



Clinical Outcomes of Oral Cavity Reconstruction Using Nasolabial Flaps

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Abstract: *Background:* Reconstruction of oral cavity defects is critical for restoring speech, mastication, and aesthetics. In resource-limited settings, nasolabial flaps offer a reliable alternative to microvascular free flaps for small to moderate defects. The current study aimed to evaluate clinical and functional outcomes following nasolabial flap reconstruction in oral cavity defects and identify predictors of postoperative complications. *Methods:* This prospective study included 50 patients undergoing nasolabial flap reconstruction at a tertiary center. Demographic data, etiology of defect, surgical details, complications, and 6-month functional outcomes were analyzed. Logistic regression identified independent predictors of complications. *Results:* Most defects were due to malignant tumor resection (64%). Unilateral flaps were used in 70% of patients. Complication rate was 34%, with trismus (10%) and wound dehiscence (8%) most common. At 6 months, 84% had mouth opening ≥ 30 mm, 60% resumed solid diets, and 84% had good to excellent speech intelligibility. Independent predictors of complications included age ≥ 60 years ($p=0.047$), smoking ($p=0.028$), comorbidities ($p=0.048$), and operation time ≥ 2 hours ($p=0.049$). *Conclusion:* Nasolabial flaps are effective for oral cavity reconstruction with favorable functional outcomes and acceptable complication rates. Risk stratification is essential to minimize postoperative morbidity.

Keywords: Nasolabial Flap, Oral Cavity Reconstruction, Postoperative Complications, Functional Outcome, Head and Neck Surgery.

Article at a glance:

Study Purpose: To evaluate clinical and functional outcomes of nasolabial flap reconstruction in oral cavity defects in Bangladesh.

Key findings: Nasolabial flaps are effective for oral cavity reconstruction with 34% complication rate and high functional recovery at six months.

Newer findings: Study emphasizes region-specific outcomes and identifies significant predictors of postoperative complications such as smoking and age.

Abbreviations: SCC – Squamous Cell Carcinoma, AOR – Adjusted Odds Ratio, ENT – Ear, Nose, and Throat



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Original Research Article

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INTRODUCTION

Oral cavity defects represent a significant clinical challenge due to their critical impact on both functional and aesthetic outcomes. Defects commonly arise from oncological resections, traumatic injuries, infections such as osteoradionecrosis, or congenital anomalies.^{1, 2} These defects are particularly debilitating as they interfere with vital daily activities, including speech, swallowing, mastication, and even facial

expression, severely impacting patients' quality of life.³ Moreover, oral cavity defects can lead to considerable psychological distress and social withdrawal due to disfigurement, difficulty in communication, and compromised nutritional status. Globally, oral cavity cancers constitute a substantial burden, with South Asia exhibiting some of the highest incidence rates. According to recent global burden data, South Asia persistently shows the highest incidence, mortality, and

disability-adjusted life years (DALYs) attributable to oral cancer.⁴ Within South Asia, Bangladesh ranks among the countries most severely affected, with lip and oral cavity cancers accounting for approximately 9.6% of all cancer cases, underscoring the significant public health concern this condition represents in the region.⁵ Research from Bangladesh further highlights oral squamous cell carcinoma (OSCC) as the predominant malignancy within oral cancers, frequently diagnosed at advanced stages due to limited public awareness and inadequate healthcare infrastructure.⁶ Reconstructing defects of the oral cavity presents considerable anatomical and functional challenges. The primary reconstructive goals in addressing these defects involve restoring crucial functions such as speech articulation, efficient mastication and swallowing, facial symmetry, and achieving acceptable cosmetic results, while simultaneously minimizing donor-site morbidity.⁷ The anatomical complexity of the oral cavity, including its intricate muscular and vascular architecture and the need for sensitivity in preserving nerve function, complicates surgical intervention and demands reconstructive solutions that are versatile, reliable, and minimally invasive.⁸ The spectrum of reconstructive options ranges from simple methods such as skin grafts and local flaps to more sophisticated techniques involving regional and microvascular free flaps. Skin grafts are limited in their application due to their inability to provide sufficient bulk or structural support, particularly inadequate for defects with significant tissue loss or structural disruption.⁹ Conversely, microvascular free flaps, such as the radial forearm or anterolateral thigh flaps, are often considered the gold standard for reconstructing extensive oral defects due to their versatility and the high-quality functional and aesthetic outcomes achievable.¹⁰ Nevertheless, their use is hindered significantly by resource-intensive surgical requirements, prolonged operative times, increased hospital stays, and specialized microsurgical expertise, which are not uniformly available, especially in low-resource or high-volume medical centers typical of low- and middle-income countries (LMICs) like Bangladesh.¹¹ As a feasible alternative, the nasolabial flap (NLF) emerges as an advantageous reconstructive option, particularly suited for small to moderate-sized oral cavity defects. The nasolabial flap is primarily a random-

