



Assessment of the Utility of Submental Flap in Reconstructing Soft Tissue Defects after Excision of Small Oral Cancers

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ABSTRACT:

Background: Post-operative oral defect is a common problem facing surgeons due to the scarcity of donor sites in the area. The submental flap or submental island pedicled flap (SIPF) offers an alternate approach in orofacial reconstruction, particularly in a setting where free-flap services are unavailable or comprises a big challenge for surgeons and patients. **Methods:** A retrospective cross-sectional study of patients with oral cavity cancers, who subjected to submental flap reconstruction. Both genders above 18 years were included. Patients with clinically positive neck nodes or who had preoperative radiotherapy were excluded. Hospital records were reviewed and data analyzed in order to assess the utility of submental flap in managing and reconstructing oral defect following excision of tumors at different subsites in a tertiary university hospital. **Results:** 26 patients were included 16 males and 10 females with age ranging from 38 to 67 years. Primary tumor sites were tongue (9), lower alveolar margin (7), buccal mucosa (6), and floor of mouth (4). All patients subjected to tumor excision and ipsilateral selective neck node dissection following flap creation. Total flap necrosis was evident in one patient, whereas partial flap dehiscence seen in two and infection in two other patients. Over follow up period with mean of 12 months there were 2 regional neck failures. **Conclusions** Submental flap is a reasonable and easy method to manage small oral cavity defect after resection of small tumors.

Keywords: Oral cancer, Submental flap, Oral reconstruction.

INTRODUCTION:

Approximately thirty percent of head and neck cancers are oral cavity cancers, making them the sixth most frequent malignancy globally. Middle-aged and older people are most typically affected by oral cancer [1]. In Egypt, the incidence rate of oral

cancer is ranging from 1.4 to 2 per 100.000 Capita [2]. Surgery has historically been the primary method of treating oral cavity cancer while individuals at a high risk of local or regional recurrence used to receive radiotherapy after surgery. Tumor excision comprises removal with a safety margin of at least 1-

1.5 cm. Nodal neck dissection is done concurrently for large tumor size, tumors that invade more than 4 mm, and clinically positive nodal disease [3]. Oral lesions that are surgically removed typically leave behind two- or three-dimension defects. The quality of life for patients with oral cancer is greatly affected by the method utilized in reconstructing these resultant defects [4]. To reconstruct oral defects following tumor excision, skin grafts, loco-regional flaps, and free flaps have all been employed. Although skin grafts have some constraints, they still can be helpful for superficial defects [5]. The drawbacks of pectoralis major myocutaneous flap and deltopectoral flap are that they are overly large and bulky, have a restricted reach, and may need to be divided and refashioned in a second operative session. Numerous local flaps, such the platysma flap, the sternomastoid muscle flap, and the nasolabial flap, have been employed; nevertheless, their ability to cover intraoral defects is either restricted or unreliable [6].

A fundamental change has occurred in the field of free flap and microvascular techniques in reconstruction of orofacial defects throughout the past thirty years. Nonetheless, different pedicled flaps persist to perform an essential role in high-volume, low-resource settings. Martin et al. was the first to describe the submental island flap in 1993 as a way to find a free flap substitute that matched in terms of shape, color, and texture. Its cutaneous dimensions can reach up to 7 cm × 18 cm, and its pedicle is long, consistent and reliable. It can be applied as an osteocutaneous flap or as a cutaneous musculofascial flap. With the exception of a small area of the forehead, submental flap can cover the whole ipsilateral face and mouth cavity and has a great color match and extended arc of rotation. However, compromise off regional nodal dissection has always been a key problem when reconstructing oral cavity defects using this flap [7]. Sterne *et al* employed this flap to treat oral defects after excision of squamous cell carcinoma three years later [8]. It has gained popularity as a reasonable option for reconstructing oral cavity defects during the past 20 years being an axial pattern skin flap based on the submental artery which is regular branch of the facial artery [9].

This study was conducted to share experience and effective use of submental island flap in reconstructing oral defect assessing its versatility and addressing associated complication and oncological outcomes in the follow-up period.

