

Crafting New Faces: An In-Depth Look at Flap Surgery for Facial Defects

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ABSTRACT

Introduction: Facial defects resulting from trauma and the excision of skin malignancies are relatively common. Management of the defects depends on a variety of factors, including the location, size, and underlying cause of the defect. Local flap surgery is commonly performed to cover defects with an appropriate skin color and texture match. The purpose of this study is to assess the various treatment options for defect coverage, outcomes, and complications.

Materials and Methods: This is a retrospective cohort study done at a tertiary care hospital's Department of Plastic Surgery between March 2021 and March 2024. Patients with facial defects who needed a flap were included in the study. Reconstruction options were selected based on age, defect size, location, and comorbidities. Data was collected and assessed using statistical analysis SPSS 20.

Results: 50 Patients of 18 to 75 years of age with facial defects were included in the study. Among the 50 cases, 12 were female and 38 were male. 5 had Nasolabial flaps, 8 Forehead, 8 Limberg and 13 Microvascular free flaps. Postoperatively complications included hematoma, and scar formation. 28 patients had excellent functional and aesthetic outcomes. The skin colour match was similar for all flaps, contour was better in local flaps than free flaps. However, local flaps allowed the donor scar to be hidden in a wrinkle line.

Conclusion: The most suitable flap for coverage of a face defect can be chosen based on the patient's condition, defect size and location.

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INTRODUCTION

The face is the centre of attention during communication and the expression of emotion. Facial defects can result from multiple etiologies, including trauma (e.g., road traffic accidents, animal bites), and the excision of skin malignancies. The management of these defects is multifaceted, and involves considering the defect size, location, underlying health conditions, and patient preferences. The

aim of reconstructive surgery is not only to close the defect but also to restore function and improve aesthetic appearance.

Plastic surgeons often aim to achieve the best possible aesthetic and functional results while minimizing complications. Local flaps are particularly advantageous in facial reconstruction because they can provide skin that closely matches the surrounding area. Various types of flaps, including local, regional, and microvascular free flaps, each have specific indications based on the characteristics of the defect and the patient's condition. Complications after reconstruction are hematoma, infection, necrosis, deviation site, scar etc.

This study aims to assess the outcomes of various flap techniques used in facial defect reconstruction and to analyze the associated complications and aesthetic results. We will also review the literature to contextualize our findings within current practices.

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LITERATURE REVIEW

The literature on facial reconstructive techniques is vast and continually evolving. A systematic review of flap techniques highlights the importance of selecting the appropriate flap based on defect characteristics. For instance, local flaps, such as the nasolabial flap and the forehead flap, have provided excellent color and texture match, particularly for smaller defects.^{1,2}

Microvascular free flaps, while being more complex, are often necessary for larger defects or those involving deeper structures. The anterolateral thigh flap and radial forearm flap are popular choices, offering versatility and reliable blood supply.^{3,4} However, these techniques come with increased risks, including longer operative times and potential complications such as vascular compromise and donor site morbidity.

Recent studies emphasize the significance of aesthetic outcomes in facial reconstruction, indicating that patients prioritize cosmetic results alongside functional restoration.⁵ As such, the choice of flap should consider the defect's physical characteristics along with the patient's personal goals and expectations.

MATERIALS AND METHODS

This study was conducted as a retrospective cohort analysis at the Department of Plastic Surgery, Tertiary care hospital, from March 2021 to March 2024. Patients aged 18 to 75 years who presented with facial defects requiring flap coverage were included in the study. Exclusion criteria included patients with significant comorbidities that contraindicated surgical intervention and those lost to follow-up.

Data were collected on demographics, defect etiology, flap types employed, locations of defects, postoperative complications, and aesthetic/function outcomes.

Postoperative follow-ups were conducted at 1, 3, and 6 months, and the outcomes were assessed using standardized aesthetic scales and functional assessments. Complications were recorded, including hematoma, infection, scar formation, contracture, and the need for revision surgery.

Statistical analysis was performed using SPSS version 20, with descriptive statistics summarizing patient demographics and outcomes. The quantitative

data was analyzed using independent student's T-test. Chi-square tests were used to compare categorical variables, while t-tests were employed for continuous variables, with $p < 0.05$ considered statistically significant.

