THE SUBMENTAL ISLAND FLAP IN HEAD AND NECK RECONSTRUCTION

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Abstract: Background. The submental island flap (SIF) is a new alternative in the reconstruction of various head and neck defects. We present our preliminary experience in the use of this flap and describe the surgical technique.

Methods. Nine patients underwent reconstruction with the SIF between January 1998 and July 1999. The SIF has been used for the reconstruction of the cervical esophageal stenosis in 2 patients, floor of mouth and tongue defects in 6 patients, and a hemilaryngectomy defect in 1 patient.

Results. With the exception of one partial flap loss caused by arterial insufficiency, no flap failures were observed. All the donor site defects but one were closed primarily. One patient who underwent reconstruction of a hemilaryngectomy defect underwent revision surgery because of intractable hair growth on the transferred skin paddle. Marginal mandibular nerve function was intact in all the cases.

Conclusions. When combined with the reported experience of other surgeons, our preliminary experience showed that the SIF was an excellent alternative in the reconstruction of head and neck defects because of its reliability, versatility, and relative ease of application. © 2000 John Wiley & Sons, Inc. Head Neck 22: 572–578, 2000.

Keywords: submental; flap; reconstruction; head and neck

Various techniques, including skin grafts, local or regional flaps, and free vascularized tissue transfer, can be used in the reconstruction of the defects to restore function and/or cosmesis after ablative surgery in the head and neck region. The size, location, and function of the defective site are the determining factors in choosing the most appropriate reconstruction modality. Ideally, the tissue used in the reconstruction of a particular defect should be reliable; functional and cosmetically acceptable; have sufficient size and minimal donor site morbidity; and match with the recipient site in terms of color, texture, and thickness. The submental island flap (SIF), which has been recently introduced by Martin et al\(^1\) in 1993, meets all these criteria for the reconstruction of the selected defects in head and neck region. The SIF is an axial patterned flap based on the submental branch of the facial artery. We present our operative technique and experience with the SIF in reconstruction of the various defects after head and neck surgery.

TECHNIQUE

The detailed anatomy of the SIF is presented elsewhere.\(^1,2\) The patient is in the supine position with the head extended. After measuring the defect, we outline the spindle-shaped flap with a marking pen in the submental region in a hori-
horizontal fashion. We pay attention to place the anterior border of the skin paddle at least 1 cm behind the mandible to hide the scar as much as possible. The length of the short axis of the skin paddle allows primary closure of the donor site defect, and this can easily be determined by pinching the skin of the submental area between two fingers before outlining the flap. We prefer starting the flap elevation from the opposite side of the pedicle in the subplatysmal plane and proceeding toward the midline (Fig. 1). When the midline is reached, the dissection is carried out carefully to identify the submental artery and the vein at the medial border of the anterior belly of the digastric muscle on the pedicle side (Fig. 2). Use of a Doppler probe is helpful at this point. After identifying the submental vessels, the anterior belly of the digastric muscle is released from its attachments and elevated with the flap because the vascular pedicle passes deep to this muscle in most cases (Fig. 3). Harvesting the flap is continued by carefully releasing the submental artery and the vein from the surrounding tissues during their course between the submandibular gland and the mandible. The surgeon should take special care not to separate the skin paddle from the submental vessels and not to injure the marginal mandibular nerve at this point. The dissection should be discontinued when sufficient length of vascular pedicle is obtained or the junction of the submental and facial vessels is reached. The flap is then transferred and attached to the recipient site (Figs. 4 and 5), and the donor site is closed primarily in layers (Fig. 6).

