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Original Research Article

Evaluation of early surgical and functional outcomes of anterolateral thigh free flap and radial forearm free flap for reconstruction of soft tissue defects of oral cavity

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ABSTRACT

Background: Anterolateral thigh free flap (ALTFF) and radial forearm free flap (RFFF) are preferred for oral cavity reconstruction due to reliability, high success, and low donor-site morbidity. The aim of this study was to evaluate the early surgical and functional outcomes of ALTFF and RFFF in the reconstruction of soft tissue defects of the oral cavity.
Methods: This prospective observational study was conducted in the department of plastic surgery, NIBPS, Dhaka, from July 2020 to December 2021. A total of 20 patients who required free flap reconstruction following surgical resection of oral cavity lesions, with or without adjacent soft tissue or bone involvement, were included.
Results: The mean patient age was 54.8±8.48 years, with a female predominance (60%). All defects were in the cheek, most commonly involving the angle of the mouth (60%). ALTFF was used in 55% and RFFF in 45% of cases. Flap survival was 90.9% for ALTFF and 77.7% for RFFF. Functional outcomes were satisfactory. ALTFF donor sites were closed primarily, while RFFF donor sites required STSG, with 33.3% showing minor graft loss. Donor site morbidity was higher in RFFF cases.
Conclusions: Both ALTFF and RFFF are reliable for reconstruction of oral cavity soft tissue defects, providing high flap survival and acceptable functional results.

Keywords: Oral cavity, Free flap, ALTFF, RFFF, Reconstruction, Surgical outcomes, Functional outcomes

INTRODUCTION

Among head and neck cancers, nearly half arise in the oral cavity. Cancer of the oral cavity is a major global health burden, ranking as the sixth most common malignancy worldwide, with oral squamous cell carcinoma (OSCC) being the predominant histological type.[1] In Bangladesh, more than 7,000 new cases of oral cancer are diagnosed annually, accounting for approximately 6.6% of cancer-related mortality.[2] The buccal mucosa is the most frequently affected site among the Bangladeshi population, which is attributed to the widespread habit of chewing tobacco and betel quid and retaining them within the oral vestibule for prolonged periods.[3] The primary treatment for OSCC involves radical oncological resection to achieve local disease control, which is often associated with extensive soft tissue and composite defects. Reconstruction of these defects is essential not only for restoring oral function, such as speech, swallowing, and mastication, but also for preserving facial appearance and overall quality of life.[4]

The reconstruction should aim to minimize both donor and recipient site morbidity while achieving satisfactory aesthetic and functional outcomes. Historically, regional pedicled flaps such as the deltopectoral flap and the pectoralis major musculocutaneous flap were widely used for head and neck reconstruction. Although the deltopectoral flap was considered a reliable option in the 1960s, it often required staged procedures and was associated with the formation of oral fistulae.[5] The pectoralis major flap gained popularity in the 1980s due to its reliability and robust vascular supply; however, its bulkiness and cosmetic issues, including nipple displacement, limited its acceptability in certain cases.[6]

The introduction of microvascular free flaps revolutionized oral cavity reconstruction by enabling single-stage radical tumor excision and immediate defect reconstruction. Over the last few decades, free flaps have become the gold standard for reconstruction of oral cavity and head and neck defects because of their versatility, reliable vascularity, and ability to restore both function and cosmesis.[5,7] Among the most widely used free flaps are the RFFF and the ALTFF. The RFFF is particularly valued for its thin, pliable, and reliable skin paddle, long pedicle, and large-caliber vessels, making it suitable for intraoral reconstruction. However, donor site morbidity, including poor cosmetic outcomes and risk of skin graft loss, remains a significant drawback (Ren et al).[4,8] In contrast, the ALTFF offers a long pedicle, large vessel diameter, versatile design, and low donor site morbidity, while also providing the possibility of harvesting a large amount of skin and subcutaneous tissue for complex reconstructions.[8] Both RFFF and ALTFF have reported flap survival rates exceeding 90%, with functional outcomes such as adequate mouth opening, satisfactory oral competence, and acceptable donor site morbidity, establishing them as reliable options for oral cavity reconstruction.[5,7,8] Nevertheless, direct comparisons of their early surgical and functional outcomes remain limited, particularly in the Bangladeshi population.

