



ELSEVIER



Combined Karapandzic-Abbé/Estlander/Stein flap for subtotal and total lower lip reconstruction



Vedran Uglesic^{a,*}, Kavita Amin^b, Emil Dediol^a, Damir Kosutic^b

^a Department of Maxillofacial Surgery, Division of Plastic and Reconstructive Surgery of the Head and neck, University Clinical Hospital Dubrava, Avenija Gojka Suska 6, 10000 Zagreb, Croatia

^b Department of Plastic and Reconstructive Surgery, The Christie NHS Foundation Trust, Wilmslow Road, M20 4BX, Manchester, United Kingdom

Received 26 February 2018; accepted 11 November 2018

KEYWORDS

Combined Karapandzic-Abbe/Estlander/Stein flap;
Subtotal and total lower lip reconstruction;
Squamous cell carcinoma;
Functional lip reconstruction

Summary Background: Lower lip reconstruction remains a challenging task due to multi-functional and high aesthetic requirements that have to be achieved for successful outcome. This is particularly true to near-total lower lip defects, encompassing over 70% of lower lip loss due to cancer, trauma or burns. Despite the fact that numerous flaps and their modifications have been described over the past century, only a few valuable techniques and concepts withstood the test of time for sub-total lower lip defects, each having their own drawbacks. We describe a new approach to these defects combining bilateral Karapandzic and Abbe/Estlander/Stein flaps, not reported so far, and present our long term outcomes.

Methods: From 2012 to 2016, five patients with T4 lower lip squamous cell carcinoma (SCC) underwent near-total and total lower lip resection and reconstruction with a combination of bilateral Karapandzic flap and double Abbé/Estlander/Stein flaps from the upper lip.

Results: Our patients were between 44 and 88 years old (mean 66.6). All flaps healed uneventfully in all patients. Patients were followed up between 18 and 60 months (mean follow up 33.6 months). There were no local tumor recurrences. All patients were able to eat perorally whilst reconstructed lips were fully functional. No drooling was observed and aesthetic outcomes were excellent.

Conclusions: Combined bilateral Karapandzic and Abbe/Estlander/Stein flaps can produce excellent functional and aesthetic outcomes in near total and total lower lip reconstructions and should be considered a reliable reconstructive option in patients with more than 70% of lower lip loss.

© 2018 British Association of Plastic, Reconstructive and Aesthetic Surgeons. Published by Elsevier Ltd. All rights reserved.

Introduction

Lips play a pivotal role both in function and cosmesis and are essential in maintaining social interactions. The most

* Corresponding author.

E-mail address: vuglesic@kdb.hr (V. Uglesic).

prevalent reason for reconstruction is acquired cutaneous malignancy. Squamous cell carcinomas have a predilection for this site secondary to sun exposure,¹ though trauma and burns can also account for large defects that warrant reconstruction.²

Tobin and O'Daniel have suggested that specific importance is paid to skin cover, oral lining, vermilion, stomal diameter, sensation and maintenance of a competent oral sphincter, preferably using innervated musculocutaneous flaps. Oral competence relies greatly upon lower lip function and therefore efforts should be steered to avoid an incompetent sphincter by appropriate choice of reconstruction.^{3,4} Donor sites for lip reconstruction rely primarily on loco-regional tissue. Free tissue transfer has been reported,⁵ though this procedure carries increased risks of prolonged operative time and the increased potential for reconstructive failure. The complexity of technique, flap texture, thickness and overall quality of tissue does not always resemble the characteristics of the defect, making loco-regional options more favourable.

