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Reconstruction of orofacial defects using the anterolateral thigh free flap: A clinical and functional evaluation

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Abstract

Background: Reconstruction of orofacial defects poses significant surgical challenges due to anatomical complexity and functional requirements. The anterolateral thigh (ALT) free flap has emerged as a reliable reconstructive option; however, data from resource-limited settings like Bangladesh remain scarce.

Objective: This study clinically and functionally evaluates outcomes of ALT flap reconstruction in patients undergoing oncologic resection of orofacial defects.

Methods: A retrospective observational study was conducted involving 40 patients undergoing ALT flap reconstruction. Outcomes included flap survival, complication rates, functional recovery (oral diet resumption, speech, and swallowing), and patient-reported quality of life at 6 months postoperatively. Logistic regression identified predictors of early functional recovery.

Results: Mean patient age was 56.3 ± 9.2 years; most patients were male (60%) with a significant smoking history (65%). Complete flap success occurred in 95%, with partial necrosis and revision surgery in 5%. At 6 months, 70% reported good oral function, 75% clear speech, 65% esthetic satisfaction, and 60% successful social reintegration. Early oral diet resumption was achieved in 75%. Logistic regression indicated increased age (odds ratio [OR] = 0.88, $P = 0.01$), smoking (OR = 0.30, $P = 0.02$), and diabetes mellitus (OR = 0.22, $P = 0.04$) as significant predictors of delayed recovery.

Conclusion: ALT flap reconstruction demonstrates high reliability and favorable functional outcomes in orofacial defect reconstruction. Factors such as older age, smoking, and diabetes should inform patient counseling and perioperative management strategies.

Keywords: Anterolateral thigh free flap, Bangladesh, functional recovery, orofacial reconstruction, quality of life

Introduction

Orofacial defects present a significant global health burden, especially in regions where trauma, oncologic resections, infections, and congenital anomalies are prevalent. These defects not only affect the anatomical integrity of the face and oral cavity but also severely impair critical functions such as speech, mastication, swallowing, and facial expression, all of which are essential for social interaction and quality of life (QoL). The World Health Organization and multiple global epidemiological reports have emphasized the increasing incidence of orofacial defects linked to both communicable and non-communicable diseases, particularly in low- and middle-income countries (LMICs), where access to specialized reconstructive care remains limited.[1,2] In South Asia, including Bangladesh, the orofacial reconstructive burden is compounded by a high prevalence of head and neck cancers, road traffic accidents, and congenital craniofacial anomalies such as cleft lip and palate, further intensifying the clinical and public health challenge.[3]

Beyond the structural impairment, orofacial defects are often associated with profound functional and psychosocial consequences. Patients with tissue loss in the oral and maxillofacial region frequently experience dysarthria, impaired mastication, nasal regurgitation, drooling, and esthetic disfigurement, all of which compromise their ability to reintegrate into society. This is particularly true in resource-constrained settings where rehabilitation services and psychosocial support are lacking.[3,4] The stigma associated with facial deformities, especially in socio-culturally sensitive environments, leads to reduced self-esteem, unemployment, social withdrawal, and even depression, highlighting the urgent need for timely and effective reconstructive strategies.[5] Restoration of both function and form is thus not a mere surgical objective but a vital component of comprehensive patient care.

Reconstructing orofacial defects, however, poses a formidable surgical challenge. The face and oral cavity are regions of extraordinary anatomical complexity, encompassing multiple tissue types, critical neurovascular structures, and high esthetic sensitivity. Successful reconstruction must restore not only bulk and contour but also dynamic functions such as speech, swallowing, and oral continence, all while minimizing donor site morbidity and preserving cosmetic appearance.[6,7] Inadequate reconstruction can lead to oronasal or orocutaneous fistulas, trismus, speech defects, and severe disfigurement. The need for individualized reconstruction strategies tailored to the defect type, tissue requirement, and patient comorbidities makes this an area demanding high surgical expertise and innovation.[8,9]

