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ASSESSING FUNCTIONAL OUTCOMES IN POST ONCOLOGICAL RECONSTRUCTION OF THE MANDIBLE WITH A FREE FIBULA FLAP

Original Research

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ABSTRACT

Background: Mandibular defects following oncologic resections present significant challenges in restoring both form and function. The free fibula flap (FFF) has emerged as the gold standard for oromandibular reconstruction due to its versatility, reliability, and ability to support vascularized bone and soft tissue transfer. Early functional outcomes provide critical insight into recovery trajectories, yet are often underreported, particularly within the initial six weeks post-surgery. This study aims to address that gap through early outcome assessment.

Objective: To evaluate early postoperative functional outcomes in patients undergoing oncological mandibular reconstruction using a free fibula flap.

Methods: This longitudinal, prospective study was conducted at the Department of Plastic Surgery, Shifa International Hospital, Islamabad, over a minimum period of three months. A total of 30 patients aged 18–80 years undergoing mandibular reconstruction with FFF were enrolled using non-probability consecutive sampling. Functional outcomes were assessed six weeks postoperatively using the Rogers 11-item clinical scoring system (range: 0–29), with scores categorized as unsatisfactory (0–11), satisfactory (12–17), good (18–23), and excellent (24–29). Data were analyzed using SPSS v26.0, with p-values <0.05 considered statistically significant.

Results: The mean patient age was 54.3 ± 11.2 years, and the male-to-female ratio was 2:1. The average defect size reconstructed was 7.8 ± 1.3 cm, and the mean Rogers score was 21.6 ± 4.1. A total of 46.6% of patients had good outcomes, 26.6% excellent, 20% satisfactory, and 6.7% unsatisfactory. Modified diet was required in 66.66% of patients, and 86.6% exhibited no drooling. Significant associations were found between functional scores and tumor type and defect size ($p = 0.01$).

Conclusion: Free fibula flap reconstruction offers favorable early functional outcomes in patients undergoing mandibular reconstruction post-oncologic resection. These findings affirm the FFF as a reliable technique for restoring mandibular function and patient quality of life.

Keywords: Fibula Free Flap, Mandibular Reconstruction, Oncologic Surgery, Oral Function, Postoperative Recovery, Quality of Life, Surgical Outcomes.

INTRODUCTION

Oral cancer remains a major global health concern, ranking among the most prevalent malignancies in the head and neck region, with nearly half a million new cases diagnosed each year worldwide (1). A substantial proportion of these patients present with advanced-stage disease, necessitating extensive surgical resection and complex reconstructive procedures to restore both form and function. In Pakistan, oral cancer is the second most common malignancy overall and the leading cancer among males, accounting for 10.58% and 15.89% of the national cancer burden, respectively (2,3). The mandible, being the largest and most structurally significant bone of the lower face, plays a crucial role in mastication, speech, and facial symmetry (4). Tumor resection in this region often results in combined hard and soft tissue defects that pose formidable reconstructive challenges (5). Advancements in microsurgical techniques have led to the widespread adoption of the free fibula flap (FFF) as the gold standard for mandibular reconstruction. Originally introduced by Taylor and colleagues in 1975 and later popularized by Hidalgo in oromandibular applications, the FFF offers the advantage of simultaneous harvest of vascularized bone and soft tissue, enabling complex three-dimensional reconstruction with high aesthetic and functional outcomes (6,7). Its reliable vascularity, ability to support osseointegrated implants, and relatively low donor site morbidity have cemented its place in the reconstructive surgeon's toolkit. In a recent study, patients undergoing FFF mandibular reconstruction reported a substantial improvement in quality of life, with a mean score of 71.4 ± 22.4 (8,9), underscoring its efficacy in long-term rehabilitation.

