

## Original Article

# The submental island flap in lingual cancer reconstruction

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**Abstract:** Purpose: Large defects resulting from surgical excision of oral cancer require various kinds of flap to reconstruct the defect. Therefore the aim of this study is to assess the application potentials of submental island flap in lingual cancer. Methods: Over the 3 years, submental island flap has been studied in a 13 cases of lingual cancer patients and follow-up was accordingly done. The sites, stage of tumor, pattern of neck dissection, technique of flap transfer as well as postoperative complications were recorded. Results: The submental island flap was used for reconstruction after lingual cancer ablation in 13 patients in our department (9 men and 4 women) from 2013 to 2015. The average age of the patients was 50.8 years (range 37 to 69 years). The follow-up period ranged from 5 to 24 months. Size of the skin paddle ranged for 5.5×4 cm to 8×4 cm. There were no cases of marginal mandible nerve palsy. In all cases, good skin color and texture match were achieved. Not any debulking of flap was found in patients. The donor site recovered well without any scar remaining and any restriction of neck movement. Conclusions: The submental island flap is an excellent alternative for reconstruction of lingual cancer defect due to its reliability, versatility, and relative ease of application. More studies will be performed to follow-up the long-term observation of the patients.

**Keywords:** Lingual cancer, submental island flap, lingual reconstruction

## Introduction

Multiple reconstruction methods have been introduced for the treatment of the lingual defects after ablative surgery. However these reconstruction techniques have a number of disadvantages the micro-vascular reconstruction technique increases the surgical time, complexity of procedure and the risk of vascular failure. In 1993 Martin et al [1] described the submental island flap. Since then, the reliability and the anatomy of this flap have been described by many researchers, and the various applications have been reported. Consequently, this article presents our experience of this flap in reconstruction of lingual defects with the anatomy, surgical technique, advantage, disadvantage and complications of this flap.

## Anatomy

The submental artery is a well-defined, consistent branch of the facial artery. It rises deep to

the submandibular gland and passes forward and crosses the mylohyoid muscle to reach the chin. The facial artery gives off the submental artery, which is behind or at the superior edge of the submandibular gland [2]. It sprouts some branches to submandibular gland, platysma and mylohyoid muscles. The terminal branches of the submental artery cross the anterior belly of the digastric muscle either superficially or deeply [3]. The submental artery originates 5.5 cm anterior to the angle of the mandible [4]. As Yelda Atamaz Pinar et al [5] observed that the external diameter of submental artery varied between 0.82 and 2.80 mm (min-max) with a mean of 1.80±0.46 mm on the left side, and between 1.02 and 2.72 mm (min-max) with a mean of 1.88±0.48 mm on the right side. In the 44% of cases submental artery runs superficially to the anterior belly of digastric muscle while in 56% it runs deeply [4]. Faltaous and Yetman [3] reported that in 70% of cases submental vessels run deeply to the anterior belly of digastric muscle, which should be included in

## Pedicle flap in lingual cancer reconstruction

the flap to prevent failure. The skin territory of the single pedicle submental island flap is as large as 7×15 cm due to its flaccidity of the region, especially in older patients [6]. The flap is drained through submental vein into the facial vein. There are 1-3 anastomoses between the vessels and the jugular vein which play an important role in the surgical procedure and venous drainage of the flap in some cases.

