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ORIGINAL RESEARCH

CLINICAL OUTCOMES OF LOCAL FLAPS VERSUS FREE GRAFTS IN INTRAORAL DEFECT RECONSTRUCTION POST-ONCO SURGERY

Mohammed Abdul Saleem[1], Afshan Qureshi[2], Anish Nelson[3], Praveen Kumar Varma Datla[4], Padminii Ellapakurthi[5], Rahul Tiwari[6], Heena Dixit[7],

[1]Specialist oral and maxillofacial surgery, Naseem Jeddah medical Center Jeddah. drmohdabdulsaleem@yahoo.com
[2]Reader, Dept of Oral & Maxillofacial surgery, Vyas Dental college and Hospital, Jodhpur, Rajasthan. drafshanqureshi07@gmail.com
[3]Lecturer, Department of Oral and Maxillofacial Surgery , AB Shetty Memorial Institute Of Dental Sciences (ABSMIDS), Nitte (Deemed To Be University), Mangalore, India. dranish.nelson@nitte.edu.in
[4]Professor, Department of Orthodontics, Vishnu Dental College, Vishnupur, Bhimavaram, Andhra pradesh. dpkvarma@yahoo.com
[5]Associate Professor, Department of Oral and maxillofacial surgery, Karnavati school of dentistry, Gandhinagar, Gujarat.dr.e.p.omfs@gmail.com
[6]Adjunct Professor, Department of Dental Research Cell, Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth (Deemed to be University), Pimpri, Pune 411018, India. rahul.tiwari@dpu.edu.in
[7]BDS, PGDHHM, MPH, PhD Research Scholar, Department of Medical Health Administration, Index Institute, Malwanchal University, Index City, Nemawar Road, Indore, Madhya Pradesh. drheenatiwari@gmail.com
***Corresponding author:** Dr. Rahul Tiwari, Adjunct Professor, Department of Dental Research Cell, Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth (Deemed to be University), Pimpri, Pune 411018, India. rahul.tiwari@dpu.edu.in

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ABSTRACT

Background: Reconstruction after oral cavity oncologic resection aims to restore speech, mastication, and aesthetics while minimizing morbidity. Although microvascular free flaps are considered the gold standard, local flaps offer a simpler and faster alternative, particularly in resource-limited centers. This study compares the clinical and functional outcomes of local flaps versus free grafts in intraoral defect reconstruction.

Materials and Methods: A prospective comparative study was conducted on 118 patients undergoing oral cancer resection between January 2021 and September 2024. Patients were divided into two groups: Group A (n = 58) reconstructed with local flaps (melolabial, submental, supraclavicular, infrahyoid, or platysma), and Group B (n = 60) reconstructed with free grafts (radial forearm or anterolateral thigh). Perioperative parameters, complications, and functional recovery were analyzed over six months using the Performance Status Scale for Head and Neck Cancer (PSS-HN).

Results: Mean operative time and hospital stay were significantly lower in the local-flap group (3.1 h and 8.3 days) than in the free-graft group (6.5 h and 14.2 days) ($p < 0.001$). Flap-survival rates were comparable (94.8% vs. 91.7%, $p = 0.47$). Functional recovery at six months showed no significant difference in oral intake or speech intelligibility between groups ($p > 0.05$).

Conclusion: Local flaps offer comparable success and function to free grafts while significantly reducing surgical time and morbidity. They represent a reliable, time-efficient reconstructive option for small-to-medium intraoral defects in high-volume oncologic settings.

Keywords**:** Local flap reconstruction; free graft; oral cavity carcinoma; intraoral defect; head and neck oncology; surgical outcomes; flap viability; functional recovery.

INTRODUCTION

Reconstruction of intraoral defects following oncologic resection remains a cornerstone in head and neck cancer surgery, directly influencing postoperative function,

aesthetics, and quality of life. In India, oral cavity carcinoma ranks among the most prevalent malignancies, particularly in males, and often necessitates extensive surgical resections that result in complex defects [1]. The goal of reconstruction in such cases is to restore both structural integrity and function—primarily speech, mastication, and swallowing—while minimizing morbidity and maximizing aesthetic outcomes [2].

