

The Submental Island Flap in Head and Neck Cancer

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Abstract

Objectives: The submental flap provides an alternative technique in orofacial reconstruction, especially in situations where free flap services are not available. The objective of this study is to demonstrate the oncological safety and benefits of this flap in oral cavity reconstruction in a tertiary care cancer hospital. **Materials and Methods:** A total of 27 patients with oral cavity cancers, which underwent submental flap reconstruction from 2015 to 2017 at Shaukat Khanum Cancer Memorial Hospital, were included in the study. We have retrospectively reviewed records of these patients. **Results:** There were 25 male and 2 female patients with age ranging from 21 to 73 years. Most common primary tumor sites were buccal mucosa (13), tongue (7), and lower alveolus (7). All patients underwent ipsilateral selective neck dissection after flap was harvested. Complete flap loss was observed in three, whereas one patient had flap dehiscence that subsequently healed. Mean follow-up was 11 months. There were four regional recurrences but no local recurrence. On the last follow-up (minimum 6 months), 15 patients were alive without any disease, 4 were alive with disease, and 3 had died. **Conclusion:** Submental flap is a satisfactory option for oral cavity reconstruction. However, preoperative selection of clinically neck node-negative patient is extremely important as it has potential risk of occult metastasis.

Keywords: Head-and-neck cancer, oral reconstruction, submental flap

INTRODUCTION

The reconstruction of orofacial defects after an ablative tumor surgery has both functional and morphological impacts. Reconstruction using microvascular free flaps is the gold standard but requires high degree of expertise, cost, time consumption, and prolonged hospital stay. The last three decades have witnessed paradigm shift in the field of microvascular free flap reconstruction for orofacial defects. However, in high-volume and low-resource centers, various pedicled flaps continue to play a crucial role. Submental artery island flap was first described by Martin *et al.* in 1993 in their attempt to search for an alternate to free flap while matching color, shape, and tissue texture. It has a long (up to 8 cm) consistent, reliable pedicle, and cutaneous dimensions having reach up to 7 cm × 18 cm. It can be used as a cutaneous, musculofascial (cervicofacial and platysma), or osteocutaneous flap. The flap has an excellent skin color match and wide arc of rotation and can extend to the whole homolateral face and oral cavity, except for a part of the forehead. However, while reconstructing the oral cavity with submental flap, compromise on neck nodal clearance has always stayed as a major concern.^[1]

Three years later, this flap was used in oral squamous cell carcinoma by Sterne *et al.*^[2] Over the last 2 decades, it has become popular as a reliable choice in the reconstruction of oral cavity defects.^[3] It is an axial pattern skin flap based on the submental artery, a consistent branch of facial artery. Although the anatomical details and functional outcomes have been studied extensively, the oncological safety of submental flap has still been questioned and sufficient data addressing this issue are lacking in the literature.

The aim of our study was to share our experience with the use of submental flap including associated complication and oncological outcomes in the follow-up period.

Surgical anatomy and technique

The submental artery is a constant vascular branch that arises

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from the facial artery. It courses forward and medially between the submandibular gland and the mylohyoid muscle, travels either deep (70%) or superficial (30%) to the anterior belly of the digastric muscle, and terminates behind the mandibular symphysis.^[4] Along its course, cutaneous perforators pierce the platysma and anterior belly of the digastric muscles to constitute the subdermal plexus forming extensive anastomoses with the contralateral artery. The submental vein drains into the facial vein, communicating with both the internal and external jugular veins.^[5,6]

The flap design depends on the size of the defect with the ellipse shape marked after pinch test based on skin laxity. The upper incision is marked at the level of the inferior border of the mandible from angle to angle while the lower incision is the limit of the pinch test allowing primary closure adequately [Figure 1]. The lower neck subplatysmal flap is raised first and up to the clavicle to allow adequate traction facilitating primary closure [Figure 2]. The upper cervical flap is raised afterward while carefully identifying and protecting the marginal mandibular nerve. The upper border of the gland is exposed to follow the facial and eventually submental vessels. The subplatysmal dissection is performed adjacent to the inferior border of the mandible anteriorly including the ipsilateral anterior belly of the digastric muscle. While raising the flap, platysma is sutured to the skin paddle to protect cutaneous perforators [Figure 3]. Next, contralateral side of the flap is raised up to the midline in the subplatysmal plane. The facial vessel above the origin of the submental vessel needs to be ligated when using proximally based flap. The submandibular gland is carefully dissected off the facial vessels while identifying and ligating the glandular branches.^[7] The facial vein has quite a variable course draining either directly into internal jugular vein or external jugular vein by communicating with the facial vein and anterior division of the retromandibular vein [Figure 4]. The flap must be temporarily sutured to the facial skin while performing neck dissection. Afterward, the flap is tunneled in between lateral border of mandible and skin for buccal mucosa defect and medial to the inferior border of the mandible for tongue defects [Figures 5-7].

