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British Journal of Oral and Maxillofacial Surgery 57 (2019) 1102–1106

BRITISH Journal of Oral and Maxillofacial Surgery

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Submental island flap for oropharyngeal reconstruction: UK experience of 25 cases

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Accepted 1 October 2019
Available online 8 November 2019

Abstract

Since the first description of the submental island flap 24 years ago, advances in techniques have expanded the indications for its use and improved its characteristics to make it a favourable reconstructive option for orofacial oncological defects. We describe our experience (particularly perioperatively) of its use, the complications, and the precautions adopted. We retrospectively reviewed the cases of 25 patients and focused on the operating time, use of tracheostomy, duration of postoperative inpatient stay, oropharyngeal function, and associated morbidities. Eighteen patients had defects of the tongue. Other defects were retromolar (n = 2), buccal (n = 1), mandibular (n = 2), and maxillary (n = 2). The mean (range) operating time was 250 (152-370) minutes and the mean (range) postoperative stay was 11 (4-16) days. Only four patients required a tracheostomy, and four required postoperative monitoring in the intensive care unit (ICU). The complications were partial flap loss (n = 6), sialocele (n = 1), and seroma (n = 1). The flap has shown its merit as an option for oral reconstruction because of its reliability, versatility, and relative ease of application. To our knowledge, our case series is the largest in the United Kingdom, and we hope that in future, this humble flap will be a standard reconstructive option for small to medium oral resection defects.

Keywords: Oral cancer; Reconstruction; Submental island flap

Introduction

The submental island flap was first introduced as an axial pattern flap by Martin et al[1] in 1993. It has since been modified, and is now gaining acceptance for reconstruction of the oral cavity. Free vascularised tissue transfer is currently the standard of choice for this, but the submental island flap, with its unique features, is still a worthwhile choice for the oral cavity and oropharynx. These features include ease of harvesting, reductions in operating time and donor site morbidity, primary closure of the donor site, and no requirement for microvascular surgery.[2]

The purpose of this paper was to present a series of 25 patients and our experience with this flap. We discuss the anatomy, surgical technique, and particularly, the complications and the precautions adopted in its use.

Methods

A total of 25 patients (17 women and 8 men) with squamous cell carcinoma (SCC) of the oral cavity were diagnosed and treated at the oral and maxillofacial department of the Mid-

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https://doi.org/10.1016/j.bjoms.2019.10.002

Essex Hospital Trust. They were discussed at our local head and neck multidisciplinary team meeting, with appropriate staging and planning of treatment according to the American Joint Committee on Cancer (AJCC) 7th edition TNM classification. They subsequently had complete resection with margins of about 1 cm, and ipsilateral neck dissection of levels I-IV at least. Intraoral defects were reconstructed with musculocutaneous submental island flaps that incorporated the anterior belly of the digastric muscle.

This retrospective review focuses on operating time, use of tracheostomy, postoperative inpatient stay, oropharyngeal function, and associated morbidities. At the time of the review, the follow-up period ranged from 12 - 18 months. All patients who had small to medium intraoral lesions, and no previous irradiation or operations to the head and neck, were included.

Anatomy

The submental island flap is based on the submental artery, which has branches to the submandibular gland and the mylohyoid and digastric muscles, and the platysma and cutaneous perforators. These perforators pierce the platysma and anterior belly of the digastric muscle to form a subdermal plexus, which anastomoses extensively with the contralateral branches.[1,3] The artery is a consistent branch of the facial artery that appears approximately 5 - 6.5 cm along its course as it exits the submandibular gland.[3] Its calibre can vary, ranging between 1 and 3 mm in diameter,[3] and it runs forward and medially between the submandibular gland and mylohyoid muscle.[1] As it courses further distally it passes either deep (70%) or superficial (30%) to the anterior belly of the digastric (sometimes through the muscle),[4] and terminates behind the mandibular symphysis. The submental vein generally drains into the facial vein, but drainage sites can vary - for example, the anterior jugular and external jugular through the retromandibular vein. These vessels enable reliable contralateral perfusion and allow for a large flap to be raised, typically from angle to angle of the mandible.