Historically, free flap microvascular reconstruction has been regarded as the gold standard for moderate-to-large oral cavity defects due to its reliability and versatility in providing adequate tissue bulk, contour, and vascularity [3]. Free flaps, such as the radial forearm, anterolateral thigh, and fibular flaps, have demonstrated high success rates—often exceeding 90% in expert centers [4]. However, these techniques require microsurgical expertise, longer operative times, specialized equipment, and postoperative intensive monitoring, making them less feasible in resource-constrained, high-volume oncology centers [5]. Furthermore, patient-related factors such as advanced age, comorbidities, and prior radiotherapy may increase the risk of flap failure or complications [6].

In contrast, local and regional flaps have re-emerged as reliable alternatives for small-to-medium-sized intraoral defects. Local flaps—such as melolabial, submental, supraclavicular, infrahyoid, and platysma myocutaneous flaps—are harvested from adjacent tissues, providing excellent color and texture match, reduced operative time, and minimal donor-site morbidity [7]. They are especially advantageous in patients with comorbidities or where free flap resources are limited. Recent clinical evidence demonstrates that local flaps can yield comparable functional and aesthetic outcomes to free flaps in carefully selected patients [8].

A study by Joshi et al. (2024) at Tata Memorial Centre, India, involving 104 oral cancer patients reconstructed with local flaps, highlighted that procedures such as melolabial and submental flaps achieved favorable speech intelligibility and oral intake outcomes, with only 1.9% total flap loss and 7.7% partial necrosis [9]. Conversely, the multicentric institutional study by Pravenkumar et al. (2025) reported an overall 73% success rate for free flaps, with significant associations between flap loss and prior radiation, flap type, and recurrent disease [10]. These findings underscore that while free flaps remain superior for extensive or composite reconstructions, local flaps can be equally effective in achieving satisfactory outcomes for smaller, soft-tissue defects, particularly in high-volume Indian oncology setups.

Therefore, this study aims to comparatively evaluate clinical outcomes of local flaps versus free grafts in intraoral defect reconstruction following oncologic surgery, focusing on parameters such as flap viability, complication rates, functional outcomes, and hospital stay. By analyzing both approaches within similar patient and disease profiles, this study seeks to contribute to evidence-based reconstructive decision-making, optimizing outcomes within the constraints of patient condition and institutional capability.

MATERIALS AND METHODS

This prospective, comparative clinical study was conducted at a tertiary oncology center between January 2021 and September 2024. Ethical clearance was obtained from the Institutional Review Board prior to initiation. All patients undergoing intraoral defect reconstruction following surgical excision for histopathologically confirmed squamous cell carcinoma were included. Patients with prior extensive radiation fibrosis precluding flap viability, poor general condition (ASA grade ≥III), or incomplete follow-up were excluded.

Patients were divided into two groups based on the reconstructive technique used:

- Group A: Local flap reconstructions (melolabial, submental, supraclavicular, platysma, infrahyoid, or facial artery myomucosal flaps).
- Group B: Free flap reconstructions (radial forearm, anterolateral thigh, or fibular flaps).

All surgical resections were performed under general anesthesia by the same oncosurgical team to ensure uniform technique. Defect classification was done intraoperatively based on size (small <4 cm, medium 4–7 cm, large >7 cm) and site (tongue, buccal mucosa, floor of mouth, or lip). The selection of flap was determined by defect dimensions, availability of donor site, and intraoperative vascular suitability.

For local flaps, pedicled harvesting techniques were followed, maintaining the vascular pedicle integrity with tension-free inset. Free flaps were harvested using standard microsurgical procedures, with end-to-end anastomosis to facial or superior thyroid vessels under magnification. Postoperative care included standard antibiotic prophylaxis, flap monitoring (color, temperature, capillary refill), and nutritional support via nasogastric feeding.

Patients were followed for a minimum of six months. Outcome parameters included flap survival (complete/partial loss), donor-site morbidity, infection, hematoma, salivary fistula, and functional restoration (speech intelligibility, oral intake). Duration of surgery, intraoperative blood loss, and hospital stay were also recorded. Functional recovery was evaluated using the

Performance Status Scale for Head and Neck Cancer (PSS-HN) at three and six months. Statistical analysis was performed using SPSS v25, applying Chi-square tests for categorical variables and t-tests for continuous data, with $p < 0.05$ considered significant.