METHODS

This study was approved by the Research Ethics Committee at faculty of medicine in Suez Canal University under No: 5669. The need for signed informed consent was waived due to the retrospective nature of the study.

Study design and Patients:

This study was conducted as a cross-sectional retrospective analysis utilizing a comprehensive sample including all patients with oral cancers with clinically negative neck nodes who had surgery and Submental flap reconstruction from 2020 to 2023 at Suez Canal University Hospital.

Inclusion criteria: Both genders older than 18 years old were included with all oral cancer subsites comprising tongue, buccal, floor of mouth or alveolar subsites.

Exclusion criteria: Patients with clinical positive lymph nodes were excluded and also patients who had preoperative radiotherapy or previous neck surgery.

Study's Procedures:

Baseline data of the eligible patients was reviewed including demographics characteristics, examination findings, tumor site, staging, data of surgical procedure, nodal retrieval and complications.

Surgical procedure:

All patient included would have the primary tumor excised followed by flap design and neck node dissection.

The used surgical technique detailed in the operative file of patients was addressed and type of the flap either ipsilateral or contralateral was designated. The need for a reverse flow flap to achieve greater mobility was recorded if it is used in any patient. Also level of neck node dissection was recorded.

Technique:

Primary tumor was excised with safety margin and if segmental mandibulectomy was included in cases with alveolar involvement, plate fixation was done before starting with flap harvesting. The flap was designed by drawing an ellipse over the submental area after a test pinching the skin. The upper incision usually done below the edge of the mandible and may extend from one angle to the other and the lower incision is limited to the pinch extent according to skin laxity and the limit that does not jeopardize primary closure. The lower flap was raised at subplatysmal level caudally followed by elevation of the upper flap during which careful identification and protection of the marginal mandibular nerve was done. The upper border of the ipsilateral

submandibular gland usually exposed to locate the facial vessels and following them to submental vessels, then the facial vessel is ligated above the origin of the Submental vessel unless a reverse flow flap is intended they are ligated proximally. The ipsilateral anterior belly of the digastric muscle was incorporated while elevating the flap from upper incision downward in the sub-platysmal plane. Following that the contralateral side is elevated scarifying the submental vessels unless needed for contralateral based pedicel supply.

Lymph node dissection was carried out as planned then the flap tunneled in between lateral border of mandible and skin for buccal mucosa and alveolar defect or routed medial to the mandible for tongue or floor defects. Finally the flap was fixed to cover the defect ensuring being tension free and avoiding rotation over the pedicel and the donor site closed primarily. (Figure 1)

Study’s Outcomes:

The primary outcome of this study was to figure out how functional is the submental island flap in reconstructing small oral defect following cancer surgery in the form of ability to cover variable subsites and assessing rate of early complications (flap necrosis, dehiscence, infection). Also the study assessed oncological outcome in regards to postoperative recurrence incidents.

Statistical analysis:

Descriptive statistics employed to describe baseline characteristics of the study population and presented as frequencies and percentages (%) in qualitative data or mean values and standard deviations (SD) in quantitative data. Collected data were coded, entered, using Microsoft Excel software. Data were processed with Statistical Package for the Social

Sciences (SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.).

RESULTS:

This study included 16 male and 10 female patients with age range from 38 to 67. All patients diagnosed as having squamous cell carcinoma (SCC) of oral cavity subsites (table 1) that showed different grades and tumor stages. Only patients with a clinically negative neck nodes was considered to be enrolled after exclusion of cases with N stage more than N0. (Table 2)

Patients had surgical resection of the primary tumor that ranged from wide local excision to more aggressive resection (hemiglossectomy, marginal mandibulectomy, segmental mandibulectomy). Reconstruction with submental island flap was done in all patients with two patient had metal plate fixation for segmental mandibulectomy, 25 of which were ipsilateral and one was contralateral based flap (table 3).