pattern flap based on a robust subdermal plexus, which ensures consistent vascularity even when specific arteries like the facial artery are compromised during surgery.¹² This flap is characterized by numerous beneficial attributes, including its proximity to the oral cavity, superior color and texture match with oral mucosal tissues, relative ease of harvesting, minimal donor-site morbidity, and shorter operative times compared to free flap procedures. Moreover, nasolabial flaps have been associated with consistently high success rates, minimal postoperative complications, and favorable patient satisfaction, further reinforcing their applicability in resource-constrained settings.¹³ Despite the positive clinical outcomes demonstrated by nasolabial flaps, existing literature exhibits several notable limitations. Many studies evaluating these flaps have relatively small sample sizes, limiting the statistical robustness and generalizability of the findings.¹⁴ Additionally, functional outcomes, particularly speech intelligibility, swallowing function, and mouth-opening capacity, are frequently assessed subjectively or qualitatively rather than employing standardized, objective measurement tools, making comparisons across studies challenging and highlighting a critical gap in the literature. Furthermore, most existing data are derived from retrospective analyses, emphasizing the necessity of prospective studies designed explicitly to evaluate functional outcomes using standardized assessment protocols. Particularly conspicuous is the scarcity of region-specific, prospective data from Bangladesh or comparable LMIC settings, which are uniquely burdened by high incidences of oral cancers and limited reconstructive resources. Robust, outcome-focused studies that specifically investigate both surgical complications and long-term functional outcomes in these settings are urgently needed. Such studies would provide essential insights, guide clinical decision-making, and potentially improve quality-of-life outcomes for patients undergoing oral cavity reconstruction using nasolabial flaps. To address these gaps and enhance the evidence base for clinical decision-making, this prospective study aims to evaluate the clinical and functional outcomes of oral cavity reconstruction using nasolabial flaps among a cohort of patients in Bangladesh. This investigation emphasizes standardized assessments of postoperative complications, speech intelligibility,

swallowing function, and interincisal mouth opening, contributing vital region-specific evidence to the reconstructive surgical literature.

METHODS

This prospective study included 50 patients who underwent oral cavity reconstruction using random nasolabial flaps between May, 2020 to April, 2024 at Ahsania Mission Cancer and General Hospital and Dhaka Specialized Hospital, and Uttara Adhunik Medical College & Hospital, Dhaka, Bangladesh. Inclusion criteria comprised patients with oral cavity defects resulting from tumour resection, trauma, infection, osteoradionecrosis, or congenital anomalies. Demographic data such as age, sex, smoking status, and presence of comorbidities were recorded. Surgical parameters including flap laterality, flap size (all ≤ 5 cm), donor site closure method, and operation time were documented. Postoperative complications, including partial flap necrosis, wound dehiscence, infection, hematoma, and trismus, were closely monitored during the follow-up period. Functional outcomes were assessed six months postoperatively focusing on speech intelligibility, oral intake (swallowing function), and mouth opening (interincisal distance). Speech intelligibility was classified from excellent to poor based on clarity and ease of understanding, oral intake was categorized by diet restrictions and feeding aid dependence, and mouth opening was measured in millimetres and dichotomized at a

threshold of 30 mm to define trismus. Statistical analysis involved descriptive statistics and logistic regression to identify factors associated with postoperative complications. Odds ratios with 95% confidence intervals and p-values were calculated, with significance set at $p < 0.05$. Statistical analysis was performed using SPSS version 26.

Functional Outcome Evaluation

Three functional domains were assessed:

- Speech Intelligibility:** Evaluated by clinician judgement and/or speech therapist report, and graded into four categories:
Excellent: Normal or near-normal speech, easily understood by unfamiliar listeners.
Good: Minor articulation issues, understood with minimal effort.
Fair: Moderate impairment, requiring repetition or clarification.
Poor: Severe difficulty, largely unintelligible.
- Oral Intake (Swallowing Function):** Based on the patient's ability to consume food orally:
Excellent: Full oral diet without restriction.
Good: Mild restrictions (e.g., soft diet), no feeding aids required.
Fair: Significant restrictions requiring supplements or partial tube feeding.
Poor: Reliance on gastrostomy or nasogastric tube feeding.
- Mouth Opening (Interincisal Distance):** Measured using a caliper or ruler:
Adequate: ≥ 30 mm
Restricted: < 30 mm, indicative of trismus.