It has been documented that lower lip defects of >30% should not be closed primarily,⁶ but in the event of significant composite full-thickness defects including those that involve >66%, preventing microstomia is very challenging. Classical flaps and their variations have been described and modified during the 19th century. Well known flaps to manage lower lip defects include Karapandzic, Bernard-Burrow-Webster and the Abbé flap,⁷ with Karapandzic and Bernard-Burrow-Webster dominating in the early 20th century.⁸ In Karapandzic technique, semicircular incisions from base of the defect to nasal ala are performed bilaterally, overlying the border of orbicularis oris muscle. Blunt dissection preserving muscle fibers and branches of facial and trigeminal nerve, preserves a sensate and functional lower lip. Bernard-Burrow-Webster technique includes medially advanced bilateral full-thickness cheek advancement flaps with mucosal advancement to reconstruct vermilion. However, in total and near-total defects, microstomia still remains a concern. **Despite multitude of literature on lip reconstruction utilizing one of the above three popular techniques, the terminology for lip flaps is often wrongly applied in common practice. The use of the term "Abbé flap" has been originally described for 'cross-lip flap' where the border of the flap was the border of the defect, which was lateral. Abbe flap is based on the labial artery with pivot point that's sits at the midpoint of opposing lip defect. On the contrary, medially based cross-lip flap was described by Estlander, who, however, described his flap for commissural defects, based on the medial pedicle. Therefore, we felt that the term "Abbé-Estlander flap" would be more appropriate to describe our combined technique. However, the person who should correctly be credited for first description of paramedian double cross-lip flap for subtotal lower lip reconstruction was Stein, who was the first to describe this technique in 1848.**⁹ Roldán et al. have recently suggested that when faced with large defects encompassing loss of mucosa, vermilion, muscle and skin, a combination of flaps produces excellent functional outcomes. Their description of a combination of Stein's double cross-lip flaps and Johanson's step technique avoids concerns over microstomia with demonstrable electromy-

graphical reinnervation at 6 months.¹⁰ Similarly, a combined Karapandzic and Bernard-Burrow-Webster flap for defects between 50% and 90% has been reported to avert the need for secondary commisuroplasty. In part, according to Weistreich et al., the main advantage of using the Karapandzic flap is its maintenance of depressor anguli oris and buccinator innervation, which contributes to immediate sphincter control.¹¹

Our senior author has years of experience with a technique that combines the Karapandzic and Abbé/Estlander/Stein flaps, never described in the literature to our knowledge. In 1974, Karapandzic described the functional innervated composite flap and though considered the primary reconstruction of choice in extensive lower lip defects, we have found its use in isolation inadequate to prevent microstomia in defects >70%.¹² We use the extended Karapandzic flap whereby the modification includes medialisation of lower cheek tissue for minimal tension which will be described.¹³ The Abbe flap is based on the labial artery, and when two flaps are harvested together, this recruits valuable volume to the lower lip, thus allowing adequate functional reconstruction of defects encompassing more than 75%. We describe our long-term experience with combined bilateral Karapandzic and Abbe/Estlander/Stein flaps, that can be used for near-total and total lower lip defects, either with or without the loss of the oral commissure. A combination of these flaps not reported so far, can produce an excellent functional and aesthetic outcomes in defects encompassing more than 75% of lower lip.

Methods/patients

From 2012 to 2016, five patients with T4 lower lip squamous cell carcinoma (SCC) underwent total lower lip resection and reconstruction with a combination of bilateral Karapandzic flap and bilateral Abbé/Estlander/Stein flap from the upper lip. Patient characteristics are presented in [Table 1](#).

Surgical technique

All patients had grade T4 lower lip SCC necessitating total lower lip resection ([Figures 1a-b](#) and [2a-b](#)). In order to reconstruct these large defects ([Figures 1c](#) and [2c](#)), we first mobilised bilateral Karapandzic flaps in the usual fashion. Incisions were placed above nasolabial folds and extended around the commissure of the lip towards the mentolabial folds ([Figure 1d](#)). In two of our cases there was a combined total lower lip and chin defect ([Figure 2c](#)), which required an extended Karapandzic technique to achieve greater tissue recruitment. Compared with the standard technique, more lateral and cranial incision was made, parallel to the original Karapandzic descriptions ([Figure 2b](#)). Incisions followed relaxed skin tension lines in the cheek and then curved medially to the lower edge of the chin defect. Following skin incision, blunt dissection was performed to preserve neurovascular structures (facial artery perforators and facial nerve branches travelling transversely, to supply lips). Adequate blunt dissection is re-

