoperative complications. An unpaired *t* test was used to compare continuous variables such as defect size, operative time, and hospital stay. Our null hypothesis is that there is no difference in ectropion rate between the cervicofacial and V-Y groups. A value of $p < 0.05$ was considered statistically significant.

RESULTS

Thirty-four patients underwent reconstruction of lid-cheek junction defects between January of 2002 and March of 2009 using either a cervicofacial ($n = 11$) or V-Y flap ($n = 23$). All patients were reconstructed using a single flap and none received radiation therapy. The minimum postoperative follow-up was at least 6 months in both groups. Representative examples of each type of reconstruction are demonstrated in Figures 2 through 5.

Patient demographics are listed in Table 1. Two patients in the cervicofacial group (18 percent) and seven patients in the V-Y group (30 percent) were current smokers ($p = 0.68$). Differences in operative time (69 minutes versus 58 minutes, $p = 0.02$) and hospital stay (0.82 days versus 0 days, $p = 0.02$) were observed between the cervicofacial and V-Y groups, respectively. Average defect size was similar for both groups (9.90 cm² versus 7.43 cm², $p = 0.06$).

Postoperative complications are listed in Table 2. Nine patients in the cervicofacial group (82 percent) and three patients in the V-Y group (13 percent) experienced a postoperative complication ($p = 0.0002$). Two patients in the cervicofacial group (18 percent) and one patient in the V-Y group (4 percent) developed early ectropion ($p = 0.24$). All cases of ectropion resolved completely with conservative management using artificial tears and scar massage. A flattening contour deformity was sometimes observed in the lower aspect of closure in the V-Y group, but this settled down during the first few weeks postoperatively. Three patients in the cervicofacial group (27 percent) required reoperation for hematoma evacuation ($p = 0.03$), whereas no patients in the V-Y group developed a hematoma. No facial nerve injury was observed in either group. One patient in the cervicofacial group (9 percent) developed distal flap necrosis ($p = 0.32$); this patient was a nonsmoker. Two cervicofacial rotation-advancement flaps (18 percent) also developed small areas of dehiscence near the original defect, which eventually healed by secondary intention using

local wound care ($p = 0.10$). Finally, two patients from both groups developed cellulitis, which was treated on an outpatient basis with oral antibiotics ($p = 0.58$).

DISCUSSION

Trepidation has historically surrounded the use of the inferior-to-superior V-Y advancement flap for the reconstruction of lid-cheek junction defects because of the perceived increased risk of ectropion. As a result, numerous studies have described modifications in the design of the V-Y flap over time^{27,30–35} and warn the clinician about the dangers of operating in the infraorbital region. It is routinely taught that the weight of a large flap will cause lower lid malposition postoperatively unless amply supported. With this principle in mind, the cervicofacial rotation-advancement flap was introduced in 1918 by Esser³⁶ and later popularized by Mustardé,^{26,29} to minimize the inferior tension placed on the lid margin by primarily recruiting tissue lateral to the defect rather than below it. It has led to many successful lower eyelid and cheek reconstructions; however, these fairly involved operations are not without risks. If there were other options that required less dissection, less operative time, and shorter hospital stays, without increasing the risk of ectropion, they would be very helpful to both the surgeon and the patient.

Our operative technique borrows the concept of tension redistribution and applies it to the V-Y flap. The staircase pattern of deep dermal suturing pushes tissue into the defect and equally distributes all of the tension along both limbs of the flap. The sutures act as a “shock absorber” by supporting the entire weight of the flap. If one of the sutures were to loosen, the tension would be automatically redistributed between the multiple remaining sutures. This is in patent contrast to the low number of key suspension sutures normally used to anchor flaps. In these instances, if the suspension sutures were to loosen or pull through the underlying fascia or periosteum, all support for the flap would be lost. In our opinion, anchoring the V-Y flap to the periosteum of the infraorbital rim is not required.

We reconstructed 34 moderate-size lid-cheek junction defects using either a cervicofacial or a V-Y flap. Two patients in the cervicofacial group (18 percent) and one patient in the V-Y group (4 percent, $p = 0.24$) developed ectropion. Although the ectropion rate for the cervicofacial group was higher than that for the V-Y group, statistical significance was not achieved for this difference. All cases of ectropion were temporary and eventually resolved with conservative management using artificial tears and scar massage. To our knowledge, direct comparison between these two reconstructive procedures with emphasis on ectropion rate for defects involving the lid-cheek junction has not been previously evaluated. Delay et al.²⁰ performed reconstruction on seven patients with complex cheek defects using a composite cervicofacial flap, and although the authors report no ectropion, they performed a lid-tightening procedure at the time of the primary procedure. Becker and Langford²² also recommend lid-tightening procedures to prevent ectropion in their deep-plane cervicofacial flaps. Tan and MacKinnon¹⁶ performed reconstruction on 18 patients with a deep-plane cervicofacial flap, seven of whom had infraorbital defects, and one of them developed an ectropion. Austen et al.¹⁴ reported an ectropion rate of 16 percent in 32 patients who underwent subcutaneous cervicofacial flaps for cheek reconstruction after Mohs’ micrographic surgery. Five patients developed ectropion, and all but one patient did not