### Surgical technique

The patient is positioned supine with the head moderately extended. The upper limit of the flap is drawn just under the mandibular arch and lower limit is marked by pinch test for primary closure [7]. An inferior incision is made through skin, subcutaneous tissue and platysma. In our experience once raising the flap we could attach the skin and subcutaneous tissue together with suturing in order to prevent them from separating from each other. After that flap is raised from distal to proximal site, just deep enough to reach the platysma, the submandibular gland is exposed. The gland is then retracted with a forceps and the small branches of submandibular arteries to the gland are ligated and dissected. The ipsilateral anterior belly of digastric muscle is also included in the flap because some authors advice raising the anterior belly of the digastric muscle with the flap to protect the submental artery during harvest of the flap [8]. After that, the facial artery and vein are identified and ligated above the mandibular margin. While doing this, a special care should be taken so that the marginal mandibular branch does not be injured. The submandibular gland is removed and the flap is skeletonized on the facial vessels. The reach of flap is checked and the adequate arch of rotation is confirmed. The flap is fed to the recipient site by creating a submandibular tunnel, taking care of the marginal mandibular nerve. The flap is then inserted into the recipient site. The donor site is closed without an additional dissection, but if the immobilization of skin is required, it should be done only on the cervical side to prevent eversion of the lower lip. The donor defect is then closed with a suction drain.

### Patients and methods

We used the submental island flap for lingual defect in 13 patients, out of which 9 were males and 4 were females. All the flaps were pedicled and were raised under loupe magnifi-

cation. Lesion is more than 5 cm in dimension and patients who had palpable or radiologically demonstrable neck node metastasis was not considered to be suitable for this reconstruction. The site and stage of the tumor, pattern of neck dissection, postoperative complications were recorded and followed up to assess the status of the flap and function and oncologic outcomes.

This study was approved by the Hospital IRB and all participants signed a form of consent agreements. This study followed the Declaration of Helsinki on medical protocol and ethics and the regional Ethical Review Board of the First Affiliated Hospital of Xinjiang Medical University approved the study.

### Results

The submental flap was implanted from 2013 to 2015 in 13 patients: 9 men and 4 women. Mean patient age was 50.8 years (range, 37 to 69 years) 3 patients had T1 lesion, 10 patients had T2 lesion .2 patients had N1 nodal metastasis and 11 had NO status which was proved by histopathology after operation. All the flaps used were raised by the same surgeon. The site of distribution, flap size, follows up, pathological reports, clinical staging, type of neck dissection current status and complication of all cases is shown in **Table 1**. All patients underwent functional neck dissection along with wide excision of primary lesion. At the meantime the submental flap was used based on the submental artery. The patients with poor prognostic factor or with positive neck nodes received postoperative radiation. 3 patients because of delayed radiotherapy had recurrence or cervical nodal metastasis after primary operation. The size of primary lesion at the surgery varied from 1.5×1.5 cm to 3×2 cm (mean size 2.6×1.9 cm). The skin paddles of flaps ranged in size from 5.5×4 cm to 8×4 cm with mean size of 6.4×4.2 cm. All the flaps exhibited good mobility and reached the intraoral recipient site without tension to the pedicle. The donor site was closed primarily in all the cases.

All patients had microscopic tumor free margins, but 2 patients had positive nodes at levels 2. The postoperative hospital stay was 11 to 18 days with mean period of 14.4 days. Total flap loss was seen in 2 patients. However these wounds healed well with conservative manage-