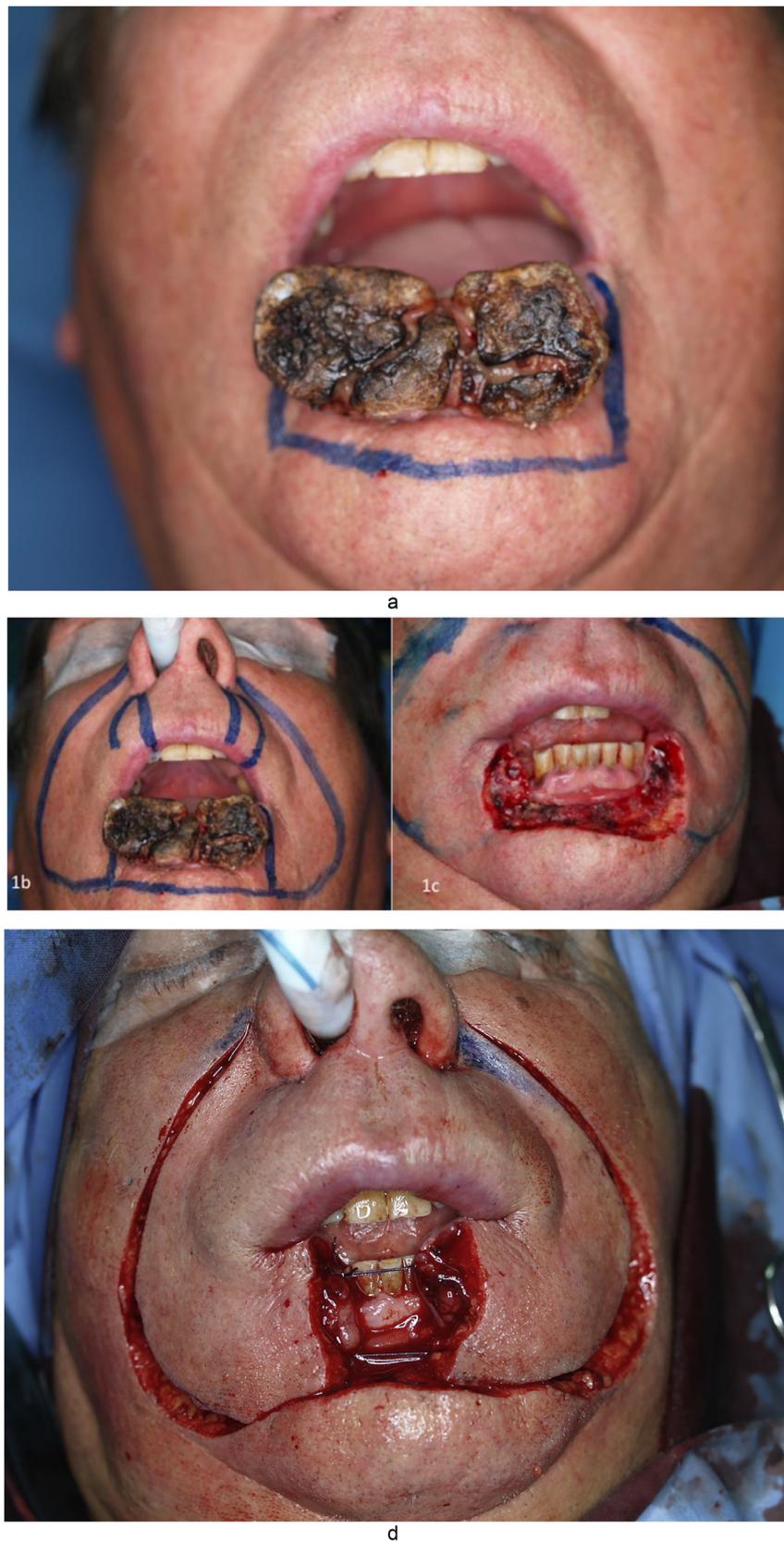


Figure 1 (a) T4 SCC requiring total lower lip resection. Figure 1(b) and (c) Outline of combined Karapandzic-Abbe flaps design and total lower lip defect following excision of SCC. Figure 1(d) Bilateral Karapandzic flaps raised and mobilised. Figure 1(e) Bilateral Abbe flaps raised. Figure 1(f) Bilateral Abbe flaps mobilised to reduce the size of lower lip defect. Figure 1(g) Bilateral Karapandzic and Abbe flaps sutured in place. Figure 1(h) Excellent aesthetic and very good functional postoperative outcome at 5-years follow-up.

