

# Submental Island Flap Vs Pectoralis Major Myocutaneous Flap in Oral Cancer Reconstruction

## Original Article

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## ABSTRACT

**Background:** The submental island flap (SIF) and pectoralis major myocutaneous flap (PMMF) offer alternative techniques in oral and maxillofacial reconstruction, particularly in conditions where, free flaps are not available, or the patients are unfit.

**Aim:** The present study aims to compare the submental island flap versus pectoralis major myocutaneous in oral cavity reconstruction after ablation of squamous cell carcinoma regarding flap morbidities, esthetic, functional, and oncologic outcomes.

**Methods:** Sixty patients with oral cavity cancers were divided into two groups of 30 patients, who underwent submental and pectoralis major myocutaneous flaps for reconstruction from January 2018 to 2020, were included in the study. The patients were evaluated and followed -up for 1 year.

**Results:** The mean age was ( $53.9 \pm 14.1$ ) in PMMF group vs. ( $51.7 \pm 15.4$ ) in SIF group. There was no statistical significant difference in age and sex distribution between the groups. PMMF has statistically significantly higher excellent functional outcome vs. SIF, while there was no statistical significance difference in esthetic outcomes between the two groups.

**Conclusion:** Both submental flap and pectoralis major myocutaneous flap are considered preferable and consistent options for oral cancer reconstruction with satisfactory cosmetic and functional results and reasonable oncological safety.

**Key Words:** Squamous cell carcinoma; Head and neck reconstruction; Oral cancer; pedicled flaps; Outcomes.

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## INTRODUCTION

Oral squamous cell carcinoma (OSCC) is the sixth most common cancer in the world and usually occur in middle aged and elderly persons.<sup>[1, 2]</sup> The tumor affects the tongue and the lip, mucosa in the floor of the mouth. The tongue is the most common site being affected.<sup>[3]</sup>

Surgery for head and neck malignancies can result in substantial soft and hard tissues defect. This may cause speech deficits and functional deficiency. As a result, the main goal of reconstructive surgery after oral cancer ablation is to restore the function of the different parts in the oral cavity with acceptable aesthetics using local and loco-regional flaps.<sup>[4]</sup> Many regional flaps have been proposed for reconstruction of oral cavity soft tissue with variable success. The pedicled flaps, commonly used for oral cavity reconstruction include Pectoralis Major Myocutaneous Flap (PMMCF),

platysma myocutaneous flap and forehead flaps<sup>[5]</sup> and also skin flaps as submental artery flap and buccal pad of fat flaps.<sup>[6]</sup> Ariyan in 1979 introduced the pectoralis major myocutaneous flap as one of the important reconstructive choices because of its simple technical aspects. PMMCF in either its myocutaneous or myofascial forms has been a mainstay flap for intraoral reconstruction and versatility in many institutions in the 1980s and 1990s.<sup>[7, 8]</sup>

In 1993, Martin introduced the Submental artery island flap (SMIF) which was broadly accepted by head and neck reconstructive surgeons.<sup>[9]</sup> Comparing between reconstructive flaps for a particular primary tumor site has never been done in a randomized method, and just sporadic retrospective studies comparing flaps were found in the literature.<sup>[10]</sup>

The present study aims to compare the submental artery

flap vs pectoralis major myocutaneous in oral cavity reconstruction after ablation of squamous cell carcinoma with respect to flap morbidities (complications), esthetic, functional, and oncologic outcomes.

#### **PATIENTS & METHODS:**

This prospective comparative study included 60 patients who diagnosed with Squamous cell carcinomas at different sites of the oral cavity, attending at Surgical Oncology Unit, Oncology Center and Oral & Maxillofacial Surgery Department clinics, Mansoura University. The patients go through surgical removal of the tumor and immediate reconstruction in the period between January 2018 to January 2020.

Inclusion criteria were; cases with primary oral cancer needed surgical excision and immediate reconstruction, patients already did surgical removal of the tumor, candidate for delayed reconstruction.

Exclusion Criteria were; primarily repaired defects, tumors cannot be resected, tumors with metastasis, primary oropharyngeal tumors, and patients salvaged by surgery after simultaneous chemo-radiotherapy.

Patients were randomly categorized into two groups according to the reconstruction method. Each group included 30 patients.

All patients' assessment included; **1)** Full history. **2)** Detailed clinical examination to check for any oropharyngeal extension **3)** lab investigations (CBC, KFTs, LFTs) **4)** Radiographic assessment by a) Head and neck Multislice Detector Computed Tomography (MDCT). b) Panorama (OPG) was done for patients in case of suspected mandibular infiltration. c) (MRI). d) Color Doppler for vasculature in donor and recipient sites.