**CASE PRESENTATIONS**

**Case 1.** A 71-year-old woman was initially seen with a history of esophageal stenosis after total laryngectomy and partial pharyngectomy for squamous cell carcinoma of the pyriform sinus, which was performed 25 years ago. She had no evidence of disease since the laryngopharyngectomy but had a progressive dysphagia for solid food because of scarring of the cervical esophagus. She was otherwise healthy and seeking oral intake. Esophagoscopy and barium swallow showed near-total stenosis involving a 7-cm segment of the cervical esophagus. The patient underwent reconstruction of the stenotic segment with the SIF. The cervical esophagus was exposed with a midline vertical incision starting from the inferior border of the submental island flap superiorly and extending to the upper edge of the tracheostomy.
The anterior wall of the stenotic segment of the esophagus was opened and a 7 × 3.5 cm SIF was patched to the opening in the anterior esophageal wall (Fig. 7). Donor site closure was not complete because of the changes in the skin caused by previous radiation treatment, and a 3 × 3 cm split-thickness skin graft was used to complete the closure of the donor site. The postoperative course was uneventful, and the patient was able to swallow both liquid and solid foods 1 month after the reconstruction (Fig. 8).

Case 2. A 32-year-old woman was seen with an extensive venous malformation involving the left oral tongue and adjacent floor of mouth and extending to the left base of the tongue. After resection of the venous malformation, a left side pedicled SIF with an 8 × 4 cm skin paddle was elevated and passed through a tunnel created in the floor of mouth. The flap was placed into the defect with its longitudinal axis corresponding to the anteroposterior direction. The donor site was closed primarily (Figs. 1 to 5). The postoperative course was uneventful, and the patient’s oral feeding was started on postoperative day 7 without any difficulties.

Case 3. A 60-year-old man was seen with a recurrent squamous cell carcinoma of the left vocal cord. He had a history of cordectomy after failure of radiation treatment. During his 6-month follow-up examination after cordectomy, a suspicious tissue growth was seen in the operated area and a biopsy was taken. Histopathologic findings were consistent with recurrent squamous cell carcinoma, and a left hemilaryngectomy was performed. Because the laryngeal defect was large and the strap muscles were not suitable for reconstruction of the defect because of prior irradiation, it was decided to use a SIF with a 6 × 4 cm skin paddle. The spindle-shaped skin paddle was
trimmed approximately 1 cm from its both ends to obtain a 4 × 4 cm rectangular-shaped flap. The flap was sutured to the contralateral thyroid cartilage ala anteriorly, cricoid cartilage inferiorly, pharyngeal mucosa posteriorly, and the base of epiglottis superiorly. The postoperative course was uneventful and the patient was discharged on postoperative day 5. Although the patient was decannulated at the end of the first month after surgery, a hair growth in the skin paddle was causing patient discomfort. Eventually, the patient underwent a revision surgery to replace the hair-bearing skin with a split-thickness skin graft.

**Case 4.** A 48-year-old man was seen with recurrent squamous cell carcinoma of the tongue, which has been treated previously with surgical resection and postoperative radiation in another facility. The patient underwent a hemiglossectomy with right supraomohyoid neck dissection and reconstruction with the SIF. Histopathologic findings showed one positive lymph node at level III. Because the patient had prior radiation treatment, another radiation treatment was not considered. The postoperative course was uneventful, and the patient started to his oral intake at the end of the first postoperative week. The shape and function of the reconstructed tongue was excellent in the late postoperative period.

**RESULTS**

Nine patients underwent reconstruction by use of the SIF between January 1998 and July 1999 (Table 1). The mean age was 58.2, with a minimum of 17 years and maximum of 95 years. There were 5 male and 4 female patients in this series. Five of 9 cases underwent reconstruction after ablative surgery for malignant tumors of the oral cavity and larynx. Four of these tumors were squamous cell carcinomas, and 2 of these 4 were recurrent cases. The other malignant tumor was mucoepidermoid carcinoma. Neck dissection was performed in 4 of 5 cases with malignancies. Three of these patients showed 1 positive lymph node in the final pathologic report. Two patients underwent reconstruction of the defect after resection of extensive venous malformations, and 2 patients were operated for the reconstruction of cervical esophageal stenosis. With the exception of 1 partial flap loss caused by arterial insufficiency, we did not experience any flap failures. The area of the partial loss granulated and healed well without any complications. All donor site defects but one were closed primarily without any difficulties. In one patient who had significant skin contracture caused by previous radiation treatment, a split-thickness skin graft was used to complete the closure of the secondary defect in the submental region. One patient who underwent reconstruction of a hemilaryngectomy defect was successfully decannulated but eventually underwent revision surgery because of an intractable hair growth on the skin paddle. Hair-bearing skin was removed and replaced with a split-thickness skin graft to provide a smooth airway surface. Two patients who underwent reconstruction for esophageal stenosis showed satisfactory improvement in swallowing. One of these patients was able to swallow liquids after surgery, although she was not able to swallow either liquids or solids before surgery. The other patient was able to swallow solids after surgery; she was not able to swallow anything other than liquids before surgery. The rest of the flaps used in the reconstruction of the oral cavity defects were functionally excellent. The function of the marginal mandibular nerve was intact in all of the patients postoperatively.

