Vertical Submental Island Flap for Head and Neck Reconstruction

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Regional flaps remain a cornerstone of head and neck reconstruction. Among their many functions, they serve a vital role in salvage surgery and for those in whom medical comorbidities preclude the use of microvascular free flaps. Recent research has also examined their potential benefit in value-based healthcare metrics such as operative time, cost, intensive care unit care, and length of stay as compared to free-flap reconstruction. The submental island flap is one such entity that is well described and validated to provide predictable, oncologically sound coverage for defects of the lower third of the face and oral cavity. Its application has also been documented for repair of defects of the midface, temporal region, oropharynx, and hypopharynx, albeit less frequently. Since its original description, there have been several modifications of this axial-based flap, though none of a vertically oriented long axis. We describe a case of a vertically based submental island flap for maxillary reconstruction that allowed for debulking and recontouring of prior pectoralis flap and correction of submental ptosis.

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Head and neck literature has shown renewed interest in the use of regional flaps as primary reconstructive methods given the decreased cost, operative time, and length of hospital stay.[1-5] The submental island flap, first described in 1993 by Martin et al[6] as an axial flap based on the submental artery, has been most frequently used to reconstruct the oral cavity and less frequently documented for maxillary reconstruction. Furthermore, several modifications of this procedure have been developed, although none have included a vertical island flap.[7-12]

We describe a novel variation using a vertically based submental island flap for maxillary reconstruction in a patient with significant coronary and peripheral arterial disease that prohibited microvascular reconstruction. The diamond-shaped flap was inset along the long axis of the maxillary arch with resulting straight line linear closure in the neck and optimized esthetics of the donor site. Also, it afforded wide access for debulking of a previous pectoralis flap and correction of cervical and submental ptosis to reestablish the cervicomental angle distorted by the previous neck dissection and reconstruction. In addition, the use of this regional flap allowed for a decreased operative time to minimize the risk of perioperative complications related to his significant medical comorbidities.

The submental island flap has well-established applications. In the present report, we have proposed our use of the flap as a potential modification of the standard horizontal submental island flap, used in the same manner and application. In addition, we sought to further establish it as a viable method of maxillary reconstruction, just as in its standard form. As such, it has the potential to improve donor site esthetics in the cervical region, which could be of utility in patients who have undergone multiple operations in the head and neck area.

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FIGURE 1. Photograph showing the verrucous, exophytic invasive squamous cell carcinoma lesion extending from the palatal aspect of the right maxillary incisor region to the right maxillary premolars. The right maxillary first molar and left maxillary central incisor had been extracted in preparation for infrastructure maxillectomy.

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Case Report

In the present report, we describe the case of a 64-year-old man with a T2N0 right maxillary squamous cell carcinoma in the setting of a history of an oral premalignant condition. He had undergone previous excision of a left buccal squamous cell carcinoma via midline lip split approach for wide local excision, marginal mandibulectomy, neck dissection, and left pectoralis major reconstruction. Regional reconstruction had been completed at that time instead of using a free vascular flap because of the patient's coronary artery disease. The final pathologic examination revealed a stage T2N0 left buccal squamous cell carcinoma. However, the patient declined adjuvant radiotherapy. In the postoperative period, he returned to his baseline oral function and speech. In addition, the clinical examination and postoperative positron emission tomography/computed tomography study showed that he was free of disease. However, at 10 months after the initial procedure, a new 2-cm exophytic, verrucous lesion developed in the right maxillary premolar region extending to the incisor area (Fig 1).

Excision with wide margins via infrastructure maxillectomy was planned. Local and regional flap reconstruction was considered instead of a free vascular flap, due to his medical comorbidities. A submental island flap was selected due to its predictable nature and pliability, and its potential to decrease operative time. Neck dissection was not performed because the depth of invasion was less than 4 mm and, because of its size and location, was deemed to have a low risk of occult metastatic disease. The flap was planned in a vertical orientation to enable correction of the obtuse cervicomental angle with redundant, ptotic, submental, and cervical tissue, in addition to the bulky pectoralis flap. The plan for direct submentoplasty and