RESULTS

Our study shows the results of 50 patients from March 2021 to March 2024 using flaps for coverage of facial defects, with ages ranging from 18 to 75 years. Out of 50, 12 were females (24%) and 38 males (76%). The etiology of defects included trauma in 15 patients, malignancy in 10 patients, and infections in 13 patients (Table 1). Regions of the face having defects include cheek defects in 12 patients, nose in 10 patients, eyelid in 8 patients, and forehead in 5 patients (Table 2).

Table 1: Etiology of facial defects.

Cause	Frequency
RTA (Road Traffic Accident)	15
Burns	2
Human Bite	2
Malignancy	10
Assault	2
Animal Attack	4
Infection	13
Others	2

Table 2: Regions of the face having defects.

Region	Frequency
Forehead	5
Eyelid	8
Nose	10
Cheek	12
Orbit	4
Multiple Areas	5
Lip	1
Mandible	2
Maxilla	2
Palate	1

Table 3: Flap distribution.

Type of Flap	Frequency
Forehead Flap	8
Cheek Advancement Flap	4
Nasolabial Flap	5
Temporalis Flap	5
TPF Flap	3
Limberg Flap	8
Buccal Mucosal Flap	1
Estlander Flap	1
Tenzel Flap	1
PMMC Flap	1
Free Flaps	13

Table 3 presents the Flap distribution as forehead flaps in 8 patients, limberg flaps in 8 patients, nasolabial flaps in 5 patients, and microvascular free flaps in 13 patients.

Post-operative complications appeared in 13 patients (Table 4) with scar formation in 4 patients, infection in 2 patients, and flap necrosis in 2 patients. At the 6-month follow-up, functional and aesthetic

outcomes were excellent in 28 patients (56%), good in 20 patients (40%), and fair in 2 patients (4%).

Table 4: Postoperative complications.

Complication	Frequency
Hematoma	1
Scar Formation	4
Reexploration	1
Suture Line Dehiscence	1
Graft Loss	2
Infection	2
Necrosis	2
None	37

The study noted a significant correlation between flap complexity and complication rate (Figure 1), with free flaps carrying the highest risk due to their application in larger, more complex defects. The correlation between the type of flap and complications is presented in Figure 1.

- **Forehead Flap:** Most frequently used flap with a relatively low complication rate.

