The Laryngoscope

Mylohyoid Advancement Flap for Closure of Composite Oral Cavity Defects

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Objectives/Hypothesis: To describe a new surgical procedure in the reconstruction of composite oral cavity resections.

Study Design: Retrospective chart review for all patients who received mylohyoid pull through muscle flap for reconstruction of oral composite resection with marginal mandibulectomy by the senior author between 1999 and 2008.

Methods: Data gathered from the chart review included demographics, pathologic diagnosis, tumor margins, use of reconstruction plate, exposure to radiotherapy, need for gastrostomy tube, flap viability, and flap complications.

Results: Twenty-nine patients received composite resection, marginal mandibulectomy, and reconstruction with the mylohyoid muscle flap between 1999 and 2008. Twenty-four of the 29 patients (82.7%) had a partial glossectomy as part of the resection. Flap success was 100%. Complications included partial skin graft loss (2 of 29) and partial flap dehiscence (2 of 29). Total complication rate was 13.8%. Twenty-five patients (86%) were exposed to external-beam radiotherapy. Two patients required supplemental alimentation with a gastrostomy tube. There were no cases of osteoradionecrosis.

Conclusions: The mylohyoid flap is a valuable addition to the armamentarium of anterior oral cavity closures. The procedure is intuitive, and surgical time is miniscule. This procedure can often be used in cases previously requiring free flap closure. It allows a quick return to oral alimentation and has minimal donor site morbidity.

Key Words: Oral cavity, squamous cell carcinoma, marginal mandibulectomy, oromandibular reconstruction.

Level of Evidence: N/A.

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INTRODUCTION

A marginal mandibulectomy is an oncologic procedure performed in conjunction with local soft-tissue ablation that is performed when oral cancers approach or superficially involve the periosteum of the mandible. In the appropriately selected patients, it achieves excellent local control and survival rates.[1] These composite resections of the anterior oral cavity resulting in variable loss of the ventral tongue, floor of mouth, and mandible have had a number of proposed reconstructive options. Factors such as defect size, radiation exposure, and overall patient health need to be considered when determining optimal closure technique.

Primary closure may be attempted with small defects and when advancement of the mucosa does not lead to distortion of the cheek or lip.[2] Larger defects, particularly those without exposure of underlying bone, may be considered for a skin graft. However, there may be scarring and fibrosis of the graft, and the take rate is less successful when the graft is placed directly on bone.[3] In addition, this technique is not typically used in a previously irradiated field.[2] Alvi and Meyers[4] reported a 25% incidence of osteoradionecrosis (ORN) in patients who underwent skin graft reconstruction of a marginal mandibulectomy with subsequent radiation therapy. In these circumstances, flaps providing for improved tissue coverage are needed to cover the exposed bone. Pedicled flaps including the infrahyoid fasciomyocutaneous flap, the platysma myocutaneous flap, or the buccinator myomucosal island flap are all possible closure options.[5–7] Although these procedures each have benefits, they also prolong surgical time, cause donor site morbidity, and may be inappropriate in reconstruction for cancer resection when neck dissections have also been performed. They have not been widely accepted or utilized. Larger defects involving significant bone excision or subtotal glossectomy or with radiation exposure often require free tissue transfer with a radial forearm free flap or anterolateral thigh flap.[2] Although it provides excellent coverage and appropriate tissue bulk, a free flap adds significant operative complexity and time. To overcome these shortcomings, we report a new technique for reconstruction of the anterior floor of mouth defect and marginal mandibulectomy, using a mylohyoid pull through flap with split-thickness skin graft. This straightforward technique uses local musculature for defect coverage thereby avoiding complex pedicled or free tissue flaps.