MATERIALS AND METHODS

The study included prospective series of 27 patients retrieved from head-and-neck cancer database of Shaukat Khanum Memorial Cancer Hospital and Research Center, Lahore, Pakistan, which were reconstructed with submental flap after ablative tumor surgery from 2015 to 2017. Patients who were reconstructed with submental flap but not for oncological resection related defects were excluded from the study. Data were collected including demographics, gender, tumor subsite, clinical and pathological staging, nodal yield, complications, and disease status of the patients. The permission for the study was granted by the institutional review board of Shaukat Khanum Memorial Cancer Hospital and Research Center, Lahore, Pakistan.

RESULTS

The study includes 25 male and 2 female patients with age ranging from 21 to 73 years. All the patients were diagnosed a case of squamous cell carcinoma involving oral cavity subsites such as buccal mucosa (13), tongue (7), and lower alveolus (7). There were three patients with complete flap failure secondary to ischemia and one with flap dehiscence. One of them was previously irradiated, developed local buccal mucosa recurrence, and planned for salvage. Another patient had oral submucous fibrosis, and tunneling between lateral mandible and skin has possibly resulted in occlusion of the vascular pedicle. The patient with flap dehiscence has developed infection (*Pseudomonas aeruginosa*) in the postoperative period resulting in pus discharge and anterior flap dehiscence. None of the patients have developed local recurrence, but there were four regional recurrences and one distant metastasis. Only one patient with regional recurrence had pathological positive node with extracapsular spread. After a mean follow-up of 15 months, three patients have died, two with cardiopulmonary issues, and one with advanced disease. The marginal mandibular nerve was preserved in all cases. Hair growth has remained a problem in those patients who spared postoperative radiotherapy and were advised electrolysis [Table 1].

DISCUSSION

Last decade has seen emergence of submental flap as a reliable option in head-and-neck reconstruction.^[8] It provides a relatively thin, easy-to-harvest, and well-vascularized tissue which eliminates the need for a second-stage operation of flap division or tedious microsurgical techniques. It has been used after infection, trauma, or tumor extirpation for reconstruction of the mustache and beard area, nose, pharynx, palate, and middle and lower face.^[9] The flap harvesting technique has been variable in published literature. The inclusion of anterior belly of the digastric muscle in the flap has been controversial. Faltaous and Yetman and Magden *et al.* found that the submental artery runs beneath the anterior belly of digastric muscle in most of the cases. However, the superficial branch runs above the muscle. In our series, we have included the anterior belly of the digastric muscle. Certainly, muscle inclusion has resulted in improved blood supply, and in the absence of oncologic contraindications, this modification should be considered a part of standard harvesting technique. Furthermore, part of the mylohyoid was occasionally incorporated with the flap to protect the perforating vessels and enhance venous drainage, providing that this does not compromise the pedicle length. The potential risk of injury to the marginal mandibular nerve during submental flap harvesting ranges from 0% to 17%. Temporary marginal mandibular nerve palsy did not develop in this series.^[10-18]

Although a small flap, it has successfully covered the reconstruction plate secured in cases of segmental mandibulectomy with no single internal extrusion. The flap