Surgical technique

Since its first description, many authors have modified the technique to provide a longer pedicle and skin paddle. We describe the one we have adopted because it is appropriate and dependable if a neck dissection is required at the same time.

The patient is placed in the supine position with the head extended slightly. The surface mark to locate the submental artery is at a point about 5.5 cm anterior to the angle of the mandible and 7 mm inferior to the mandibular border.[5] Its termination is a point about 8 mm below the mandibular border and 6 mm from the midline.[5] The outline of the flap will generally follow the shape of the defect created (usually elliptical), and will be about 6 × 4 cm in size, although the vertical dimensions should not exceed 5 cm to prevent cosmetic and functional problems.[2] From the lower incision line a modified apron neck incision is taken from the midline to enable access to the neck and adequate aesthetic closure of the wound. The upper limit of the flap is at least 1 cm behind the mandibular arch to hide as much of the scar as possible and to prevent eversion of the inferior lip.[6] The lower limit is decided after a pinch test of the submental skin between two fingers to find out if there is enough skin to allow for primary closure of the donor site.[2,7]

To raise the flap an incision is made along the margins of the skin paddle down to the platysma muscle. Care should be taken to protect the perforators of the superficial submental artery that are close to the overlying platysma.[2] The apron incision is then completed and a subplatysmal flap raised with identification and preservation of the marginal mandibular nerve. The pedicle is identified proximally, as the facial vessels are easily identified. The submental artery will usually be seen with gentle downward retraction of the submandibular gland and, in our experience, the facial node often lies superficial to it. The submental vessels are then traced distally towards the lateral border of the anterior belly of the digastric muscle.[2]

This initial anterograde approach ensures location of the submental artery and identification of the "septocutaneous perforators" that arise proximal to the anterior belly of the digastric muscle. If these perforators are present, a fasciocutaneous flap can be raised.[2] If absent, retrograde dissection that starts from the contralateral side of the flap will identify a "musculocutaneous" perforator, which will be protected if the anterior belly of the digastric is incorporated in the flap.[2] Occasionally a strip of mylohyoid muscle can be taken to ensure the safety of the pedicle that runs on the undersurface of the anterior belly of the digastric muscle.[8,9] The flap with the pedicle is then released in a retrograde approach to the facial vessels. To improve oncological safety, we suggest that level 1A should be dissected meticulously off the flap (Fig. 1) to reduce the possibility of transferring nodal tissue to the recipient site. After complete mobilisation, a generous tunnel is created to route it into the oral cavity.

Results

Between April and November 2017 we used orthograde submental island flaps for primary reconstruction of oncological defects of the oral cavity in 25 patients (17 women and 8 men) (Table 1). All patients had resection, neck dissection, and immediate reconstruction. Most of the flaps were about 5 × 3 cm in size, but this was adjusted if they were larger than the defect. Eighteen patients had defects in the tongue. The other defects were retromolar (n = 2), buccal (n = 1), mandibular (n = 2), and maxillary (n = 2). The mean (range) age of the patients was 70 (43 - 94) years.

All patients had a successful outcome and no flaps failed completely. Six who had a partial loss had local debridement of superficial skin necrosis, which gradually recovered. Two