MATERIALS AND METHODS

Charts were reviewed for patients receiving oral composite resection with marginal mandibulectomy by the senior author

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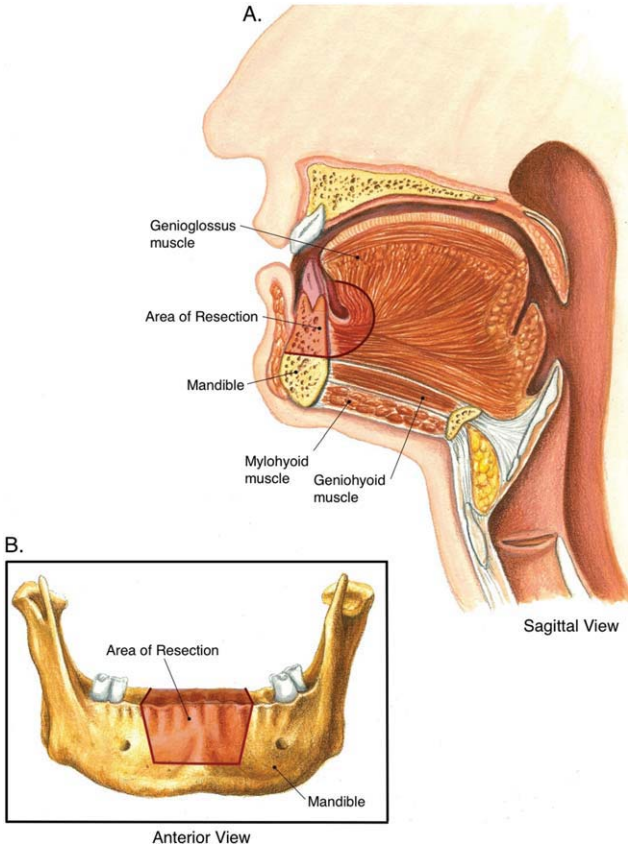

Fig. 1. Illustration depicting the area of resection in sagittal (A) and anterior (B) views.

(Y.D.) between 1999 and 2008 in a tertiary referral-based private practice. All patients who received mylohyoid pull through muscle flaps for reconstruction by the senior author were included in this cases series. Institutional review board approval was obtained. Data gathered from chart review comprised demographics, pathologic diagnosis and tumor margins, use of reconstruction plate, exposure to radiotherapy, need for gastrostomy tube, flap viability, and flap complications.

Technique

After induction of general anesthesia, unilateral or bilateral neck dissections are first performed (if oncologically indicated). Composite resection of the tumor is then performed with Bovie electrocautery. The tooth that is on either of the proposed osteotomy is extracted, which allows for improved osteotomy as well as a smoother, watertight closure and decreases the risk of bony exposure. A reciprocating saw is used for the osteotomies, and a locking screw plate is placed for support if the vertical height of the mandible is less than 11 mm.[8] After frozen sections of margins are sent to pathology and determined to be negative for tumor, reconstruction of the defect begins (Fig. 1–Fig. 3).

First, the mylohyoid and geniohyoid are released from the mental spine of the mandible using Bovie electrocautery. The muscular flap is then transposed intraorally and draped over the surface of the rim mandibulectomy, filling the vertical height of the defect (Fig. 4 and 5). This is sutured to the musculature of the lower lip with 4.0 Vicryl sutures (Ethicon Inc., Piscataway, NJ). A split thickness skin graft is obtained with a dermatome set at 15/1,000 of an inch and placed on the muscle

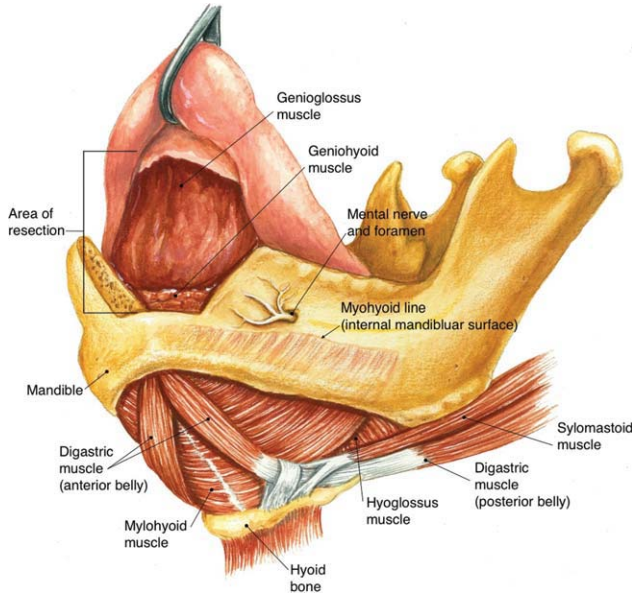

Fig. 2. Illustration showing the composite resection, including partial glossectomy, floor of mouth resection, and marginal mandibulectomy.