This study, therefore, aims to evaluate the early surgical and functional outcomes of RFFF and ALTFF in the reconstruction of oral cavity soft tissue defects. The findings will help identify the relative advantages and limitations of these two flap techniques in terms of flap survival, donor site morbidity, and postoperative functional recovery, thereby guiding optimal reconstructive decision-making.

Objectives

The main objective was to evaluate the early surgical and functional outcomes of ALTFF and RFFF in the reconstruction of soft tissue defects of the oral cavity.

METHODS

This prospective observational study was conducted in the Department of plastic surgery, National Institute of Burn and Plastic Surgery (NIBPS), Dhaka, from July 2020 to December 2021.

A total of 20 patients who required free flap reconstruction following surgical resection of oral cavity lesions, with or without adjacent soft tissue or bone involvement, were included. Among them, 11 patients underwent reconstruction with an ALTFF, and 9 patients underwent reconstruction with a RFFF. Tumor resection or defect creation and flap harvesting were performed simultaneously by two surgical teams. The RFFF was designed over the radial forearm, incorporating the radial artery, its venae comitantes, and the cephalic vein, with donor sites resurfaced using split-thickness skin grafts. The ALTFF was harvested based on perforators identified with Doppler ultrasound, either as septocutaneous or musculocutaneous, and donor sites were closed primarily or with local advancement flaps. Microvascular anastomosis was performed using standard end-to-end or end-to-side techniques. All patients received standardized postoperative care with strict flap monitoring, including assessments of color, temperature, tissue turgor, pinprick bleeding, and Doppler signal. Donor sites were evaluated for healing and complications. Patients were followed up at the 1st, 2nd, and 4th postoperative weeks to assess flap survival, mouth opening, and donor-site morbidity. Written informed consent was obtained after full explanation of the study, and ethical approval was secured from the ethical review committee of NIBPS.

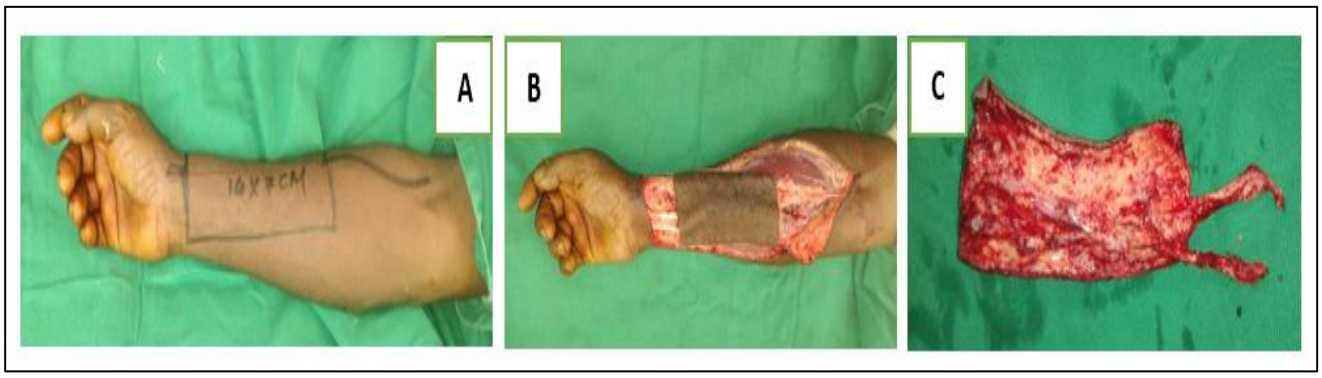

Figure 1 (A-C): Harvesting of RFFF.

