

A COMPARATIVE RETROSPECTIVE STUDY OF PLASTIC RECONSTRUCTIVE SURGERY AFTER EXCISION OF ORAL CAVITY CARCINOMA USING PMMC FLAP, RADIAL FREE FLAP, OR ALT FREE FLAP

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ABSTRACT

OBJECTIVES & AIMS:

- To determine whether the known **risk factors** such as comorbidities like diabetes & hypertension, or smoking increase the complications of flap transfer.
- Whether **the type of flap transfer** has any effect **on flap related complications or on post-operative rehabilitation** of patients.

METHODOLOGY:

This is a retrospective study conducted at GCS Hospital, Ahmedabad, between January 2020 to July 2021. Sample size is 63 patients with oral cavity cancer, out of which 21 underwent PMMC flap reconstruction, 21 underwent free ALT free flap reconstruction and 21 underwent Radial free flap reconstruction.

CONCLUSION:

Risks have not increased complications in free flap or PMMC group in our study. Various other studies have similar results however a larger patient pool may be needed to assess them. Though the flap related complications & donor site related complications are more with PMMC flap as compared to ALT & Radial free flap, statistically there is no significant difference. Also, in the functional post-op outcomes there is no statistically significant difference with PMMC flap, ALT free flap or Radial free flap.

KEYWORDS:

Pectoralis Major Myocutaneous Flap (PMMC); Anterolateral Thigh free flap (ALT free flap); Radial free flap.

INTRODUCTION

- Reconstruction of the head and neck is challenging due to the **variety of tissues** whose structural deficiencies must be corrected [1-3]. This is because the defects include a variety of structures: **skin, mucosa, soft tissue, and bone**. In particular, the anatomy of the oral cavity is complicated, and each structure plays a specific role in speech, swallowing, and facial expression. In addition, defects in one specific functional unit can affect adjacent structures [1-3]. Before reconstruction, a comprehensive assessment of the defect is required. **Disease status** and tumour **staging** may also affect postoperative treatment and outcomes.
- Reconstruction options for defects of the head and neck include **primary closure, skin graft, local flap, pedicled flap, and vascularized free flap transfer [1-3]**. In the 1970 to 1980s, the local flap or pedicled flap was performed for coverage of defects. However, although the **pedicle flap** was adequate for reconstruction, several limitations, such as revision surgery for a bulky flap, limited arc of rotation, and partial **flap necrosis** due to decreased blood flow of the flap **distal portion**, remained. In addition, reconstruction using a pedicled flap is impossible in cases involving an accompanying bone defect [3-5]. Recently, **free flap surgery** for surgical defects of the head and neck has gained popularity as an advanced microvascular surgical technique [2,3]. However, free flap failure remains a challenging problem [5].
- First reported by Ariyan [6] as an island pedicle flap in 1979, the **pectoralis major flap** has been the standard for head and neck reconstruction because it is stable and can be promptly and easily elevated [7]. **The anterolateral thigh (ALT) free flap & Radial free flap** has recently gained popularity for head and neck reconstruction because it provides a **larger surface area** of expendable tissue with a long vascular pedicle. In addition, the distance from the head and neck allows this flap to be **harvested at the same time** as the ablative procedure is carried out to shorten the duration.
- The purpose of this study is to compare various aspects of these three types of flap reconstruction.

AIMS & OBJECTIVES

- To determine whether the known **risk factors** such as comorbidities like diabetes & hypertension, or smoking increase the complications of flap transfer.
- Whether **the type of flap transfer** has any effect **on flap related complications or on post-operative rehabilitation** of patients.

ALT free



Radial free flap



PMMC flap

Materials and methods

INCLUSION CRITERIA:

Patients included in plastic reconstructive procedure after the excision of oral cavity carcinoma were:

1. Male
2. Age group of **30-80 years**
3. Buccal mucosal biopsy proven squamous cell carcinoma
4. Giving the written consent for surgery
5. Fit for general anaesthesia
6. Tumour of T2, T3 or T4a

EXCLUSION CRITERIA:

Patient having following conditions were excluded:

1. Female patient
2. age group **< 30 years**
3. **Above 80 years** of age
4. Salvage free flap cases
5. Pre-operative radiotherapy
6. Unfit for general anaesthesia
7. Recurrence of oral cavity carcinoma
8. Advanced malignancy (**T4b**)