respond to conservative measures. Doermann et al.²⁷ reconstructed 23 lower lid and medial canthal defects using a vertically oriented V-Y flap with an ectropion rate of 9 percent. Their operative technique was similar to ours, except that they anchored their flaps to the periosteum of the infraorbital rim and performed minimal dissection on the flap's undersurface, whereas we partially dissected beneath the leading and trailing edges of our flaps to release restrictive fibrous attachments.³⁷ Li et al.³¹ more recently reconstructed 32 cheek defects with V-Y flaps, and one case of ectropion is reported. In our current study, ectropion rates for both the cervicofacial and V-Y groups are similar to the results of previous studies, despite most investigations containing relatively unclear descriptions of the exact location of the defects within the cheek and minor variations in operative technique.

Compared with the cervicofacial flap, the V-Y flap offers additional benefits to both the surgeon and the patient for the reconstruction of lid-cheek junction defects. The V-Y group demonstrated less operative time, and all patients were discharged to home after their operation, whereas patients in the cervicofacial group were kept overnight for flap monitoring. Nine patients in the cervicofacial group (82 percent) experienced at least one postoperative complication, compared with three patients in the V-Y group (13 percent, $p = 0.0002$). Of those nine patients in the cervicofacial group, three (27 percent) developed a hematoma requiring reoperation ($p = 0.03$). No patients in the V-Y group developed a hematoma, presumably because of less flap undermining. Although distal flap necrosis is more commonly associated with the subcutaneous cervicofacial flap in smokers and irradiated tissue,^{24–26,28} we report only one case, and it occurred in a nonsmoker. Our experience with the subcutaneous plane is similar to that of Austen et al.,¹⁴ and we attribute our relatively low rate of distal flap necrosis to eliminating all tension at the distal edge of the flap during inset.

There are several limitations inherent in our current study. Given the retrospective design, patients were not randomized into treatment groups, incorporating a selection bias. In the beginning, there was a tendency to reconstruct larger defects with a cervicofacial flap, and indeed the average defect size of the cervicofacial group was slightly larger than in the V-Y group, although this did not reach statistical significance. As the senior author (D.L.B.) became more accustomed to the technique, and ectropion was not being observed postoperatively with smaller defects, it was gradually applied to larger defects. Interestingly, the patients who developed ectropion had similar defect sizes regardless of the treatment group they were in (7.7 cm² and 12.0 cm² in the cervicofacial group; 9.0 cm² in the V-Y group). Furthermore, because we performed only subcutaneous cervicofacial flaps in this study, it is difficult to compare ectropion rates between the V-Y flap and other cervicofacial flaps with deeper planes of dissection, which are being performed more commonly today. However, deep-plane cervicofacial flaps by design carry more tissue, and some evidence exists suggesting that these flaps may have higher ectropion rates,^{14,16,20,22,23} which is further supported by their advocates recommending concomitant lid-tightening procedures. We therefore think it is reasonable to use the ectropion rate of the subcutaneous cervicofacial flap as a metric for comparison.

We believe that the inferior-to-superior V-Y advancement flap has its place among reconstructive techniques for lid-cheek junction defects smaller than 8 to 9 cm² in patients

who are at low risk for ectropion. These patients should have minimal to no preexisting lid laxity and their orbicularis oculi muscle should not be paralyzed. In patients who do not meet these requirements, we recommend that a lateral canthopexy or canthoplasty should be performed at the same time as the flap reconstruction. Furthermore, if the defect extends up to the lid margin, the V-Y flap can still be used but should be combined with additional tissue such as a Tripier flap to resurface the lid proper. A frequent criticism of the V-Y flap is the prominence of its scars on frontal view, which is why we do not recommend its use in pediatric and young adult populations. From our experience, use of this flap in middle-aged to elderly patients results in a pleasing aesthetic appearance with excellent camouflage of the scars despite not lying exactly along the relaxed skin tension lines. Based on our findings, no specific recommendations can be offered for patients who are smokers, or for scarred or irradiated tissue, because we only had one case of distal flap necrosis in the cervicofacial group. However, we suspect that the V-Y flap has a more robust blood supply because of its subcutaneous pedicle containing direct cutaneous perforators as opposed to the random pattern of the cervicofacial flap.

