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RECONSTRUCTION WITH SUBMENTAL ISLAND FLAP IN ORAL CAVITY TUMORS: ADVANTAGES AND DISADVANTAGES IN THE CURRENT APPROACH

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Abstract

Aim: Reconstruction of defects emerged after resection of the oral cavity cancers, whose first-line treatment is surgical, is a complex process. The gold standard approach for this is the microvascular free flap. However, the use of pedicle flap remains a valuable option in elderly patients who are not suitable for long-term surgery, have poor nutrition, and have additional comorbid diseases.

Discussion: Submental island flap, is widely used in oral cavity reconstructions. There was no significant difference between free flaps and submental island flaps for swallowing and speech functions, general and local recurrence rates. In addition, submental island flap has important advantages such as shorter operation time, shorter hospital stays, and fewer complications in the donor area.

Conclusion: Submental island flap is a suitable option for the reconstruction of oral cavity defects without compromising oncologic results after tumor resection, especially in patients who are poor candidates for microvascular surgery.

Keywords: *Oral cavity tumor, submental island flap, reconstruction*

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Introduction

Head and neck squamous cell carcinomas are the sixth most common cancer worldwide. Of these, the oral cavity is the most frequently observed region. They are generally observed in middle-aged and elderly individuals[1,2]. These tumors can be seen on the tongue, floor of the mouth, buccal mucosa, inner lip, gingiva, retromolar trigone and hard palate. The most frequently affected subregion is tongue[3]. Reconstruction of oral cavity soft tissue defects is a complex and sophisticated process. In the current approach, gold standard is the microvascular free flap. However, the utilize of free flaps brings with its high cost, need for surgical expertise, and longer hospital stay. Therefore, free flaps are not always an ideal option. Local-regional flaps offer a good alternative option in cases where reconstruction cannot be performed with free flap tissue transfer. In addition, locoregional flaps are a very good option for a salvage procedure due to necrosis in a previously made free flap[4]. Because of these advantages, locoregional flaps must be well-adopted by all surgeons dealing with oral cavity tumors.
Submental island flap (SIF), one of the locoregional flaps, was first described by Martin et al. for the reconstruction of facial defects due to its color, shape and tissue compatibility[5]. Subsequently, Sterne et al. described the utilize of SIF for the reconstruction of the defect emerged after oral cavity tumor resection[6]. Besides the publications claiming that reconstruction of the oral cavity with SIF is a safe oncological option, there also have been some reports to the contrary, due to the potentially compromised neck nodal clearance[7].

Anatomy

The submental island flap is a fasciocutaneous flap that includes a rhomboid skin, subcutaneous tissue, and platysma area located under the lower border of the mandible. The submental artery can supply blood to a skin area as large as 10-16 cm, reaching from one angle of the mandible to the contralateral angle[8]. Although this horizontal dimension includes an area supplied by the bilateral submental artery, the entire flap can be perfused from one side thanks to the anastomoses of the arteries. The anterior-posterior diameter of the flap is determined by leaving enough skin for primary closure, depending on skin flexibility, and usually 6-8 cm of skin can be harvested. The flap is supplied with blood by the submental artery, which is a branch of the facial artery. Venous drainage is from the submental vein, which drains into the facial vein. The submental artery branches from the facial artery in front of the submandibular gland. The submental artery runs anteriorly, between the submandibular gland and the lower edge of the mandible, and then along the lower surface of the mylohyoid muscle[9]. The artery may rarely follow an intraglandular course. While the submental artery runs deep in the anterior belly of the digastric muscle in 70% to 80% of patients, it more rarely courses superficial to this muscle. The submental artery gives off branches to the lower lip, mylohyoid muscle, digastric muscle, mandibular periosteum, platysma, and submental skin. There are perforator vessels connecting the submental artery to the subdermal plexus, and their location and number can be variable. Therefore, it is necessary to include this large area in the flap to ensure that the perforators remain on the harvested flap. For this, the ipsilateral anterior belly of the digastric muscle as well as the part of the mylohyoid muscle that corresponds into this region are included in the flap[10]. This technique does not cause any significant functional deficit. It should be paid attention to the marginal mandibular nerve and the nerve of the mylohyoid muscle, which may be damaged during flap harvesting.