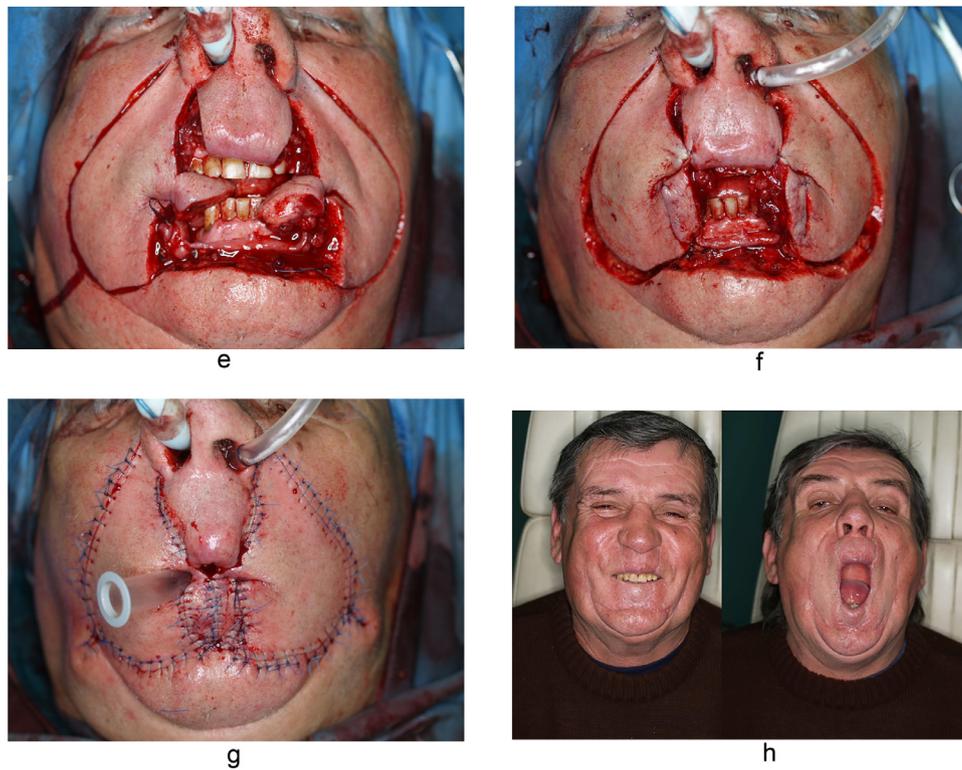


Figure 1 (continued)

quired to enable sufficient medial mobilization of these flaps.

The second part of the operation begins by designing double Abbé/Estlander/Karapandzic flaps from the upper lip. Abbé/Estlander/Karapandzic flaps are raised in a standard fashion, just lateral to the philtrum on both sides with the pedicle oriented laterally (Figures 1e and 2d). After elevation and transposition to the lower lip defect (Figures 1f and 2e), they are sutured together in the midline and

inset into the new lower lip. Karapandzic flaps are then advanced medially and sutured to the Abbé/Estlander/Stein flaps on both sides in layers (Figures 1g and 2f). After three weeks, pedicles of both Abbé/Estlander/Stein flaps are divided under local anaesthetic.

Patient no.	Years	Gender	TNM	Operation	Reconstruction	Other medical condition	Follow up (months)	Status
1	55	M	T4N0M0	Total lower lip resection	Karapandžić + Abbe	None	60	NED
2	61	M	T4N1M0	Total lower lip resection Neck dissection	Karapandžić + Abbe	None	36	NED
3	44	M	T4N0M0	Total lower lip resection	Karapandžić + Abbe	Cleft lip Dilatative cardiomyopathy	36	NED
4	85	M	T4N0M0	Total lower lip and chin resection	Extended Karapandžić + Abbe	Hypertension	18	NED
5	88	M	T4N0M0	Total lower lip and chin resection	Extended Karapandžić + Abbe	Hypertension	18	NED

Results

All patients in our cohort were men (Table 1). The youngest patient was 44, and the oldest 88 years old (mean 66.6). Patients were followed up between 18 and 60 months (mean 33.6 months). There were no local recurrences. Patient 2 did however, develop regional neck metastases in level I eighteen months after first surgery. He subsequently had a neck dissection, segmental resection of the mandible and reconstruction with a microvascular free fibula flap.

