



Our Experience in Oral Commissure Reconstruction After Surgical Excision of Stage 3 and Stage 4 Oral Cavity Malignancy

Vikas Kakkar¹ · Vanita Sarin² · Anurag Salwan¹ · Rajeev Gupta³ · Shveta Mahajan⁴

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Abstract

Introduction The upper and lower lips represent the most important functional and aesthetic anatomical structures of the lower segment of the face. The reconstructive aims are to restore the oral lining, oral competence and function (i.e. articulation, speech and mastication). Functional and aesthetic restoration of lip and oral commissure defects can be achieved using the composite radial free forearm flap (RFFF) with Palmaris longus tendon.

Methodology To present the technique, we have used our experience with this form of reconstruction in 30 consecutive patients with lip and oral commissure defects who were surgically treated between 2012 and 2018. Reconstruction of the lip defect was done with RFFF with Palmaris longus tendon. The ends of the Palmaris longus tendon were passed intraorally and anchored to the remnant orbicularis oris muscle of the upper lip to provide adequate tension so that oral competency could be achieved and sagging of the commissure could be prevented, and in cases, where adequate orbicularis oris was not present, the

tendon was sutured to the zygomatic prominence. The patients were followed for 1 year.

Results In our study of 30 cases of stage 3 and stage 4 oral cavity squamous cell carcinoma, we did RFFF with Palmaris longus and found that the graft uptake was excellent, i.e. 93.33%. Flap failure occurred in only 2 out of the total 30 cases. Re-exploration of the flap was done, and venous congestion was the cause of flap failure. Re-anastomosis of the vessels was done, but still the flap could not be salvaged. Donor site healed satisfactorily without any complications except for scarring. All patients had excellent oral competence during rest, speaking and eating. Good sphincteric function was obtained in early post-operative days. Drooling or air leakage was seen only in 6 out of 30 cases after 1 year of follow-up. The patients' articulation was near-normal. The aesthetic results were accepted by 24 patients. All patients were able to resume regular diet. No complications were observed such as dehiscence, fistula formation or abscess formation. The mouth opening was also adequate (2–3 finger width) in 24 out of 30 patients of oral commissure reconstruction.

Conclusion The RFFF with Palmaris longus has excellent viability. It is a secure and reliable reconstructive option which produced satisfactory aesthetic and functional results.

✉ Vanita Sarin
vanitasarin@yahoo.co.in

¹ Department of General Surgery, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

² Department of Otorhinolaryngology, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

³ Department of Medicine, Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar, Punjab, India

⁴ Oral Medicine and Radiology, JK Health Services, Jammu, India

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Introduction

Large, full thickness lip defects after head and neck surgery continue to be a formidable challenge for reconstructive surgeons. The reconstructive aims are to restore the oral

lining, oral competence and function (i.e. articulation, speech and mastication) [1].

The radial free forearm flap (RFFF) was one of the first free tissue transfer flaps to be described. It has since become a workhorse for soft tissue replacement in head and neck cancer surgery, being commonly used to replace external skin and internal mucosal linings. It is an extremely versatile flap allowing intricate folding of the skin, using two or more skin paddles/islands, and incorporating vascularised tendon and/or bone (osteocutaneous flap) [2]. It was first developed by Yang Goufan, Chen Baoqui and Gao Yuzhi of the Shenyang Military Hospital in 1978. The thin, pliable, predominantly hairless skin of the forearm has potential for intra-oral reconstruction, and to date, this flap has been widely used to the success and reliability of the method, and its versatility in coping with defects of differing size, shape and site within the oral cavity is remarkable [3]. The lips can be divided into several aesthetic subunits. The upper lip is divided into 3 subunits—2 lateral subunits and 1 medial subunit, the philtrum. The lower lip is considered as one unit. The nasolabial crease separates the upper and lower lips from the cheeks, and the labio-mental crease separates the lower lip from the chin. The goals of lip reconstruction therefore should be to restore the complex function and form of this anatomical unit. The end result should achieve a competent oral sphincter that has sensations and is of adequate diameter. There should be complete skin cover, oral lining and the semblance of vermilion. The site and size of the defect ultimately determine the feasibility of achieving these goals. Lip defects less than one-third in size can be closed directly. Defects greater than one-third require the import of new tissue. This new tissue which can be borrowed from the remaining lip, the opposite lip, the adjacent cheek or local flaps may be used. Once the defect involves the whole lower lip and extends onto the chin, it is necessary to consider distant flaps [4].

We report our experience with this form of reconstruction in 30 consecutive patients surgically treated from 2012 to 2018 in the Department of Otolaryngology, in a tertiary care centre.