Surgical Technique

The patient is in the supine position with the head slightly extended. To locate the submental artery, it is marked the skin approx-

imately 5.5 cm in front of the angle of the mandible and 7 mm below the lower border of the mandible. The terminal portion of the artery is marked approximately 8 mm below the lower edge of the mandible and 6 mm distance from the midline[6]. The size of the skin island is usually determined by the size of the defect, but will be a maximum of 12 × 6 cm, moreover, it is recommended that the vertical size should not exceed 5 cm to avoid cosmetic and functional problems[11]. The upper border of the skin island should be at least 1 cm inferior to the mandibular arch to hide the scar as much as possible and prevent eversion of the lower lip[12]. To determine the lower border of the skin island, pinch testing is performed to see whether there is enough skin to allow primary closure of the donor area or not[13]. After the borders of the donor area are determined, an incision is made and continued until the platysma. The incision is extended towards the flap pedicle. The marginal mandibular nerve is identified and preserved. The pedicle is determined proximally as the facial artery and vein are easily identifiable. The submental artery will usually be seen by gently pulling down on the submandibular gland. After the vascular structures are found, they are followed towards the lateral border of the anterior belly of the digastric muscle and released from the surrounding tissues (Figure 1). This anterograde approach allows the identification of the location of the submental artery and of "septocutaneous perforators" originating proximal to the anterior belly of the digastric muscle.

