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ORIGINAL ARTICLE

Inferiorly based nasolabial flap for reconstruction of full-thickness medium-sized lower lip and commissural defects following ablative cancer surgery

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Abstract

Background: Information regarding the design and usage of inferiorly based nasolabial flap for lower lip and commissural defect reconstruction following ablative cancer surgery remains limited. This study aimed to provide our design and experiences for such reconstructive purpose.

Methods: Patients with lower lip or oral commissural cancer who received curative surgery involving reconstruction with inferiorly based nasolabial flap were included. The demographic data and clinical outcomes of these patients were obtained by retrospective chart review.

Results: A total of eight patients were enrolled in this study. All patients received ablative surgery at the National Cheng Kung University Hospital during May 2019 to May 2021, with their surgical defects reconstructed with unilateral inferiorly based nasolabial flap successfully. Among the five patients with lower lip cancer, one had a limited area of necrosis at flap tip. Another patient had a small orocutaneous fistula that healed spontaneously. No trismus or oral incompetence was noted following recovery. For the three patients with commissural cancer, a second stage commisuroplasy was needed after primary reconstruction. One patient had limited wound dehiscence at mouth angle following surgery, resulting in mild oral incompetence. Although mild trismus was noted in these three commissural cancer patients, all patients resumed normal diet during follow-up.

Conclusion: Inferiorly based nasolabial flap is an excellent local flap for lower lip reconstruction following cancer ablative surgery. It is also a viable option for reconstruction of oral commissural defects. Minimal donor side morbidity, good functional recovery, and esthetic outcomes can be achieved with meticulous flap design.

Keywords: Esthetic; Fistula; Morbidity; Necrosis; Trismus

1. INTRODUCTION

Squamous cell carcinoma (SCC) of the lip accounts for more than 25% of all oral cancers, with more than 90% of cases occurring in the lower lip.[1] Surgical resection is still the mainstay treatment of lip SCC. Although a 5-year overall survival around 70% can be achieved in lip SCC patients,[1] the resulting facial disfiguring and oral dysfunction can significantly impair a patient's quality of life. Since both facial contour and oral competence have to be restored simultaneously, reconstruction of lip and commissural defects following ablative cancer surgery remains challenging.

A variety of surgical approaches have been proposed for lower lip reconstruction. The choice of reconstructive method relies mainly on the location, thickness, and size of the defect.[2–4] Large, full-thickness defects often require reconstruction with free flaps. For small- to medium-sized defects, regional flap or local flap could be used. According to the literature, local flaps such as Abbe cross-lip flap, Webster-Bernard flap, Karapandzic flap,[5] Gillies fan flap, and their various modifications[6,7] have been successfully used in reconstruction of small- to medium-sized lower lip defects with good functional and cosmetic results. However, since these approaches provide limited amount of additional tissue for reconstruction, using such approach to reconstruct medium- to large-sized defects may result in microstomia and suboptimal function restoration in some cases. Although bilateral or combined approach could be performed simultaneously, the additional procedure(s) needed for reconstruction may add operation complexity and donor site morbidity. Unfortunately, for cancers involving lower lip or oral commissure, medium- to large-sized defects (more than 50% full-thickness lower lip defect, or commissural defects combined with upper and/or lower lip defect) are always anticipated due to the necessity of adequate margin control during tumor resection. In addition, in Asian oral cancer patients with marked oral submucosal fibrosis,[8] oral soft tissue rigidity may further add difficulty for defect

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reconstruction. Thus, local or regional flaps that can reliably provide moderate amount of tissue for reconstruction would be mandatory.

Nasolabial flap is one of the most commonly used local flaps in orofacial reconstruction that can provide moderate amount of tissue for reconstruction. Results from previous studies have confirmed the successful usage of nasolabial flap to reconstruct various kinds of oral defects,[9] including defects of the lower lip.[10,11] However, although we considered inferiorly based nasolabial flap as a simple and viable option for lower lip and commissural defect reconstruction following ablative cancer surgery, information regarding the flap design and clinical results for such reconstructive purpose are limited. Thus, in this study, we reported our methods and experiences of using inferiorly based nasolabial flap as a reconstructive approach for medium-sized lower lip and commissural defects.