**5)** Wedge biopsy to confirm the diagnosis. All the participants sign up informed consent, and the study was approved by institutional ethical committee.

#### **Surgical Techniques:**

##### **Submental island flap - technique:**

The surgical technique used was a standard SAIF previously described by other authors.<sup>[11]</sup> A large tunnel is formed between the donor site and the defect, which is either lateral or medial to the mandible according to site to be reconstructed.

##### **Pectoralis major myocutaneous flap- technique:**

The PMMF was harvested with the same technique described previously.<sup>[12]</sup> Mobilization and elevation of the myocutaneous flap was performed from the chest wall, serratus, and pectoralis minor maintaining its nutrient vascular pedicle that was depend only on the pectoralis branch of the thoracoacromial artery. Subcutaneous tunnel was made at the neck root, through it the PMMF was moved to oral defect site.

#### **Postoperative assessment and follow-up:**

This period ranged between 6-12 months for assessment of the chosen reconstructive flaps with regard to:

#### **Post-operative complications including;**

Recipient site complications (intraoral hair growth, hematoma, infection & salivary leak), donor site complications (wound infection and dehiscence, ugly scar, and general complications (hematoma and hemorrhage, deep venous thrombosis, chest infection, pulmonary embolism).

#### **Functional outcome:**

Assessment of the function includes oral competency restoration, mouth opening and closure, oral feeding and mastication, and speech. The outcomes were sorted on a 4-point score in which 4 = excellent, 3 = good, 2 = fair, 1 = poor. In oral competency evaluation: normal=excellent; rarely drooling= good; occasional drooling= fair and severe drooling= poor. In speech: normal=excellent; good= intelligible, fair =intelligible with effort; poor= not intelligible. In mouth opening and closure: excellent =normal movement; good = normal with difficulty in movement; fair=incomplete movement and poor= extremely restricted movement. Oral feeding and mastication: excellent = normal diet tolerance; good = semisolid, fair= soft diet and poor = fluids only). The overall functional outcome: excellent score ranges from 17- 20; good from 13 – 16; fair from 9 - 12 and poor is less than 8.

#### **Esthetic outcome:**

Evaluate facial appearance, facial symmetry restoration, and mouth angle shift by means of 4 point scale, wherein 4 = excellent, 3 = good, 2 = fair, 1 = poor. In facial appearance: excellent = nearly equal to normality; good = a little changed; fair = obviously changed from normality and not very distorted and poor= much distorted. In symmetry: excellent = no change; good= minor change; fair= considerable difference and poor = noticeable difference. Mouth angle shift: excellent =normal, good =slight shift of angle, fair = shift of angle on smile and poor= inconsistency between upper and lower lip.

The total esthetic outcome: excellent score from 13-16; good score from 9-12; fair score from 5-8 and poor score less than 4.

#### **Oncological outcome:**

Included evaluating the disease recurrence (loco- regional or distant), disease free survival, and overall survival.

### Statistical analysis

Data were entered and analyzed using IBM-SPSS software (Version 26) and MedCalc software (version 20). Qualitative data were stated as frequency (N) and percentage (%). Quantitative data were first-ly evaluated for normality by Shapiro-Wilk's test, the data being normally distributed if ( $p > 0.05$ ). Quantitative data were stated as Median (25<sup>th</sup> – 75<sup>th</sup> percentiles) as it was not normally distributed.

Categorical data was compared by Chi-Square or Fisher's exact test. Quantitative data between the two groups were compared by Mann-Whitney U-test. ROC curve analysis was used to find a cut-point of a quantitative data that discriminates recurrent from non-recurrent cases. Binary logistic regression (univariable and multivariable) was performed to determine the effects of predictor variables on the likelihood of recurrence. For any of the used tests, results were considered as statistically significant if  $p$  value  $\leq 0.05$ .

### RESULTS:

The mean age was ( $53.9 \pm 14.1$ ) in PMMF group vs. ( $51.7 \pm 15.4$ ) in SIF group. In PMMF group, (76.7%) were male while (63.3%) in SIF group. There was no statistical significant difference in age and sex distribution between the studied groups. Twenty-four patients (40%) were having comorbidities (diabetes, and hypertension). Patients' clinical staging were III/IV (T1/T2/T3, N0) oral malignancy. Stage III was in 32 (53.3%) patients and stage IV in 28 (46.7%) patients. Most of cases with stage III underwent Submental island flap 21 (65.6%), while most of cases with stage IV underwent PMMF. Thirty-six patients (60%) had de-novo cancers and 24 (40%) had recurrent cancers. Most of recurrent cases underwent PMMF 18 cases (60%).