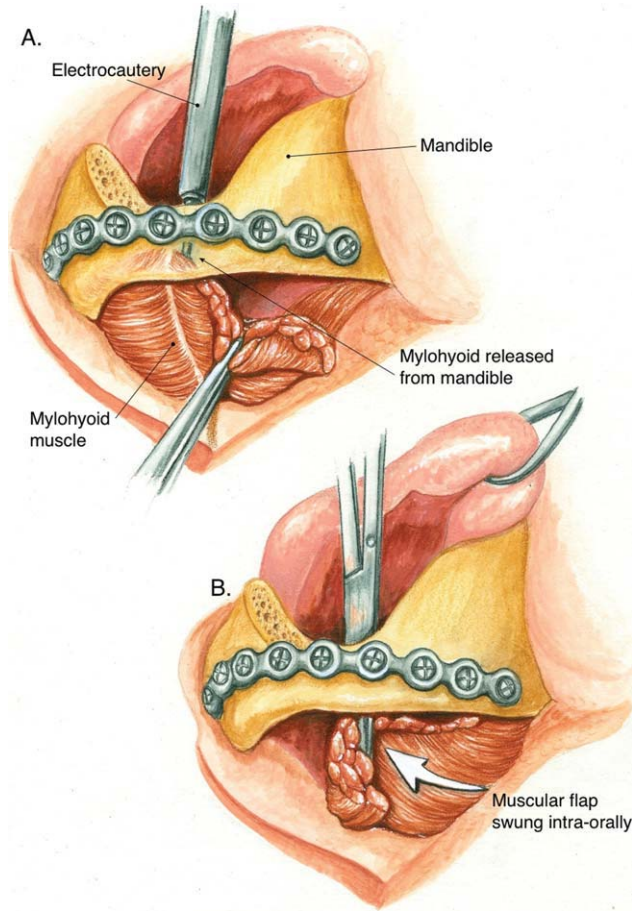

Fig. 3. Illustration showing flap elevation. (A) Release of the mylohyoid. (B) Rotation of the mylohyoid intraorally. The reconstruction bar is placed only when the remaining mandible vertical height is <11 mm.

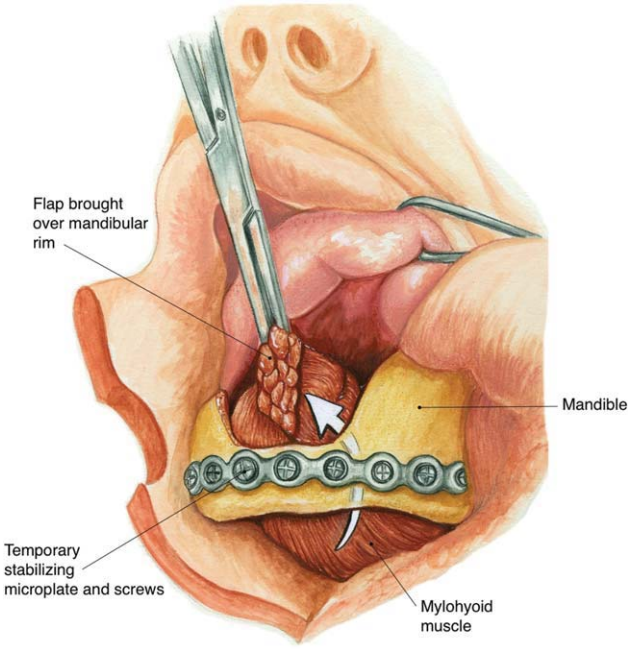

Fig. 4. Illustration showing flap placement over the mandibular defect.

flap, providing coverage for the mucosal defect. This is sutured to the surrounding mucosa of the tongue, floor of mouth, and lower lip with 4.0 chromic sutures. A bolster is not routinely applied over the skin graft. The neck dissection and oral cavity surgical sites are separated from each other using local tissue sutured in a layered fashion. Average harvest time is approximately 5 minutes. Patients are typically started on a clear liquid diet on the first postoperative day and are kept on prophylactic antibiotics for 1 week.