Patient 3 had a cleft lip on the left side and Millard cheiloplasty was performed during childhood. He also had severe dilated cardiomyopathy, for which he was a candidate for cardiac transplantation. As a consequence of his severely low ejection fraction, general anesthesia was contraindicated and therefore the operation was performed under local anaesthetic (infraorbital and mental nerve block).

Patients 4 and 5 also had involvement of the skin overlying the chin, so an extended Karapandzic flap was performed to facilitate closure of the chin defect. Postoperatively, none of the local flaps necrosed and there was no dehiscence of any wound. Patients were seen in clinic for regular assessment 3 monthly throughout. All patients

had some degree of microstomia but were able to eat perorally. All reconstructed lips were functional and no drooling was observed. Aesthetically, patients were very pleased with their results (Figures 1h and 2g).

Discussion

Lower lip reconstruction remains a challenging task due to multi-functional and high aesthetic requirements that have to be achieved for successful outcome. This is particularly true to near-total lower lip defects, encompassing over 70% of lower lip loss due to cancer, trauma or burns. Despite the fact that numerous flaps and their modifications have been described over the past century, only a few valuable techniques and concepts withstood the test of time for sub-total lower lip defects, each having their own drawbacks. Ideal lower lip reconstruction should maintain adequate oral aperture, orbicularis muscle function¹⁴ and sensate skin and mucosal lining to allow speech, oral competence and facial expressions. Bernard-Webster flaps recruit adjacent cheek skin to resurface large lower lip defects, however, without important sensation and maintained orbicularis function



Figure 2 (a) T4 SCC requiring total lower lip and chin resection. Figure 2(b) and (c) Outline of flaps-design; extended Karapandzic incisions to recruit more cheek tissue And Combined total lower lip and chin defect following excision of extensive SCC. Figure 2(d) Combined bilateral extended Karapandzic-Abbe flaps raised. Figure 2(e) Bilateral Abbe flaps mobilised to reduce the lower lip defect. Figure 2(f) All 4 flaps sutured in place to reconstruct both lower lip and chin. Figure 2(g) Excellent aesthetic and good functional outcome at 18 months follow-up.