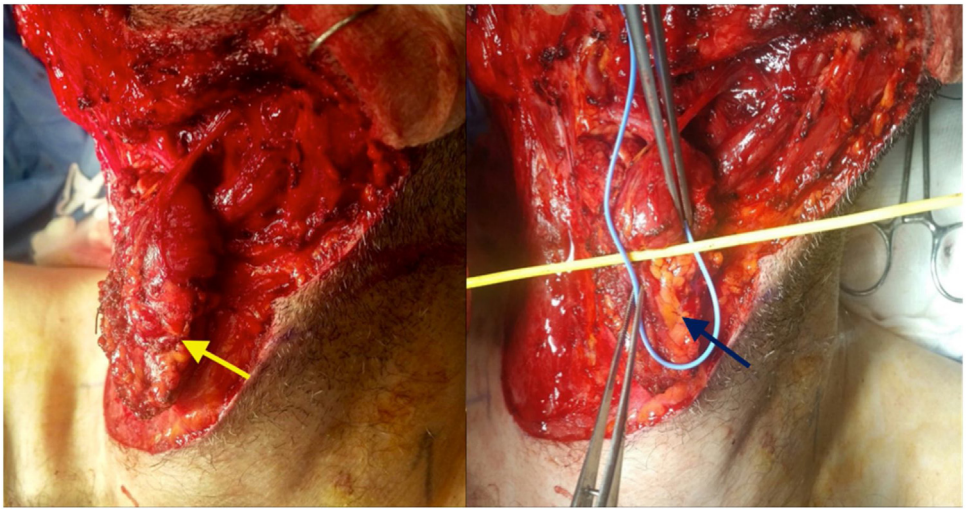

Fig. 1. Images showing level1A attached to flap (yellow arrow), which was meticulously removed (blue arrow) to ensure oncological safety.

Table 1
Summary of 25 patients who had reconstruction with submental island flaps between April and November 2017.

Case No.	Sex/age (years)	Defect	TNM 7th edition	Operating time (minutes)	Duration of stay (days)	Complications
1	M/53	Tongue	T2N0M0	160	8	Dehiscence
2	F/66	Mandible	T4N0M0	280	11	Partial loss
3	F/62	Retromolar	T2N0M0	218	7	None
4	M/68	Tongue	T2N0M0	310	16	Partial loss
5	F/73	Tongue	T2N0M0	181	12	Seroma
6	F/68	Tongue	T1N0M0	370	16	None
7	M/75	Tongue	T2N0M0	250	11	None
8	F/73	Tongue	T1N0M0	330	11	None
9	M/49	Tongue	T1N0M0	220	8	None
10	F/91	Mandible	T4aN0M0	285	16	Dehiscence
11	F/77	Tongue	T1N1 M0	180	12	None
12	F/73	Tongue	T2N0M0	222	12	None
13	F/79	Retromolar	T2N0M0	259	6	None
14	F/73	Tongue	T2N0M0	152	11	Partial loss
15	F/70	Tongue	T2N0M0	259	14	None
16	F/85	Maxilla	T1N0M0	219	5	Sialocele
17	M/43	Tongue	T1N0M0	205	7	None
18	M/74	Retromolar	T1N0M0	310	4	None
19	F/58	Tongue	T1N0M0	300	16	None
20	F/94	Tongue	T1N0M0	200	16	Partial loss
21	F/60	Tongue	T1N0M0	300	7	None
22	F/76	Tongue	T1N0M0	285	13	Partial loss
23	M/84	Tongue	T1N0M0	280	7	None
24	M/61	Tongue	T1N0M0	310	7	Partial loss
25	F/81	Maxilla	T3N0M0	255	7	Recurrence

had venous congestion, which spontaneously resolved, and one was returned to theatre to assess the vitality of the flap. Two patients with defects in the tongue had minimal dehiscence anteriorly and were treated with primary closure. One patient developed a seroma of the neck and one a sialocele; both were managed conservatively with complete resolution. Two patients developed regional neck recurrence after radiotherapy, which suggested aggressive disease. One had recurrence at the primary site, which was probably caused by resection with close margins and delayed radiotherapy.

The mean (range) operating time for resection, neck dissection, and reconstruction, was 250 (152-370) minutes. The mean (range) postoperative duration of stay was 11 (4 -16) days. This depended on postoperative stays in the intensive care unit (ICU) and whether patients had a tracheostomy. Only four patients required a short stay in the ICU, and four a tracheostomy.

Discussion

Surgical treatment for cancer of the oral cavity leaves patients with varying degrees of functional deficit and associated morbidity. The primary goals of surgery are to cure, and to minimise donor-site morbidity and deficits in oropharyngeal function. Appropriate reconstruction will restore some oral function and allow healing of the resection site.