2. METHODS

2.1. Patients

For patients with lower lip cancer, an anticipated surgical defect with its width exceeding more than half of the original lip length was considered as an appropriate candidate for nasolabial flap reconstruction. For oral commissural cancer, patients with an anticipated surgical defect that does not extend beyond nasolabial fold was considered as a suitable candidate. In both lower lip and commissural defects, the vertical height of the surgical defect should be, preferably, less than 3 cm for optimal reconstruction. A total of eight patients were enrolled in this study. All of these patients received ablation surgery during May 2019 to May 2021. The diagnoses of these eight patients were either lower lip SCC (mucosal lip or vermillion) or buccal SCC involving oral commissural area (Table 1). Following ablative surgery, immediate reconstruction with nasolabial flap was performed. The clinico-pathological parameters, including age, sex, diagnosis, clinical and pathological stages, operation methods, morbidities, and follow-up records were obtained from retrospective chart review.

2.2. Surgical technique

A simple pinch test was first performed before operation to estimate the skin laxity and available flap dimensions (length and width). For simple lower lip defect following tumor resection, the vertical height and width of the surgical defect were measured after tumor resection. Detailed design of the inferiorly based nasolabial flap is shown in Fig. 1. The width of the flap should roughly equal to the vertical height of the defect. The pivot point of the flap was placed at the level of mouth angle, with the length of flap inner limb roughly equal to the distance measured from the pivot point to the medial margin of lip defect. The tip of the nasolabial flap was placed at least 5 mm below the ipsilateral medial canthus[12] to avoid ectropion. The designed flap was then harvested at a plane superficial to the facial expression muscles. In patient with neck dissection and concomitant ipsilateral facial artery ligation, the length to width ratio of the planned nasolabial flap was maintained at a 2:1 ratio.[10] After flap harvest, wound at donor site was first closed to release flap tension and facilitate flap inset. The harvested flap was then rotated clockwise and inset into the lower lip defect with simple sutures. The inner surface of inset nasolabial flap containing subcutaneous fat was left uncovered to allow spontaneous epithelization. Complete epithelization occurs within 1 to 2 months after operation. For lower lip defect with vertical height larger than available flap base dimension, primary sutures were first performed to decrease the vertical height of defect, followed by same reconstruction process described as above. Lower lip defects involving limited area of oral commissure could also be reconstructed in one stage after slight reshaping of the nasolabial flap during inset. For oral commissural defects affecting both upper and lower lips (Fig. 2), the width of the flap base should be ideally larger than the vertical height of defect. The rotated nasolabial flap was then used to close the commissural, upper lip and lower lip defects. Due to temporary limitation of mouth opening, a nasogastric tube was placed for feeding. Two weeks following primary operation, a second stage commissuroplasty was performed to create new mouth angle under local anesthesia, using contralateral mouth angle as a reference point.

3. RESULTS

The demographic data and clinical parameters of these eight patients are shown in Table 1. All patients had cT1-2N0 OSCC, with five patients having tumors located on the lower lip. The remaining three patients had tumors located mainly at the oral commissural area. Unilateral inferiorly based nasolabial flap was performed for defect reconstruction in all of these eight patients. None of these patient received post-operative radiotherapy. None of them suffered from substantial flap loss. No major donor site morbidity was noted except for an inconspicuous facial scar mimicking nasolabial fold.

In the five patients with lower lip cancer (case 1-5), a more than 50% lower lip loss (with or without limited commissural defect) was consistently noted after tumor resection. Among these five patients, one of them (case 1) received concomitant elective neck dissection during tumor resection with ipsilateral facial artery ligation. He suffered from a limited necrosis at the flap tip, which later resolved spontaneously without any functional deficit (Fig. 3). Another patient (case 2) suffered from a primary oral cancer and had tumor resection at about 7 years ago. Due to neck recurrence, he received bilateral neck dissection and post-operative radiotherapy. This time, he had operation for a second primary cancer, with a near total loss of his lower lip after tumor resection. Although he had bilateral facial artery ligation performed during last operation, the lip defect

Table 1

Demographic data and clinical parameters of patients (n = 8)