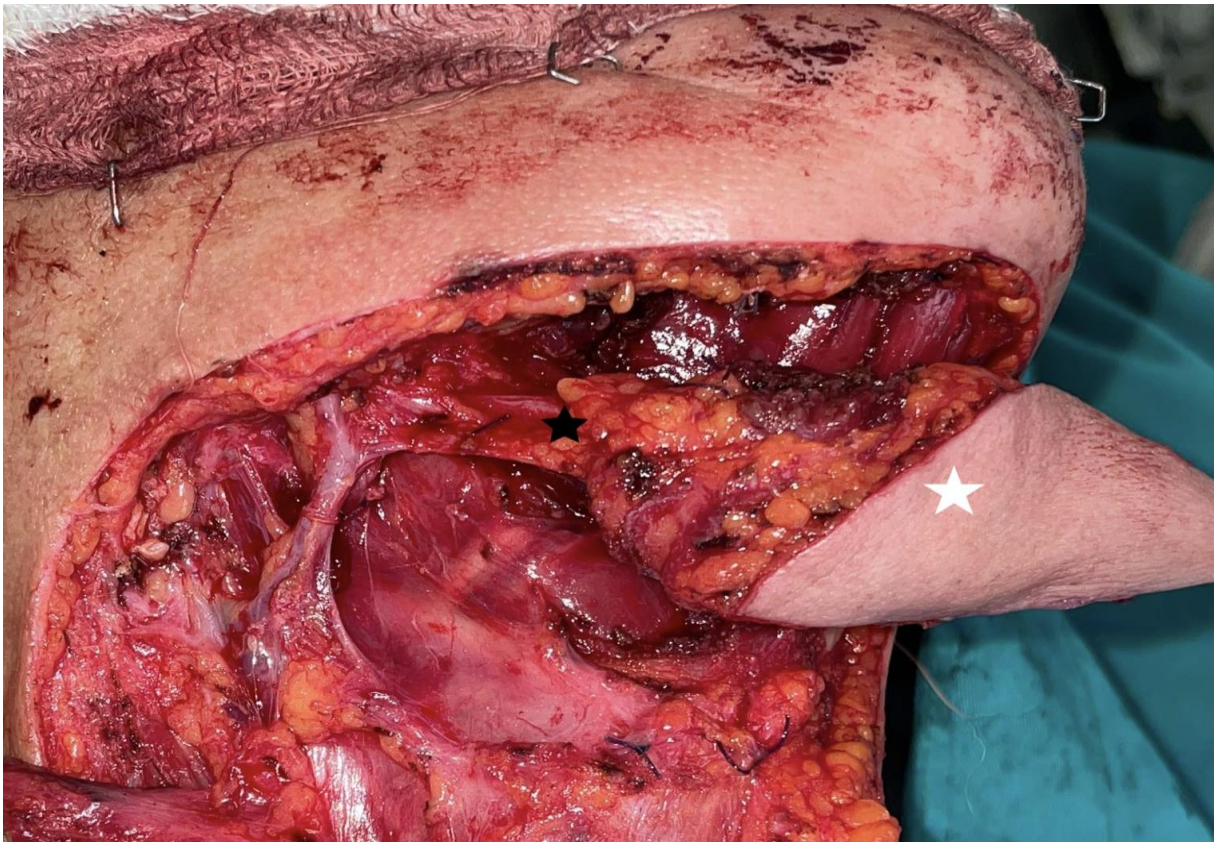

Figure 1. Submental island flap with vascular pedicle on the right side (Black star: Vascular pedicle, white star: Submental skin island)

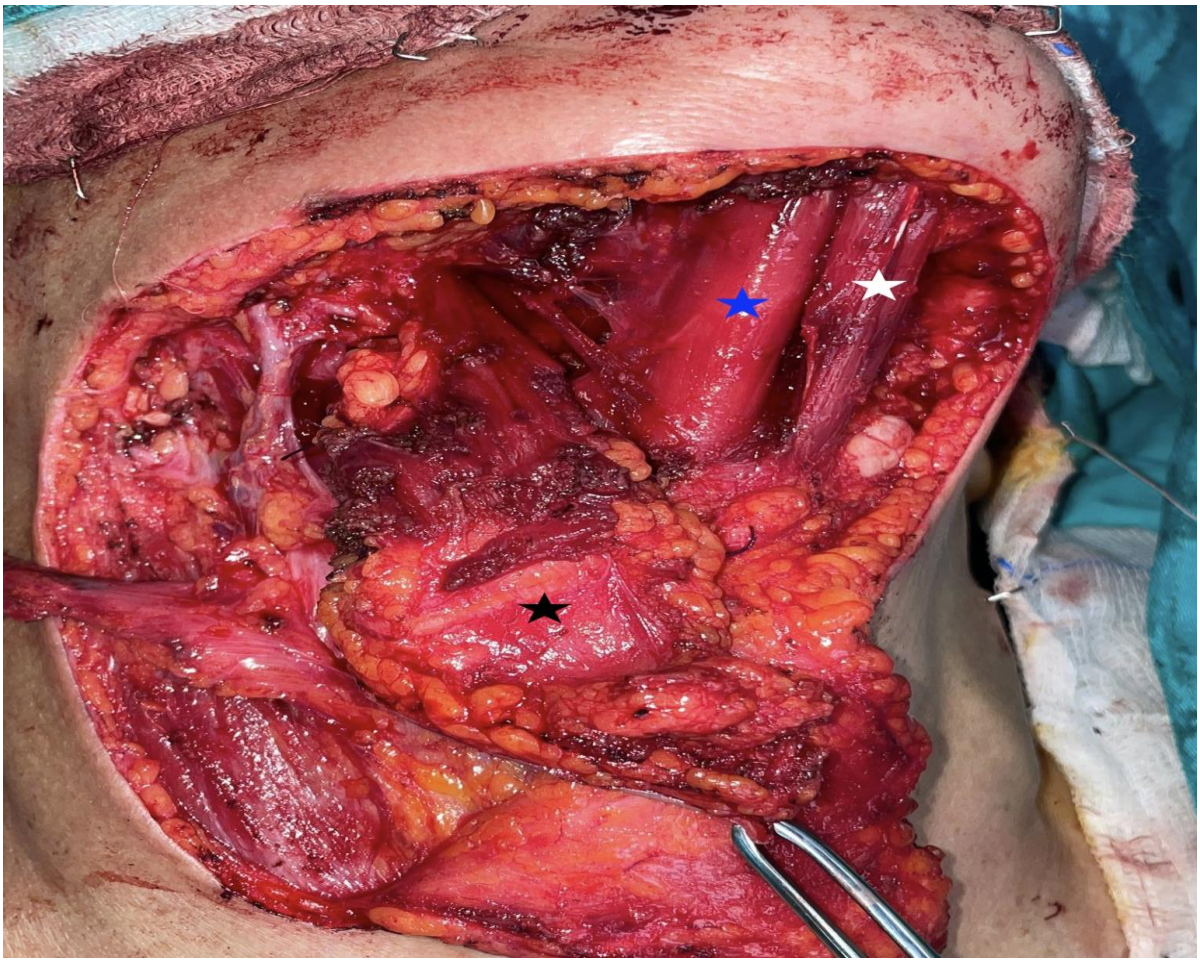

Figure 2. Ventral side of flap and postharvest donor area view (Black star: Right digastric muscle anterior belly and flap with mylohyoid muscle included, white star: Left digastric muscle, blue star: Right geniohyoid muscle)