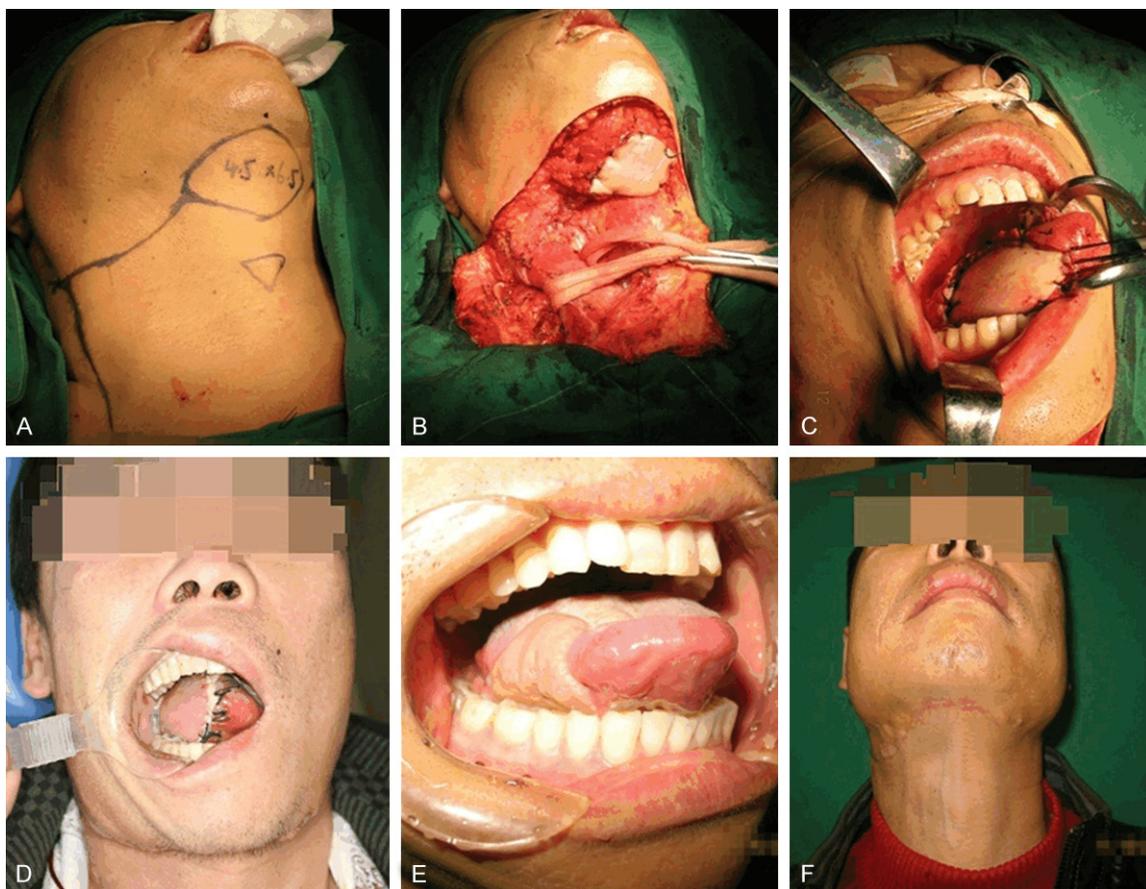
## Pedicled flap in lingual cancer reconstruction

**Table 1.** Personal data and local status of patients

Case	Age/sex	Pathology	Location	Primary lesion size (cm)	Flap size (cm)	Type of neck dissections	Follow-up (months)	Clinical staging	Complication	Last information
1	44/F	SCC	RLM	3×2	5.5×4	SND	24	T2N0M0	No	No evidence of disease
2	45/M	SCC	BRL	3×2	6×4	SND	18	T2N1M0	No	Local recurrence and ipsilateral lymph nodes metastasis
3	43/M	SCC	RLM	1.5×1.5	6.5×4.5	SND	17	T1N0M0	No	No evidence of disease
4	68/F	SCC	RLM	3×2.5	6×4.5	SND	19	T2N0M0	Total flap loss	Local recurrence
5	48/M	SCC	BRL	3×2	7×4.5	SND	12	T2N0M0	No	No evidence of disease
6	37/M	SCC	RLM	3×2	8×4	SND	10	T2N1M0	Wound dehiscence	Nodes metastasis bilateraly
7	49/M	SCC	LLM	2.5×2	6×4	SND	5	T2N0M0	Total flap loss	No evidence of disease
8	47/F	SCC	RLM	2×1.5	6.5×4.5	SND	20	T1N0M0	No	No evidence of disease
9	52/F	SCC	RLM	2.5×2	6×4	SND	18	T2N0M0	No	No evidence of disease
10	69/M	SCC	BLL	3×2	7×4.5	SND	16	T2N0M0	No	No evidence of disease
11	41/M	SCC	LLM	1.5×1.5	6×4	SND	12	T1N0M0	No	No evidence of disease
12	62/M	SCC	LLM	2.5×2	6×4	SND	8	T2N0M0	No	No evidence of disease
13	55/M	SCC	RLM	3×2	6.5×4.5	SND	14	T2N0M0	No	No evidence of disease

RLM: Right lingual margin; LLM: Left lingual margin; BRL: Base of right lingual; BLL: Base of left lingual; SND: supraomohyoid neck dissection.