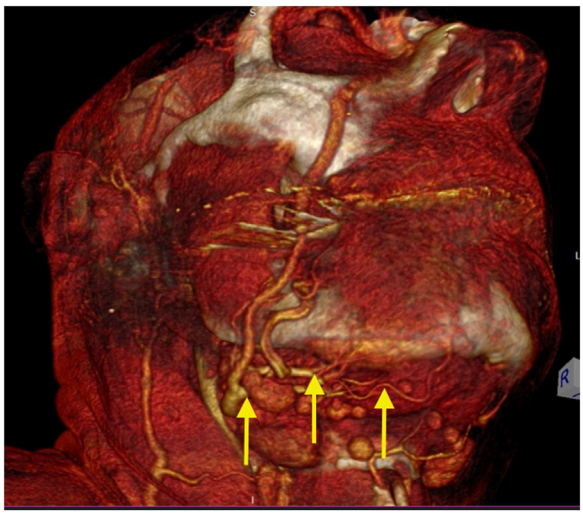

Fig. 2. Computed tomographic angiogram showing right submental artery branching off the facial artery as it exits the submandibular gland and courses anteriorly (yellow arrows).

Currently, reconstruction often involves free-tissue transfer with microvascular anastomosis. This, however, may not always be appropriate – for example, in older patients with coexisting conditions and those whose defects are small, also in those who may need future free tissue transfer because of an increased risk of recurrence or aggressive disease,[10,11] or those who do not choose it. We acknowledge that not all T1 and T2 defects require reconstruction, and such decisions are made with the involvement of the wider multidisciplinary team, particularly our speech and language therapists, and the patient. With modern-day imaging we can usually see the submental artery, which helps us assess the flaps' suitability (Fig. 2).

The submental island flap has undoubtedly had a role in the armamentarium of reconstruction of orofacial defects since it was first described more than two decades ago,[1] and over the last decade modifications in its design have expanded its indications and advantages.[12–15] Its thinness, pliability, and versatility (shared by the radial forearm free flap (RFFF)) make it ideal for soft-tissue reconstruction of the head and neck (Fig. 3).[9] The main advantages are its reliability and the fact that it enables good speech and swallowing postoperatively, has low donor-site morbidity, and reduces the operating time and duration of hospital stay.[11] It also does not interfere with the need for a free flap if this is required later.

Compared with free-flap reconstruction, the submental island flap has many advantages. Paydarfar and Patel[16] conducted a multi-institutional retrospective review to compare intraoperative, postoperative, and functional results after reconstruction of the tongue and floor of the mouth with 27 submental island flaps and 33 RFFF. They concluded that patients who had submental island flaps had significantly shorter operating times (mean 8 hours 44 minutes compared with 13 hours 00 minutes, respectively, $p < 0.001$) and hospital stays (mean 10.6 days compared with 14.0 days, respectively, $p < 0.008$) than those who had RFFF. Our experience has been similar with a mean operating time of 250 minutes and a reduced mean duration of stay (11 days) compared with patients who had free-flap reconstruction.

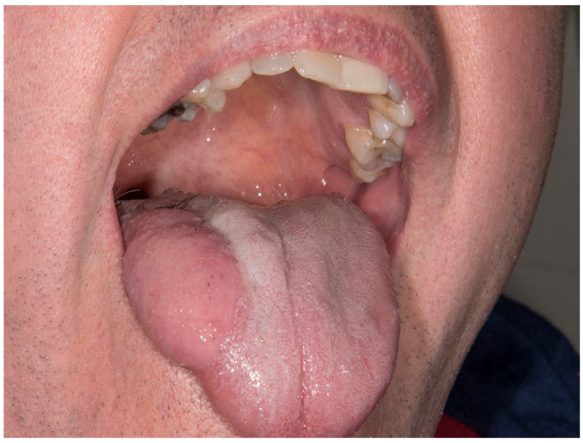

Fig. 3. The submental island flap is ideal for its thinness, pliability, versatility in design, and restoration of function. Note: projection of tongue unaffected by flap.

