Clinical Study

Total Lip Reconstruction with Tendinofasciocutaneous Radial Forearm Flap

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1. Introduction

Squamous cell carcinoma is a common tumor of lower lip that requires radical surgery. Small defects created by surgical resection may be readily reconstructed by linear closure or with local flaps. However, large defects involving over 60% of lip local flaps previously described by Gillies and Millard [1], Karapandzic [2], Webster et al. [3], Nakajima et al. [4], and others often results with microstomia and oral incompetence resulting in drooling and speech incomprehension [5, 6]. Microstomia may result with impaired oral hygiene and inability to use dentures. When tumor involves adjacent facial regions such as cheek and chin local and regional flaps are even less reliable in providing enough tissue and therefore living the patient with severe deformity. The reconstructive goal is to restore mucosal lining and external skin coverage and restoring oral competence so as to achieve good oral food intake without drooling, understandable speech, opportunity for good oral hygiene care, and acceptable aesthetics [7]. Sakai et al. [7] first described the use of a composite radial forearm along with palmaris longus tendon to reconstruct large lower lip defects. The folded skin island provides mucosal lining and skin coverage while the palmaris longus tendon is sutured to the modiolus on both ends and serves as a suspension sling. The goal of this study is to describe our experience with composite free radial forearm-palmaris longus tendon flap.

2. Patients and Methods

Between May 2005 and July 2008 we used tendinofasciocutaneous radial forearm flap for total or near total lower lip reconstruction in five patients. Age of patients ranged from 46 to 82 years. They are three male patients and two females. All tumors were T3 or T4 and tumour...
Table I: Patient and tumor characteristics.

| Patient | Age (y)/sex | Tumor stage | % of lip defect | Adjacent tissue involvement and resection | Remarks |
|---------|-------------|-------------|----------------|------------------------------------------|---------|
| 1       | 72/M        | T4N0M0      | 80             | Chin                                     | recurrent tumor, radiation therapy failure |
| 2       | 82/F        | T4N0M0      | 80             | Chin, mandible, and mouth floor           |         |
| 3       | 56/M        | T3N0M0      | 90             |                                          |         |
| 4       | 46/F        | T3N0M0      | 100            |                                          |         |
| 5       | 58/M        | T4N0M0      | 80             | Chin                                     |         |

Figure 1: Surgical technique. (a) Marking of radial artery (two arrows) and palmaris longus tendon (three arrows), (b) Flap elevated showing vascular pedicle (thin arrows) and palmaris longus tendon (thick arrows) attached to the under surface of the flap by thin peritendon. (c) Part of the flap is sutured to the oral mucosa for lining and the tendon (Arrows) is secured to the Modiolus, Buccinator muscle. (d) The skin paddle is folded over the tendon (e) and suturing it in place. (f) Donor site is covered with split thickness skin graft.
The resection resulted with lip defect of 80–100%. Patients 2–4 received postoperative radiation therapy. Follow-up time ranged between three and six years. The details of patients' tumours are summarized in Table 1.

2.1. Operative Technique. All patients underwent radical resection of tumor combined with supraomohyoid neck dissection flowed by immediate reconstruction. Lip defects ranged 80–100%. In all cases the defect was reconstructed using a tendino-fasciocutaneous radial forearm free flap. Skin paddle was designed according to mucosal and skin defects (Figure 1(a)). Three patients needed reconstruction of chin skin as well as lip and one patient needed reconstruction of anterior floor of mouth. The flap was raised in a usual manner except for special care to keep the palmaris longus tendon with the flap (Figure 1(b)). This part of the dissection is delicate since the tendon is attached to the under surface of the skin paddle by peritendon only. The pedicle was tunneled to the neck and microvascular anastomosis was performed. The tendon was anchored on both sides to the modiolus and buccinator muscle and the skin paddle was sutured to the oral mucosa (Figure 1(c)). The flap was then folded over the tendon and sutured in place (Figures 1(d) and 1(e)). The donor site was covered with skin graft (Figure 1(f)). In one case palmaris longus muscle and tendon were absent and half of flexor carpi radialis tendon was harvested and used in a similar manner as a tendon graft. In one case (Figures 2 and 3) the resection included a 5 cm segment of anterior mandible that was reconstructed using a vascularised segment of radius with the flap. The radius bone segment is a wedge of about one-third of bone circumference or cross-sectional area. No plating of the remaining bone was done and the patient was casted for two weeks. The two mandible segments and the bone flap were plated using a reconstruction plate.