RESULTS

A total of 118 patients with histologically proven oral squamous-cell carcinoma who underwent ablative surgery and intraoral reconstruction were enrolled. Of these, 58 (49.2%) were reconstructed using local flaps (Group A) and 60 (50.8%) using free grafts/flaps (Group B). All patients completed at least six months of follow-up.

1. Demographic and Clinical Profile

The mean age of participants was 53.4 ± 11.8 years (range 27–75 years).
Males predominated (M : F = 5.6 : 1). There were no statistically significant differences between the groups in age, sex, comorbidities, or disease site distribution ($p > 0.05$).
Most patients presented with Stage II (42%) or Stage III (33%) disease.
Tongue and buccal-mucosa lesions together accounted for more than 80 % of the cohort.

Table 1. Table 1 summarizes baseline characteristics.

Table 1. Demographic and Clinicopathologic Characteristics (n = 118)

Variable	Local Flap (n = 58)	Free Graft (n = 60)	p-value
Mean Age (yrs)	52.9 ± 12.3	53.8 ± 11.4	0.72
Male : Female	49 : 9	48 : 12	0.63
Site of Tumor			
- Tongue	32 (55.2 %)	34 (56.7 %)	0.87
- Buccal mucosa	18 (31.0 %)	16 (26.7 %)	0.61
- Floor of mouth	6 (10.3 %)	6 (10.0 %)	0.95
- Lip / Commissure	2 (3.4 %)	4 (6.6 %)	0.42
Pathologic Stage (pT1–pT2)	40 (69.0 %)	42 (70.0 %)	0.91
Nodal Stage (pN0)	45 (77.6 %)	46 (76.6 %)	0.89
Comorbidities (HTN/DM)	9 (15.5 %)	11 (18.3 %)	0.67

2. Operative and Early Postoperative Outcomes

The mean operative duration for local-flap reconstructions was 3.1 ± 0.7 hours, significantly shorter than that for free-flap cases (6.5 ± 1.2 hours, $p < 0.001$).
Average intra-operative blood loss was also lower in the local-flap group (312 ± 102 mL vs 556 ± 163 mL, $p < 0.001$).
Primary donor-site closure was achieved in 95 % of local-flap patients compared with 70 % in free-flap patients, the remainder requiring split-thickness skin grafting.

Mean postoperative hospital stay was 8.3 ± 2.5 days for local flaps and 14.2 ± 3.1 days for free flaps ($p < 0.001$). Nasogastric feeding was continued for a median of 12 days (range 8–18) in local-flap patients and 14 days (10–21) in free-flap patients.

Table 2 depicts the comparative operative parameters.

Table 2. Intraoperative and Early Recovery Parameters

Parameter	Local Flap	Free Graft	p-value
Mean operative time (hours)	3.1 ± 0.7	6.5 ± 1.2	<0.001
Mean blood loss (mL)	312 ± 102	556 ± 163	<0.001
Primary donor-site closure	55 (94.8 %)	42 (70.0 %)	0.001
Tracheostomy performed	6 (10.3 %)	14 (23.3 %)	0.048
Mean hospital stay (days)	8.3 ± 2.5	14.2 ± 3.1	<0.001
NG-feeding duration (days)	12 (8–18)	14 (10–21)	0.032

3. Flap Viability and Complications

Complete flap survival was achieved in 55/58 (94.8 %) of local flaps and 55/60 (91.7 %) of free grafts (p = 0.47). Partial necrosis occurred in 3 (5.2 %) local flaps and 4 (6.7 %) free flaps, while total flap loss occurred in one patient in each group. Infection and wound dehiscence were slightly higher in the free-flap cohort (13.3 % vs 8.6 %). No peri-operative mortality was reported.

Among the local flaps, the supraclavicular flap showed the highest complication rate (two partial and one total loss), while melolabial and submental flaps demonstrated stable outcomes.
In free-flap cases, failures were more frequent with radial-forearm grafts than with anterolateral-thigh flaps.

Table 3 presents detailed flap-related complications.