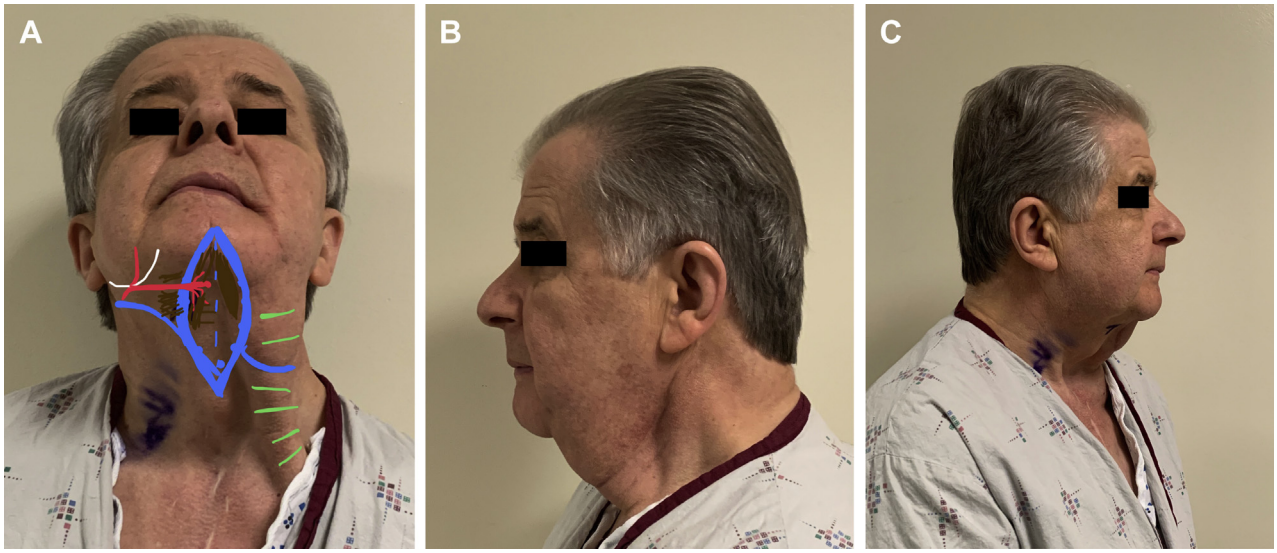

FIGURE 2. *A*, Photograph showing surgical plan marked on the patient's neck. The *green dashed lines* mark the previous pectoralis major flap; the *blue lines,* the outline of the vertical submental island flap with releasing incisions; the *red lines,* the vascular pedicle; and the *white line,* the course of the marginal mandibular nerve. *B*, Left lateral and *C*, right lateral profile photographs showing cervical laxity, ptosis, and prominent left-sided pectoralis major flap.

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FIGURE 3. Intraoperative photograph showing the maxillary resection defect with buccal fat present laterally, maxillary sinus, and nasal mucosa and nasal floor. In the cervical region, the outline of vertical submental island flap and releasing incisions can be seen. The *horizontal dashed lines* overlying the left pectoralis flap mark the plan for debulking. The *vertical dotted line* marks the cervical midline; and the *horizontal line,* the approximate course of the marginal mandibular nerve. In the mental region, the lower portion of the previous midline lip and chin transfacial incision was incorporated into the most superior portion of the flap.

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recontouring of the pectoralis flap is outlined on the preoperative image shown in Figure 2.

Technique

The submental island flap anatomy and technique has been well described in reported studies.[13-17] The same basic anatomic landmarks and principles were used for our patient. First, the right-side infrastructure maxillectomy was completed with negative margins from the right maxillary first molar to the left maxillary central incisor region, which was facilitated by the extraction of these teeth, followed by osteotomy through these sites. The lesion was evident as an exophytic, papillary, fungating mass in the canine–premolar region (Fig 1). The defect was measured, and the elliptical shaped flap was designed and outlined in a vertical fashion (Fig 3).

FIGURE 4. Photograph showing the inset of the vertical submental island flap along the right maxillary defect with anterior incision line visible.

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The flap and its releasing incisions were incised (Fig 3), and its elevation was begun along the contralateral aspect of the ellipse, farthest from the pedicle. As reported in previous modifications, the ipsilateral digastric muscle and mylohyoid were released from the mandible and incorporated within the flap. Neck dissection was not performed for this maxillary lesion. Once the pedicle had been dissected and released in standard fashion, a subcutaneous tunnel was made to allow the flap to be rotated through it, medial to the mandible, and into the oral cavity. It was then inset and sutured into the maxillary defect, with its long axis oriented linearly along the axis of the maxillary arch (Fig 4).

After inset, the subplatysmal flap in the left neck was elevated further, and the previously reconstructed pectoralis major muscle was identified. The vertical nature of the submental island incision design afforded greater access to this region, allowing for debulking and recontouring along nearly the entire length of the muscle in the cervical region. Furthermore, this approach allowed for plication of the platysma. This, combined with the rotation of a significant amount of myocutaneous cervical tissue to the maxilla, resulted in significant tightening of the cervical region on straight line linear closure. This aided in restoring the cervicomental angle and, thus, greatly improved donor site esthetics.