#### Post-operative complications result:

Complications related to reconstruction method included partial and total flap loss. Partial loss occurred in 4 patients, and total loss (reconstruction failure) in 4 patients, Recipient site complications were; intraoral hair growth occurred in SIF patients, hematoma in 4 patients), and infection & salivary leakage in 5 patients.

Complications are significantly higher in SIF group (46.7%) than PMMF group (10%). Donor site complications were; wound infection that occurred in 5 patients and ugly scar formation in one patient with PMMF.

General complications occurred in 9 patients, which included postoperative hemorrhage in 2 patients, Chest infection in 4, Deep venous thrombosis in 2 cases and pulmonary embolism in one case. Complicated cases are significantly less in PMMF 3 patients (10%) than SIF group. Total number of complications were significantly higher in SIF group than PMMF. As shown in **(Table 1)**

#### The overall functional outcomes:

Excellent outcomes were in 23 PMMF patients (76.7%), while in SIF patients were 11 (36.7%). **(Table 2)** showed a statistically significant difference in functional outcome categories between the two groups. PMMF has statistically significantly higher excellent functional outcome mainly in feeding function vs. SIF (77% vs. 37%), where ( $p = 0.004$ ).

#### The overall esthetic outcomes:

No statistical significance difference in the outcomes between the SIF and PMMF groups. **(Table 2)**

#### Oncological outcomes:

Local recurrence occurred in 19 cases (13 SIF, 6 PMMF) and the mean time of recurrence was  $4.46 \pm 2.94$  months.

Two patients of SIF group showed distant metastasis and the mean time was  $6.46 \pm 2.19$  months. All recurrences were 21 cases (15 SIF, 6 PMMF). The median disease free survival was 3.9 months. The overall survival in one year was 95%.

**(Table 3)** showed that recurrence was statistically significantly associated with lower age ( $\leq 64$  years) and SIF reconstruction method.

(Table 1): Comparisons of categorical characteristics between the two reconstruction methods.

Categorical characteristic	PMMF	SIF	X <sup>2</sup>	P value
<b>Sex</b>			1.270	0.260
<b>Male</b>	23 (76.7%)	19 (63.3%)		
<b>Female</b>	7 (23.3%)	11 (36.7%)		
<b>Pathological nature</b>			10.00	0.002
<b>Primary</b>	12 (40%)	24 (80%)		
<b>Recurrent</b>	18 (60%)	6 (20%)		
<b>Comorbidities</b>				
<b>Any</b>	12 (40%)	12 (40%)	0.000	1.000
<b>Diabetes</b>	6 (20%)	5 (16.7%)	0.111	0.739
<b>Hypertension</b>	6 (20%)	7 (23.3%)	0.098	0.754
<b>Reconstruction-related complications</b>			FET	0.327
<b>Flap loss</b>				
<b>No</b>	28 (93.3%)	24 (80%)		
<b>Partial</b>	1 (3.3%)	3 (10%)		
<b>Complete</b>	1 (3.3%)	3 (10%)		
<b>Post-donor site</b>				
<b>All complications</b>	2 (6.7%)	4 (13.3%)	FET	0.671
<b>Infection</b>	1 (3.3%)	4 (13.3%)	FET	0.353
<b>Ugly scar</b>	1 (3.3%)	0 (0%)	FET	1.000
<b>Post-recipient site</b>				
<b>All complications</b>	3 (10%)	14 (46.7%)	9.932	0.002
<b>Hair growth</b>	0 (0%)	8 (26.7%)	FET	0.005
<b>Hematoma</b>	1 (3.3%)	3 (10%)	FET	0.612
<b>Salivary leakage</b>	2 (6.7%)	3 (10%)	FET	1.000

\*Test of significance is Chi- Square test or FET (Fisher's exact test)

**(Table 2):** Outcome categories in the two groups.

Outcome	PMMF	SIF	P value
<b>Overall functional outcome</b>			0.004
<b>Excellent</b>	23 (76.7%)	11 (36.7%)	
<b>Good</b>	7 (23.3%)	18 (60%)	
<b>Poor</b>	0 (0%)	1 (3.3%)	
<b>Overall esthetic outcome</b>			0.299
<b>Excellent</b>	23 (76.7%)	26 (86.7%)	
<b>Good</b>	7 (23.3%)	3 (10%)	
<b>Poor</b>	0 (0%)	1 (3.3%)	

Data are N (%).