Historically, a wide array of reconstructive techniques has been employed to address orofacial defects, ranging from local flaps such as the nasolabial or buccal advancement flaps to regional pedicled flaps like the pectoralis major myocutaneous flap. While these approaches remain relevant for smaller or superficial defects, they are frequently limited by arc of rotation, bulkiness, and lack of tissue pliability.[10,11] The introduction of free tissue transfer in the late 20th century revolutionized the field of head and neck reconstruction, enabling surgeons to harvest tissue with independent vascular supply from distant parts of the body. Among the various free flaps, including the radial forearm, fibula, and scapular flaps, the anterolateral thigh (ALT) flap has emerged as a preferred option due to its unique combination of reliability, versatility, and minimal donor site morbidity.[12,13]

The ALT flap is harvested from the lateral thigh region and can be configured as either a fasciocutaneous or musculocutaneous flap depending on the defect's volume and tissue requirements.[14] It offers a long, sizable vascular pedicle (typically from the descending branch of the lateral circumflex femoral artery), a large skin paddle (up to 25 × 15 cm), and the ability to include vastus lateralis muscle if required.[15] Moreover, the flap thickness can be adjusted, and the donor site often permits primary closure, significantly reducing morbidity and enhancing postoperative mobility.[16,17] These features make the ALT flap

particularly suitable for large, three-dimensional, and composite defects in the orofacial region, where multiple tissue types must be reconstructed in a confined anatomical space.

Recent clinical data reinforce the role of the ALT flap as a workhorse in orofacial and head and neck reconstruction. Flap survival rates consistently exceed 95%, with donor site complications remaining below 5% in most high-volume centers.[12,18] Functional outcomes are similarly promising; over 80% of patients achieve meaningful restoration of oral competence, intelligible speech, and acceptable esthetic results within a few months postoperatively.[19] The flap's adaptability and robust perfusion also enable it to withstand postoperative radiotherapy in oncologic cases, a crucial factor in head and neck cancer treatment pathways. As a result, its popularity has grown steadily not only in high-resource settings but also in LMIC surgical programs, where its reproducibility and low donor-site morbidity offer tangible advantages.[6]

Given these multifactorial benefits, the present study was undertaken to clinically and functionally evaluate the outcomes of orofacial defect reconstruction using the ALT free flap in a tertiary care setting in Bangladesh. By assessing flap viability, donor site morbidity, and functional rehabilitation (speech, mastication, and appearance), this research aims to provide context-specific evidence to further strengthen the role of the ALT flap in modern orofacial reconstructive surgery.

Methods

This retrospective observational study was conducted at Ahsania Mission Cancer and General Hospital and Dhaka Specialized Hospital, and Uttara Adhunik Medical College and Hospital, Dhaka, Bangladesh, over a period from January 2020 to December 2024. A total of 40 patients who underwent orofacial reconstruction using the ALT free flap following oncologic resection were included. Patients with a history of previous flap failure or incomplete follow-up data were excluded from the study. Demographic and clinical variables collected included age, sex, smoking history, diabetes status, defect size and location, tumor site, and operative characteristics. Primary surgical outcomes were flap survival, postoperative complications, and need for revision surgery. Functional outcomes included time to oral diet resumption, swallowing capacity, duration of speech therapy, and return to occupational or routine activity. QoL at 6 months postoperatively was assessed across four critical domains relevant to orofacial reconstruction: Oral function, speech, esthetic satisfaction, and social reintegration. A structured, interviewer-administered questionnaire-adapted from validated tools used in head-and-neck cancer rehabilitation research-was employed to collect patient-reported outcomes. Each QoL domain was evaluated as follows:

- Oral function: The patient's ability to chew and eat various food textures was categorized as Good (able to eat most solid foods), Moderate (limited to soft or semi-solid foods), or Poor (dependent on liquid or pureed diet, or feeding tube).
- Speech: Clarity and intelligibility of speech were assessed through patient self-report and corroborated with speech therapist documentation. Ratings were categorized as clear/understandable, occasionally difficult, or frequently unintelligible.
- Esthetic satisfaction: Patients scored their postoperative appearance using a 5-point Likert scale (1 = very dissatisfied to 5 = very satisfied). For analysis, scores were dichotomized into Satisfied (≥3) or Unsatisfied (<3).
- Social reintegration: This domain captured the patient's ability to resume social interactions such as attending public events or participating in family gatherings. Responses were recorded as Yes (socially active with minimal limitation) or No (persistent withdrawal or discomfort in social settings).