If these perforators are present, the fasciocutaneous flap can be harvested[11]. If these perforators are not identified, the digastric muscle anterior belly is combined with the flap, and the musculocutaneous flap can be harvested with the perforators to be preserved[11]. Occasionally, a strip of mylohyoid muscle may also be included in the flap to protect the pedicle[10,14] (Figure 2). To increase oncological safety, level I needs to be carefully dissected from the flap to reduce the possibility of lymphatic tissue transfer to the defect site. After full mobilization, a wide tunnel is created to guide the flap into the oral cavity. The defective area in the oral cavity is reconstructed by passing the flap through this tunnel (Figure 3).

Indications and contraindications

Submental island flap has many uses in head and neck surgery, especially in oral cavity tumors. The flap is utilized in oral cavity tumor surgery to reconstruct tongue and/or floor of the mouth defects, buccal mucosal defects, palate defects, and large lip defects. In addition, it can be utilized in the repair of soft tissue defects in the lower, middle and upper parts of the face, in the repair of skin defects in the beard area, in nasal reconstruction, in the repair or reconstruction of the cervical esophagus, in the repair of hemilaryngectomy defects, in the reconstruction of the neopharynx after a total laryngectomy, and in the repair of pharyngocutaneous fistulas.

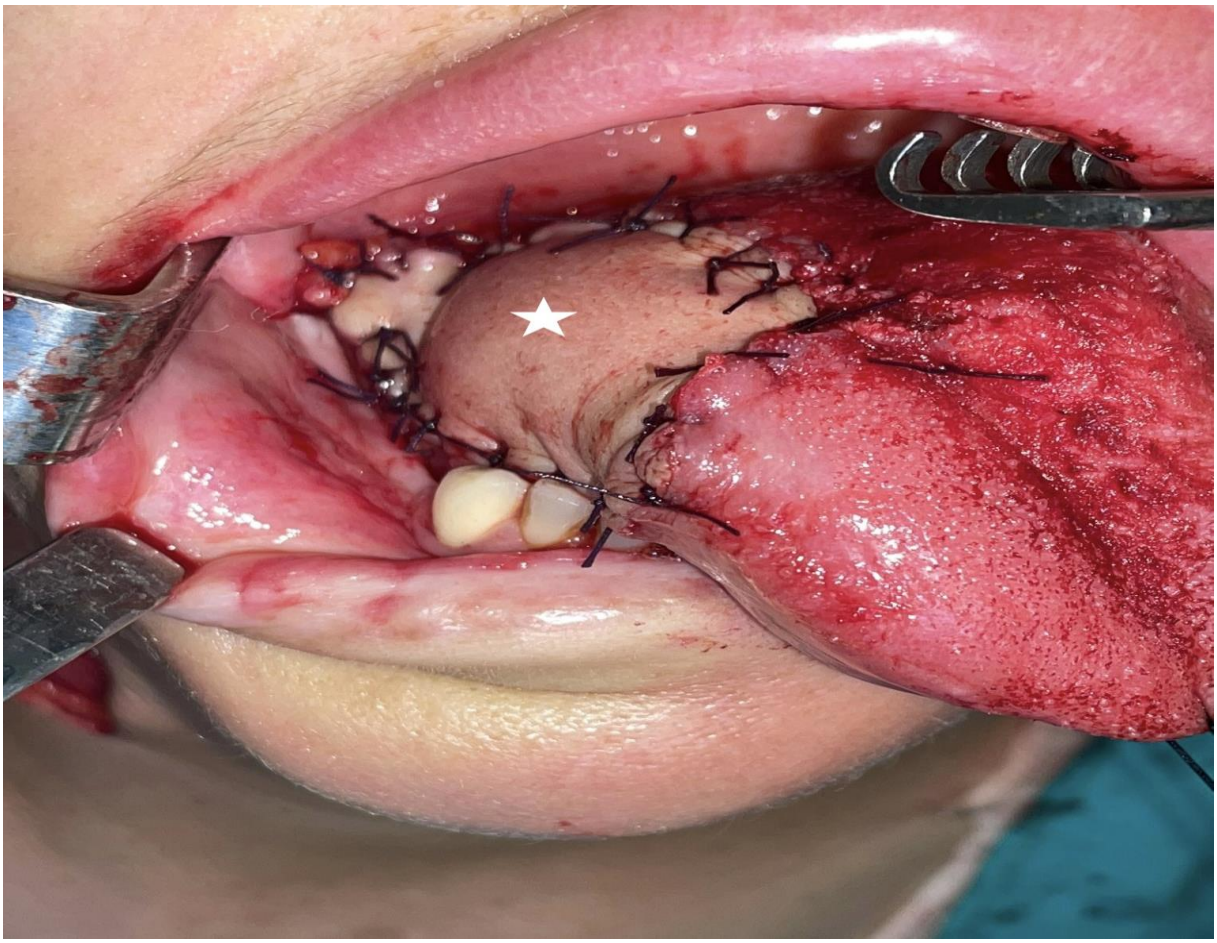

Figure 3: Submental island flap placed on the right-sided tongue defect (White star: Reconstructed flap tissue)

There are few absolute contraindications to the use of a submental island flap for reconstruction in oral cavity tumors. The first is serious medical comorbidities that preclude major surgery. The second is metastatic disease involving ipsilateral Level I lymphatic tissue. This situation will make it extremely difficult to harvest the flap and preserve the pedicle when dissecting an oncologically sound neck.

In addition, in some cases, care should be taken when choosing this flap. Patients with non-Level I neck positivity or deep invasive floor-of-mouth tumor should be meticulously examined. According to the study of Howard et al., they found no tumor recurrence in 50 patients with oral squamous cell carcinoma at Level I who did not have clinical nodal metastases and whose defects were reconstructed with submental island flaps[15]. Nevertheless, since it is not technically possible to completely remove the lymphatic tissue without damaging the flap, an alternative reconstruction method should be considered in case of a high risk of metastasis to this region. In situations that increase the risk of flap failure such as local trauma, especially burns, care should be taken in choosing this flap if the pedicle is adjacent to the trauma area.