Despite its established role, existing literature primarily focuses on long-term functional outcomes assessed six months or later postoperatively, often overlooking the critical early phases of recovery. Early evaluation at six weeks may offer valuable insights into patient adaptation, rehabilitation needs, and predictive factors for long-term success. Yet, there is a notable lack of studies assessing functional domains such as speech, mastication, and swallowing during this transitional period. Moreover, correlating early outcomes with one-year postoperative function could yield important data to guide clinical decision-making, patient counselling, and rehabilitation planning. Given this gap, the present study aims to evaluate the functional outcomes of post-oncological mandibular reconstruction using a free fibula flap, with a particular focus on early (6-week) and late (12-month) postoperative recovery. By examining key functions such as chewing, speech, and aesthetics, this study seeks to provide a more comprehensive understanding of the effectiveness of FFF reconstruction in restoring mandibular function and improving patient quality of life.

METHODS

This longitudinal study was conducted in the Department of Plastic Surgery at Shifa International Hospital, Islamabad. Ethical clearance was obtained from the Institutional Review Board of Shifa International Hospital under approval number (607-24). The minimum follow-up period for all participants was 6 weeks. A total of 30 participants were enrolled using a non-probability consecutive sampling technique. The sample size was calculated based on a 95% confidence level, a population mean of 7.14, a standard deviation of 2.24, and an absolute precision of 1. Informed written consent was obtained from all participants prior to inclusion in the study, ensuring ethical adherence and voluntary participation. Eligibility criteria included patients aged between 18 and 80 years who required reconstruction of mandibular defects measuring 6 cm or more. Patients with systemic illnesses that posed a risk to general anesthesia, those with suspected deep vein thrombosis, or defects requiring double free flaps for both soft tissue and bony reconstruction were excluded (10). Additionally, individuals undergoing marginal mandibulectomy, segmental mandibulectomy, reconstructions other than with a free fibula flap, those not undergoing reconstruction at all, or patients with multiple comorbidities were also excluded. These criteria were designed to ensure the homogeneity of the study cohort and the reliability of outcome measures.

Data collection was carried out by trained medical staff using standardized protocols. Relevant clinical data, including surgical history and radiological records, were retrieved from patient medical files. All patients underwent routine preoperative investigations including complete blood count, urine analysis, and assessments of hepatic and renal function to ensure surgical fitness. Functional outcomes were evaluated postoperatively at six weeks using a combination of patient interviews and physical examinations. Participants who were unable to attend follow-up in person due to geographical constraints were assessed remotely through video conferencing under the supervision of the principal investigator. The 11-item clinical assessment tool developed by Rogers was employed for functional evaluation, covering parameters such as mouth opening, jaw deviation, speech, swallowing, oral competence, and sensory deficits. Each

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parameter was scored, with cumulative scores ranging from 0 to 29. These were categorized as unsatisfactory (0–11), satisfactory (12–17), good (18–23), and excellent (24–29), providing a standardized framework for evaluating postoperative recovery and function (11,12). Data were analyzed using SPSS version 26.0. Descriptive statistics were employed for continuous variables such as age, body mass index (BMI), duration of hospital stay, and Rogers scores, presented as means and standard deviations. Categorical variables including gender, education level, residence, and comorbidities were reported as frequencies and percentages. Stratification was carried out to control for effect modifiers such as age, gender, BMI, comorbidities, and hospital stay duration. Post-stratification, independent t-tests were applied to assess statistical significance, with a p-value of <0.05 considered statistically significant.

RESULTS

A total of 30 patients were enrolled in the study, all of whom underwent oncological mandibular resection followed by immediate reconstruction using a free fibula flap. The mean age of the cohort was 54.3 ± 11.2 years, with a male predominance (66.7% male vs. 33.3% female), and the mean body mass index (BMI) recorded was 24.8 ± 2.7 kg/m². The average hospital stay was 5.2 ± 1.6 days. The mean size of the mandibular defect reconstructed was 7.8 ± 1.3 cm. Among the tumors resected, 73.2% were malignant and 26.7% were benign. Bone involvement was present in all patients, with mucosa plus bone involvement observed in 56.6%, isolated bone involvement in 33.3%, and combined skin and bone involvement in 10%. Functional outcomes were evaluated at six weeks postoperatively using the Rogers 11-item clinical scoring system. The mean overall Rogers score was 21.6 ± 4.1, indicating a generally favorable early postoperative functional recovery. Based on total scores, 46.6% (n = 14) of patients were categorized as having a "Good" functional outcome (score range 18–23), while 26.6% (n = 8) achieved an "Excellent" outcome (score range 24–29). Satisfactory outcomes (score 12–17) were observed in 20% (n = 6), and only 6.7% (n = 2) had "Unsatisfactory" scores (below 12).