RESULTS

A total of 29 patients (21 male, 8 female) received oral composite resection, marginal mandibulectomy, and reconstruction with the mylohyoid muscle flap between 1999 and 2008,with a minimum follow-up of 40 months. Twenty-four of the 29 patients (82.7%) had a partial glossectomy as part of the oral composite resection. Average age was 63.7 years (range, 49–84; median, 61.3). Pathology of specimens included 25 patients with squamous cell carcinoma, one patient with mucoepidermoid carcinoma, one patient with spindle cell sarcoma, and two patients with adenocarcinoma. Staging of the tumor included four patients who were T2, seven who were T3, and 18 who were T4 (all had cortical bone involvement on surgical pathology). Nineteen of 29 patients (65.5%) needed a reconstruction plate placed for reinforcement. No pathologic fractures were noted. Pathologic review revealed clear margins on all 29 specimens. All flaps were viable; flap success was 100%. Complications included partial skin graft loss (2 of 29) and partial flap dehiscence (2 of 29); all four patients required operative intervention. Total complication rate was 13.8%. Twenty-five patients (86%) were exposed to external-beam radiotherapy: seven patients preoperatively and 18 patients postoperatively. Two patients, who had preoperative radiation therapy, required supplemental alimentation with a gastrostomy tube, although they were not dependent long term. Another patient, with postoperative radiation therapy, experienced partial flap dehiscence. There were no cases of ORN at most recent follow-up. There were no local recurrences, although one patient had a regional recurrence within the neck outside the field of selective neck dissection. There was one patient with distant pulmonary metastases that became known at 18 months postoperatively.

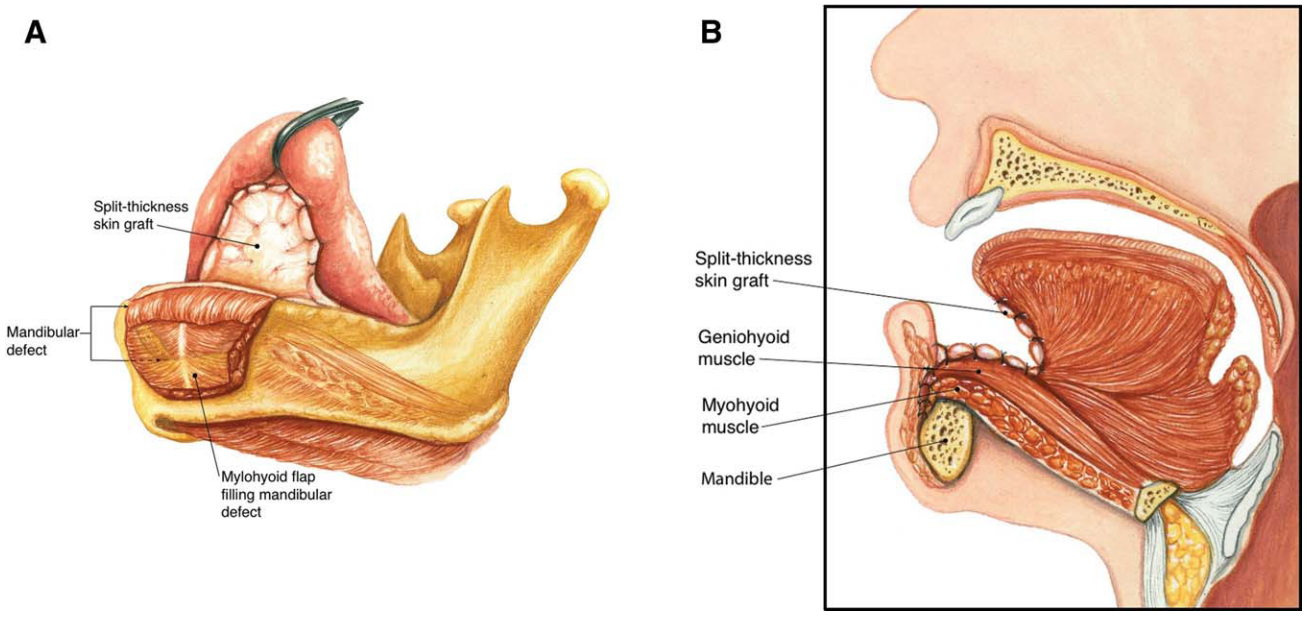

Fig. 5. Illustrations showing the flap secured over the mandibular defect (A), with a skin graft placed over the mylohyoid and the ventral surface of the tongue, sagittal view (B).