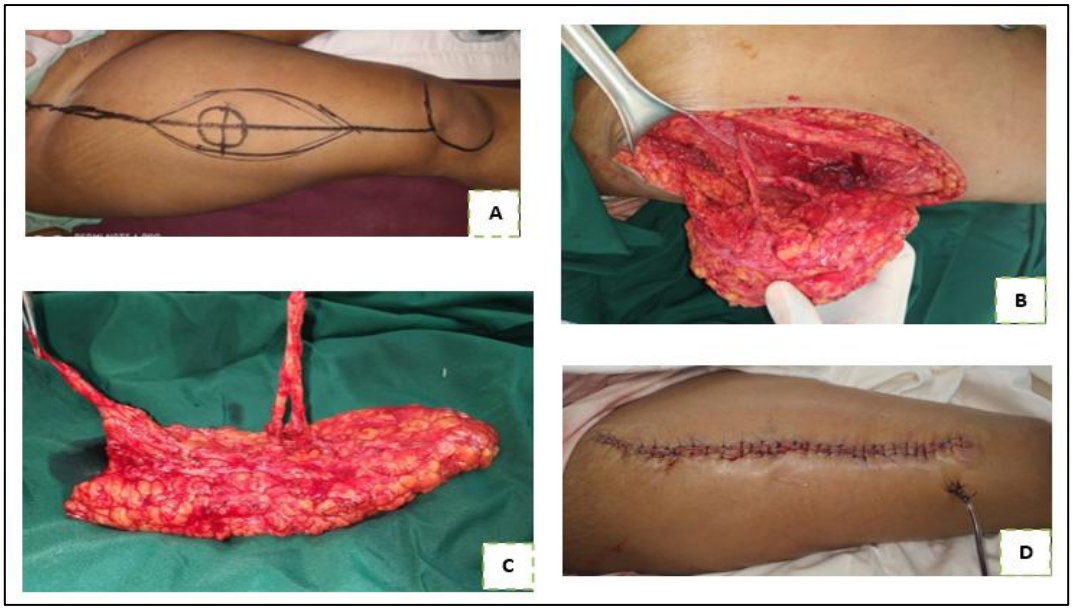

Figure 2 (A-D): Harvesting of anterolateral thigh free flap.

Statistical analysis

All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was done by using SPSS (Statistical package for social science) version 23. Confidentially was strictly maintained.

RESULTS

Table 1 showed that the mean age of patients was 54.8±8.48 years, with most patients in the 40-49 years (35%) and ≥60 years (35%) groups. Females were more common (60%) than males (40%). Over half of the patients (55%) had no comorbidities, while hypertension (25%) was the most frequent among those with associated conditions.

Table 1: Baseline characteristics of patients, (n=20).

Variables	N	Percentage (%)
Age group (in years)		
40-49	7	35
50-59	6	30
≥60	7	35
Mean±SD	54.8±8.48	
Gender		
Male	8	40
Female	12	60
Comorbidities		
None	11	55
DM	1	5
HTN	5	25
IHD	1	5
DM + HTN	2	10

Table 2 shows most of the defects involved the angle of the mouth (60%) and the mandible (55%). Cervical lymph node involvement was present in the majority of patients (80%).

Table 2: Distribution of the respondents according to adjacent structure and lymph node involvement.

Variables	N	Percentage (%)
Adjacent structure involvement		
Mandible	11	55
Lip	8	40
Angle of mouth	12	60
Maxilla	2	10
Tongue	1	5
Lymph node involvement		
Yes	16	80
No	4	20

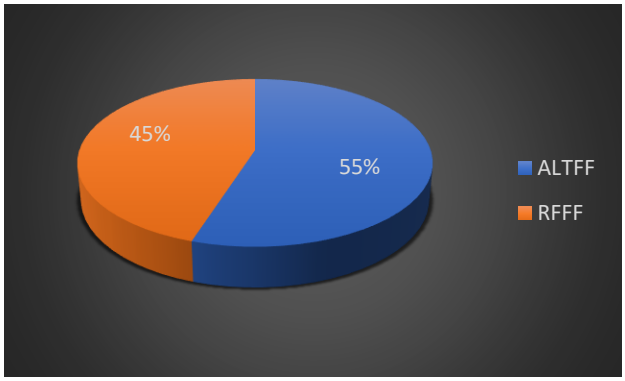

Figure 3: Distribution of the respondents according type of flap used, (n=20).