- This retrospective study was carried on **63 patients** from Jan 2020 to July 2021 with oral cavity cancer who underwent reconstruction with a **PMMC flap (21 cases)**, a **Radial free flap (21 cases)** or an **ALT free flap (21 cases)** at our department.
 - Relevant data were collected retrospectively using the medical records from MRD & following parameters were observed:
 1. Age
 2. K/C/O DM or HTN or H/O smoking
 3. Operation time (in hours and defined as the length of time that elapsed between intubation and extubation)
 4. Flap related complications (flap necrosis, flap dehiscence, fistula formation, congestion)
 5. Hospital stays (in days and defined as the length of time that elapsed between surgery and discharge)
 6. Decannulation (RT out time in days)
 7. Oral real mentation (up to taking soft diet orally)
 - All of the reviewed reconstructive operations were performed by a **single experienced reconstructive team** to minimize the effect of the learning curve and measurement bias.
 - Three types of reconstruction approaches were compared with regard to **systemic morbidity** and **functional outcome**. Systemic morbidities were classified as **flap-related complications** while functional outcomes were classified as **oral re-alimentation and decannulation time** for swallowing.
 - If more than one complication was involved, the more serious or ultimate complication was included in the analysis.
 - Differences were considered statistically significant at $P < 0.05$.
- Excision of Oral Cavity Carcinoma and Plastic Reconstruction using PMMC flap

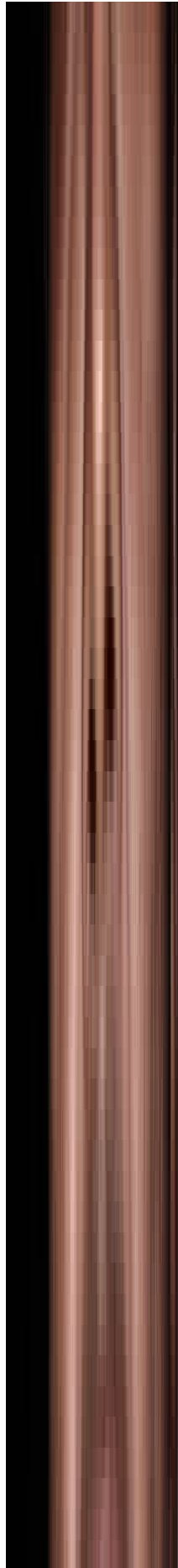




Excision of Oral Cavity Carcinoma and Plastic Reconstruction using ALT Free Flap



Excision of Oral Cavity Carcinoma and Plastic Reconstruction using Radial Free Flap



Observation and Results

- Number of patients: 63 Males
- PMMC flap in 21 cases
- ALT free flap in 21 cases &
- Radial free flap in 21 cases.

TABLE 1: Patient characteristics

CHARACTERISTICS	VALUE
Mean age	59.38 years
H/O smoking	30
H/O alcohol	15
Diabetes	3
Hypertension	6

TABLE 2.1: AVERAGE OT DURATION (IN HOURS) FOR FLAP RECONSTRUCTION

TYPE OF FLAP	DURATION (AVERAGE)
PMMC flap	1.5 HOUR (90 MINUTES)
ALT free flap	2 HOURS (120 MINUTES)
Radial free flap	2.5 HOURS (150 MINUTES)

TABLE 2.2: AVERAGE OT DURATION (IN HOURS) FOR COMMANDO SURGERY

TYPE OF FLAP	DURATION (AVERAGE)
PMMC flap	3.5 HOUR (210 MINUTES)
ALT free flap	4.5 HOURS (270 MINUTES)
Radial free flap	5 HOURS (300 MINUTES)

TABLE: 3 Flap related Complication rate associated with risk factors

	Complication(%)	Non-complication(%)	P-value
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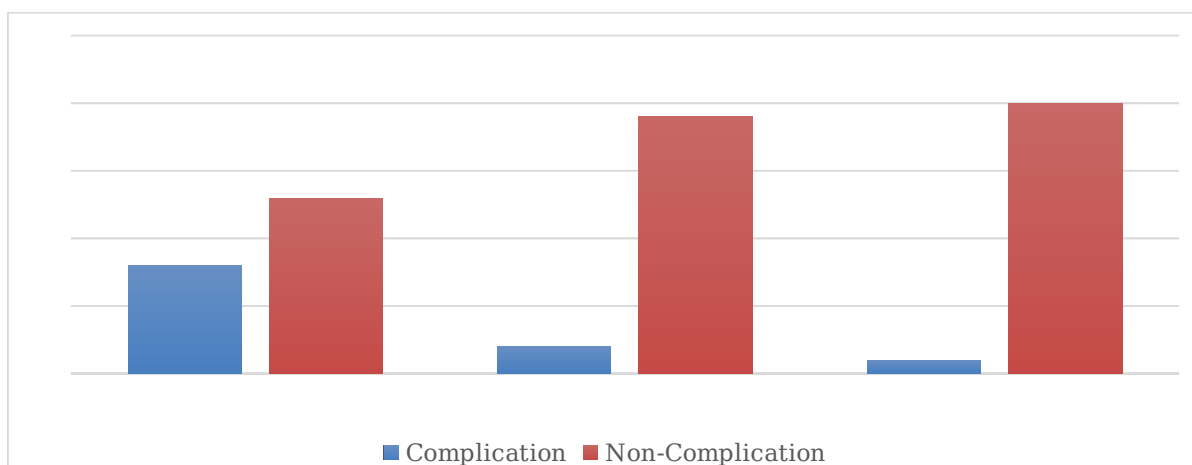
smoking	8(26.7)	22(73.3)	0.696
Non-smoking	2(16.7)	10(83.3)	
HTN	1(16.7)	5(83.3)	1.00
Non-HTN	8(22)	28(78)	
diabetes	1(33.3)	2(66.7)	1.00
Non-diabetes	5(12.8)	34(87.2)	