Methodology

This study was conducted from 2012 to 2018 at the Department of Otolaryngology, in a tertiary care centre. Thirty patients suffering from malignancy (stage 3 and 4) of the oral cavity were selected for this study. All the patients showed involvement of oral commissure with varying portions of the lower and/or upper lip. These patients were taken up for surgery after thorough work up. The safety margins of the resection were 1 cm, and

pathological examination revealed tumour-free margins in all cases. Frozen section histopathological examination was done during the perioperative period in the lesions in which the margins were poorly defined. All lip defects were caused by resection of the squamous cell carcinoma that required repair by the plastic surgery team.

Before operation, an Allen test was performed in order to determine whether the hand will survive without a radial arterial input. The suitability of the radial artery as a donor vessel was assessed in the non-dominant hand by palpation and its course in the forearm carefully marked. The subcutaneous forearm veins were identified and similarly marked (Fig. 1). The appropriately designed flap was drawn, and an arm tourniquet was inflated after elevation—exsanguination. The flap was elevated in a standard fashion (Figs. 2, 3, 4). Following release of the tourniquet, haemostasis was secured and the viability of the flap was assessed prior to final separation and transfer. The simplest way to close the donor soft tissue defect was to use a split-skin graft from the thigh (which was done in all our patients). Thereafter, the forearm and hand were immobilized for 10–12 days. The flap was transferred to the recipient site. Both ends of Palmaris longus tendon were passed intramuscularly and anchored to the remaining orbicularis muscle of the commissure of the upper lip. In cases, where there was no remnant muscle, we sutured the tendon to the corresponding zygomatic prominence. The tension of tendon suturing was adjusted so that oral competence could be achieved. The microneural anastomosis was performed between the antebrachial nerve and the cut end of the mental nerve. Finally, the microvascular anastomosis was performed. The arterial anastomosis was done with facial artery in the submandibular triangle itself after removal of the submandibular gland (after modified neck dissection (Fig. 5)). The venous anastomosis was done in a standard manner, i.e. cephalic vein with external jugular vein (EJV) and the venae comitantes with the common facial vein at the site just before it drains into the internal



Fig. 1 Markings for composite radial forearm Palmaris longus free flap



Fig. 2 Volar surface of left forearm showing cephalic and median antebrachial vein



Fig. 3 Palmaris longus tendon



Fig. 4 Medial edge of brachioradialis tendon along with the vascular pedicle

jugular vein (IJV) (Figs. 6, 7). Post-operatively, Dextran 40 microdrops/min for first 24 h and Enoxaparin 60 mg subcutaneous thrice a day for 5 days along with systemic antibiotics and analgesics were given. Patients were kept under close observation regarding colour change in the RFFF and temperature change (as compared to surroundings by infrared thermometer every 1 hourly for the first

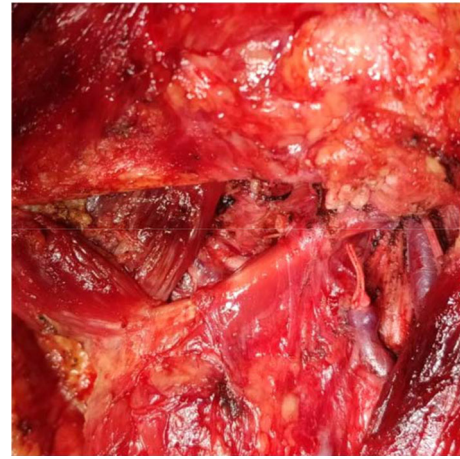


Fig. 5 Submandibular triangle showing the stump of facial artery

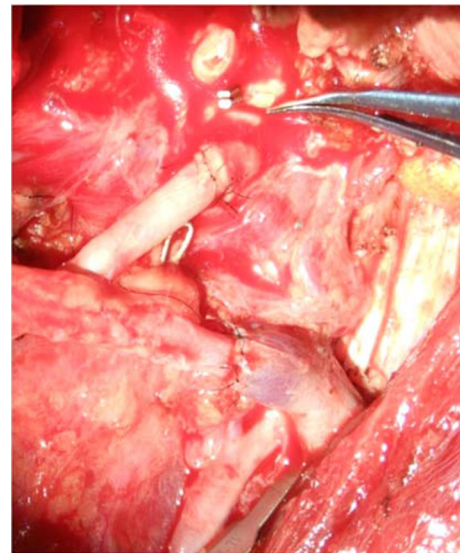


Fig. 6 The arterial anastomosis with facial artery and venous anastomosis with common facial vein

24 h and every 3 hourly for the next 48 h post-operatively). If there was a change in temperature by 1 F, then a needle prick test was performed. A decreased flow or dark coloured blood was an indication of doing doppler examination to see the flow and patency at both the arterial and venous anastomotic sites. If required, then re-exploration was done. Standard post-operative care was done, and patients were fed by nasogastric tube for 10–15 days.