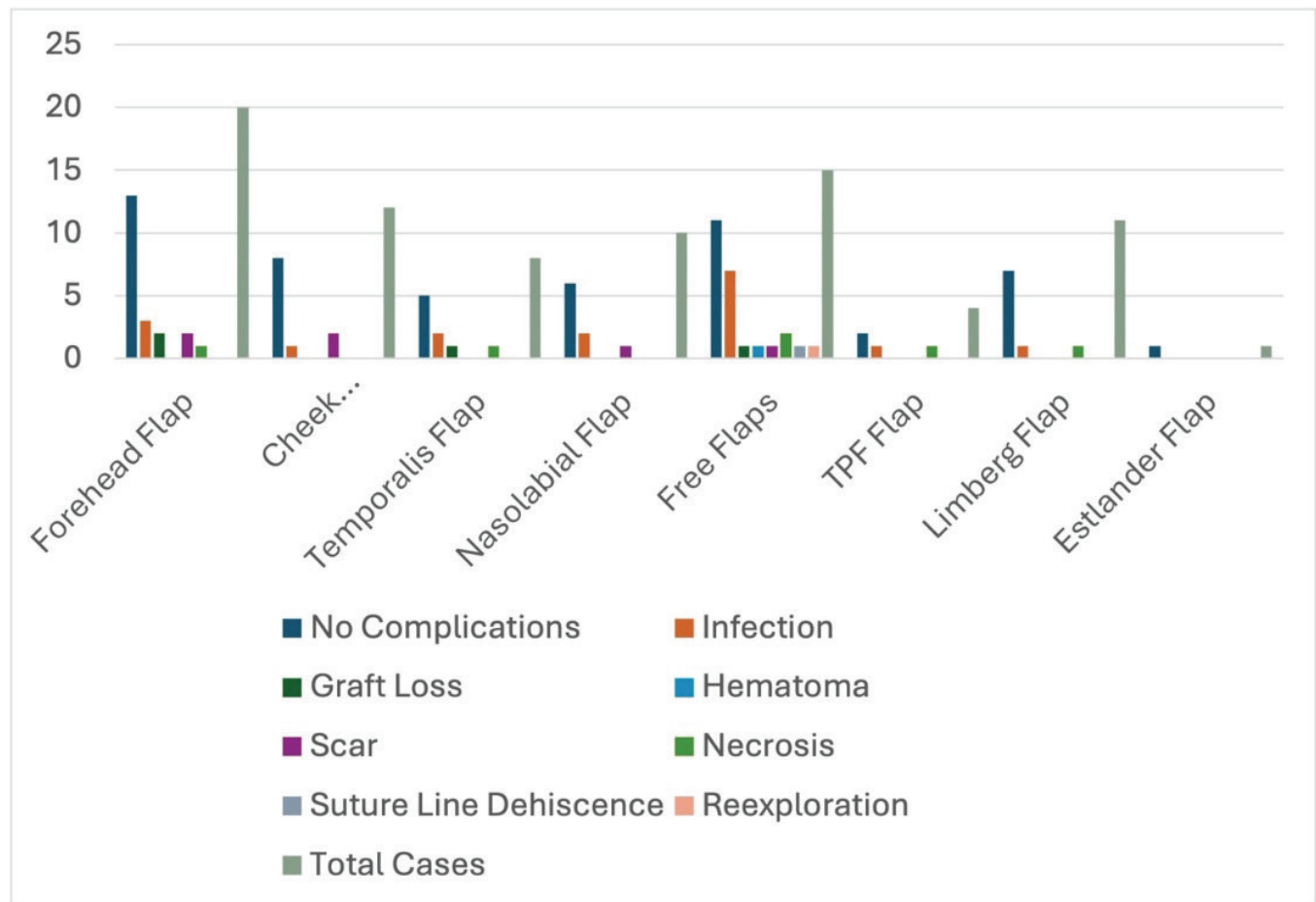


Figure 1: Correlation between the type of flap and complications.

Notable complications include infection and graft loss, but no occurrences of hematoma.

- **Cheek Advancement Flap:** Minimal complications, with a single case each of infection and scar, demonstrating generally favourable outcomes.
- **Temporalis Flap:** Moderate complication rates, with infections and graft loss being notable issues.
- **Nasolabial Flap:** Similar to the forehead flap, with minor complications including infection and scar formation.
- **Free Flaps:** Shows the highest total number of complications, particularly infections, reflecting their use in more complex cases.
- **TPF Flap:** Lower total cases with minor complications, indicating a generally good outcome.

- **Limberg Flap:** Limited complications, with infection and necrosis being the primary concerns.

- **Estlander and PMMC Flaps:** Used in a very few cases, each with minimal complications.

Contour and color matching were favourable in most cases, particularly with local flaps like the forehead and nasolabial. These flaps also yielded high patient satisfaction due to their effective aesthetic integration.

The study results highlight the benefit of matching flap choice to defect complexity and patient-specific needs. All the flaps have been shown in Figure 2-9.

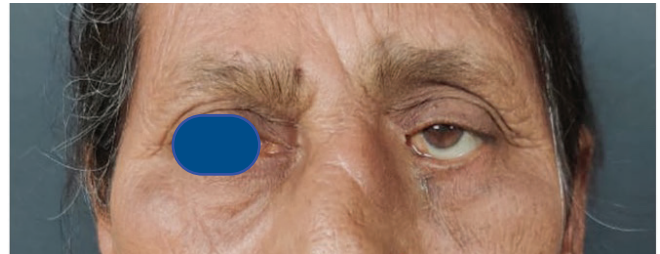


Figure 2: Forehead Flap cover for a case of Basal Cell Carcinoma Nose.



Figure 3: Forehead flap cover for a case of Bear attack over face.

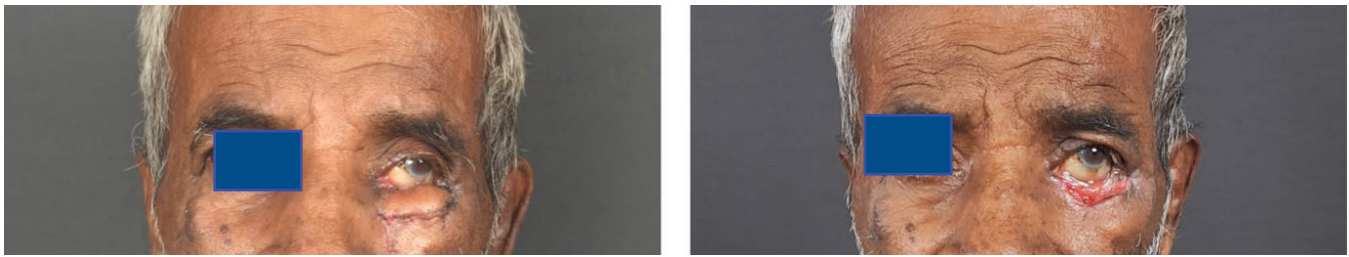


Figure 4: Nasolabial flap cover for a left lower eyelid defect.