All data were entered and analyzed using Statistical Package for the Social Sciences version 26. Descriptive statistics (mean ± standard deviation, frequency, percentage) summarized baseline and outcome variables. Logistic regression analysis was used to identify independent predictors of early functional recovery, defined as the ability to resume oral intake within 14 days postoperatively. $P < 0.05$ was considered statistically significant. Ethical approval was obtained from the Institutional Review Board of the study hospital.

Results

A total of 40 patients underwent orofacial reconstruction using the ALT free flap. The mean age of the study population was 56.3 ± 9.2 years, with a male predominance (60%, $n = 24$) compared to females (40%, $n = 16$). A substantial proportion of patients had a history of smoking (65%, $n = 26$), while 15% ($n = 6$) had comorbid diabetes mellitus [Table 1].

The most common tumor site requiring reconstruction was the oral cavity, accounting for 62.5% ($n = 25$) of cases. Other tumor sites included the oropharynx (15%, $n = 6$), hypopharynx (7.5%, $n = 3$), and larynx (5%, $n = 2$). An additional 10% ($n = 4$) of cases involved other orofacial subsites [Table 2].

Regarding the extent and anatomical location of surgical defects, half of the patients (50%, $n = 20$) presented with medium-sized defects measuring 4–8 cm. Small defects (≤4 cm) and large defects (>8 cm) were observed in 25% ($n = 10$) of patients each. The most frequently reconstructed anatomical subunits included the mandible and tongue, each comprising 35% ($n = 14$) of cases, followed by the floor of the mouth in 30% ($n = 12$) of cases [Table 3].

Surgical outcomes were favorable, with complete flap success achieved in 95% ($n = 38$) of patients. Partial flap necrosis occurred in 5% ($n = 2$) of cases, while no instances of total flap loss were reported. Revision surgery was required in the two cases with partial necrosis (5%) [Table 4], underscoring the overall reliability of the ALT flap in orofacial reconstruction.

At 6 months postoperatively, QoL assessments revealed encouraging functional and psychosocial recovery among the majority of patients. Good oral function-defined as the ability to consume most solid foods-was reported by 70% ($n = 28$)

Table 1: Demographic characteristics of ALT flap patients (n=40)

Characteristics	ALT flap (n=40) (%)
Mean age (years)	56.3±9.2
Male	24 (60)
Female	16 (40)
Smoking history	26 (65)
Diabetes mellitus	6 (15)

ALT: Anterolateral thigh

Table 2: Tumor site distribution (n=40)

Tumor site	Number of patients (%)
Oral cavity	25 (62.5)
Oropharynx	6 (15)
Hypopharynx	3 (7.5)
Larynx	2 (5)
Other	4 (10)

Table 3: Defect size and location (n=40)

Variable	Number of patients (%)
Small defects (≤4 cm)	10 (25)
Medium (4–8 cm)	20 (50)
Large (>8 cm)	10 (25)
Floor of mouth	12 (30)
Mandible	14 (35)
Tongue	14 (35)

Table 4: Surgical outcomes (n=40)

Outcomes	Number of patients (%)
Complete success	38 (95)
Partial necrosis	2 (5)
Total flap loss	0 (0)
Revision surgery needed	2 (5)

of the cohort. Speech was described as clear and understandable in 75% (n = 30) of patients, while 65% (n = 26) expressed satisfaction with their postoperative facial appearance. In addition, 60% (n = 24) of patients reported successful social reintegration, indicating their return to family and public life with minimal discomfort or restriction [Table 5].

In terms of early functional recovery, 75% (n = 30) of patients resumed an oral diet within 2 weeks following surgery. Nearly half of the cohort (45%, n = 18) required speech therapy for 4 weeks or less, and by the 3-month postoperative mark, 70% (n = 28) had achieved normal swallowing function. Furthermore, 65% (n = 26) of patients were able to return to their preoperative occupational or daily activities within 3 months of reconstruction, demonstrating the ALT flap's efficacy in restoring critical orofacial functions and promoting rehabilitation [Table 6].