All the patients underwent follow-up till 1 year. During this post-operative follow-up, the aesthetic and the functional outcome of the flap was assessed. Functional outcome was assessed by documenting, non-speech task (including swallowing, *puckering, spreading and rounding*), speech task (including bilabials), mouth opening (2–3 finger width was considered adequate), chewing



Fig. 7 The arterial anastomosis with facial artery and venous anastomosis with common facial vein



Fig. 9 Preoperative carcinoma cheek involving commissure



Fig. 8 Preoperative carcinoma cheek involving commissure

movements, drooling of saliva, blowing of whistle, straw sucking, spoon holding and sensation of neolip (cotton wisp test) and, every 3 months till 1 year of the post-operative period. All patients were, however, subjected to speech therapy, jaw stretching exercises and physiotherapy for achieving adequate oral competence during the follow-up period of 1 year.

Results

In our study of 30 cases of stage 3 and stage 4 squamous cell carcinoma of the oral cavity, all cases showed involvement of oral commissure with varying portions of the lower and/or upper lip (Figs. 8, 9). The mean age was 48 ± 12 years, there were 22 males and 8 females, and the M/F ratio was 2.75:1.

The RFFF with Palmaris longus survival rate of the graft was 93.33% (28 out of 30 cases). Two cases showed drop of temperature of > 1 F when compared with the surroundings within 24 h of surgery. Needle prick test showed dark blood coming at the prick site and doppler reported a decrease in blood flow at the anastomotic site. Both 2 cases were re-explored, and a thrombus was found at the venous anastomotic site. Re-anastomosis was done after freshening the margins of the donor and recipient vessels. Perfusion of the RFFF was seen on table. Again there was change in colour with drop in temperature of > 1 F after 24 h of surgery and doppler revealed a decrease in blood flow at the venous anastomotic site. Though re-anastomosis was done, the perfusion of RFFF was not acceptable and it failed. In these two patients, where the RFFF flap could not be salvaged, the surgical wound was debrided and antero-lateral thigh (ALT) free flap was planned for reconstruction. Since ALT flap is too thick to reconstruct lip and oral commissure defects, these two patients were excluded from the study.

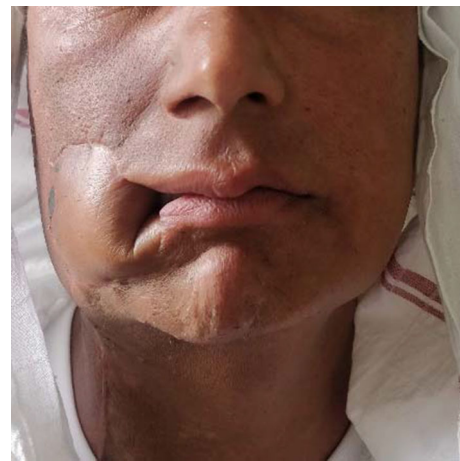
The donor area healed without any complications except for scarring. All patients underwent follow-up every 3

Table 1 $n = 30$ patients

	Functional outcome	Post-operative	3 months	6 months	1 year
1	Non-speech task	20	20	26	26
2	Speech task	15	20	20	24
3	Mouth opening	24	20	20	20
4	Chewing	30	30	30	30
5	Drooling of saliva	10	8	8	6
6	Blowing of whistle	5	5	5	5
7	Straw sucking	25	26	26	26
8	Spoon holding	22	23	24	24
9	Sensation of neolip	1	12	15	17
10	Aesthetic satisfaction	20	23	24	24

**Fig. 10** Three weeks post-operatively mouth close**Fig. 11** Three weeks post-operatively mouth open

months for 1 year. Out of 30 patients, only 26 patients underwent post-operative radiotherapy. Functional outcome (Table 1) was assessed by documenting, non-speech task (including swallowing, puckering, spreading and rounding), speech task (including bilabials), mouth opening (2–3 finger width was considered adequate), chewing movements, drooling of saliva, blowing of whistle, straw sucking, spoon holding and sensation of neolip (cotton wisp test). Twenty patients could perform the non-speech task post-operatively, and by the end of 1 year, 26 patients could perform the non-speech task. Fifteen out of the total of 30 patients could perform the speech task, and this number increased to 24 by the end of 1 year of complete treatment. Twenty-four patients (Figs. 10, 11, 12, 13) had adequate mouth opening post-operatively, but the mouth opening reduced by the end of 1 year and only 20 out of the total of 30 patients demonstrated adequate mouth opening. The reason was post-operative radiotherapy and fibrosis. Chewing movements, however, remained unaffected in all the patients. Drooling of saliva occurred post-operatively in only 10 patients, it improved and by the end of 1 year, only