RESULTS

Table 1: Demographic Characteristics of Patients (n = 50)

Characteristic	Frequency (n)	Percentage (%)	p-value
Age Group (years)			
<40	12	24%	0.48
40–59	25	50%	
≥ 60	13	26%	
Sex			
Male	28	56%	0.61
Female	22	44%	
Smoking Status			
Smoker	28	56%	0.037*
Non-Smoker	22	44%	
Comorbidities			
Present	20	40%	0.021*
Absent	30	60%	

A total of 50 patients underwent nasolabial flap reconstruction for oral cavity defects. The majority of patients were aged between 40 and 59 years (50%), followed by those aged ≥ 60 years (26%) and those aged < 40 years (24%). No statistically significant association was observed between age group and the occurrence of postoperative complications ($p = 0.48$). Among the patients, 56% were male and 44% were female, with no significant

difference in complication rates based on sex ($p = 0.61$). A majority (56%) were smokers, and smoking status was significantly associated with higher postoperative complication rates ($p = 0.037$). Additionally, 40% of the patients had one or more comorbid conditions such as diabetes or hypertension, and the presence of comorbidities was significantly associated with increased postoperative complications ($p = 0.021$).

Table 2: Etiology of Oral Cavity Defects (n = 50)

Etiology	Frequency (n)	Percentage (%)
Malignant tumor resection (SCC)	32	64%
Benign tumor/cyst resection	8	16%
Traumatic defect (e.g., RTA, injury)	4	8%
Osteoradionecrosis	3	6%
Infection-related defect	2	4%
Congenital anomaly correction	1	2%

The most common indication for oral cavity reconstruction was resection of malignant tumors, predominantly squamous cell carcinoma, accounting for 64% of cases. Benign tumor or cyst resection constituted 16% of cases, while traumatic injuries (including road traffic accidents and mechanical trauma) accounted for 8%. Other causes

included osteoradionecrosis in 6%, infection-related tissue loss in 4%, and congenital anomalies in 2% of patients. These findings indicate that malignant tumor resection is the leading cause of intraoral defects requiring reconstructive intervention with nasolabial flaps.

Table 3: Flap and Surgical Details (n=50)

Surgical Parameter	Frequency (n)	Percentage (%)
Flap Laterality		
Unilateral	35	70%
Bilateral	15	30%
Flap Size		
≤ 5 cm	50	100%
Donor Site Closure		
Primary Closure	50	100%
Operation Time < 2 hours	38	76%
Operation Time ≥ 2 hours	12	24%

In terms of flap laterality, 70% of patients underwent unilateral nasolabial flap reconstruction, while 30% required bilateral flaps, likely reflecting the extent and location of the defects. All flaps used were ≤ 5 cm in size, consistent with the design limitations of random-pattern nasolabial flaps. The donor site was successfully

closed in all patients, achieving a 100% success rate. Regarding operative duration, 76% of procedures were completed within 2 hours, and the remaining 24% took longer than 2 hours. These findings reflect the relatively straightforward and time-efficient nature of nasolabial flap harvesting and inset in most cases.

Table 4: Postoperative Complications

Complication	Frequency (n)	Percentage (%)
Partial Flap Necrosis	3	6%
Wound Dehiscence	4	8%

Infection	3	6%
Hematoma/Seroma	2	4%
Trismus	5	10%
None	33	66%

Postoperative complications were observed in 17 patients (34%), while the majority (66%) experienced no adverse events following nasolabial flap reconstruction. The most frequently encountered complication was trismus, noted in 5 patients (10%), followed by wound dehiscence in 4 patients (8%). Partial flap necrosis and

postoperative infection each occurred in 3 patients (6%), and hematoma or seroma formation was observed in 2 patients (4%). All complications were managed conservatively without the need for flap revision or reoperation. These findings indicate a favorable safety profile of the nasolabial flap, with a relatively low overall complication rate.

Table 5: Functional Outcomes at 6 Months Post-op

Functional Domain	Excellent	Good	Fair	Poor
Speech Intelligibility	24 (48%)	18 (36%)	6 (12%)	2 (4%)
Oral Intake (Solid Diet)	30 (60%)	12 (24%)	5 (10%)	3 (6%)
Mouth Opening	≥30 mm – 42 (84%)	<30 mm – 8 (16%)		

Functional outcomes at the six-month follow-up showed promising results across all assessed domains. Regarding speech intelligibility, 48% of patients (n = 24) achieved excellent articulation, while 36% (n = 18) had good speech. Moderate impairment was reported in 12% (n = 6), and severe speech difficulty was observed in only 4% (n = 2). For oral intake, 60% of patients (n = 30) returned to a full solid diet without restrictions, 24% (n = 12) required a mildly restricted or soft diet,

10% (n = 5) had significant restrictions necessitating supplementation, and 6% (n = 3) remained dependent on feeding assistance. In terms of mouth opening, 84% of patients (n = 42) maintained an interincisal distance of ≥30 mm, while 16% (n = 8) developed restricted mouth opening (<30 mm), consistent with trismus findings reported earlier. Overall, the majority of patients regained satisfactory functional abilities by the end of the follow-up period.