To identify predictors of early functional recovery, defined as resumption of oral diet within 2 weeks postoperatively, a logistic regression analysis was performed. Increasing age was significantly associated with reduced odds of early recovery (odds ratio [OR]: 0.88, 95% confidence interval [CI]: 0.80–0.97; P = 0.01), suggesting that older patients had a slower return to oral intake. Similarly, a history of smoking was found to be a significant negative predictor (OR: 0.30, 95% CI: 0.10–0.85; P = 0.02), indicating compromised healing capacity among smokers. Diabetes mellitus also showed a statistically significant association with delayed functional recovery (OR: 0.22, 95% CI: 0.05–0.91; P = 0.04), highlighting the metabolic challenges posed by this comorbidity. While larger defect size (>8 cm) was associated with a lower likelihood of early recovery (OR: 0.45, 95% CI: 0.12–1.65), the result did not reach statistical significance (P = 0.23). Sex was not a significant factor in predicting early functional recovery (OR: 1.10, P = 0.87). These findings underscore the importance of age, smoking status, and diabetes in influencing postoperative rehabilitation trajectories following ALT flap reconstruction [Table 7a].

Table 5: Quality of life at 6 months postoperatively (n=40)

QoL domain	Number of patients (%)
Oral function (good)	28 (70)
Speech (understandable)	30 (75)
Esthetic satisfaction	26 (65)
Social reintegration	24 (60)

Table 6: Functional recovery (n=40)

Functional outcomes	Number of patients (%)
Oral diet resumed ≤2 weeks	30 (75)
Speech therapy duration ≤4 weeks	18 (45)
Normal swallowing at 3 months	28 (70)
Return to work by 3 months	26 (65)

Discussion

In this retrospective observational study, we evaluated the clinical and functional outcomes of orofacial reconstruction using the ALT free flap. Our findings underscore the reliability and effectiveness of ALT flap reconstruction, demonstrating high surgical success rates and favorable functional recovery, aligning well with previous reports. Demographic characteristics such as age, gender distribution, smoking history, and prevalence of diabetes mellitus among our patients reflect a typical profile seen in head and neck reconstruction studies globally, particularly in LMICs like Bangladesh. The high proportion of patients with a smoking history (65%) aligns with established literature highlighting tobacco use as a prominent risk factor for head and neck cancers, thereby influencing postoperative healing and functional recovery.[20,21] Our study revealed the oral cavity as the most frequent tumor site necessitating reconstruction, consistent with global epidemiological data, which emphasize the oral cavity's predominant involvement in head and neck oncologic defects.[22,23] In addition, most defects in our cohort were medium-sized (4–8 cm), often involving critical functional areas such as the mandible and tongue. These findings

Table 7a: Logistic regression analysis predicting early functional recovery (oral diet resumed ≤2 weeks)

Variables	Odds ratio	95% confidence interval	*P*-value	Interpretation
Age (per year increase)	0.88	0.80–0.97	0.01	Significant
Smoking history (yes)	0.30	0.10–0.85	0.02	Significant
Defect size >8 cm	0.45	0.12–1.65	0.23	Not significant
Diabetes mellitus (yes)	0.22	0.05–0.91	0.04	Significant
Male sex (vs. female)	1.10	0.35–3.47	0.87	Not significant

Table 7b: Interpretation of logistic regression results for predicting early functional recovery

Variable	Odds ratio	95% confidence interval	*P*-value	Interpretation
Age (per year increase)	0.88	0.80–0.97	0.01	Increasing age significantly reduced the odds of early oral diet resumption, indicating older patients may experience delayed functional recovery.
Smoking history (yes)	0.30	0.10–0.85	0.02	A history of smoking was significantly associated with lower odds of early functional recovery, suggesting a negative effect on healing and rehabilitation.
Defect size >8 cm	0.45	0.12–1.65	0.23	Larger defects were associated with reduced odds of early recovery, but this relationship was not statistically significant.
Diabetes mellitus (yes)	0.22	0.05–0.91	0.04	Diabetes mellitus significantly decreased the likelihood of early oral intake, indicating a relevant clinical and metabolic barrier to recovery.
Male sex (vs. female)	1.10	0.35–3.47	0.87	Sex did not significantly influence early recovery; odds were slightly higher in males but not meaningful.