Figure 3 shows that among 20 patients, 55% underwent reconstruction with ALTFF and 45% with RFFF.

Table 3 shows the surface area of oral cavity defects was significantly greater in patients reconstructed with ALTFF (63.73±21.66 cm²) compared to RFFF (37.56±13.55 cm², p=0.007). Similarly, the flap surface area was significantly greater for ALTFF (137.82±60.52 cm²) than for RFFF (68.56±26.47 cm², p=0.003).

Table 4 shows the surgical outcomes among ALTFF patients, 9 (81.8%) had no flap necrosis, 1 (9.1%) had marginal necrosis, and 1 (9.1%) had complete necrosis. In the RFFF group, 7 (77.8%) had no flap necrosis, while 2 (22.2%) had complete necrosis. All ALTFF donor sites were managed with local advancement flaps (100%), whereas all RFFF donor sites were resurfaced with split-thickness skin grafts (100%). Donor site complications occurred only in RFFF patients, with 3 out of 9 showing partial graft loss (5-10%) that healed secondarily. Functional outcomes indicate that the mean mouth opening improved from 4.15±1.36 cm preoperatively to 4.71±0.58 cm postoperatively, indicating functional gain.

Table 3: Surface area of oral cavity defects and corresponding flaps (ALTFF vs RFFF).

Variables	ALTFF, mean±SD (cm²)	RFFF, mean±SD (cm²)	P value
Surface area of the defect	63.73±21.66 (Range-32 to 96 cm²)	37.56±13.55 (Range-20 to 64 cm²)	0.007
Surface area of the flap	137.82±60.52 (Range-63 to 270 cm²)	68.56±26.47 (Range- 20 to 64 cm²)	0.003

Table 4: Outcome measure of the respondents.

Outcomes		ALTFF (n=11)	RFFF (n=9)
Surgical outcome			
Flap outcome	No flap necrosis	9 (81.8%)	7 (77.8%)
	Marginal necrosis	1 (9.1%)	-
	Complete necrosis	1 (9.1%)	2 (22.2%)
Donor site management	Local advancement flap	11 (100%)	-
	STSG	-	9 (100%)
Donor site complications (RFFF)	No graft loss	-	6 (66.67%)
	5% graft loss	-	2 (22.2%)
	10% graft loss	-	1 (11.1%)
Functional outcome		**Mean±SD**	
Mouth opening (cm)	Preoperative	4.15±1.36	
	Postoperative	4.71±0.58	