Case	Age	Sex	Tumor site	Tumor size, cm	Lip defect	Flap size, cm	Facial artery	Healing events	Functional deficits
1	58	M	Lower lip	2.2×2.1	50%	5.0×2.5	Ligated	Flap tip necrosis	-
2	84	M	Lower lip	2.5×1.5	75%-100%	7.0×3.0	Ligated	-	-
3	74	M	Lower lip	1.5×1.2	50%-75%	6.5×2.5	-	Orocutaneous fistula	-
4	80	M	Lower lip	1.5×1.3	50-75%	6.5×2.5	-	-	-
5	71	M	Lower lip	2.2×1.6	50-75%	6.5×2.5	-	-	-
6	59	M	Commissure	1.4×1.4	25%	6.0×3.0	-	-	Mild trismus
7	61	M	Commissure	1.4×1.2	25%	6.0×2.5	-	-	Mild trismus
8	53	M	Commissure	1.5×1.3	25%	5.0×2.5	-	Wound dehiscence	Mild trismus incompetence

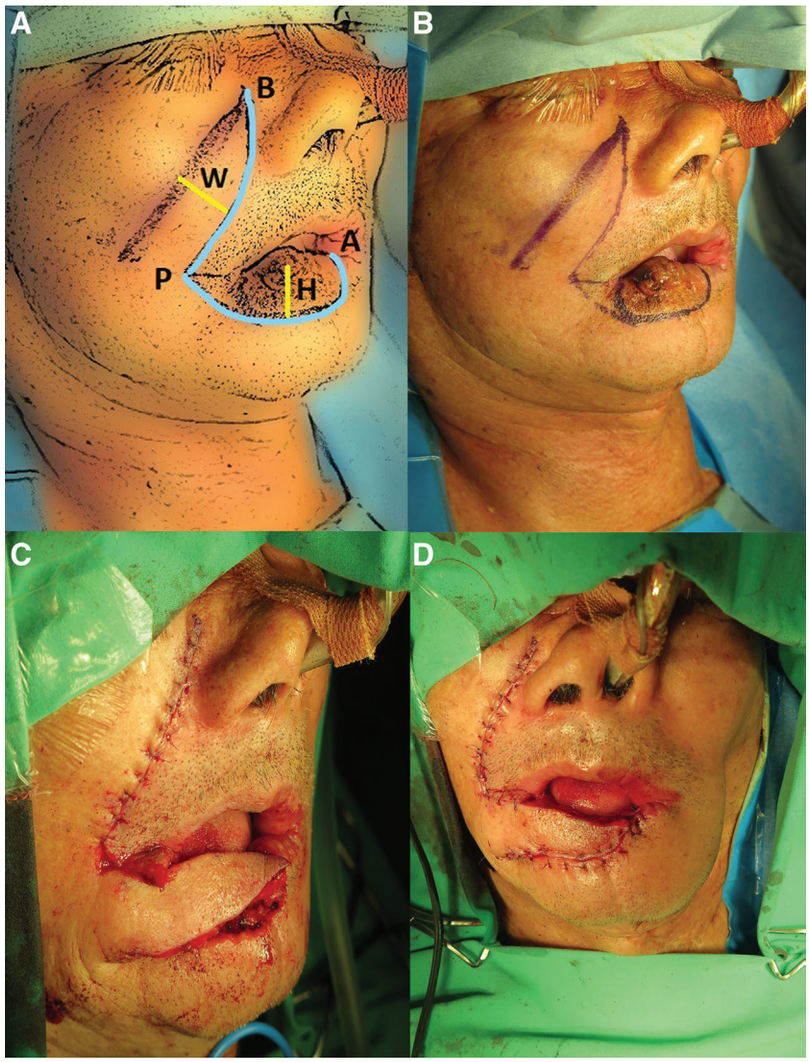

Fig. 1 Nasolabial flap reconstruction for a lower lip defect. A and B, Flap design. The length of PB equals the length of PA, while the width (W) of flap roughly equals to the height (H) of the lip defect. C, The donor wound is first closed to facilitate flap rotation. D, Inset of flap.

was also reconstructed with unilateral inferiorly based nasolabial flap successfully. The post-operative course was uneventful. Another patient (case 3) suffered from a small orocutaneous fistula at the suture line of the reconstructed lower lip, which also healed spontaneously without the necessity of additional intervention. One patient (case 5) developed prominent trapdoor deformity after successful wound recovery. None of the five patients suffered from oral incompetence following tumor resection and reconstruction. All of these five patients resumed their normal diet without issue of mouth opening.