Specific limitations to the use of the mylohyoid flap include those primary lesions that require the resection of the mylohyoid musculature or in defects extending lateral to the angle of the mandible.

DISCUSSION

Ours is not the first study looking at local muscle flaps as a closure option for marginal mandibulectomy. Weissler and Goldsmith describe mobilizing the geniohyoid and genioglossus muscles and suturing them to the remnant mandible.[9] Although this is a viable closure option for smaller floor-of-mouth resections, there is often significant resection of both of these muscles in the ablation portion of larger floor-of-mouth cancers. One has to question the amount of mobility that can be obtained with these muscles without leading to significant speech and swallowing issues, especially in the case of significant partial glossectomy. On the other hand, the mylohyoid is often spared in floor-of-mouth cancer, even those of significant size, therefore allowing closure with the pull through flap without impacting oncologic clearance. In our study, 24 (82.7%) of our patients required a partial glossectomy, which is significantly higher than other studies looking at reconstruction of marginal mandibulectomy. Despite the high number, closure with a mylohyoid advancement flap still allowed for relatively quick return to an oral diet. The majority of our patients were restarted on an oral diet by postoperative day 1, with two needing supplementation through gastrostomy tube. This quick return to oral intake is in part due to circumventing the placement of an overlying bolster of the skin graft, which a number of authors favor.[2] It had been believed that immobilization of the skin graft through bolster placement was essential to graft take and survival. In our study there was partial loss of the skin graft in only two of 29 patients despite early oral alimentation and the lack of a bolster, which suggests that the bolster can be bypassed without marked increase in morbidity.

Radiation therapy also plays a hand in choosing the optimal closure technique. As suggested by Lambert and Patel, placement of skin grafts on irradiated tissue has a high failure rate compared with similar grafts placed on a nonirradiated bed.[10] This may lead to the placement of a free tissue graft, which in a nonirradiated patient would not be required.[2] In our study, 25 patients (86%) who had closure performed using the mylohyoid pull through flap were exposed to either neoadjuvant or adjuvant external-beam radiotherapy with no loss of the flap coverage. There was partial dehiscence of the flap in one of the patients.

Radiation exposure, especially in edentulous portions of the mandible, also leads to concerns in regard to ORN. The reported overall rate of developing ORN after hyperfractionated or accelerated radiation exposure with concomitant boost is around 5%.[11] Alvi and Myers reported an ORN rate of 25% (2 of 8 patients) when a patient underwent marginal mandibulectomy reconstruction with skin graft alone, followed by adjuvant radiation therapy.[4] We had no reported cases of ORN at the most recent follow-up. The use of the mylohyoid flap circumvented the need for placement of a radial forearm free flap without increasing the incidence of ORN.

Use of the mylohyoid flap significantly cuts down on other concerns, beyond ORN, that are intrinsic to free flap reconstruction. The first is marked increase in time that is inherent with free tissue transfer. The harvesting of the pull through flap only adds a few minutes to the reconstruction and is clearly quicker than free flap harvest and placement. This is important given that head and neck cancer patients often have a number of comorbidities and may be unable to tolerate the additional time on the surgical table. Postoperatively the mylohyoid flap circumvents the time required of physicians and nurses for free flap monitoring, even when an implantable Doppler is used. The local flap is also advantageous in that it does not require the additional surgical skill set necessary to performing microvascular surgery. Finally, donor site morbidity is essential nil with the mylohyoid flap, and the morbidity that is involved with radial forearm harvest, especially if bone is also harvested, can be quite considerable.

CONCLUSION

The addition of the mylohyoid flap into the armamentarium of anterior oral cavity closures offers a number of benefits in a broad spectrum of patients. The procedure is intuitive and surgical time is small, especially when used in cases that would typically have required free flap closure. The quick return to oral alimentation as well as minimal donor site morbidity associated with the flap assist in minimizing the time a patient is hospitalized.

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