

# ORAL RECONSTRUCTION WITH FREE LATERAL ARM FLAP ANALYSIS OF COMPLICATIONS AND DONOR SITE MORBIDITY FOR PATIENTS WITH ADVANCED STAGE ORAL CANCER

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*Radial forearm flap is a gold standard for oral soft tissue defect reconstruction after tumour ablative surgery of oral cancer in advanced stages. The main disadvantage of this flap is donor site morbidity. The goal of our study was to show versatility of lateral arm flap in 34 cases with different oral defects that were reconstructed after tumour ablation, and to analyse complications and donor site morbidity. Thirty-four patients with advanced stage oral cancer (T3 and T4) underwent tumour ablation with or without suspicious lymph node removal and with immediate reconstruction of oral defect with lateral arm flap. Analysis of complications and donor sites morbidity was carried out. The Michigan Hand Outcome Questionnaire was used to evaluate functional and esthetical donor site outcome during at least one year follow up. Thirty-one patients had successful free flap surgery with uneventful post-surgery period. Flap loss due to vascularity problems was in one case (2.9%). The flap success rate was 97.1%. The donor site was closed primarily in all cases and healed uneventfully. The Michigan Hand Outcome Score was average 94.30%. The lateral arm is an excellent choice for oral reconstruction after ablative tumour surgery. It is versatile, safe and reliable for oral reconstruction with very good functional and aesthetical donor site outcome.*

**Key words:** oral cancer, lateral arm free flap, oral reconstruction, morbidity, head and neck cancer.

## INTRODUCTION

Oral cancer is a serious malignant disease. A rough patch, ulcer, or lump affecting the floor of the mouth, tongue, buccal mucosa or lips with significant tendency to metastasise to cervical lymph nodes is a usual beginning of disease. The ability of cancer to remain asymptomatic for a long time usually is a reason for diagnosis at advanced stages. Resection of a tumour is the cornerstone of treatment. Closure of the surgical defect may be simple in early stages, but complicated and challenging in advanced stages. Local and regional flaps have been mainstays of reconstruction for surgical defects after ablation of tumours. The main disadvantages are multiple surgeries, poor donor site outcome and possible flap distal part vascularity problems. The microsurgical free tissue transfer has been a common option for reconstruction of head and neck defects since the 1980s

(Rohrich *et al.*, 1992). The free flap with its rich vascularity gives a high degree of versatility and reliability in design for reconstruction of surgical defects. Introduction of the radial forearm flap by Yang *et al.* (1981) opened wide reconstruction options in head and neck surgery. The flap is versatile, reliable, with constant anatomy and a large diameter long vascular pedicle. Over time the radial forearm flap has become a “work horse” due to its characteristics in many institutions. The main disadvantages are loss of one the main arteries, which may compromise vascularity of the hand and donor site morbidity due to loss of the skin grafts over tendons. Tendon exposure and adhesion formation cause delayed healing, poor appearance and loss of function. Literature showed different success rates with up to 53% partial skin graft failure and up to 33% for tendon exposure (Swanson, 1990; Lutz *et al.*, 1999). These considerations made looking forward and searching for the perfect flap,

which has easy harvesting, a long pedicle, saves the main arteries and primary donor site closure. Partially these demands are met by the lateral arm flap. The free lateral arm flap was initially described by Song *et al.* (1982) as a septocutaneous flap. Later different variations of the flap were introduced. Sensitive flap using posterior brachial cutaneous nerve (Harpf *et al.*, 1998; Hennerbichler *et al.*, 2003; Karamursel *et al.*, 2005), osteofasciocutaneous flap with distal *humerus corticalis* (Haas *et al.*, 1992; Hennerbichler *et al.*, 2003), musculotendofasciocutaneous flap with triceps muscle components (Hennerbichler *et al.*, 2003) or just fascial flap were described as different reconstruction options using the lateral arm flap.

The goal of our study was to show the versatility of the lateral arm flap in 34 cases with different oral defects that were reconstructed after tumour ablation, and to analyse complications and donor site morbidity.

## MATERIAL AND METHODS

In this study 34 patients were included, who had oral reconstruction with lateral arm flap. All patients had advanced stage oral cancer and underwent tumour ablation with immediate reconstruction of the oral defect with a lateral arm flap. All vascularised tissue transfers were performed from November 2009 till June 2016. All patients had simultaneous extirpation of tumour with or without suspicious lymph node removal and reconstruction of the defect with a free lateral arm flap. Postoperative adjuvant radiotherapy with or without concurrent chemotherapy was administered when indicated, based on patient's general condition, tumour stage and pathological adverse features. The Michigan Hand Outcome Questionnaire was used to evaluate functional and aesthetical donor site outcome. The Michigan Hand Outcomes Questionnaire (MHQ) has been used to assess a variety of hand and upper extremity injuries and conditions for nearly 15 years. The MHQ consists of 37 questions, which refer to the function of patient's hand(s) and/or wrist(s) during the past week and is expressed in percentages, where 0% is the worst and 100% is the best result. In this study patients completed the questionnaire at least after one-year post surgery.