In two patients a reverse flow flap was utilized, one of them showed later flap necrosis. Two patients suffered partial flap dehiscence and two others showed minimal infection where all of them treated conservatively by minimal debridement and follow up with good healing results.

None of our patients showed postoperative donor site problems with good healing results and none showed marginal mandibular nerve affection.

Most male patients suffered intra-oral hair growth at flap surface that treated temporarily by shaving or plucking and they were advised for laser ablation or electrolysis.

With a mean follow up of 12 months none of our patients showed local recurrence, but two of them showed regional neck nodal recurrence. (Table 4)

Table (1): Primary tumor subsites

Site	No.	Percent
Tongue	9	34.6
Alveolar margin	7	26.9
Buccal mucosa	6	23
Floor of mouth	4	15.4

Table (2): Tumor type and histopathology

Type	No. (%)
SCC	26 (100)
Other	0 (0)
Grade	

I	2 (7.6)	
II	16 (61.5)	
III	8 (30.8)	
Stage	Clinical	Pathological
T stage T1	6(23)	8(30.7)
T2	11(42)	10(38.4)
T3	7(26.9)	6(23)
T4	2(7.6)	2(7.6)
N stage N0	26(100)	19(73.1)
>N0	0 (0)	7(26.9)

Table (3): Extent of surgical procedure and type of flap reconstruction

	<i>No.</i>	<i>Percent</i>
Extent of resection		
WLE + SOHD	19	73
Hemiglossectomy + SOHD	2	7.6
WLE & marginal mandibulectomy + SOHD	3	11.5
WLE & segmental mandibulectomy + SOHD	2	7.6
Type of flap		
Ipsilateral orthotopic	23	88.4
Ipsilateral reverse flow	2	7.6
Contralateral orthotopic	1	3.8
Contralateral reverse flow	0	0

Table (4): complication following SIPF reconstruction

	No.	Percent
Total flap loss	1	3.8
Partial flap loss	2	7.6
Flap infection	2	7.6
Hair growth	11	42
Donor site wound problem	0	0
Local recurrence	0	0
Neck nodal recurrence	2	7.6



Fig 1a: Lateral tongue tumor



Fig 1b: Excision of Lateral tongue tumor



Fig 1c: Submental flap elevated showing its pedicle with feeding vessels



Fig 1d: Postoperative shape with flap inset

DISCUSSION:

Over the last 20 years submental island flap had been shown as a valuable tool in reconstructive surgery in head and neck defects offering reliable vascularization, minimal donor site morbidity and versatility in tissue coverage [4]

The submental flap is a versatile option for reconstructing oral defects post-cancer excision. It's based on the submental artery, providing well-vascularized tissue. Its thinness allows for intraoral lining reconstruction, and its proximity to the defect reduces the need for microvascular anastomosis. SIPF can be tailored to match the size and shape of the defect, offering flexibility in reconstruction. SIPF reconstruction usually performed as a single-stage procedure, reducing overall surgical morbidity and healthcare costs compared to multi-stage reconstructions [10].

Incorporating the anterior belly of the digastric muscle in the SIPF has been controversial issue [11, 12]. Faltaous & Yetman [11] and Magden et al [13] found that the main submental artery runs beneath the anterior belly of digastric muscle in most specimens. Indeed, flap survival has not been affected by omitting the muscle [9, 14].

Amin et al from NCI-Egypt concluded that including this muscle may have improved flap viability in their study, and in the absence of oncologic contraindications, this modification is to be considered. Also, they occasionally incorporated part of the mylohyoid muscle along with the flap in order to protect the perforating vessels and promote venous drainage, provided that this does not impact the length of the pedicle [6].

In our series, the anterior belly of digastric muscle was incorporated in all cases at the ipsilateral side of the feeding submental artery.