Discussion

The use of free flaps has become the first choice for reconstruction after oral cavity tumor resection[2,16]. The most preferred region as a free flap is the radial forearm region. However, the use of pedicle flaps remains a valuable option in elderly patients who are not suitable for long-term surgery,

have poor nutrition, and have additional comorbid diseases[17-19]. There are many studies comparing these two techniques. Both techniques have their own advantages and disadvantages. In Patel's comparison between these two methods in 146 patients, it was found that SIF was advantageous compared to the radial forearm free flap (RFFF) with a shorter operation time, shorter hospital stay, and fewer complications in the donor area. Functional outcomes for swallowing and speech were similar between the two reconstructive techniques and no difference was found between patients who underwent SIF and RFFF in terms of local recurrence rate or overall recurrence. The author advocated that SIF should be the first choice in oral cavity reconstructions, with reduced patient morbidity and lower cost of care[20].

When the SIF compared with traditional pedicle flaps such as pectoral major flap and deltopectoral flap, no difference in survival rate was found and it is quite reliable in terms of survival[15,17,19,21,22]. The fact that the flap can be harvested quickly, the pedicle has a suitable rotation arc, and the flap survival rate is quite high make the SIF a very good option for oral cavity reconstruction. Compared with RFFF, the SIF was associated with a shorter operative time and hospital stay[23]. In the Sittitrai et al.'s study, they found the average operation time to be 3 hours in the SIF group, while it was 7 hours in the RFFF group[17]. Forner et al. compared the cost effectivity between SIF and RFFF used for glossectomy reconstruction. Accordingly, although there was no significant difference in overall hospital stay between the two groups, they indicated a significant reduction in both the operative time and the intensive care unit stay in the SIF group. Thus, they observed a significant cost reduction with SIF compared to RFFF[21].