In the three patients who had oral commissural tumor (case 6-8), a surgical defect involving oral commissural, upper lip and lower lip (less than 25% loss of lips) was noted after tumor resection. The defects from these three patients were also successfully reconstructed with an ipsilateral inferiorly based nasolabial flap. After reconstruction, nasogastric tube feeding was performed for the temporary limitation of mouth opening. A second stage operation was performed in two patients (cases 6, 7) to divide the inset nasolabial flap and reconstruct the mouth angle 2 weeks after primary operation. The remaining patient (case 8) suffered from a minor wound dehiscence at the suture line of the lower lip, which soon resolved spontaneously. Second stage operation was delayed until 5 weeks after primary operation. All of the three patient had mild limitation of mouth opening after successful recovery. Nonetheless, they regained normal diet during follow-up, with only one patient having minor oral incompetence without interference of his oral intake (case 8).

4. DISCUSSION

The strength of this study is mainly in two aspects. First, although nasolabial flap has been widely used to reconstruct various kinds of oral defects,[9–11] information regarding the detailed design and techniques of using inferiorly based nasolabial flap to specifically reconstruct full-thickness, medium-sized lower lip defects following ablative cancer surgery is very limited. Our study provides important supplementary information to fill the insufficiencies in the literature. Second, reconstruction of full-thickness oral commissural defects following tumor resection remains challenging. In this study, to our knowledge, we have provided a novel two-stage surgical approach of using inferiorly based nasolabial flap for reconstructing such defects.

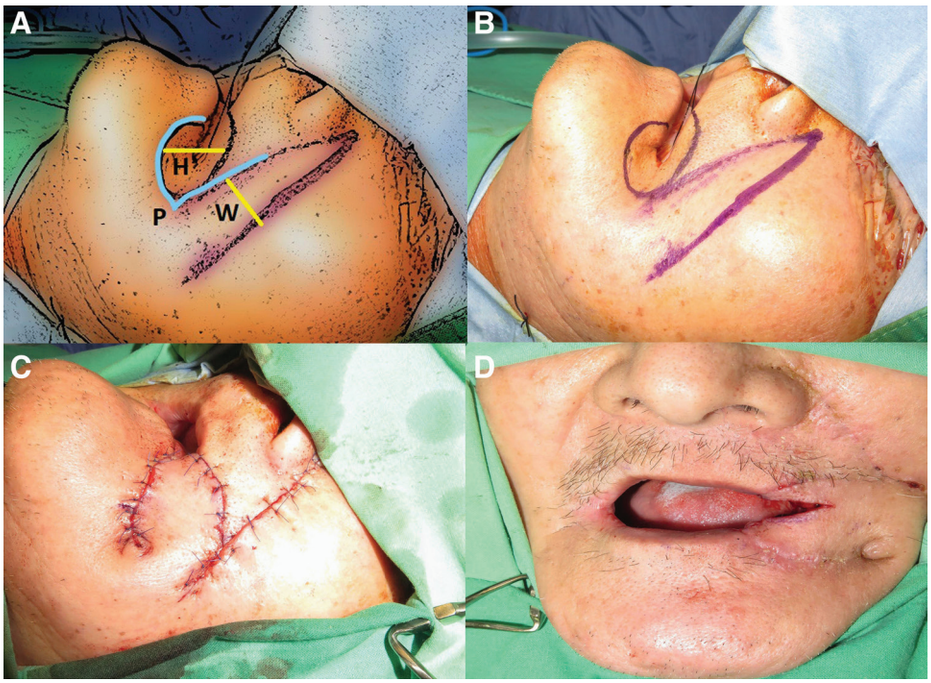

Fig. 2 Nasolabial flap reconstruction for an oral commissural defect. A and B, Flap design. The width (W) of flap is, ideally, slightly larger than the height (H) of the commissural defect. C, Inset of flap to complete commissural reconstruction. D, Second stage commisuroplasy at 2 wk after primary operation.

Fig. 3 Representative pictures taken from a lower lip cancer patient at 6 mo after operation, showing good oral competence (A) with no impairment of the mouth opening (B).

The proposed two-stage reconstructive procedure is both simple and effective, with good clinical outcomes.