confirm the complex reconstructive demands and the necessity of versatile techniques such as the ALT flap for restoring critical functions and esthetic appearance in these anatomically challenging regions.[8,24] Regarding surgical outcomes, our ALT flap success rate of 95% is comparable with published literature, underscoring the technique's reliability and robustness in reconstructing complex orofacial defects.[18,25] Partial flap necrosis occurred in only 5% of cases, with no total flap loss observed, highlighting minimal morbidity associated with this reconstructive method. Revision surgery was similarly low (5%), reflecting the flap's excellent vascular supply and tissue adaptability.[12] Functional recovery outcomes, notably early resumption of oral diet within 2 weeks (75%), align positively with prior studies demonstrating rapid functional rehabilitation facilitated by ALT flap reconstruction.[26,27] Speech intelligibility and swallowing functions recovered swiftly in most patients, indicating the ALT flap's suitability for reconstructing defects requiring intricate functional restoration. These results are consistent with other studies emphasizing ALT flap versatility and reduced donor-site morbidity, contributing to faster recovery of critical oral functions.[28,29] Patient-reported QoL outcomes at 6 months postoperatively revealed significant clinical improvements. Good oral function (70%), clear and understandable speech (75%), esthetic satisfaction (65%), and social reintegration (60%) underscore the holistic benefits of the ALT flap beyond mere anatomical reconstruction. These findings correspond well with existing literature that has consistently reported high patient satisfaction due to the ALT flap's excellent esthetic and functional integration.[16,30] Logistic regression analysis highlighted important predictors affecting

early functional recovery. Specifically, increased patient age, smoking history, and diabetes mellitus emerged as significant negative predictors, substantially decreasing the odds of early oral diet resumption. These results corroborate previous findings that older age, smoking, and diabetes significantly impair postoperative healing and functional recovery following major reconstructive procedures.[20,21] Although larger defect size (>8 cm) suggested reduced odds of early functional recovery, this association was not statistically significant, possibly due to sample size limitations. Overall, our study reinforces existing evidence supporting the ALT free flap as a robust and reliable reconstructive option for complex orofacial defects. The observed clinical outcomes, combined with encouraging patient-reported QoL measures, substantiate the ALT flap's role as a preferred reconstructive choice in contexts requiring precise restoration of both functional and esthetic parameters. However, future prospective studies with larger cohorts are recommended to further confirm these findings and explore detailed long-term outcomes, especially within resource-limited settings like Bangladesh.

Limitations of the study

The current study has several limitations. First, it was a retrospective analysis, inherently associated with biases related to data collection and patient selection. Second, the relatively small sample size and short-term follow-up (6 months) restrict the generalizability and long-term assessment of functional outcomes and QoL measures. In addition, the single-center design may limit the applicability of these findings to other healthcare settings. Future prospective multicenter studies with larger cohorts and longer follow-up durations would help validate these findings.

Conclusion

The ALT free flap is an effective and reliable option for reconstructing complex orofacial defects following oncologic resection, demonstrating high flap survival rates, favorable functional recovery, and enhanced quality-of-life outcomes. Despite the influence of negative predictors such as older age, smoking, and diabetes mellitus, most patients achieve meaningful functional rehabilitation and satisfactory esthetic outcomes. This study highlights the ALT flap's utility and suitability in resource-constrained environments, reinforcing its critical role in modern reconstructive practice in Bangladesh.

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Conflict of Interest

None declared.

Ethical Approval

The study was approved by the Institutional Ethics Committee.

Recommendation

Clinicians should strongly consider the ALT free flap for patients requiring extensive orofacial reconstruction, particularly in settings where rapid functional recovery and esthetic restoration are essential. Preoperative counseling should include discussions about the potential impacts of age, smoking, and diabetes on recovery. Future research initiatives should focus on larger, prospective, multicenter studies to further substantiate these findings and explore long-term outcomes comprehensively.

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