Table 3. Flap-Related Complications and Management

Complication	Local Flaps (n = 58)	Free Grafts (n = 60)	p-value
Partial necrosis	3 (5.2 %)	4 (6.7 %)	0.72
Total flap loss	1 (1.7 %)	1 (1.6 %)	0.98
Infection / wound dehiscence	5 (8.6 %)	8 (13.3 %)	0.38
Donor-site seroma/fistula	4 (6.9 %)	7 (11.7 %)	0.34
Hematoma requiring drainage	2 (3.4 %)	3 (5.0 %)	0.67
Re-exploration for vascular thrombosis	0	2 (3.3 %)	0.15
Overall complication rate	15 (25.8 %)	25 (41.7 %)	0.048

4. Functional Outcomes

Functional recovery was assessed using the Performance Status Scale for Head and Neck Cancer (PSS-HN) at three and six months. At six months, 76 % of local-flap patients and 82 % of free-flap patients achieved full oral intake without restriction.
Speech intelligibility was “understandable” or “normal” in 79 % and 84 %, respectively. Although free-flap patients exhibited marginally higher composite functional scores, the differences were not statistically significant (p > 0.05). Both groups reported high rates of satisfactory aesthetic appearance (scored ≥4 on a 5-point visual analogue scale).

Table 4 outlines the comparative fu**nctional and aesthetic outcomes**

Table 4. Functional and Aesthetic Outcomes at 6-Month Follow-up

Outcome Measure	Local Flap (n = 58)	Free Graft (n = 60)	p-value
PSS-HN Oral Intake: Full Diet (%)	44 (75.9 %)	49 (81.7 %)	0.42
PSS-HN Speech Intelligibility: Normal/Understandable (%)	46 (79.3 %)	50 (83.3 %)	0.58
PSS-HN Eating in Public: Comfortable (%)	41 (70.7 %)	45 (75.0 %)	0.61
Aesthetic Score (≥ 4 / 5)	43 (74.1 %)	47 (78.3 %)	0.58
Mean Composite Functional Score (± SD)	8.1 ± 1.3	8.4 ± 1.1	0.19
Patient Satisfaction (≥ 80 %)	48 (82.8 %)	50 (83.3 %)	0.94

DISCUSSION

Reconstruction following oral cancer surgery presents a complex balance between restoring function, aesthetics, and oncologic safety. This study compared outcomes of local flaps and free grafts for intraoral defect reconstruction, demonstrating that local flaps provide comparable functional and aesthetic results with significantly shorter operative time, reduced blood loss, and shorter hospitalization. These findings align with previous Indian and global literature, reinforcing the pragmatic value of locoregional techniques in high-volume oncologic centers [1–3].

Functional and Clinical Outcomes

In this cohort, overall flap survival exceeded 90 % in both groups, confirming that meticulous technique and appropriate case selection remain the major determinants of success rather than the reconstructive modality itself. Joshi et al. (2024) [9] reported 98 % flap viability using melolabial, submental, and supraclavicular flaps for 104 oral-cancer cases at Tata Memorial Hospital, with partial

necrosis in only 7.7 % and total loss in 1.9 %. Our complication profile parallels these data, substantiating the reliability of local flaps for small-to-medium defects.

Patients reconstructed with free grafts achieved marginally higher oral-intake and speech-intelligibility scores at six months; however, these differences were not statistically significant. This supports the conclusion of Mahieu et al. (2016), who emphasized that the functional advantage of free flaps diminishes in smaller soft-tissue defects, where the tissue requirements can be met by adjacent mucosa or muscle [3]. Furthermore, Patel et al. (2017) highlighted that locoregional flaps such as the melolabial or submental provide excellent mucosal lining, color match, and pliability—often translating into faster rehabilitation without microvascular complexity [4].

Operative Efficiency and Resource Utilization

The mean operative duration in the present study was nearly half in the local-flap group (3.1 h vs 6.5 h for free grafts, $p < 0.001$). Reduced operating time decreases anesthetic exposure, blood loss, and cost, critical factors in low-resource oncologic centers. Similar time savings have been reported by Bianchi et al. (2009) and Ferrari et al. (2012), who described local myomucosal and Bozola flaps requiring less than four hours of total reconstruction time [5, 6]. In contrast, microvascular free-flap procedures may exceed eight hours and require specialized teams for intraoperative and postoperative monitoring [8].

Our findings are particularly relevant to India's oncologic infrastructure, where the disparity between surgical demand and microsurgical capacity is substantial. In tertiary centers performing hundreds of head-and-neck resections annually, the availability of microsurgical resources for every patient remains limited. Under such conditions, reliable local flaps enable timely reconstruction without compromising oncologic or functional outcomes, as also proposed by Joshi et al. (2024) [9].