**DISCUSSION**

The SIF has several advantages. Its donor site defect can be closed primarily most of the time because of the laxity of the submental skin, especially in elderly patients. Its donor site scar is acceptable and not visible in most cases. The SIF has a long and reliable vascular pedicle, which provides a pedicle length up to 8 cm, with an av-
Average of 2-mm arterial diameter. If a longer pedicle is needed, it can be used as a reverse-flow flap by dividing the facial artery and vein proximal to the junction of the submental vessels. A rich vascular network between the ipsilateral and contralateral facial arteries and veins allows the SIF to survive in such use, although there is reported flap failure because of the presence of venous valves in the facial vessels. The SIF can also be used as a free flap or as an axial pattern osteocutaneous flap in the reconstruction of the bony defects of the cervical esophagus, where bulky flaps may lead to difficult closure of the skin overlaying the cervical esophagus or may negatively affect swallowing after flap transfer. Our experience with 2 patients showed that the SIF did not obliterate the esophageal passage and provided satisfactory postoperative swallowing function.

Use of the SIF may eliminate the need for a distant flap for head and neck reconstruction. This is especially important in cases with benign

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Table 1. Data of the patients who underwent reconstruction with the submental island flap

<table>
<thead>
<tr>
<th>Patient No.</th>
<th>Sex/age</th>
<th>Preoperative diagnosis</th>
<th>Location</th>
<th>Skin paddle (cm)</th>
<th>Neck dissection (+) nodes</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F/71</td>
<td>Postlaryngectomy stenosis</td>
<td>Cervical esophagus</td>
<td>7 × 3.5</td>
<td>—</td>
<td>Incomplete primary closure of the donor site necessitating split-thickness skin grafting</td>
</tr>
<tr>
<td>2</td>
<td>F/32</td>
<td>Venous malformation</td>
<td>Left oral tongue</td>
<td>8 × 4</td>
<td>—</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>M/60</td>
<td>Recurrent squamous cell carcinoma</td>
<td>Left glottis and supraglottis</td>
<td>4 × 4</td>
<td>—</td>
<td>Revision surgery for removal of the hair-bearing skin and split-thickness skin grafting</td>
</tr>
<tr>
<td>4</td>
<td>M/48</td>
<td>Recurrent squamous cell carcinoma</td>
<td>Right oral tongue</td>
<td>Not recorded</td>
<td>Levels 1 to 3</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>F/17</td>
<td>Venous malformation</td>
<td>Left oral tongue and floor of mouth</td>
<td>7 × 4</td>
<td>—</td>
<td>None</td>
</tr>
<tr>
<td>6</td>
<td>F/76</td>
<td>Recurrent squamous cell carcinoma</td>
<td>Left floor of mouth and lower alveolar ridge</td>
<td>10 × 5</td>
<td>Level 1</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>F/95</td>
<td>Mucoepidermoid carcinoma</td>
<td>Left floor of mouth</td>
<td>9 × 5</td>
<td>Bilateral level 1</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>F/49</td>
<td>Squamous cell carcinoma</td>
<td>Right oral tongue</td>
<td>Not recorded</td>
<td>Bilateral levels 1 to 3</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>F/76</td>
<td>Postlaryngectomy stenosis</td>
<td>Cervical esophagus</td>
<td>5 × 4</td>
<td>—</td>
<td>None</td>
</tr>
</tbody>
</table>
Pathologic conditions such as vascular malformations, where donor site morbidity is also of concern because of the relatively young age of this group of patients. Reconstruction of the oral tongue and floor of mouth defects with the SIF may save the surgeon from performing a complicated technique such as radial forearm free flap, which would be the only reasonable alternative in the reconstruction of the large defects of these regions. We were able to perform successful reconstructions with the SIF with excellent chewing, swallowing, and speech functions and barely noticeable donor site scars in two cases with large oral tongue defects after resection of extensive venous malformations.