The usage of inferiorly based nasolabial flap to reconstruct medium-sized lower lip and commissural defects has several advantages: (1) nasolabial flap can provide moderate amount of tissue to replenish the surgical defect, hence avoiding microstomia; (2) mismatch of the skin tone between donor and recipient sites is minimal; (3) the thickness of nasolabial flap roughly equals to the full-thickness defect of lip and commissural defect; (4) the inner aspect (subcutaneous fat pad) of nasolabial flap requires no resurfacing, with complete epithelization occurring within 1 to 2 months after operation; (5) the direction of scar tension generated by the nasolabial flap helps in maintaining oral competence; (6) donor site morbidity is minimal, with an inconspicuous scar mimicking nature-occurring nasolabial fold; (7) compared to regional or free flaps, the reconstructive technique of nasolabial flap is straightforward, less technique-demanding and less time-consuming, which would be beneficial in patients with severe comorbidities; (8) although vasculature of inferiorly based nasolabial flap is technically random, the "axial" pattern of subdermal plexus provides robust blood supply of the flap, even after ligation of ipsilateral facial artery[10,13,14]; and (9) the angle of rotation during flap inset is less than 90° without torsion, which increases the chance of flap survival. Taken together, we consider the inferiorly based nasolabial flap as an ideal local flap for reconstruction of full-thickness, medium-sized lower lip and commissural defect following ablative cancer surgery.

There are still a few disadvantages in our reconstructive approach. First, trapdoor effect is a common late cosmetic deformity of nasolabial flap, with bulging flap tissue forming within the semicircular confines of a U-, C-, or V-shaped scar.[15] One of our patients did exhibit prominent trapdoor deformity after successful wound recovery (Fig. 4). Although Z-plasty and debulking could be utilized to rescue such deformity, until writing of this report, no patient considered a re-operation for correction of trapdoor deformity after ablative cancer surgery.

Fig. 4 A patient with trapdoor deformity following wound recovery (same patient as in Fig. 1).

Second, the color difference between the flap skin and the remaining lip vermillion is evident. Such cosmetic defect can be rescued by either a second stage tongue flap reconstruction,[16] or by cosmetic tattooing.[17] Alternatively, Yu's technique offers simultaneous reconstruction of the labial vermilion and is considered another good alternative for the reconstruction of medium-sized lower lip defects.[18] Third, although nasolabial flap has a robust blood supply, ligation of ipsilateral facial artery may still have an impact on the viability of this flap. In a large series including 224 oral cancer patients reconstructed with nasolabial flap, ligation of facial artery was significantly correlated with complicated wound healing and flap loss.[19] In our cohort, although we intentionally maintained the length/width ratio of the planned nasolabial flap under 2 in the patient (case 1) who received concomitant ligation of ipsilateral facial artery during operation, necrosis at a small area of the flap tip still occurred. Thus, concomitant ligation of ipsilateral facial artery may limit the length of nasolabial flap available for defect reconstruction. Fourth, although we considered resurfacing of the inner aspect of nasolabial flap not necessary, a certain degree of fibrosis will inevitably occur in the subcutaneous fat of flap during wound healing, resulting in partial loss of tissue elasticity. In our cases, we did encounter a certain degree of tissue rigidity in the reconstructed lower lip and oral commissure. For lower lip defects (cases 1-5), the space-filling effect of the inset nasolabial flap can alleviate the effect of tissue rigidity and decrease the possibility of trismus and microstomia. However, for oral commissural defects (cases 6-8), a certain degree of limitation in mouth opening is anticipated due to loss of tissue elasticity over the commissural area. Fifth, simultaneous reconstruction of oral commissure, upper and lower lip with nasolabial flap results in temporary limitation of mouth opening. A second stage commisuroplasty is required. Nonetheless, the second stage operation can easily be performed under local anesthesia, using the contralateral mouth angle as a reference point for flap division to achieve facial symmetry.

In conclusion, we considered inferiorly based nasolabial flap as an excellent local flap for one stage reconstruction of a full-thickness, medium-sized lower lip defect following ablative cancer surgery. For an oral commissural defect, this flap is still a viable option, with the necessity of a second stage commisuroplasy. Flap survival and wound recovery are excellent, with minimal donor side morbidity. Good functional and esthetic outcomes can be achieved.

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