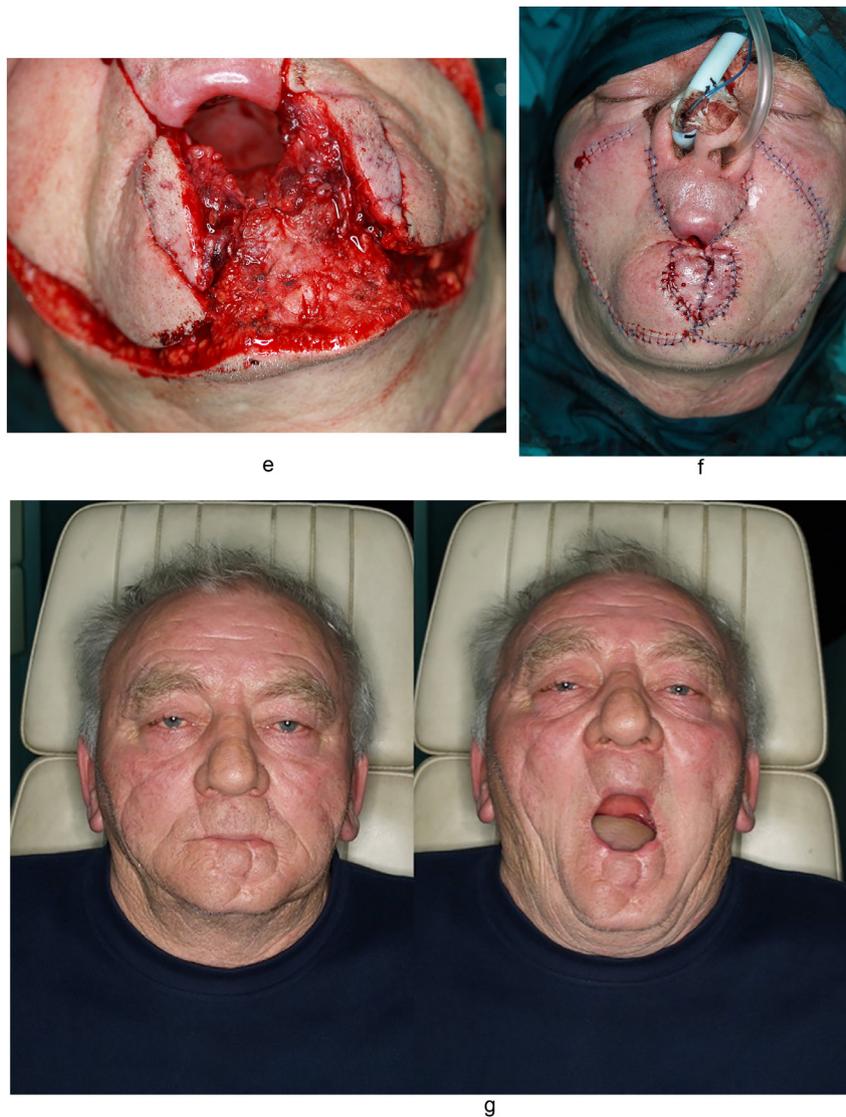


Figure 2 (continued)

control, hence affecting oral competence, speech and facial expressions. In addition, effacement of gingivo-buccal sulcus and notching of central lip have been described as common aesthetic disadvantages¹⁵ of this, otherwise, reliable old technique. To address some of these issues, 43-years ago, Karapandzic described a technique that would provide reconstruction of near-total lower lip defects whilst maintaining sensation and sphincter-control.¹⁶ Karapandzic flaps rotate and advance remaining skin and innervated orbicularis oris from the upper lip and cheek while preserving labial arteries and buccal-nerve branches to provide functionally better-quality reconstruction. However, this is done at the expense of decrease in total oral circumference, thus creating significant microstomia in near-total and total lower lip defects. For defects smaller than 75% of lower lip, useful and well-known technique is unilateral or bilateral Abbe or cross-lip flaps.¹⁷ This axial-pattern blood supply flap is particularly useful in replacing both vermilion and cutaneous lip tissue and can be extended to include the chin. Drawbacks of these flaps, apart from inability to reconstruct

subtotal lip defects, include 3 weeks of lip-adhesion, which requires high-compliance in patients as well as potential imbalance of vermilion and white roll at the suture lines.¹⁸ Subtotal and particularly total lower lip defects have been so far an indication for a free flap reconstruction. While free flaps can provide enough well vascularized tissue, different skin properties including color match, texture, pliability and more importantly - maintaining oral competence, in most cases produce less than satisfactory aesthetic and functional outcomes, compared to local flaps. Even though perforator flaps provide greater versatility in this area as well, none of the donor-sites can provide voluntary tightening of the lip coupled with preservation of aesthetic subunits. Innervated gracilis muscle transfer, as described by Ninkovic et al., has been reported to provide favorable oral competence.⁵ In our opinion, this technique is an excellent choice in large lower lip defects, which include chin and the mandible. However, tumors that encompass entire vermilion but don't involve the mandible present the reconstructive challenge. In our opinion, and experience,

this subgroup of patients is better served with combined Karapandzic-Abbe/Estlander/Stein flaps as both function and aesthetics are superior to microvascular free innervated flaps. In recent years, dual-flap microvascular lower lip reconstructions were reported^{19,20} for extensive intra-oral and extra-oral defects, however, long-term functional and aesthetic outcomes of these reconstructions are yet to be validated on greater number of patients. Clearly, microvascular lower lip reconstruction requires multiple stage procedures as both functional and aesthetic refinements are required to improve the outcome of initially transplanted free flap.¹⁸ Our technique of combining extended Karapandzic flaps with bilateral Abbe/Estlander/Stein flaps provides an innervated sensate functional reconstruction in 2 stages, both amenable to local anesthetic, if dictated by patients' co-morbidities. This option is ever so important due to aged population we commonly treat for skin malignancies. Whilst extended Karapandzic flaps provide sufficient amount of skin for adequate closure of soft tissue defect encompassing over 75% of lower lip loss, they also transfer functional orbicularis muscle thereby maintaining oral competence. Addition of double-Abbe flaps has, in our hands, significantly reduced the main limitation of Karapandzic flaps - microstomia, as seen in our long-term outcomes. Moreover, adding a double-Abbe/Estlander/Stein flaps have, in our opinion, produced a superb aesthetic outcome as improved symmetry can be obtained compared to unilateral Abbe flap based reconstruction, let alone free flap-based reconstructions. We recommend this technique for near-total lower lip defects encompassing over 75% of lip loss as reliable, straightforward and superior to other techniques used for similar defects in terms of function and aesthetics.