Ethical approval of the Ethics Committee of Rīga Stradiņš University was received, and consent from included patients was obtained to accomplish this research.

Statistical analysis was performed using IBM SPSS version 24.0 software (SPSS, Inc., Armonk, NY, USA). Results are presented as means ( $\pm$  Standard Deviation). The categorical variables are reported as counts and percentages. Differences between groups were analysed using a binomial statistical test with 95% confidence interval (CI). A *p*-value of 0.05 was considered statistically significant.

## RESULTS

Of the 34 patients included in this study, 27 patients were males (79%) and seven patients were females (21%). Aver-

age patient age was 55.8 (SD = 12.2) years. All patients had oral squamous cell carcinoma in advanced stage (T3 or T4), except in one case where pleomorphic carcinoma was diagnosed (Table 1). Cancer was located on the floor of the mouth with partial tongue or buccal involvement in 29 cases. Three patients had tongue cancer and two patients had buccal cancer. Detailed tumour location is showed in Table 2.

Of the 34 patients, 31 patients (91%) had successful free flap surgery with an uneventful post-surgery period (Figs. 1–4). Complications were observed in three cases (9%), which are listed in Table 3. Flap loss due to vascularity problems was in one case (3%). Salvage reconstruction was done with radial forearm flap for this patient. Flap marginal necrosis that healed by secondary intension was in another case (3%), and hematoma was in one case (3%). Flap success rate was 97.1%. We did not observe any donor site complication in this study. Average flap dissection time was 8.93 (SD = 6.80) minutes (from 50 min. till 68 min.). Donor

Table 1

SUMMARY OF PATIENTS DEMOGRAPHIC FEATURES, TNM CATEGORY (n = 34)

Category	n (% of the total)	95% CI	<i>p</i>
Sex			
Male	27 (79)	63–89	0.001
Female	7 (21)	10–36	
T-stage			
T3	24 (71)	53–83	0.024
T4	10 (29)	16–46	
N-stage			
N0	15 (44)	28–60	< 0.001
N1	6 (18)	8–33	
N2	12 (35)	21–52	
N3	1 (3)	0.5–14	
M0	34	-	

Table 2

TUMOUR LOCATION

Location	n (%)	95% CI	<i>p</i>
Tongue	8 (23)	12–40	< 0.001
Buccal mucosa	2 (6)	1–19	
Floor of mouth	5 (15)	6–30	
Floor of mouth with partial tongue	15 (44)	28–60	
Mandibular alveolus	4 (12)	4–26	

Table 3

COMPLICATION OF RECIPIENT SITE

Recipient site severe complication	n (%)	95% CI	<i>p</i>
Total flap loss	1 (3)	0.5–14	-
Recipient site minor complication			
Marginal necrosis/dehiscence	1 (3)	0.5–14	0.05
Hematoma	1 (3)	0.5–14	

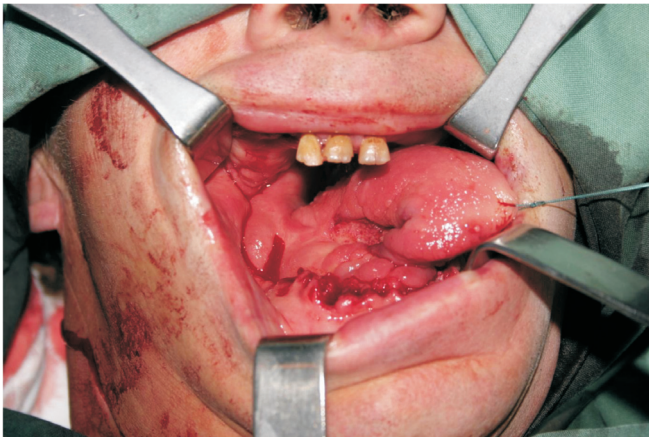


Fig. 1. Patient with cancer on the floor of mouth with partial tongue involvement.

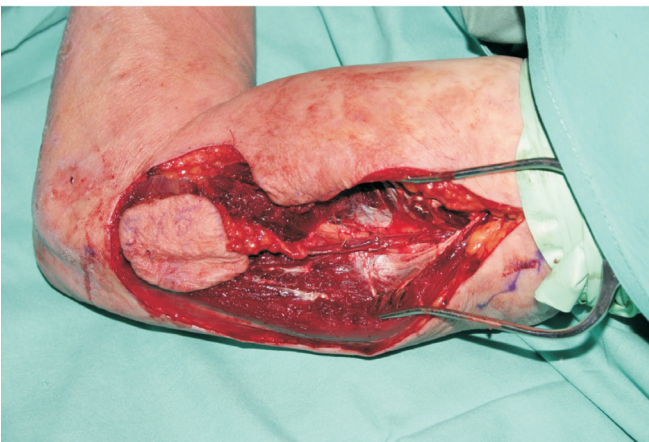


Fig. 2. Harvested lateral arm flap.