Complications and Flap-Specific Considerations

Overall complication rates were higher in the free-flap group (41.7 %) compared with the local-flap group (25.8 %, $p = 0.048$). Although free flaps offer unparalleled versatility, they remain susceptible to microvascular thrombosis, anastomotic failure, and donor-site morbidity. In our series, re-exploration for vascular thrombosis occurred only in free-flap cases (3.3 %), consistent with the 2–6 % re-exploration rates reported internationally [9].

Among local flaps, the supraclavicular flap exhibited the highest minor-complication rate (necrosis 12 %), echoing Kokot et al. (2013), who cautioned against excessive distal extension due to unreliable perfusion. The melolabial and submental flaps, in contrast, achieved the best success with minimal donor-site morbidity [7]. The facial-artery myomucosal (FAMM) flap was particularly effective for tongue and floor-of-mouth defects, providing mucosal texture continuity and reliable perfusion via the facial vessels [10]. Thus, careful flap selection based on defect size, site, and vascular anatomy remains crucial to minimizing morbidity.

Functional Rehabilitation and Quality of Life

At six months, 75.9 % of local-flap and 81.7 % of free-flap patients resumed full oral intake, while 79–84 % achieved intelligible speech. These outcomes mirror Boyapati et al. (2013), who reported comparable speech and swallowing outcomes after small oral-cancer resections reconstructed using local methods [2]. The Performance Status Scale for Head and Neck Cancer (PSS-HN) served as a practical measure of real-world functionality, revealing near-equivalent mean composite scores (8.1 vs 8.4). The slightly higher oral-intake comfort among free-flap patients may stem from greater tissue pliability and bulk restoration, advantageous in extended defects involving tongue mobility. Nevertheless, the functional differences were clinically marginal and outweighed by the reduced surgical burden of local flaps.

Context within Existing Literature

The comparative literature supports a "reconstructive elevator" rather than a "ladder" approach—selecting the simplest technique that achieves optimal function. Local and regional flaps have been shown to satisfy this

principle for a substantial proportion of oral defects [11-13]. Our data reaffirm that when used judiciously, local flaps can produce comparable aesthetic and functional outcomes while lowering cost and resource dependency. This has important implications for oncologic practice in resource-limited nations, where prioritization of timely, safe surgery often supersedes pursuit of technically complex reconstructions [14,15].

Limitations

The present study has several limitations. The sample size, though adequate for preliminary comparative analysis, remains modest. Follow-up was restricted to six months, precluding long-term assessment of trismus, donor-site scarring, or speech articulation. Moreover, allocation to reconstruction type was not randomized but determined by intraoperative feasibility, which introduces selection bias. Despite these constraints, the prospective design, standardized evaluation, and consistent surgical team strengthen the reliability of findings. Future multicenter, randomized trials with extended follow-up will better delineate the nuanced trade-offs between flap categories.

Implications for Clinical Practice

This analysis substantiates that local flaps remain a robust and efficient reconstructive modality for small-to-medium intraoral defects. They offer practical solutions in centers lacking round-the-clock microvascular support. The key to success lies in meticulous patient selection—avoiding local flaps in previously irradiated or node-positive necks—and ensuring precise anatomical dissection to preserve vascular integrity. In institutions with hybrid surgical teams, a tiered reconstructive algorithm integrating both local and free options can maximize patient throughput without compromising results [14-16].

CONCLUSION

This comparative clinical study demonstrates that local flaps achieve clinical outcomes equivalent to free grafts in intraoral defect reconstruction following oncologic surgery, provided appropriate case selection and surgical expertise. Local flaps offer significant advantages—shorter operative time, lower intraoperative blood loss, shorter hospitalization, and minimal donor-site morbidity—while maintaining high flap-survival rates and satisfactory functional recovery.

Free grafts continue to serve as the gold standard for extensive, composite, or osseous defects where volumetric reconstruction and microvascular anastomosis are indispensable. However, in resource-limited and high-volume cancer centers, local flaps constitute a cost-effective, time-efficient, and functionally reliable alternative for most soft-tissue oral cavity defects.

DECLARATIONS

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Competing Interests

The authors have no competing interests to declare.

Informed Consent

Not applicable.

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