3. Results

Patients’ outcome is summarized in Table 2. All patients survived the procedure and were discharged home back to their previous day-to-day activities. All flaps totally survived. All patients regained normal diet and good oral competence. Aesthetic result was usually good or excellent (Figures 4 and 5). One patient with a composite reconstruction of lower lip chin mandible and mouth floor resulted with a less than acceptable result. Although we estimate that secondary revision may have resulted with significant improvement, the patient did not consent to this. Four patients regained normal speech and one patient reported minor speech and communication difficulties. None of the patients suffered microstomia or problems with oral hygiene maintenance. Figure 5 shows good mouth opening and good lips competence with the patient blowing a rubber glove and holding a wooden mouth opener with his lips only. No significant donor site morbidity was obtained (Figures 1(f) and 3(c)).
4. Discussion

Total or near total lower lip reconstruction remains a challenge to the reconstructive surgeon. Goals of the reconstruction procedure are to restore patients oral competence, speech, and diet as well as to permit oral hygiene and as normal as possible appearance [6–8]. Local flaps often fail to achieve these goals and require numerous revision procedures [5]. Also, regional skin flaps from the neck may suffer from questionable blood supply after neck dissection.

Table 2: Patients Outcome.

| Patient | Postoperative complication | Flap survival | Diet     | Static lip suspension | Oral competence | Speech      | Aesthetic acceptance | Remarks                                                                                     |
|---------|---------------------------|---------------|----------|-----------------------|-----------------|------------|---------------------|---------------------------------------------------------------------------------------------|
| 1       | No                        | 100%          | Normal   | Good                  | Adequate        | Normal     | Excellent           | Vermilion reconstruction with mucosal graft. Combined with mandible reconstruction by radius bone in the flap. Flap to bulky, patient refused debulking procedure. |
| 2       | No                        | 100%          | Normal   | Good                  | Adequate        | Normal     | Less than acceptable |                                                                                              |
| 3       | Wound infection: incision and drainage | 100%          | Normal   | Good                  | Adequate        | Normal     | Good                | Debulking surgery 6 months postoperatively. No palmaris longus. Hemi-flexor carpi radialis tendon was used for suspension. |
| 4       | Venous insufficiency: Leeches therapy | 100%          | Normal   | Good                  | Adequate        | Normal     | Acceptable          |                                                                                              |
| 5       | No                        | 100%          | Normal   | Good                  | Adequate        | Normal     | Excellent           |                                                                                              |
Figure 4: Patient number 1. (a) Preoperative marking. Tumor border (dashed line) planned resection (continuous line). (b) Intraoperative defect showing 80% thru thru lower lip defect and chin defect with exposed mandible. ((c), (d)) Postoperative result.

Figure 5: Patient number 5: (a) preoperative tumor resection outlined, (b) Postoperative anterior view, and (c) lateral view. Lip function: (d) patient is blowing a rubber glove. (e) Mouth wide open. (f) Patient is holding a wooden mouth opener with his lips only showing good lip competence.
and radiation prior to surgery. Several methods of suspension procedures have been introduced in the literature. We find the method described by Sakai et al. [7] and modified by others [5, 6, 8] very useful in these difficult cases. In this paper we describe our experience with total lip reconstruction using the tendino-fasciocutaneous radial forearm flap. We find this procedure to be safe and to achieve most reconstructive goals. In one of our patients we found the palmaris longus to be absent; in this case we used half of the flexor carpi radialis tendon as a suspension sling. To the best of our knowledge this is the first report of that technique. We would like to point out to the readers that about 15% of patients are lacking the palmaris longus [9, 10]. Therefore it is important to bear in mind the option of using hemi-FCR tendon in this case. In one case we incorporated also a piece of radius to reconstruct a segment of mandible. We have not seen such a report before. Incorporation of bone into the flap makes planning harvesting and insetting of the flap somewhat difficult and limited. We were reluctant to attempt to segment the bone flap since it is relatively small and thin so we were apprehend to shatter it. This obviously limits one’s ability to create good chin contour due to the limited bone bulk and safety with ostectomy of the partial thickness bone. Radial forearm flap is not our flap of choice for mandible reconstruction; however in some elderly patients with significant peripheral vascular disease when the use of fibula flap is not feasible due to occlusion of peroneal vessels, it may serve as a second option in spite of its limitations.

**Conflict of Interests**

The authors declare that there is no conflict of interests regarding the publication of this paper.

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