FIGURE 5. Postoperative frontal view after flap inset, pectoralis flap debulking, submentoplasty with platysmal plication, and tracheostomy.

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A tracheostomy was completed at the end of the operation owing to the bulk of the flap, its tunneling medial to the mandible, and our subsequent concern for lateral pharyngeal edema. The desired restoration of the cervical tissues was accomplished with this vertical orientation and straight line linear closure. The outcome is shown in the postoperative frontal and profile photographs (Figs 5 and 6, respectively).

No dehiscence of the suture line, venous congestion, or loss of flap tissue occurred during the postoperative period. In addition, the patient healed well at both the harvest and the recipient site and continued to do well at the last follow-up examination. Despite the loss of teeth from 2 separate oral ablative procedures, he has been able to maintain a modified-consistency soft diet. The suture line healed well, without any significant incisional irregularities.

Discussion

In recent years, a resurgence of interest in regional flaps has occurred. The submental island flap, originally described in 1993, has been used most often for reconstruction of oral, oropharyngeal, facial, and pharyngeal defects. It has also been described for palatal and temporal defect reconstruction.[18-20] Its use has been less often documented as a method for maxillary reconstruction.[21,22] Thus, we sought to expand on and reaffirm the use of this flap for reconstruction of maxillary defects through our description in the present case report. Furthermore, although several modifications have been developed of the submental island, none of the modifications has included a vertical component.[7-12]

This vertically oriented flap provides for straight line linear closure in the midline of the neck, which in the present case, aided in reestablishing the cervicomental angle, normalizing the cervical contour, and improving donor site cosmesis. Moreover, given our patient's previous ablative and reconstructive procedures, the vertical orientation allowed for direct access to nearly the full length of the pectoralis major muscle flap, which, after debulking and recontouring, further facilitated cervical recontouring. This would not have been as easily achieved via the standard horizontal submental island flap approach. Thus, the vertical orientation of the flap and linear closure functioned as a direct submentoplasty, which resulted in an enhanced jawline and restoration to a more normal cervicofacial profile in the present patient.[23,24]

The main reported disadvantage of the vertical island flap is the midline scar that results from this procedure. However, this can be camouflaged somewhat in male patients by performing the incision in the hair-bearing region.[23,24] This disadvantage should be weighed against the cosmetic shortcomings of the esthetics of the horizontal flap. The latter have also been the impetus for previous modifications. Chen et al[7] described the use of 2 V-Y advancement flaps to aid in closure of the horizontal incision to shorten its length and avoid the occurrence of "dog ears," with a 97% success rate. They reported that this decreased the amount of contracture and increased the range of motion of the horizontal oriented flap.[7] However, we believe that the use of vertical flap with releasing incisions will result in less incision irregularity and obviate the potential need to elevate separate flaps to aid in closure. Thus, we believe this new orientation of the submental flap should be considered as an alternative to the standard technique when straight line vertical closure and submentoplasty might be desired to enhance donor site esthetics.

Finally, the traditional submental island has been validated as a predictable, oncologically safe procedure that can reduce donor site morbidity and decrease the costs and operative and hospitalization time.[2-5,13,14] Paydarfar and Patel[2] reported decreased operative times, lengths of stay, and donor site morbidity, with functional and oncologic outcomes similar to those with the radial forearm free flap. They used it selectively as reconstruction for partial glossectomy and floor of

FIGURE 6. *A,C,* Preoperative profile views with cervical laxity, ptosis, and bulky pectoralis major flap as previously described and *B,D,* postoperative profile views for comparison showing recontoured pectoralis flap, restoration of the cervicomental angle, and a lack of cervical ptosis.

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mouth reconstruction of 8 × 6 cm or less.[2] Forner et al[5] also reported shorter operative times, the need for fewer intraoperative resources, and comparable outcomes at a lower hospital cost. From a patient selection standpoint, the decreased operative time helps to minimize complications in patients with medically complex head and neck cancer, such as our patient. Furthermore, it is an excellent regional option for the coverage of defects in patients who are not candidates for microvascular surgery.

In conclusion, in the present report, we have proposed an alternative modification, a vertical orientation, of the submental island flap and its use for maxillary reconstruction. As shown in our patient, this regional flap is an excellent choice for those for whom medical comorbidities might preclude microvascular reconstruction. The standard submental island flap has the benefits of decreasing costs and the operative and hospitalization time. In the present case report, we have demonstrated the potential for

improving the esthetics of the donor site using a vertically oriented submental island flap for patients who have undergone multiple operations in the head and neck area. Additional use of this variation of the standard submental island flap is needed to establish it as a viable, predictable alternative.

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