Financial disclosure

All authors have nothing to disclose. No funding was received for this article.

References

1. Luce EA. Carcinoma of the lower lip. *Surg Clin North Am* 1986;66(1):3-11.
2. Rajmohan S. Ian's modification of the classic V excision for reconstruction of the lower lip. *Br J Oral Maxillofac Surg* 2016;54(2):228-9.
3. Jabaley ME, Orcutt TW, Clement RL. Applications of the Karapandzic principle of lip reconstruction after excision of lip cancer. *Am J Surg* 1976;132(4):529-32.
4. Wilson JS, Walker EP. Reconstruction of the lower lip. *Head Neck Surg* 1981;4(1):29-44.
5. Ninkovic M, Spanio di Spilimbergo S, Ninkovic M. Lower lip reconstruction: introduction of a new procedure using a functioning gracilis muscle free flap. *Plast Reconstr Surg* 2007;119(5):1472-80.
6. Luce EA. Reconstruction of the lower lip. *Clin Plast Surg* 1995;22(1):109-21.
7. Baumann D, Robb G. Lip reconstruction. *Semin Plast Surg* 2008;22(4):269-80.
8. Webster RC, Coffey RJ, Kelleher RE. Total and partial reconstruction of the lower lip with innervated musclebearing flaps. *Plast Reconstr Surg Transplant Bull* 1960;25:360-71.
9. Stein SA. The classic reprint: *Lip repair (cheiloplasty) performed by a new method*, by S.A. Stein, in: *Hospital-s-Meddelelser*, vol. 1, 212-6, 1848. *Plast Reconstr Surg* Mar 1974;53(3):332-7.
10. Roldan JC, Schulte-Mattler W. Stein's double cross-lip flaps combined with Johanson's step technique for subtotal lower lip reconstruction. *Plast Reconstr Surg Glob Open* 2016;4(2):e615.
11. Westreich R1, Meisner J, Reino A, Lawson W. The use of combined Bernard-Webster and Karapandzic flaps for subtotal lower lip reconstruction. *Plast Reconstr Surg* 2008;121(5):340e-341e.
12. Karapandzic M. Reconstruction of lip defects by local arterial flaps. *Br J Plast Surg* 1974;27(1):93-7.
13. Hanasono MM, Langstein HN. Extended Karapandzic flaps for near-total and total lower lip defects. *Plast Reconstr Surg* 2011;127(3):1199-205.
14. Kroll S. *Reconstructive Plastic Surgery for Cancer*. In: Kroll S, editor. *Lip reconstruction*. St. Louis, MO: Mosby Year Book; 1996. p. 201-9.
15. Langstein HN, Robb GL. Lip and perioral reconstruction. *Clin Plast Surg* Jul 2005;32(3):431-445 viii.
16. Karapandzic M. Reconstruction of lip defects by local arterial flaps. *Br J Plast Surg* 1974;27:93-7.
17. Salgarelli AC, Sartorelli F, Cangiano A, Collini M. Treatment of lower lip cancer: an experience of 48 cases. *Int J Oral Maxillofac Surg*. Jan 2005;34(1):27-32.
18. Baumann D, Robb G. Lip reconstruction. *Semin Plast Surg* Nov 2008;22(4):269-80.
19. Jeng SF, Kuo YR, Wei FC, Su CY, Chien CY. Reconstruction of extensive composite mandibular defects with large lip involvement by using double free flaps and fascia lata grafts for oral sphincters. *Plast Reconstr Surg* Jun 2005;115(7):1830-6.
20. Ueda K, Oba S, Ohtani K, Amano N, Fumiya Y. Functional lower lip reconstruction with a forearm flap combined with a free gracilis muscle transfer. *J Plast Reconstr Aesthet Surg* 2006;59(8):867-70.