In the submental flap, donor site morbidity is very minimal. Due to the removal of excess cervical skin, tightening occurs in the anterior cervical region and this creates a positive aesthetic result. Lee et al. confirmed the low morbidity of the SIF in their study[24]. The size of the harvested skin island can be as large as 12 × 6 cm, and the donor site defect can be closed primarily without functional intervention[25]. In the literature, wound dehiscence has been reported rarely (0-7.4%) at the SIF donor site. In contrast, partial skin graft loss and restricted arm function have been identified in a significant number of patients who underwent reconstruction using RFFF[17,23]. SIF is also very suitable for oral cavity reconstruction with its thin and flexible skin structure. When greater volume is required, the flap can be raised as a musculocutaneous flap involving the mylohyoid muscle, or bone tissue can be harvested as an osseomusculocutaneous flap when required[15]. Another advantage is that orocutaneous fistula is rarely seen. The musculofacial component of the flap occludes the dead space resulting from tumor removal and provides watertight closure of the defect[25].

Since the primary lymphatic drainage of oral cavity cancer is to the submental and submandibular lymph nodes, the oncological safety of the use of the SIF has been a concern[15,18,22]. There are differences of opinion among the authors regarding oncological safety. In addition to the authors advocating that SIF is contraindicated in a patient with clinical or radiographic evidence of metastatic disease at level I[15], authors who argue the opposite advocate that SIF can be used without compromising local recurrence in patients who have a cervical lymph node diameter less than 1.5 cm and no clinical evidence of extracapsular invasion and whose sentinel lymph nodes are carefully dissected during the procedure[25]. While using SIF in oral cavity cancer reconstruction, careful patient selection and surgical technique are very important to ensure oncological safety. Each patient should be evaluated meticulously with physical examination and imaging methods before surgery. To ensure adequate treatment of the regional lymphatic area, dissection of these areas should be performed carefully following flap elevation. Howard et al. stated that

they did not experience recurrence due to metastatic disease transfer with SIF technique, which they have applied for 11 years in their studies. Furthermore, according to the results of elective neck dissection in the clinical No neck, the rate of occult metastasis at level I was 10%[15].

The functional outcomes of reconstruction of oral cavity tumors, particularly of the tongue, are determined by the mobility and volume of the reconstructed tongue[26]. While the skin harvested with RFFF, which is preferred as the primary option in oral cavity reconstruction, promises a good function with its thin and flexible structure, SIF is advantageous in terms of providing sufficient bulk tissue. In addition, the more flexible and malleable skin of SIF provides better functional results than traditional regional flaps. In functional evaluation, basically speaking and swallowing functions are evaluated. While objective scales were used for evaluation in some of the studies, a superficial evaluation such as continuous use of the feeding tube and speech intelligibility was made in others. In the study comparing the functional outcomes of RFFF and SIF for oral cavity reconstruction, the authors achieved excellent to good speech results for the majority of patients in both groups, although there was no significant difference between the two groups. While the rate of patients with good or perfect speech was 82.8% in the SIF group, this rate was 92% in the RFFF group. None of these patients needed a permanent feeding tube[17]. Similar results were found in another study[23]. Although there are similar functional results between the two flaps, poor swallowing functions were found in patients who used SIF in anterior floor of mouth reconstruction. Therefore, free flaps should be preferred due to the flexible skin structure in order to minimize the deterioration in tongue movements, especially in defects that may occur due to resection of the anterior part of the tongue and anterior floor of the mouth[20].

Conclusion

Submental island flap offers the advantages of shorter operative time, shorter hospital stay, and avoidance of donor site complications compared to the radial forearm free flap. Functional outcomes for swallowing and speech are similar between the two reconstructive techniques. In patients who underwent submental island flap after resection of malignancy, no significant difference was observed in terms of local recurrence rate or overall recurrence compared to radial forearm free flap. Therefore, this flap is suitable for reconstruction of oral cavity defects without compromising oncologic outcomes after tumor resection, especially in patients who are poor candidates for microvascular surgery.

Conflict of interest
The authors declare that they have no conflict of interest.

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Ethical approval
Approval was obtained from the patient for this review

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