In our study, Complication rates for patients with hypertension and diabetes were 16.7% and 33%, respectively. In the smoking patient group, complications occurred in eight patients (26.7%).

- For above mentioned data on flap related complication rate, after **Fisher's exact test p value is >0.05** associated with smoking, HTN or diabetes.
- So, there is no statistically significant association of either smoking, HTN or diabetes with flap related complications.

TABLE 4.1: Flap related Complication rate associated with the type of flap transfer

	Complication	Non-complication
PMMC flap	8 (38%)	13 (62%)
ATL free flap	2 (10%)	19 (90%)
Radial free flap	2 (10%)	19 (90%)



■ Complication ■ Non-Complication

TABLE 4.2: Flap Complication

Flap type	Flap failure	Salivary leak	Infection	Suture dehiscence
PMMC	0	5	2	1
ALT free flap	0	0	2	0
Radial free flap	1	0	0	1

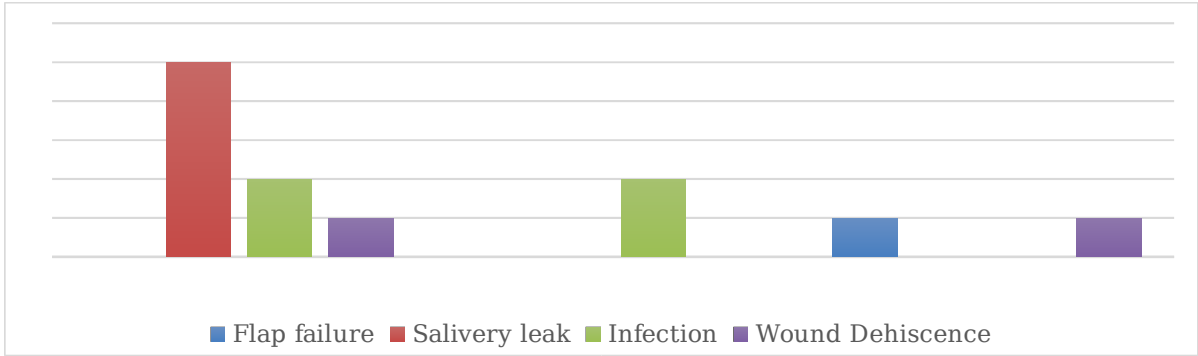


TABLE 5: Mean post-op hospitalization duration

	Mean Duration (range)
PMMC flap	10 days (8-45)
ALT free flap	6 days (5-30)
Radial free flap	5 days (4-30)



■ PMMC flap ■ ALT free flap ■ Radial free flap

- The mean length of post-operative hospitalization was 11days for the total cohort. It was **slightly longer in the PMMC flap group** as compared to the ALT free flap group (12.2 days vs. 9.8 days), but this difference was not statistically significant.

TABLE: 6 Oral realimentation upto soft diet orally

	Oral realimentation (range)
PMMC flap	27.1 days (11-80)
ALT free flap	18.6 days (08-72)
Radial free flap	19 days (10-60)



■ PMMC flap ■ ALT free flap ■ Radial free flap

TABLE: 7 Decannulation (RT out) time

	Decannulation (range)
PMMC flap	31.0 days (15-105)
ALT free flap	26.5 days (10-84)
Radial free flap	30 days (10-80)



■ PMMC flap ■ ALT free flap ■ Radial free flap

- For the functional post-op outcome two parameters were compared: **oral realimentation & decannulation.**
- Oral reillumination was achieved with a mean of 27.1 days for PMMC flap group, 18.6 days for ALT free flap group & 19 days for Radial free flap
- The mean Decannulation time was 31 days for PMMC flap group, 30 days for Radial free flap & 26.5 days for ALT free flap group.

DISCUSSION

- In this retrospective comparative study of ALT free flap, radial free flap and PMMC flaps, we stratified patients and procedures to objectively assess functional outcomes and

investigate possible correlations between preoperative risk factors and postoperative morbidities.