Figure 5: Nasolabial Flap for a case of Road traffic accident with loss of tissue over dorsum of nose.

DISCUSSION

Reconstructive surgery aims to restore not only the function but also the aesthetic appearance of facial structures. The principle of using local flaps, where possible, aligns with the maxim of replacing like with like in reconstructive surgery. Local flaps provide several benefits, including improved color and texture match, enhanced vascularization, and minimized risk of contracture compared to skin grafts.

While microvascular free flaps are invaluable for larger defects, they are associated with higher complexity and potential for complications. Our study corroborates existing literature, demonstrating that local flaps can yield excellent aesthetic outcomes with a lower complication rate.

Complications such as hematoma and infection remain significant concerns in flap surgery. Proactive management and careful patient selection are critical in minimizing these risks. Our results suggest that local flaps should be prioritized when feasible, particularly for smaller to moderate-sized defects.

The discussion surrounding aesthetic outcomes in facial reconstructive surgery is essential. Patients often have high expectations regarding the cosmetic results of their surgeries, and achieving a natural appearance can significantly enhance patient satisfaction.⁴ In our study, we noted that local flaps provided functional coverage along with allowed for better contouring, contributing to more aesthetically pleasing results.

Comparing our findings to previous studies, we found a consistent trend regarding the success



Figure 6: Limberg flap cover for a case of Road traffic accident with cheek defect.



Figure 7: Limberg flap cover for a case of Assault with cheek defect.



Figure 8: Radial Forearm Microvascular Free flap cover for a case of Basal cell carcinoma cheek and nose.



Figure 9: Anterolateral Thigh Microvascular Free flap for a case of electrical Burns injury involving Face.

Table 5: Comparison of our study findings to previous studies.

Aspect	Study Findings	Comparative References
Choice of Flap	Preference for forehead and free flaps due to superior color/texture match and reduced bulkiness.	- Forehead flap effective for large defects, good color/texture match. ⁶ - Free flaps offer excellent color match and texture for complex reconstructions. ⁷ - Local and regional flaps provide effective, tailored coverage. ⁸
Complications	Low frequency of complications such as infection and graft loss.	- Low complication rates with established flaps like forehead and free flaps. ⁹ - Free flaps have higher complications than local flaps but still high success rate. ¹⁰ - Local flaps have lower complication rates compared to distant flaps. ¹¹
Functional and Aesthetic Outcomes	Excellent functional and aesthetic outcomes in most patients.	- Excellent outcomes with forehead and free flaps. ¹² - High satisfaction with nasolabial and free flaps. ¹³ - Flaps offer better outcomes than skin grafts. ¹⁴
Colour Match and Contour	Acceptable color match and good contour results in the majority of cases.	- Forehead and free flaps excel in color match and contour. ¹⁵ - Local and regional flaps generally provide superior color match. ¹⁶ - Nasolabial and forehead flaps offer excellent contour and color match. ¹⁷

of local flaps in facial reconstruction. Baker *et al.* (2019)¹ reported similar outcomes with nasolabial flaps in terms of both aesthetic results and patient satisfaction. This reinforces the notion that careful flap selection can lead to optimal outcomes.

In addition to technical considerations, it is crucial to address the psychosocial aspects of facial reconstructive surgery. Patients with facial defects often experience psychological distress, and successful reconstruction can significantly impact their quality of life. Aesthetic outcomes are not just about physical appearance; they also play a vital role in restoring self-esteem and social interaction.⁵

Further comparison of our and previous studies with respect to Choice of flap, Complications, functional and aesthetic outcomes, colour match, and contour match is done (Table 5).

CONCLUSION

The choice of flap for facial defect coverage must be individualized considering patient characteristics, defect specifics, and surgical goals. This study highlights that various local flap techniques can effectively cover facial defects with minimal postoperative complications and satisfactory functional and aesthetic outcomes.

Future research should focus on long-term outcomes, patient-reported satisfaction, and the development of standardized assessment tools to measure aesthetic results in facial reconstruction.

Additionally, as surgical techniques and technologies evolve, further studies could explore the integration of advanced imaging and planning technologies to enhance surgical precision and outcomes.

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