## Pedicle flap in lingual cancer reconstruction



**Figure 1.** A. Flap and incision design. B. The submental island flap is shown raised on its vascular pedicle. C. The flap was transferred to the recipient site. D. Intraoral photograph shows lingual reconstruction at 14 days. E. Intraoral photograph shows lingual reconstruction at 17 months. F. Extraoral photograph shows the donor site recovered well with no ugly scarring and no restriction to neck movement.

ment. 2 patients had immediate postoperative venous congestion that resulted in flap loss. All the donor sites healed well without any complication (dysaesthesia, restriction of neck movement) and the chances of long term cosmesis and well function of the flap considered good.

All patients were followed up for 5 to 24 months with a median of 14.8 months. 2 patients developed recurrence at the primary site as well as distant metastasis. 1 patients developed bilateral nodal recurrence on follow up due to delayed radiotherapy and 2 patients had ipsilateral nodal recurrence. The marginal mandibular nerve palsy was not reported.

### Case reports

#### Case 1

A 43 year old man presented a T1 squamous cell carcinoma on the right lingual margin. The

patient underwent supraomohyoid neck dissection along with the wide excision of the primary lesion. Excision with adequate margins was performed, and it had microscopic tumor free margins during the operation. After tumor resection, a right-side pedicle submental island flap was raised and transferred to the defect through ipsilateral floor of mouth. After 17 months of follow up there was no recurrence or any residual disease or cervical nodes metastasis in which full course radiotherapy was received after primary operation. The donor site was closed primarily and recovered well. The patient was able to speak and swallow with great satisfaction. The details of the patient was showed in **Figure 1**.

#### Case 2

A 42 years old man presented T2 squamous cell carcinoma on the base of right lingual aspect of tongue. The patient underwent supra-

## Pedicled flap in lingual cancer reconstruction



**Figure 2.** A. Flap and incision design. B. The submental island flap is shown raised on its vascular pedicle. C. The flap was transferred to the recipient site. D. Extraoral photograph shows the donor site recovered well. E. Intraoral photograph shows lingual reconstruction at 12 months. F. Extraoral photograph shows the donor site recovered well with no ugly scarring and no restriction to neck movement.

omohyoid neck dissection along with wide excision of the primary lesion. Excision with adequate margins was performed, and it also had microscopic margins during the operation. After tumor resection, a right-side pedicle submental island flap was raised and transferred to the defect through ipsilateral floor of mouth. After 12 months of follow up, the patients had no recurrence or residual disease or cervical nodes metastasis after primary treatment and radiotherapy on time. The donor site recovered well and the patient was able to speak and swallow with great satisfaction. The details of the patient was showed in **Figure 2**.

### Discussion

Different kinds of flaps, such as platysma flap, pectoralis major myocutaneous flap and free skin flap such as free radial forearm flap, and latissimus dorsi muscular flap have been de-

scribed by different authors for the reconstruction of the intraoral soft tissue defects [9]. These defects are either due to trauma or tumor excision. Each have their own advantages and disadvantages such as the adjacent flap provides good color matches for facial skin but it is unreliable and limited by poor mobility. These flaps are abandoned due to frequent or partial or total loss of the skin pedal [10]. The free skin flap when used in microvascular reconstruction technique may increase time and complexity of the process and carry an inherent risk of vascular failure [11].