**Fig. 12** One-year follow-up pictures post-operatively mouth close

6 patients experienced drooling of saliva. Improvement was mainly due to physiotherapy. Blowing of whistle was only present in 5 cases, and even physiotherapy did not improve the blowing inpatients. Straw sucking and spoon



Fig. 13 One-year follow-up pictures post-operatively mouth open

holding were present post-operatively in 25 and 22 patients, respectively, and it improved to 26 and 24 patients, respectively, by the end of 1 yr of treatment. The sensation of neolip (tested by cotton wisp test) was present in only 1 patient post-operatively, but it increased gradually and by the end of 1 year of follow-up, 17 patients tested positive for cotton wisp test. Aesthetic satisfaction was present in 24 patients by the end of 1 year of follow-up.

Discussion

Lip cancer is the most common malignancy in the oral cavity (15%). Squamous cell carcinoma (the most common type) has a prevalence that is 20 times higher in the lower lip than in the upper lip [5, 6]. The first evidence of lip reconstruction is seen as far back as 1000 BC in Sushruta Samhita. Reconstruction of lip and its commissure depends upon the size, extent of the defect, patient's general health condition and the surgical skill of the operating surgeon. Various reconstructive procedures have been developed like Karapandzic, Abbe and Fan flaps. These procedures have a drawback of significant microstomia and necessity of a second stage [7]. When the defects become large and include the oral commissure, none of these regional flap techniques can be used. For these cases, some reconstructive techniques have been developed [8–11]. The composite radial free forearm flap with Palmaris longus tendon [12, 13] can be performed in such cases. The toe web free flap [14] or the galeal skin island flap [15] can also be performed in one stage and has a similar purpose. A two-stage technique using a tensor fascia lata muscle was also reported [16]. By the use of a firm support such as a tendon

and fascia in these techniques, sagging of the lower lip can be prevented, but the results are not acceptable functionally and aesthetically [8, 9]. Jeng and others used a composite radial forearm Palmaris longus flap in one stage and sutured the tendon bilaterally through the modiolus to the upper orbicularis oris muscle. This method achieved good oral competence without sialorrhea [17]. Serkan and colleagues used a composite anterolateral thigh-tensor fasciae lata flap and divided the fascia into four strips. The upper two strips were passed through the upper orbicularis oris muscle and were sutured together at the philtrum. The lower two strips were anchored to the periosteum of zygomatic eminences. Thus, dynamic suspension was created by the upper two strips, and static suspension, by the lower two strips [18]. Other flaps which can be used for lip reconstruction are ALT flap, and some consider it superior as there is no sacrifice of a major vessel as it is in RFFF flap. Some preferred a combination flap comprising of the pedicled submental flap and the dorsalis pedis free flap for commissure reconstruction. But the advantages and disadvantages are debatable as ALT flap is too bulky for commissure reconstruction and doing two flaps in one sitting from different regions instead of one is associated with morbidity and is a time- and energy-consuming process and exposes the patient to flap complications [19, 20].

In our study of 30 cases of stage 3 and stage 4 oral cavity squamous cell carcinoma, we did RFFF with Palmaris longus and found that the graft uptake was excellent (93.33%). All patients had excellent oral competence during rest, speaking and eating. Good sphincteric function was obtained in early post-operative days. Drooling or air leakage was seen only in 6 out of 30 cases after 1 year of follow-up. The patients' articulation was near-normal. The aesthetic results were accepted by 24 patients. All patients were able to resume regular diet. No complications were observed such as dehiscence, fistula formation or abscess formation. The mouth opening was also adequate (2–3 finger width) in 24 out of 30 patients of oral commissure reconstruction. The pre and postoperative outcome of patients are presented in Figs. 8, 9, 10, 11, 12 and 13.

This technique, because of its reliability and versatility, provides a satisfactory sphincter function. Thus, oral nutrition and proper speech are re-established even in elderly patients, without much evidence of microstomia. Innervation, sensation and adequate cosmesis are provided by this surgery, which restores the defect with 'like' tissue.

This article will help most of the plastic surgeons to improve their result and provide good functional and aesthetic outcome in surgeries involving the oral commissure.

Conclusion

The RFFF with Palmaris longus has excellent viability. It is a secure and reliable reconstructive option which produced satisfactory aesthetic and functional results.

Compliance with Ethical Standards

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

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