Test of significance is Fisher's exact test.

**(Table 3):** Comparisons between recurrent vs. non-recurrent cases

Characteristic	Non-recurrent	Recurrent	P value
<b>Sex</b>			0.859
Male	27 (69.2%)	15 (71.4%)	
Female	12 (30.8%)	6 (28.6%)	
<b>Age*</b>			0.042
> 64 years	11 (28.2%)	1 (4.8%)	
≤ 64 years	28 (71.8%)	20 (95.2%)	
<b>Reconstruction method</b>			0.015
PMMF	24 (61.5%)	6 (28.6%)	
SIF	15 (38.5%)	15 (61.4%)	
<b>Presence of comorbidities</b>			0.377
Diabetes*	6 (15.4%)	5 (23.8%)	0.493
Hypertension*	8 (20.5%)	5 (23.8%)	0.755
<b>Overall functional outcome*</b>			0.257
Excellent	24 (61.5%)	10 (47.6%)	
Good	15 (38.5%)	10 (47.6%)	
Poor	0 (0%)	1 (4.8%)	
<b>Overall aesthetic outcome*</b>			0.443
Excellent	32 (82.1%)	17 (81%)	
Good	7 (17.9%)	3 (14.3%)	
Poor	0 (0%)	1 (4.8%)	
<b>Post-recipient site complications*</b>	8 (20.5%)	4 (19%)	1.000

Test of significance is Chi-Square or \*Fisher's exact test

## DISCUSSION

The management of oral cancer is a complex process regarding cancer resection and reconstruction. A multidisciplinary approach is required to plan the resection and functional reconstruction to get the best esthetic results and functional rehabilitation of the patient. It is impossible to substitute the removed part with similar tissue with respect to mobility and multifaceted movements. Consequently, patients need to integrate compensatory methods to enhance functional outcome.<sup>[12]</sup>

Though free flaps are measured as the gold standard for head& neck cancer reconstruction, pedicle flaps also play a main role in oral malignancies reconstruction.<sup>[13]</sup> Using the free flap is tiresome, prolonging the surgical time and postoperative hospital stay for the patients. As well, increase the financial load on the patients that have low socioeconomic status.

Otherwise, the pedicled flaps as SIF and PMMF can be used in oral cancer giving suitable thickness and mucosal lining, reducing the surgical time, hospital stay and with less cost when compared with free flaps.<sup>[13]</sup> In the developing countries like Egypt, where most of the patients are of low socioeconomic status, the cost of the surgery is the main factor in determining the method of the reconstruction as reported by Miller et al.<sup>[14]</sup>

In this study we evaluated two different modalities for reconstruction of oral cavity large defects after removal of squamous cell carcinoma (PMMF and SIF), as regard to postoperative complications, functional, esthetic, and oncologic outcomes.

In this study Partial flap loss was in 4 patients and reconstruction failure (total flap loss) in 4 patients, both were (three SIF & one PMMF) which is in agreement with the study of Mehrhof et al.<sup>[15]</sup> In submental island flap, the postoperative complication of hair growth was (26.7%) while in PMMF was (0%). Hair transported to the oral cavity, trap food and cause bad odor, irritates the tongue and generates an unpleasant sensation for the patient.<sup>[16]</sup>

Total complicated cases were significantly less in PMMF group 3 patients (10%) than SIF group, and total complicated cases were 9/60 patients (16%) unlike Schusterman and Horndeski.<sup>[17]</sup> who stated that complicated cases represented (50.8%) of the patients.

The PMMF and SIF both showed no statistically significant difference as regarding esthetic outcomes and this result was in accordance with Pistre et al.<sup>18</sup> Regarding oncological outcomes, recurrence occurred in 21 cases (35%). Most of recurrent cases 15/21 were in SIF group. Recurrence was statistically significantly associated with SIF group, the same results as Mizrachi et al.<sup>[19]</sup>

who attributed this recurrence to the fact that the close vicinity of submental vessels to the level I group of the neck lymph nodes.

## CONCLUSION

Both submental flap and pectoralis major myocutaneous flap are considered preferable and consistent options for oral cancer reconstruction with satisfactory cosmetic and functional results and reasonable oncological safety.

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## CONFLICTS OF INTEREST

There are no conflicts of interest.

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