In 1993 Martin et al [1] developed submental island flap, initially he studied the flap design and technique in 20 fresh cadavers and then the flap was used successfully in the reconstruction of orofacial defects in 8 patients who underwent radical neck dissection. After that it has been widely adapted and disseminated by

## Pediced flap in lingual cancer reconstruction

various authors with various applications. The submental flap represents a good alternative to a free flap because it is easily available and takes shorter operative time as well as it has an excellent reach and good mobility. This has proved especially advantageous for reconstruction of mobile structures such as the tongue. The relatively thin skin over the submental area makes it suitable for reconstruction of intraoral defect without intraoral flap debulking. Another advantage of the submental flap is the fact that it easily hides the donor scar. Primary closure of the donor site defect is possible in virtually all patients, particularly in old patients [12]. And when we carry out neck dissection along with the flap reconstruction, the benefit as we consider is to share only one incision which contrast with the free radial forearm flap. A potential disadvantage of the submental flap is the possible damage to the marginal mandibular nerve [13]. But based on our past experience, there were no incidence of marginal mandibular nerve paresis in our patients, which we believe can be easily avoided by identifying and preserving the nerve early during the dissection of flap. Hair growth in the flap when used in intraoral defects in males may be a problem. As A. Multinu et al [14] says that it is easily managed with laser treatment is the presence of hair growing on a submental flap inside the oral cavity, which the patient finds very uncomfortable. But for us, to avoid this we can use moist intraoral environment or radiotherapy to reduce the hair growth.

There are some operative skills or key points during or after operation which is concluded by predecessors or our department. Many authors describe ipsilateral anterior belly of the digastric muscle when raising the submental flap, to provide better venous drainage and prevent flap loss and also to protect the submental artery during harvesting [5, 14]. In our experience, the flap has always been raised while keeping the ipsilateral anterior belly of the digastric muscle intact in order to offer much blood supply, but in our study we observed two patients who lost flaps. As we exclude ischemia of the flap, the chief reason is immediate postoperative venous congestion, which results in flap loss. As we know, the flap is drained by the submental vein, which drains into the facial vein and then drains into the internal jugular vein. There is at least one communicating vein

between the facial vein and the external jugular vein. But when the two ways of venous drainage were blocked simultaneously, we could notice venous congestion of the flap on the postoperative day which is why the flap is lost. In our experience to deal with it, a careful manipulation during the operation and anticoagulant drugs used after operation may be the conventional practice to solve this problem. But extreme care after operation must be taken to avoid twisting the pedicle, especially when tunneling the flap into the recipient site. We can advise patient to lie in a supine position and the head to be turned contralateral for 5 degree. Another key point is that we focus on the oncological security of submental island flap, as some authors are against its use in patients with oral cancer [1, 2]. Lymph nodes which drain most of the lower third of the face and the oral cavity may overrun by malignant cells into the flap or its pedicle [15]. But we recognize that lymph node metastasis is not contraindicated in oral cancer patients. It is essential that careful removal of all lymphatic tissue be carried out and the pedicle is thinned as much as possible. A frozen section of the suspicious nodes would be useful in this situation. When the frozen section reported a positive result, the surgeon should be prepared to consider abandoning the plan for a submental island flap. Other contraindications for using the submental flap are ligation of the facial artery and previous neck surgery. Based on our experience, the need for postoperative radiotherapy is not a contraindication, because in our study 3 patients expressed local recurrence and ipsilateral lymph nodes metastasis without radiotherapy on time for personal reasons. On the contrary, it plays an important role in comprehensive treatment postoperatively.

### Conclusion

The submental artery island flap is a simple reliable and versatile flap for reconstruction of lingual defects after excision for lingual cancer. Because of its reliability, versatility, color and texture match and relative ease of application it appears to be oncologically secure if selected by surgeon. Further study with long term follow up of patients is needed.

### Disclosure of conflict of interest

None.

## Pedicled flap in lingual cancer reconstruction

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