Use of the SIF in reconstruction of the oral cavity, oropharynx, mid or lower face, and cervical esophagus defects has been reported previously; however, it has not been used in the reconstruction of the partial laryngectomy defects before. Although we performed a revision surgery to replace the hair-bearing skin with a split-thickness skin graft in the patient, the outcome was promising in terms of early decannulation and adequate airway patency. Therefore, we believe that the SIF can also be used in the reconstruction of this particular defect if the patient is a woman or if the patient is a man without heavy hair growth in the submental skin.

Most of the cases reported in the literature, including almost half of our cases that underwent reconstruction with the SIF, constitute patients with malignant neoplasms of the oral cavity and the lower third of the face.1–5 Use of the SIF in such cases may be complicated if the neck dissection is planned in addition to the surgical resection of the primary site. Because first echelon lymphatic drainage of these anatomic regions is toward the submental (level Ia) and submandibular (level Ib) lymph nodes, isolation of the flap pedicle with a thick surrounding fibrofatty tissue may compromise the continuity of the neck dissection specimen if special attention is not paid. Therefore, if reconstruction with the SIF is considered in such cases, neck dissection should be performed meticulously and the vascular pedicle should be thinned as much as possible to prevent incomplete removal of the lymph nodes. Although we had a partial flap loss caused by arterial insufficiency because of excessive thinning of the vascular pedicle, this was our first case with a neck dissection, and this complication did not occur again in other cases in which a neck dissection was added to the procedure. If the resection is performed for treating a benign disease or a low-grade malignancy such as basal cell carcinoma, where the neck dissection is not a concern, the vascular pedicle can be isolated with a thick surrounding tissue to prevent a possible flap failure as a result of kinking or compression of the relatively small diameter vessels.

Controversy in the literature exists about harvesting the anterior belly of the digastric muscle with the SIF. Faltaous and Yetman6 proposed that the anterior belly of the digastric muscle should be included in the flap on the basis of their anatomic study, which showed the submental artery ran deep to this muscle in 70% of cadaveric dissections, whereas it ran superficial to the muscle in the remaining 30% dissections. On the other hand, Yilmaz et al3 reported that the inclusion of the anterior belly of the digastric muscle was not necessary because they did not experience any flap loss despite exclusion of the muscle in most of their cases. They proposed that the muscle can be included in the flap if a bulky flap is desired. This situation can be explained by the presence of perforator branches leaving the artery before its course deep to the anterior belly of the digastric muscle.6 However, we prefer to harvest the anterior belly of the digastric muscle with the flap to prevent possible flap loss.

CONCLUSIONS
When combined with the reported experience of other surgeons, our preliminary experience shows that the SIF is an excellent alternative in the reconstruction of head and neck defects because of its reliability, versatility, and relative ease of application.

Although donor site defects can be closed primarily in most cases, closure may be incomplete because of skin changes in patients with a history of previous radiation treatment, and the surgeon should be prepared to perform an alternative closure in such cases.

Our experience shows that the SIF can be used in the reconstruction of partial laryngectomy defects without compromising airway patency. However, excessive hair growth of the flap may limit its use in reconstruction of the airway.

We find the SIF an excellent reconstruction modality for esophageal stenosis. It does not interfere with swallowing and the closure of the skin overlying the cervical esophagus.

If a neck dissection is planned as an adjunctive procedure to the SIF, the neck dissection should be performed meticulously and the vascu-
lar pedicle should be thinned as much as possible to prevent incomplete removal of the lymph nodes.

REFERENCES