Table 1: Clinicopathological characteristics

Age/sex	Subsite	Clinical stage (c)	Path stage (p)	Complication	LNP/LNR	RT	Recurrence	Status
55/male	Buccal mucosa	4 (cT1N0)	3 (pT2N0)	Flap necrosis	NA	RT	NA	Alive
63/male	Lower alveolus	4 (cT4N0)	4 (pT4N2)	Flap infection	6/63	RT	No	Alive
52/male	Buccal mucosa	1 (cT1N0)	2 (pT2N0)	None	0/34	RT	Regional	Alive
53/male	Tongue	2 (cT2N0)	4 (pT1N2)	None	0/41	RT	No	Alive
56/male	Tongue	1 (cT1N0)	2 (pT2N0)	None	2/21	RT	Regional	Alive
57/male	Buccal mucosa	1 (cT1N0)	1 (pT1N0)	None	0/38	NA	No	Alive
40/male	Lower alveolus	1 (cT1N0)	1 (pT1N0)	None	0/18	RT	No	Alive
21//male	Tongue	3 (cT3N1)	1 (pT1N0)	Flap necrosis (thrombosis)	0/28	NA	No	Alive
41/male	Tongue	1cT1N0)	2 (pT2N0)	None	0/43	RT	Distant	Alive
38/male	Buccal mucosa	3cT3N1)	2 (pT2N0)	None	0/31	RT	Regional	Alive
52/male	Lower alveolus	4cT4N0)	4 (pT4N0)	None	0/27	RT	No	Alive
60/female	Lower alveolus	4cT4N0)	4 (pT4N0)	None	0/36	RT	No	Alive
73/female	Lower alveolus	4cT4N0)	4 (pT4N0)	None	0/47	NA	No	Died
40/male	Buccal mucosa	2cT2N0)	1 (pT1N0)	Flap necrosis (thrombosis)	0/38	NA	No	Alive
57/male	Tongue	2cT2N0)	2 (pT2N0)	None	0/47	RT	Regional	Died
46/male	Buccal mucosa	3cT3N1)	3 (pT1N1)	None	1/48	RT	No	Alive
47/male	Buccal mucosa	4 (cT4N0)	4 (pT4N0)	None	0/53	RT	No	Alive
46/male	Buccal mucosa	4 (cT4N0)	4 (pT4N0)	None	0/66	RT	No	Alive
45/male	Buccal mucosa	2 (cT2N0)	3 (pT1N1)	None	1/50	RT	No	Alive
64/male	Buccal mucosa	3 (cT3N0)	3 (pT3N0)	None	0/25	RT	No	Died
40/male	Buccal mucosa	4 (cT4N1)	4 (pT4N0)	None	0/28	RT	No	Alive
70/male	Lower alveolus	4 (cT4N0)	4 (pT4N0)	None	0/57	RT	No	Alive
40/male	Tongue	1 (cT1N0)	1 (pT1N0)	None	0/54	NA	No	Alive
48/male	Lower alveolus	4 (cT4N0)	4 (pT4N0)	None	0/30	RT	No	Alive
62/male	Buccal mucosa	2 (cT2N0)	2 (pT2N0)	None	0/27	RT	No	Alive
63/male	Tongue	2 (cT2N0)	2 (pT2N0)	None	0/60	RT	No	Alive
48/male	Buccal mucosa	2 (cT2N0)	2 (pT2N0)	None	0/36	RT	No	Alive

c=Clinical; P=Pathological; LNP=Lymph node positive; LNR=Lymph node retrieved; RT=Radiotherapy; NA=Not applicable

was used successfully for reconstruction after composite intraoral resection of the upper or lower jaw in eight patients. As to our knowledge, this had never been mentioned in literature before.

Chow *et al.* reported partial loss of two out of ten flaps.^[19] Merten *et al.* reported loss of 1 flap in 11 nonirradiated patients. The authors mentioned that they avoided this flap if the neck had been previously irradiated.^[20] In our series, two complete and three partial flap losses were recorded. Most of the literature has

not assessed the effect of irradiation on flap viability. However, in the experience of Taghinia *et al.*, preoperative radiotherapy was the most consistent finding in those who suffered flap loss.^[21] In the current study, none of the two patients had flap compromise who received preoperative radiotherapy. Interestingly, postoperative radiation therapy has been thought to be a contributing factor resulting in complications of scar contractures requiring multiple procedures. Our experience is nothing different in this respect.