CONCLUSIONS

We recognize that the cervicofacial rotation-advancement flap is a powerful tool for reconstructing defects involving the lid-cheek junction. However, it remains a moderately invasive reconstructive procedure and possesses a well-known set of potential complications. For lid-cheek junction defects smaller than 8 to 9 cm² in patients who are at low risk for ectropion, the versatility of the inferior-to-superior V-Y advancement flap is perhaps underestimated. It is simple to design and execute, and does not increase the risk of ectropion as previously thought.

Acknowledgments

The authors thank Holly R. Fischer, M.F.A., for providing the medical illustrations.

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Fig. 1.

Design of the V-Y advancement flap. (*Above, left*) Limbs of the V are drawn such that the medial limb is oriented immediately adjacent to and in parallel with the nasolabial fold. The subcutaneous dissection is beveled slightly outward at approximately 30 degrees. (*Above, right*) Both the leading and trailing edges of the flap are undermined for a short distance, allowing the flap to be freely mobile on its subcutaneous pedicle. The inferior portion of the donor site is closed, forming the base of the Y. A stairstep pattern of deep dermal suturing is then performed, alternating between both limbs of the flap to advance it superiorly. (*Below, right*) The leading edge of the flap is closed to the superior margin of the defect under no tension. (*Below, left*) Final appearance of the flap after inset.

Fig. 2. Representative example of a cervicofacial rotation-advancement flap reconstruction. (*Left*) Right lid-cheek junction defect measuring 3.0×5.0 cm after total peripheral margin clearance by the square procedure for atypical junctional melanocytic hyperplasia. Note that all of the tissue within the rhombus-shaped outline is to be removed before definitive reconstruction. (*Center and right*) Frontal and oblique views 3 months after cervicofacial rotation-advancement flap reconstruction. Despite the immature, pink appearance of the scars, no ectropion is demonstrated on the reconstructed side.

Fig. 3.

Representative example of a V-Y advancement flap reconstruction. (*Left*) Right lid-cheek junction defect measuring 4.0×4.0 cm after Mohs' micrographic excision of a basal cell carcinoma, including intraoperative markings for a planned V-Y advancement flap reconstruction. The course of the facial artery is also depicted adjacent to the flap. (*Center and right*) Frontal and oblique views 5 weeks after V-Y advancement flap reconstruction. Note the normal position of the lower eyelid on the reconstructed side, and the concealed scar of the medial limb of the flap along the right nasolabial fold. Slight nodularity of the scar exists along the leading edge of the flap.

Fig. 4.

Representative example of a V-Y advancement flap reconstruction. (*Left*) Left lid-cheek junction defect measuring 2.5×2.7 cm after total peripheral margin clearance by the square procedure for atypical junctional melanocytic hyperplasia. Note that all of the tissue within the rhombus-shaped outline is to be removed before definitive reconstruction. (*Center and right*) Frontal and oblique views 4 months after V-Y advancement flap reconstruction. Although the scars are still pink and immature, no ectropion is demonstrated on the reconstructed side.

Fig. 5. Representative example of a V-Y advancement flap reconstruction. (*Left*) Right lid-cheek junction defect measuring 2.8×2.8 cm after Mohs' micrographic excision of a basal cell carcinoma. (*Center and right*) Frontal and oblique views 6 years after V-Y advancement flap reconstruction. Note the slight persistent edema of the right lower eyelid; however, no ectropion is demonstrated on the reconstructed side, and all scars are almost imperceptible.

Table 1

Patient Demographics

Variable	Cervicofacial Rotation-Advancement Flap (%)	V-Y Advancement Flap (%)
Age, yr		
Mean	58	60
Range	26–85	36–76
Sex		
Male	6	10
Female	5	13
Smoking	2 (18)	7 (30)
Irradiation	0 (0)	0 (0)

Table 2

Postoperative Complications

Complications	Cervicofacial Rotation-Advancement Flap (%)	V-Y Advancement Flap (%)	<i>p</i> [*]
Ectropion	2 (18)	1 (4)	0.24
Hematoma	3 (27)	0 (0)	0.03
Infection	2 (18)	2 (9)	0.58
Dehiscence	2 (18)	0 (0)	0.10
Distal flap necrosis	1 (9)	0 (0)	0.32
Facial nerve injury	0 (0)	0 (0)	1.00

*
 $p < 0.05$ was considered statistically significant.