Table 6: Logistic Regression Analysis of Factors Associated with Postoperative Complications (n = 50)

Logistic Regression Analysis	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)*	p-value
Age (≥60 vs <60 years)	3.5 (1.1–11.0)	0.035*	3.1 (1.0–9.8)	0.047*
Sex (Male vs Female)	1.2 (0.3–4.3)	0.77	1.1 (0.3–4.2)	0.89
Smoking Status (Smoker vs Non-Smoker)	4.5 (1.3–15.4)	0.018*	4.0 (1.1–14.7)	0.028*
Comorbidities (Present vs Absent)	4.0 (1.1–14.5)	0.036*	3.6 (1.0–13.3)	0.048*
Flap Laterality (Bilateral vs Unilateral)	1.8 (0.5–6.6)	0.35	1.6 (0.4–6.3)	0.50
Operation Time (≥2 hrs vs <2 hrs)	3.2 (1.0–10.2)	0.046*	2.9 (0.9–9.7)	0.049*

Multivariable logistic regression analysis was performed to identify predictors of postoperative complications following nasolabial flap reconstruction. Six variables were analyzed: age, sex, smoking status, presence of comorbidities, flap laterality, and operation time. Patients aged 60 years or older were found to have significantly higher odds of developing complications compared to younger patients, with an adjusted odds ratio

(AOR) of 3.1 (95% CI: 1.0–9.8, p = 0.047). Smoking status emerged as a strong predictor; smokers had approximately 4 times the odds of developing complications compared to non-smokers (AOR = 4.0; 95% CI: 1.1–14.7; p = 0.028). Similarly, the presence of comorbidities significantly increased the risk of postoperative complications (AOR = 3.6; 95% CI: 1.0–13.3; p = 0.048). Operation time was another relevant factor; procedures lasting ≥2 hours

were associated with a nearly 3-fold increase in complication risk (AOR = 2.9; 95% CI: 0.9–9.7; $p = 0.049$), although the confidence interval approached marginal significance. In contrast, no statistically significant associations were found for

sex ($p = 0.89$) or flap laterality ($p = 0.50$), indicating that these variables did not independently influence the likelihood of complications in this cohort.

Table 7: Interpretation of Logistic Regression Results for Postoperative Complications (n = 50)

Variable	Interpretation
Age (≥60 years)	Patients aged 60 or older have about 3 times higher odds of developing postoperative complications compared to younger patients ($p = 0.047$).
Sex (Male vs Female)	No significant difference in complication risk between males and females ($p = 0.89$).
Smoking Status (Smoker)	Smokers have 4 times greater odds of complications compared to non-smokers ($p = 0.028$).
Comorbidities (Present)	The presence of comorbidities increases the odds of complications by about 3.6 times ($p = 0.048$).
Flap Laterality (Bilateral)	No significant association between flap laterality and complications ($p = 0.50$).
Operation Time (≥2 hours)	Operations lasting 2 hours or more are associated with nearly 3 times increased odds of complications ($p = 0.049$).

DISCUSSION

This prospective study evaluated the clinical and functional outcomes of oral cavity reconstruction using nasolabial flaps in a cohort of 50 patients in Bangladesh. The findings highlight the nasolabial flap as a versatile and effective reconstructive option for small to moderate intraoral defects, with favorable complication rates and functional recovery. Several patient-related and surgical factors were found to influence postoperative outcomes, which are discussed below in comparison with existing literature. In our cohort, the majority of patients were aged between 40 and 59 years, with only 26% being ≥60 years. Advanced age (≥60 years) was significantly associated with higher postoperative complication rates (AOR = 3.1; $p = 0.047$). This finding is in line with previous reports, where increasing age was independently linked to higher morbidity following flap-based reconstructions.¹⁵ However, age alone does not preclude the use of nasolabial flaps, as they remain relatively low-risk procedures even in elderly patients due to shorter operative time and minimal donor site morbidity. There was no significant association between sex and postoperative complications in our study ($p = 0.89$), a finding similarly reported by Chakrabarti *et al.*, suggesting that biological sex may not be a major determinant of flap viability or postoperative outcomes in nasolabial reconstructions.¹⁶ Smoking status was significantly associated with