- PMMC flap is considered “work-horse” pedicle flap for head and neck reconstruction. It has vascular supply from Thoracoacromial artery, with skin paddle surface area of 26 x 16 cm. The disadvantages of this include bulky flap, postoperative stenosis, unesthetic supraclavicular bulge and chest wall deformity, fistula problems, etc.
- Anterolateral Thigh (ALT) free flap is supplied by descending branch of lateral femoral circumflex artery. It has reliable vascularity and significant bulk. It can be easily combined with other tissues if necessary. It is available in emergency settings and can be used for wider surface areas. It has good cosmetic outcome. It has less reliable healing at leading end when compared to free tissue transfers. It may not be reliable in obese.
- Radial free flap is taken from volar surface of forearm. It is thin and pliable with dimensions of 13 x 12 cm and vascular supply by radial artery, cephalic vein or venae comitantes. Disadvantages for this flap are tendon exposure, sacrifice of blood supply, unsightly scar, hand stiffness, pain and anaesthesia or paraesthesia.
- **High incidences of overall wound complications** and dehiscence at recipient sites were found in the PMMC flap group. However, it should be taken into consideration that PMMC flaps were usually selected to **shorten the operative duration** as well as the post-op hospital stay due to a **poor general condition** caused by severe preoperative comorbidities.
- Given the level of experience of the single reconstructive team at our medical institution, our results should be **more reliable** than those of studies evaluating **multiple reconstructive teams’** surgical outcomes by minimizing the effect of the learning curve and measurement bias, as shown in other studies.
- In our study, an analysis using Fisher’s exact test revealed that the **risk factors of patients did not increase the incidence of complications**. Similar to our report, multiple centers have previously reported that risk factors of microvascular surgery did not increase the rate of complications. **Bozikov and Arnez** [8] reported that only **diabetic** patients had a **higher** incidence of **free flap complication**, although this fact did not achieve significance in the statistical analysis.
- The functional evaluation did not show meaningful differences between the ALT free flap group and PMMC flap group. **Chepeha et al.** [9] recently reported that an **free Flap group had better functional outcomes** than a PMMC flap group. Although many studies have reported that free flaps are superior, we found no evidence for this hypothesis in our study.

Conclusion

- Risks have not increased complications in free flap or PMMC group in our study. Various other studies have similar results however a larger patient pool may be needed to assess them.
- The **PMMC flap is more favourable** for patients with **possibly lethal pre-op morbidities**, when a long operation is not advisable and a small defect is expected as compared to the longer to duration of ALT free flap & Radial free flap.
- Though the flap related complications & donor site related complications are more with PMMC flap as compared to ALT & Radial free flap, statistically there is no significant difference. Also, in the functional post-op outcomes there is no statistically significant difference with PMMC flap, ALT free flap or Radial free flap.

REFERENCES

1. Cheng MH, Huang JJ. Oral cavity, tongue, and mandibular reconstructions. In: Neligan

- PC, editor. Plastic surgery. 3rd ed. London: Elsevier Saunder; 2013. p.307-35.
2. Lenert JJ, Evans GR. Oral cavity reconstruction In: Mathes SJ, Hentz VR, editors. Plastic surgery: Vol. III head and neck. 2nd ed. Philadelphia, PA: Saunders Elsevier Cop.; p.917-56.
 3. Hurvitz KA, Kobayashi M, Evans GR. Current options in head and neck reconstruction. *Plast Reconstr Surg* 2006; 118:122e-33e.
 4. Hsing CY, Wong YK, Wang CP, et al. Comparison between free flap and pectoralis major pedicled flap for reconstruction in oral cavity cancer patients: a quality-of-life analysis. *Oral Oncol* 2011; 47:522-7.
 5. Chen CH, Lin GT, Fu YC, et al. Comparison of deltopectoralis flap and free radial forearm flap in reconstruction after oral cancer ablation. *Oral Oncol* 2005; 41:602-6.
 6. Ariyan S. The pectoralis major myocutaneous flap: a versatile flap for reconstruction in the head and neck. *Plast Reconstr Surg* 1979; 63:73-81.
 7. Yang GF, Chen PJ, Gao YZ, et al. Forearm free skin flap transplattation: a report of 56 cases. 1981. *Br J Plast Surg* 1997; 50:162-5.
 8. Bozиков K, Arnez ZM. Factors predicting free flap complications in head and neck reconstruction. *J Plast Reconstr Aesthet Surg* 2006; 59:737-42.
 9. Chepeha DB, Annich G, Pynnonen MA, et al. Pectoralis major myocutaneous flap vs revascularized free tissue transfer: complications, gastrostomy tube dependence, and hospitalization. *Arch Otolaryngology Head Neck Surg* 2004;130: 181-6.