A-D: Sequential views of mandible reconstruction using an osteocutaneous fibula free flap. (**A:** Pre-operative frontal view. **B:** Squamous cell carcinoma involving the mandible**. C:** Intraoperative bone fixation with miniplates. **D:** Immediate post-operative result after flap inset.)

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A-C: Six-week postoperative follow-up after mandible reconstruction with an osteocutaneous fibula free flap. (**A:** Frontal view demonstrates excellent facial symmetry. **B:** Good mouth opening with a well-healed intraoral flap. **C:** OPG showing robust fibula bone stock and early callus formation.)

Detailed functional analysis revealed that 66.6% of patients were rated as having a good facial appearance, and 93.3% had normal lip competence. Tongue mobility was fully preserved in 86.6% of cases, and normal oral mucosa was observed in 83.3%. However, 73.2 % of patients had dysfunctional dental states due to the absence of occlusal rehabilitation at this early stage. Full mouth opening was achieved by 66.6%, and 40% had clear speech, while 53.3% had moderately clear articulation. Drooling was absent in 86.6% of patients, and 66.6% were able to maintain a modified diet, though none had returned to a normal diet at this point. Oral sensation was partially preserved in 83.3%, with only 6.6% regaining full sensation. All patients (100%) demonstrated normal shoulder movement, indicating successful preservation of the donor site functionality. Stratified analysis showed that age, BMI, and presence of comorbidities did not significantly influence the postoperative functional outcomes ($p > 0.05$). However, a statistically significant association was found between the size of the defect and the type of tumor with the Rogers scores ($p = 0.01$), suggesting that larger defects and malignant tumors may adversely affect early functional recovery.

Table 1: Patient Demographics and Clinical Data (N = 30)

Variable	Frequency (%)/ Mean + SD
Mean Age (years)	54.3 ± 11.2
Gender	
Male	20 (66.7%)
Female	10 (33.3%)
Mean BMI (kg/m²)	24.8 ± 2.7
Mean Hospital Stay (days)	5.2 ± 1.6
Defect Size (cm)	7.8 ± 1.3
Types of Tumors	
Benign (Locally Aggressive)	8 (26.66%)
Malignant	22 (73.33%)
Bone Involvement	10 (33.33%)
Mucosa + Bone Involvement	17 (56.6%)
Skin Bone Involvement	3 (10%)

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Table 2: Functional Outcomes according to Rogers 11-Item Form (n=30)

Variable	Frequency (%)
Appearance	
0 - Poor,	0(0%)
1 - Fair,	10 (33.3%)
2 - Good,	20 (66.6%)
3 - Excellent)	0 (0%)
Lip Competence	
0 - Incomplete closure,	1 (3.33%)
1 - Slight difficulty	1(3.33%)
2 - Normal closure	28 (93.33%)
Tongue Movement	
0 - Limited movement	3 (10%)
1 - Moderate movement	1(3.33%)
2 - Full range	26(86.6%)
Oral Mucosa	
0 – Abnormal	0 (0%)
1 - Mild abnormalities	5 (16.66%)
2 - Normal	25 (83.33%)
Dental State	
0 – Dysfunctional	23 (73.33%)
1 - Slight dysfunction	7 (23.33%)
2 - Functional)	0 (0%)
Mouth Opening	
0 - Severe limitation	1(3.33%)
1 - Moderate limitation	9 (30%)
2 - Full range	20 (66.66%)
Speech	
0- Unintelligible,	2 (6.66%)
1-Moderately clear	16 (53.33%)
2-Clear	12(40%)
Drooling	
0 - Severe drooling	0 (0%)
1 - Mild drooling	4(13.33%)
2 - No drooling	26 (86.66%)
Diet	
0 - Cannot eat regular food	10 (33.33%)
1 - Modified diet	20 (66.66%)
2 - Normal diet	0 (0%)
Oral Sensation	
0 - No sensation	3 (10%)
1 - Partial sensation	25 (83.33%)
2 - Full sensation	2 (6.66%)
Shoulder Movement	
0 - Severe restriction	0 (0%)
1 - Moderate restriction	0 (0%)
2 - Normal movement	30 (100%)