postoperative complications in our cohort (AOR = 4.0; $p = 0.028$). This result is strongly supported by existing literature, including systematic reviews and large series, which demonstrate that smoking impairs wound healing and increases the risk of flap necrosis and infection due to compromised microvascular circulation.¹⁷ Therefore, smoking cessation should be emphasized during preoperative counseling for flap-based reconstructions. Comorbid conditions were present in 40% of patients and significantly predicted complications (AOR = 3.6; $p = 0.048$). The role of comorbidities in surgical risk stratification has been well established. Plaeke *et al.* similarly reported that patients with systemic illnesses, particularly diabetes and cardiovascular disease, had higher complication rates following flap procedures.¹⁸ The predominant indication for reconstruction in this study was malignant tumor resection (64%), consistent with literature where oral squamous cell carcinoma accounts for the majority of intraoral defects requiring surgical closure. This reinforces the clinical relevance of nasolabial flaps in oncologic surgery, particularly when microvascular reconstruction is not feasible. In our series, 70% of patients underwent unilateral flap reconstruction, and 30% required bilateral flaps. Flap laterality was not significantly associated with complications ($p = 0.50$), a finding corroborated by Hiremath *et al.*, who concluded that bilateral nasolabial flaps are safe and effective for larger

defects without added morbidity.¹⁹ All flaps were ≤ 5 cm in length, in accordance with nasolabial flap design limits to ensure optimal perfusion. Ullah *et al.* reported similar dimensions in their cohorts, emphasizing that flaps larger than 5–6 cm may increase the risk of distal necrosis due to the random-pattern vascular supply.²⁰ Donor site closure was achieved primarily in 100% of patients. This is consistent with outcomes from Mishra *et al.*, where primary closure was successful in most cases, aided by the skin laxity of the nasolabial fold, leading to well-hidden scars and high patient satisfaction.²¹ Operative time was another important predictor of complications. While 76% of surgeries were completed in under 2 hours, longer operative times (≥ 2 hours) were significantly associated with complications (AOR = 2.9; $p = 0.049$). This supports findings from Shaikh *et al.*, who reported that prolonged surgical duration correlates with increased flap failure and infection risk due to tissue desiccation and prolonged anesthesia exposure.²² The overall complication rate in our study was 34%, with trismus (10%), wound dehiscence (8%), partial flap necrosis (6%), infection (6%), and hematoma/seroma (4%) being the most commonly observed issues. Most complications were minor and manageable conservatively. These findings are in line with large-scale reviews such as Agarwal *et al.*, where the complication rate with nasolabial flaps remained under 30%, and most events resolved without revision surgery.²³ Functional outcomes were notably positive. At 6 months, 84% of patients had adequate mouth opening (≥ 30 mm), with only 16% developing restricted opening. These results align with those reported by Madhoon *et al.*, who demonstrated significant improvement in interincisal distance following nasolabial flap use in trismus cases.²⁴ Likewise, speech intelligibility was rated as excellent or good in 84% of patients, comparable to findings by Shah *et al.*, who showed that the nasolabial flap allows acceptable speech function in most oral cavity reconstructions.²⁵ Oral intake was restored fully in 60% of patients, and a further 24% managed with a soft diet. This recovery is comparable to outcomes reported by Gupta *et al.*, where nasolabial flap patients showed rapid return to oral feeding, often within 7–10 days postoperatively.²⁶ Overall, our findings reinforce the utility of the nasolabial flap as a reliable, low-morbidity solution for reconstructing small to

moderate oral cavity defects, particularly in resource-limited settings. The outcomes in our study are consistent with those reported globally, validating its continued use as a valuable reconstructive option in appropriately selected patients.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This prospective study demonstrates that nasolabial flaps provide a safe, efficient, and functionally favorable option for the reconstruction of small to moderate oral cavity defects. With a low overall complication rate (34%) and high rates of functional recovery—84% of patients achieving adequate mouth opening, 60% resuming a solid diet, and 84% achieving good to excellent speech intelligibility—the nasolabial flap proves to be a dependable reconstructive technique. Significant predictors of postoperative complications included older age, smoking, presence of comorbidities, and prolonged operative time. These findings underscore the importance of careful preoperative evaluation and surgical planning, particularly in patients with modifiable risk factors. In resource-constrained settings like Bangladesh, where microsurgical expertise and infrastructure may be limited, the nasolabial flap stands out as a valuable, context-appropriate option for restoring both form and function after oral cavity defect repair.

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