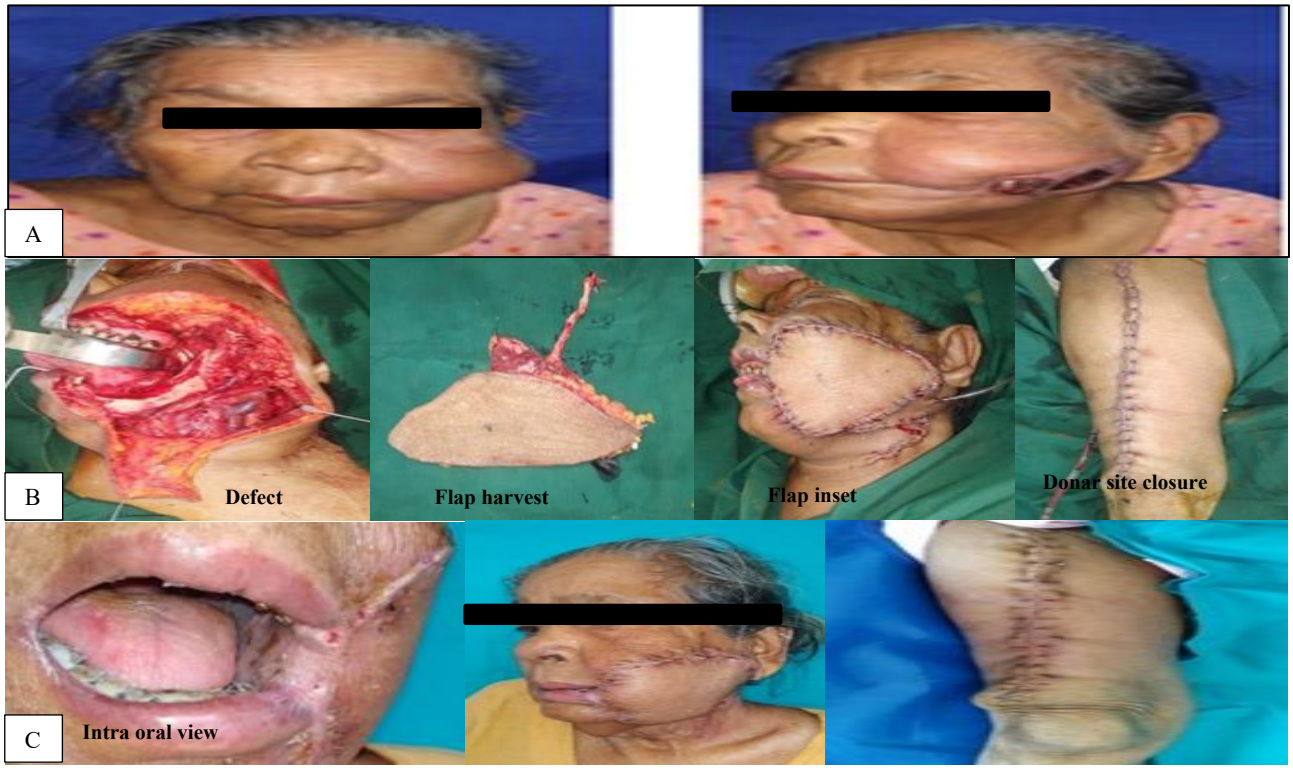

Figure 4 (A-C): Reconstruction with ALTFF. A-Preoperative, B-Surgical procedure and C- Follow up at 4th week.

Figure 5 (A-C): Reconstruction with RFFF. A-Preoperative, B-Surgical procedure and C- Follow up at 4th week.

DISCUSSION

This prospective observational study was conducted from July, 2020 to December, 2021 over one and half year in the department of department of plastic surgery, NIBPS, Dhaka. The purpose of the study was to evaluate the early surgical and functional outcomes of RFFF and ALTFF in the reconstruction of oral cavity soft tissue defects. So, the appropriate treatment can be given. The number of respondents 20 who were male and female. Among them, 11 patients underwent reconstruction with an ALTFF, and 9 patients underwent reconstruction with a RFFF. RFFF and ALTFF are two broadly accepted options for oral reconstructions after tumor ablative surgery worldwide. With the advancement of microsurgical techniques and instruments, failure rate has reduced in last few decades and function and appearance of recipient and donor sites have come into consideration (Camaioni et al).[7] RFFF is effective to restore function and appearance in patients with post tumor excision oral defects. It provides relatively hairless, thin pliable skin paddle with long, consistent vascular pedicle (Jeremic and Nikolic, 2015).[9] On other hand, major advantage of ALTFF is avoidance of sacrifice of major vascular axis and exposure of important structures like tendons and nerves. It shows comparable functional outcomes at receiving site with less donor site morbidities and higher level of patient satisfaction (Loreti et al).[10] This study described demography of the cases, surgical and

functional outcomes of flap, donor site healing complications.