Fig. 3. Reconstructed floor of mouth with free lateral arm flap.

vessel was *a. facialis* in 23 cases (68%), and *a. thyroidea superior* was in 11 cases (32%). Average hospital stay was 20.7 (SD = 8.4) days (from 9 to 44 days). Donor site was closed primarily in all cases and healed uneventfully. Average Michigan Hand Outcome Score at least one year follow up was 94.30% (SD = 6.4%). The patient with the worst hand functional and aesthetical result (minimal score) had a score of 80%, and patient with the best hand functional and aesthetical outcome had a score of 100%.



Fig. 4. Donor site of lateral arm flap.

## DISCUSSION

Reconstruction strategies of the oral defects are dependent on type and amount of tissue resected. With the introduction of new flaps and surgical techniques for reconstruction of oral defects, the condition of the donor site of the flap must also be considered. The radial forearm flap has minimal bulk, pliability and possibility to create a composed flap. The relatively long pedicle can reach either side of the neck, regardless of the site of the defect. Both the radial artery and cephalic vein have large diameter, which is essential for easy anastomosis. Concomitant veins may be reliably used for venous anastomosis. It is a very good flap for oral reconstruction. The main disadvantage is donor site closure, which usually requires a skin graft. Donor site morbidity is mainly due to loss of the skin graft over tendons. Tendon exposure and adhesion formation cause delayed healing, poor appearance and loss of function (Chung-Ming Chen *et al.*, 2005).

Since the first description in 1982 by Song *et al.*, the lateral arm flap has been used in reconstruction of the oral cavity. Reconstruction of the tongue, floor of the mouth, mandible, inner cheek, oropharynx and lower lip has been reported. (Civantos *et al.*, 1997; Reinert, 2000; Nahabedian *et al.*, 2001; Schipper *et al.*, 2003; Thankappan *et al.*, 2011). The



lateral arm flap has similar structure to the radial forearm flap, with the same versatility, but with better donor site outcome.

Harvesting a radial forearm flap involves the sacrifice of a major artery of the hand, whereas a lateral arm flap is based on the posterior radial collateral artery which is not an essential vessel of the arm. The lateral arm flap has following advantages. It has predictable and reliable vascular anatomy with constant location of the posterior radial collateral artery. However, Haas *et al.* (2007) had one case of 14 patient's series where a radial collateral artery was absent (Haas *et al.*, 2007). Our study supports the statement of constant anatomy of the flap. Once the anatomy is familiar and technical skills are gained, lateral arm flap dissection is fast. The main advantage is possibility to use a two-team approach surgery.

Our experience shows that it takes a shorter time to harvest and close the donor site of a lateral arm than radial forearm flap, mostly due to ability to close the donor site primarily. A lateral arm flap gives opportunity to harvest variable thickness of the skin paddle depending on the location of flap on an upper arm. Hage *et al.* expressed doubts of distal lateral arm flap reliability due to less robust vascular anatomy and requiring advanced surgical expertise to raise and handle it (Hage *et al.*, 2005).

Our case series did not show statistically significant vascularity compromise of the distal part of the flap. Although a sensate flap is the most common flap used as a composed flap, there is also possibility to harvest a flap with different other components like fascia, muscle and bone when it is needed.

The biggest advantage of a lateral arm flap is low donor site morbidity. There is no vascular compromise to the arm, elbow function is not affected, and donor site morbidity is restricted to aesthetic consideration and sensory deficit when the sensory branch is harvested. The main disadvantage of lateral arm flap is a relatively short pedicle with small vessels and relatively small size of the flap. Our study shows that due to limits of pedicle length we conducted anastomosis with *a. facialis* in 68% of cases, which might be a technically more demanding surgery due to inconvenient location. The size of flap did not present an issue. We were able to reconstruct most of the oral soft tissue defects without problems of donor site closure primarily mostly due to weight loss, which is often present in advanced stages of cancer, lost elasticity and sagging skin in elderly age patients.

## CONCLUSION

Our study shows that primarily the closure of the donor site provides a very good functional and aesthetical long-term outcome. We observed no complications of the donor site with very little donor site morbidity. When choosing the

type of oral reconstruction, the surgeon must first determine the goal of reconstruction and then use the reconstruction type that provides necessary characteristics to meet the demands to reach the goal. Our study shows that the lateral arm flap is a very useful tool in reconstructive surgery and undeservedly undervalued. The lateral arm is an excellent choice for oral reconstruction after ablative tumour surgery. It is versatile, safe and reliable for oral reconstruction with very good functional and aesthetical donor site outcome.

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#### REKONSTRUKCIJA AR BRĪVIEM AUGŠDELMA LĒVERIEM PACIENTIEM AR IELAISTU MUTES VĒZI

Ielaists T3 un T4 mutes vēzis radikālai ārstēšanai prasa plašas ekscīzijas, 1–1,5 cm atkāpjoties no audzēja robežām. Tādu audu defekta slēgšanai nepieciešami plaši brīvie lēveri, kādus var izveidot un pārnest vajadzīgajā vietā, pielietojot mikrovaskulāras transplantācijas metodes. Brīvais augšdelma lēveris dod iespēju slēgt plašus audu defektus ar labu piedzišanu un praktiski bez donora vietas deformācijas. Rakstā parādītais 34 slimnieku materiāls ir lielākais starp zināmajām publikācijām ar 97,1 % piedzišanu bez vēlinām komplikācijām.