Table 3: Functional Outcomes Based on Rogers 11-Item Score (6 Weeks Post-Surgery)

Outcome Category	Score Range	Number of Patients (n = 30)	Percentage (%)
Unsatisfactory	0–11	2	6.7%
Satisfactory	12–17	6	20%
Good	18–23	14	46.6%
Excellent	24–29	8	26.6%
Mean Rogers Score	0-29	21.6 ± 4.1	N/A

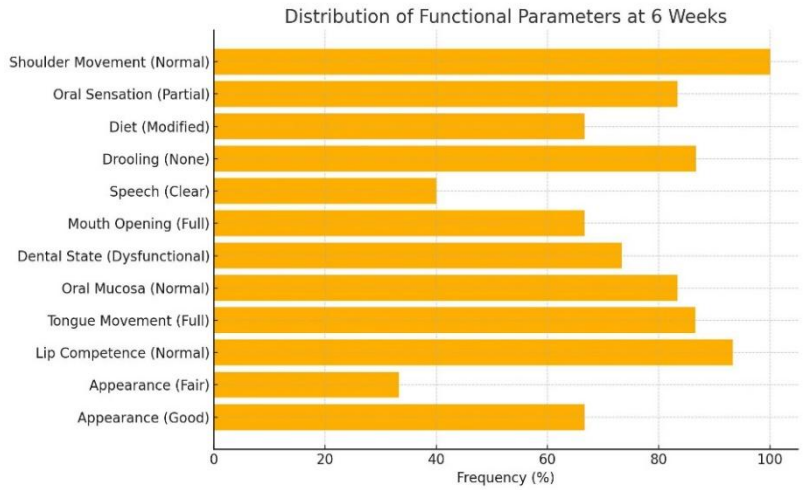

Figure 1 Distribution of Functional Parameters at 6 Weeks

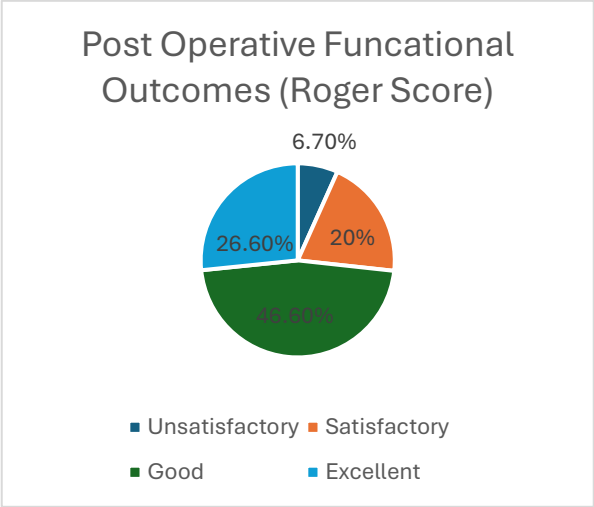

Figure 2 Post Operative Functional Outcomes (Roger Score)