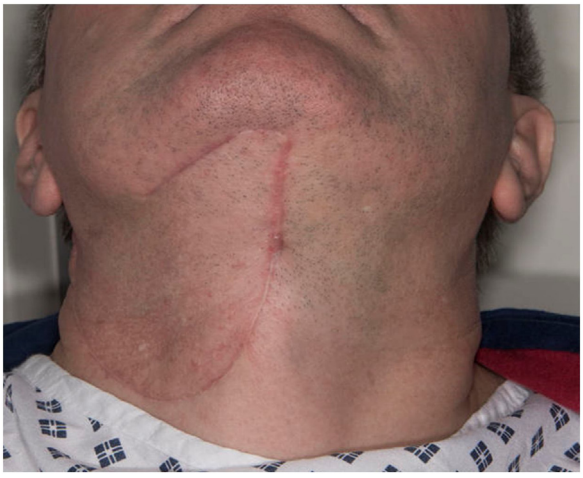

Fig. 4. Incorporation of the submental island flap incision with the neck incision can achieve a good aesthetic outcome.

In a comparative study of the submental island and RFFF, Aslam-Pervez et al[17] also concluded that the submental island flap was a viable option, and that it avoided a second donor site and issues that arise from the forearm such as loss of skin grafts, neurosensory deficits of the hand, and aesthetic concerns.[17] Incorporation of the flap's incision with the neck incision can allow for primary closure, a better aesthetic outcome, and the added benefit of a "neck lift" for elderly patients (Fig. 4).[6,7,17]

With increasing financial burdens on the National Health Service and rising healthcare costs, hospitals need to be economically responsible and maintain high standards of care for patients. Longer operations and hospital stays, as well as the need for a tracheostomy and stay in the ICU, will inevitably lead to higher costs for extensive oncological treatment of the head and neck. In a comparison between patients who had

submental island flaps and those who had RFFF, Reuter[18] found a reduced cost of care and better quality of life in those who had submental island flaps. In a Canadian study, Forner et al[19] also concluded that the combined overall cost of operations, stay in the ICU, and nursing requirements, was lower for patients who had submental island flaps than those who had RFFF despite no significant difference in hospital stay (12 days compared with 15 days, respectively). Only four patients in our series required a short stay in the ICU whereas it is necessary in all those who have free flaps.

There has been concern over the transfer of metastatic nodal tissue from level 1A and 1B to the recipient site, as harvest of the submental island flap includes at least half of level 1A. The incidence of level 1A nodal metastasis is low,[20] but the possibility must be considered, as some authors are reluctant to use the flap unless there is clinical and radiological evidence of a N0 neck.[6,15] However, meticulous harvesting to exclude nodal tissue in appropriately selected patients has been shown to prevent any risk of local recurrence.[11] Amin et al[15] completed the neck dissection before harvesting the flap and reported that when anatomical planes are respected, the chances of tumour spread are minimised. Huang et al[2] suggested that the harvesting of perforator flaps and meticulous separation of the perforators from the surrounding fatty tissues allow for adequate removal of the level 1A nodal compartment. In a recent series of 45 patients with SCC of the oral cavity, Kramer et al[21] reported no increased risk of local or regional recurrence with the use of the flap. In our series there was only one instance of local recurrence that probably resulted from resection with close margins and delayed radiotherapy. The two neck failures occurred in the retropharyngeal region and anterior level 3 regions after postoperative radiotherapy, which could imply aggressive disease.

There are some limitations to this case series that may have an impact on outcomes. A sample size of 25 patients, which although small, is (to our knowledge) still the largest group of patients in the UK to be assessed after reconstruction with submental island flaps. Also, the follow-up period of 12 - 18 months was too short to comment on recurrence and survival, but was adequate for the assessment of operating time, inpatient stay, oropharyngeal function, and associated morbidities.

Conflict of interest

We have no conflicts of interests.

Ethics statement/confirmation of patients' permission

This case series was a service evaluation project that involved the retrospective review of case files. The medical illustration team obtained consent from the patients to use the medical images.

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