The majority patients (65%) were above 50 years of age and mean age was 54.80±8.48 years (range 43-70). In study of Jeremic and Nikolic average age was 53 years (range 37-68).[9] Both male and female were included in the study. Maximum cases were female (female, 12 and male, 8). Fang et al also studied 20 patients, where female cases were 11 in number and male cases were 9.[11] In this study, 45% patients presented with comorbid conditions, of which 35% were hypertensive and 15% were diabetic. Suh et al conducted a study where 43% patient had comorbidities, 15.4% were diabetic among them.[5] This study showed cervical lymph node involvement was present in 80% patients, who underwent selective neck dissection. According to Hashmi et al over last 3 decades, selective neck dissection has been recommended for node-positive oral cavity SCC. The regional control rate was 96% in node-positive cases in that study.[12] ALTFF reconstruction was done in 11 (55%) cases and RFFF in 9 (45%) cases. Choice of flap was based on location and dimension of the defect, patient's preference and surgeon's judgment. Loreti et al showed similar findings, 25 (59.5%) patients were reconstructed with ALTFF and 17 (40.4%) were with RFFF.[10] Among the involved structures adjacent to buccal lesion, angle of mouth and mandible were the highest. Most common site of oral cancer is buccal mucosa, which may be due to habit of high intake of tobacco and betel products and retaining them on the buccal mucosa for a long time (Rahman et al).[3] In the study of Hsing et al primary tumor sites were 44% in buccal mucosa, 24% in tongue and 9% in palate.[13] Patients reconstructed with ALTFF had significantly larger defect areas (63.73±21.66 cm^2) compared to RFFF (37.56±13.55 cm^2, p=0.007). Similarly, the mean flap size was significantly greater for ALTFF (137.82±60.52 cm^2) than RFFF (68.56±26.47 cm^2, p=0.003). Flap size was higher than defect size for both flaps as both intraoral and extraoral defects were reconstructed with same flap. Suh et al showed average flap size for ALTFF was 146.1 cm^2 (range, 56-234 cm^2) and for RFFF was 69.8 cm^2 (range, 7-176 cm^2).[5] Flap survival rate was 90.9% (10 in 11) in patients treated with ALTFF with a case of epidermal loss that healed secondarily and 77.8% (7 in 9) in patient treated with RFFF. Loreti et al observed, flap survival rate was 100% in ALTFF group and 94.2% in RFFF group. Another study done by Kesting et al showed 97.8% success rate in ALTFF group and 97.4% in RFFF group.[14] All these studies showed higher flap survival rate in ALTFF in comparison to RFFF that is consistent with this study.

Regarding complications, complete flap necrosis was found in 1 patient treated with ALTFF and 2 patients having RFFF. Epidermal only loss was observed in 1 case with ALTFF. In the study of Young et al no flap necrosis in ALTFF group and 1 partial flap necrosis in RFFF group were observed.[8] Jeremic and Nikolic observed 1 complete and 1 partial flap loss in patients treated with RFFF.[9] Kesting et al conducted a study where 1 complete and 1 partial flap necrosis in ALTFF group and 2 complete flap necrosis in RFFF group were found.[14] Functional result at recipient site was satisfactory. Average postoperative mouth opening was 4.7 cm. Study of Fang et al had mean mouth opening width: 4.3 cm that coincides with this study.[11] All the donor sites of RFFF were closed with STSG and all donor sites of ALTFF were closed with local advancement flap. Study of Camaioni et al and Loreti et al showed all RFFF donor site was closed with skin graft and in ALT flap group, donor site was always closed primarily, except in one case repaired with skin graft.[7,10] This study showed 5-10% graft loss in 33.3% (3 in 9) of RFFF which was healed secondarily, no wound healing complication was seen in ALTFF. Camaioni et al observed 41.2% graft loss in RFFF group and 6.4% healing complication in ALTFF group in their study.[7]

Limitations

This was a single-center study with a relatively small sample size, which may limit the generalizability of the findings to larger populations. In addition, the short follow-up period may not adequately reflect long-term outcomes, such as recurrence rates and late complications.

CONCLUSION

In the last few decades, failure rate has reduced significantly as a result of advancement in surgical techniques and instruments. Due to these improvements, the focus has shifted from flap anatomy and survival to the functional and aesthetic outcomes of both donor and recipient sites. ALTFF is comparable to the RFFF in terms of flap survival and functional results at the recipient site with less donor site morbidity and a higher level of patient satisfaction. Both flaps are reliable options in oral reconstruction considering high flap survival rate with acceptable donor site outcomes.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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