DISCUSSION

In the present study, the use of free fibula flap (FFF) for immediate mandibular reconstruction following oncological resection demonstrated encouraging early postoperative functional outcomes. A total of 73.2% of patients achieved good to excellent outcomes at six weeks post-surgery, as evaluated by the Rogers 11-item clinical scoring system. This finding is consistent with previously reported results in the literature, where similar rates of functional restoration were observed in clinical settings utilizing FFF as the reconstructive modality. One study reported approximately 100% restoration of overall functionality, though a slightly lower outcome compared to the present study. The discrepancy was attributed to factors such as trismus, xerostomia, tissue atrophy, and loss of dentition that affected both appearance and function in the long term (13). Other comparative studies have reported higher primary success rates, with some noting up to 94% success in reconstruction outcomes; however, the differences in findings may be related to variations in study design, duration of follow-up, and the underlying etiology of mandibular resection (14-16). For instance, studies with a minimum follow-up of six months or more tend to reflect better integration of function due to extended rehabilitation, including dental restoration and adaptation to prostheses, which was not accounted for in the present cohort due to the shorter follow-up period.

Functional analysis of dietary outcomes in this study revealed that 66.66% of patients required a modified diet, and 33.33% were unable to return to a regular diet at six weeks. These outcomes align with findings from more recent investigations where, despite the use of advanced reconstructive technologies such as CAD-CAM-assisted titanium implants, domains like mastication and chewing consistently scored lowest on quality-of-life indices postoperatively (17,18). This consistency across studies reinforces the inherent difficulty in achieving early restoration of masticatory function, regardless of technological sophistication. Overall patient satisfaction in the present study correlated well with other reports highlighting high functional and aesthetic acceptance of the FFF, especially in centers with established microsurgical capabilities (19,20). The versatility of the fibula flap, with its capacity to provide both vascularized bone and soft tissue, continues to support its role as the gold standard in oromandibular reconstruction. However, slight deviations in reported

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outcomes across studies may also result from methodological differences, including retrospective versus prospective designs and variable scoring systems (21,22).

Despite the positive trend observed, several limitations were evident in the current study. The sample size was relatively small, limiting the statistical power and generalizability of the findings. The six-week follow-up interval, although meaningful in capturing early recovery, may not adequately reflect long-term rehabilitation, particularly in areas such as dental function, speech articulation, and psychosocial adjustment. The absence of CAD-CAM-guided reconstruction may have influenced flap inset precision and bony contour alignment, factors known to affect postoperative occlusion and symmetry. Furthermore, a substantial proportion of patients presented with advanced-stage malignancies, which likely increased surgical complexity and postoperative morbidity, potentially dampening the overall functional outcomes. Nevertheless, the study holds strength in being a prospective clinical evaluation with standardized assessment criteria and a defined follow-up period. It offers valuable insight into the early phase of functional recovery following mandibular reconstruction, a topic that remains underexplored in existing literature. Future research should consider longitudinal studies with extended follow-up to capture progressive changes and long-term adaptation. Comparative trials involving alternative reconstructive techniques, such as scapular or iliac crest flaps, may further refine surgical choices. The incorporation of CAD-CAM technology should be encouraged to enhance surgical accuracy and reproducibility. Moreover, coordinated efforts toward early dental rehabilitation through implant placement could significantly improve mastication and overall quality of life. Multi-center collaborations would further strengthen data validity, support broader applicability, and address regional disparities in reconstructive oncology outcomes.

CONCLUSION

This study concludes that the free fibula flap remains a dependable and effective approach for oncological mandibular reconstruction, offering substantial restoration of oral function in the early postoperative period. By enabling meaningful recovery in speech, mastication, and aesthetics, the technique reinforces its role as a cornerstone in complex head and neck reconstruction. These findings underscore its practical value in improving patient quality of life and support its continued use in clinical settings aiming for both functional and aesthetic rehabilitation following oncologic mandibular resection.

AUTHOR CONTRIBUTION

Author	Contribution
Shahrukh Mohmand*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Mamoon Rashid	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Saad Ur Rehman Sarwar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Muhammad Ibrahim Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Rafia Masud	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Fatima Askari	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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