The risk of flap necrosis or loss is a significant consideration in submental flap reconstruction for oral defects following cancer excision. Several factors contribute to this risk, including compromised blood supply, wound healing issues, and patient-related factors. While the submental artery provides a reliable blood supply, vascular compromise can occur due to factors such as kinking or compression of the pedicle, thrombosis, or inadequate perfusion of the flap. Smoking is a well-established risk factor for flap necrosis and wound healing complications. Nicotine and other components of cigarette smoke can impair microvascular function and decrease tissue oxygenation, increasing the risk of flap necrosis. Also Patients with comorbidities such as diabetes, vascular disease, or immunosuppression may be at higher risk of flap necrosis or loss due to compromised tissue perfusion and impaired wound healing.

Pertrand et al, analyzed complications associated with submental flap harvest across multiple studies. Reported rates of flap necrosis ranged from 0% to 12%, with most studies reporting rates below 5%. Factors associated with increased risk of complications included smoking, previous neck surgery, neck irradiation and older age [15].

Thomas et al., reported a flap necrosis rate of 6.98% with total loss in only 1.74% in patients undergoing submental flap reconstruction for intraoral defects. The authors emphasized the importance of meticulous surgical technique and patient selection

in minimizing complications [16]. In our series only one patient (3%) had flap necrosis due to vascular compromise while being a reverse flow flap. While two other flaps (5%) showed partial dehiscence one of them was ipsilateral based flap and the other was contralateral submental artery based flap.

Marginal mandibular nerve injury is a recognized complication that can occur during submental flap reconstruction for oral defects following cancer excision due to its proximity to the surgical site and the dissection required for flap harvest and inset. It has been reported in literature in the range of 0 to 17%. Pistre et al encountered one patient suffering of temporary nerve palsy out of 31 cases in their series. Although exposing the nerve early in their series, they suggest that avoidance may be a better approach [17]. Others report similar results and highlight the risk of nerve injury if dissection is not performed carefully [18, 19].

In our series no nerve injury was encountered. We assume that surgeons must exercise meticulous dissection techniques to identify and preserve the marginal mandibular nerve during submental flap harvest. Gentle handling and avoidance of excessive traction are essential to minimize the risk of nerve injury. In cases of transient nerve injury, the majority of patients experience spontaneous recovery over time. However, in cases of permanent nerve injury, rehabilitative measures such as physical therapy, speech therapy, and cosmetic interventions may be necessary to address functional and aesthetic concerns.

Harvesting the submental flap typically results in minimal scarring and functional impairment at the donor site, as the incision can be well hidden within the submental crease especially with skin redundancy with older patients. Our results in regards to the scar quality and wound healing at donor site compare well with those of previous reports.

Neck nodal recurrence following neck node dissection in patients who have undergone submental flap reconstruction for oral cancers is a significant concern, as it can impact patient prognosis and treatment outcomes. Howard et al., 2014 [20] and Pradhan et al., 2019 [21] and others [17, 19] in their studies assessed oncologic outcomes, including nodal recurrence, in oral cavity cancer patients undergoing submental island flap reconstruction and provided valuable data on oncologic safety and recurrence rates associated with this reconstruction technique. These studies collectively suggest that while nodal recurrence is a concern following neck

dissection and reconstruction in oral cancer patients, the use of the submental flap for reconstruction appears to be associated with favorable oncologic outcomes, including low rates of nodal recurrence.

In this series, which was limited to patients with preoperative clinically negative nodes, there are only 2 patients had regional nodal recurrence on follow up that required later comprehensive nodal dissection and this is comparable to most similar previous studies. However, larger prospective studies specifically focusing on nodal recurrence in patients undergoing submental flap reconstruction would provide further insights into this topic.

CONCLUSIONS:

In conclusion, the submental island pedicled flap is a valuable tool in reconstructive surgery, offering reliable vascularization, minimal donor site morbidity, and versatility in tissue coverage. While it has certain limitations and potential complications, careful patient selection, surgical planning, and postoperative management through multidisciplinary approach can help maximize its benefits and ensure successful outcomes in head and neck reconstruction.

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Ethics approval and consent to participate

Approval of the research ethics committee was obtained from Faculty of medicine Suez Canal University under No. 5669.

All procedures and data management ran in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans [22].

Conflicts of Interest

The authors report no conflicts of interest.

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