Figure 1: Flap design. Pinch test is recommended to define the width of the skin paddle

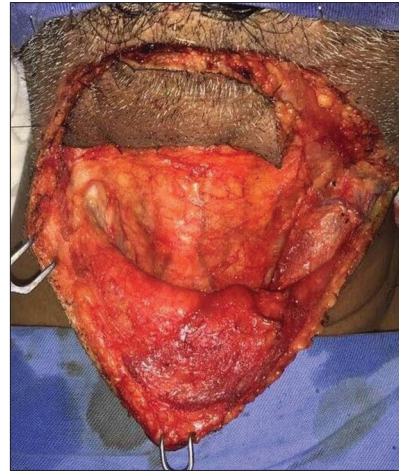


Figure 2: Raising lower subplatysmal flap up to clavicle



Figure 3: Skin paddle sutured to the underlying platysma

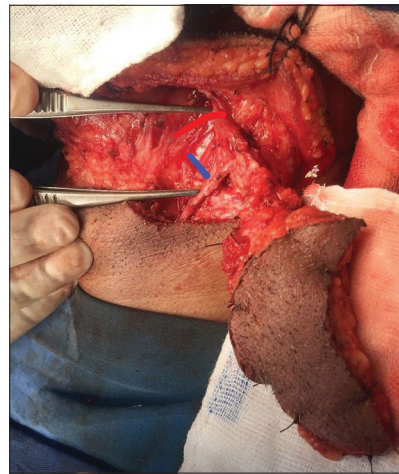


Figure 4: Dissecting facial vessels off the submandibular gland



Figure 5: Flap in-setting into the oral cavity



Figure 6: Submental flap for the oral tongue reconstruction

Pistre *et al.* reported only one case of temporary marginal mandibular nerve palsy in their series of 31 cases of submental flap reconstruction. Although the latter authors exposed

the nerve early in their series, they found that avoidance may be a better approach.^[22] Sterne *et al.* recommended the identification of the nerve and preserving it before raising the flap.^[2]

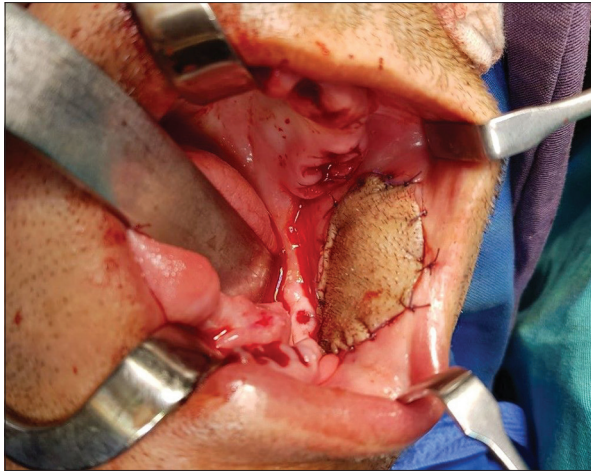


Figure 7: Submental flap for the buccal mucosa reconstruction

The concerning point of this flap in the previous studies was oncological safety and potential risk of occult disease transfer to the recipient site. However, the dissection plane is the same as that of skin flap elevation. Thus, if proper anatomical planes are followed, the potential risk of tumor spread can be reduced. Chow *et al.* addressed these oncologic concerns in 10 cases. Three cancer recurrences were noted which were more likely related to the aggressive nature of the tumors than to the oncologic violation by the flap.^[19] In our series, there were four cases with nodal involvement found intraoperatively by frozen sections, but no single recurrence has been observed at the recipient site. Other studies correlate well with our findings and favor the oncologic safety of this flap.^[23] Moreover, we have adopted the practice of lymph node dissection first before harvesting the flap. The surgeon should be prepared to experience any oncological surprise, such as finding positive lymph nodes at Level I, which could be either seen intraoperatively or proven by frozen sections. The surgeon must not hesitate to perform the contralateral neck dissection in such situation. If deemed necessary, the surgeon must abandon the flap and think of other reconstructive option. Despite its established safety, we believe that indiscriminate use of this flap in head-and-neck oncology should be discouraged at the cost of jeopardizing oncological safety. This flap must not be a consideration in advanced nodal disease in the neck (>N1).

CONCLUSION

Submental island flap has shown promising results due to its versatile use, wide arc of rotation, color match, and low donor site morbidity. Its use must not compromise the oncological safety of the procedure.

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Conflicts of interest

There are no conflicts of interest.

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