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Research Article

# Reconstruction of Mandibular Defect Brown Type IId with FAN-FLAP: Surgical Approach and Clinical Considerations

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## Abstract

**Introduction:** This case describes a 62-year-old female patient with a 10-year history of habitual Catha edulis use, presenting with a verrucous lesion on the inner buccal mucosa, suspected to be a malignant neoplasm.

**Objective:** To document the diagnostic and therapeutic approach to a well-differentiated squamous cell carcinoma with extensive involvement of oral and mandibular structures, emphasizing surgical planning and reconstruction using a FAN-FLAP.

**Materials and Methods**

- Clinical Evaluation: A 3.5 x 5 cm lesion on the inner buccal mucosa, infiltrating the buccinator muscle, extending to the skin, and involving the hemimandible in the premolar region.
- Diagnostic Imaging: Computed tomography with 3D reconstruction to determine the bone extension of the lesion.
- Incisional Biopsy: Confirmation of well-differentiated squamous cell carcinoma.
- Preoperative Assessment: Hematological studies and liver and kidney function tests.
- Surgical Planning: Resection of the affected mandibular segment with safe oncological margins and immediate reconstruction using a FAN-FLAP, secured with titanium plates and vascular microanastomosis.

**Results:** The procedure was performed without immediate complications. The patient experienced a favorable postoperative recovery, with proper flap integration and functional and aesthetic restoration of the affected area.

**Conclusion:** Mandibular reconstruction using a FAN-FLAP is an effective option for complex defects resulting from the resection of advanced squamous cell carcinomas, allowing for satisfactory functional and aesthetic rehabilitation.

**Keywords:** Reconstruction; Mandibular; Brown; FAN-FLAP; Surgical; Clinical

## Introduction

Mandibular defects represent a significant challenge in reconstructive surgery due to the functional and aesthetic importance of the mandible in speech, chewing, and facial support. These alterations can result from oncological processes, trauma, or advanced infectious diseases. In the context of oral squamous cell carcinoma, the mandible is often affected by tumor extension, requiring its resection to achieve adequate oncological control.

Reconstruction of these defects is complex due to the simultaneous need to restore bone continuity, masticatory function, and soft tissue coverage [1-3].

Type IId defects, according to the Brown classification, are particularly challenging as they involve the loss of a lateral mandibular segment with both internal and external soft tissue involvement, which may compromise swallowing, speech, and facial aesthetics.

The frequency of these defects varies depending on the casuistry of each institution but is commonly seen in patients with advanced squamous cell carcinomas requiring extensive resections to ensure adequate oncological margins [1-3].

There are various reconstructive options for mandibular defects, including microvascular flaps such as the osteocutaneous fibula, scapular, and radial flaps. However, microvascular surgery may be unfeasible in many institutions due to economic and infrastructure limitations. In this context, the FAN-FLAP emerges as a viable alternative for reconstructing type IId mandibular defects, providing both soft tissue coverage and structural support without the need for microvascular anastomosis, reducing surgical time and associated morbidity [4,5].

### Objectives

### General objective

The aim of this study is to present a clinical case of mandibular reconstruction using the FAN-FLAP, analyzing its applicability and results as an alternative strategy in centers without access to advanced microvascular surgery.

### Specific objectives

- To describe the surgical technique of mandibular reconstruction with a modified FAN-FLAP for Brown type IId defects.
- To evaluate the feasibility and functional and aesthetic results of this reconstructive alternative in patients without access to microvascular surgery.

## Methodology

### Study design

This study is based on the presentation and analysis of a clinical case treated in a healthcare facility with limited resources, aiming to demonstrate the viability of the FAN-FLAP as a reconstructive alternative for Brown type IId mandibular defects, particularly in institutions where microvascular surgery is not a viable option.

The mandibular defect addressed in this case involved the loss of a lateral mandibular segment with internal and external soft tissue involvement, presenting a significant reconstructive challenge. The surgical technique used was described in detail, including the design and mobilization of the FAN-FLAP, as well as the fixation strategy employed.

Given that the literature reports a 67 % rate of postoperative dehiscence in cases using reconstruction plates without bone grafts, it was decided not to perform rigid fixation with plates but to opt for temporary intermaxillary fixation, allowing for flap consolidation and leaving open the possibility of a second procedure for bone graft placement based on the patient's evolution. This strategy was adopted to reduce the risk of exposure, infection, and failure of the osteosynthesis materials in the absence of adequate bone support.

Possible surgical alternatives available in resource-limited centers were evaluated and the feasibility of the FAN-FLAP was compared to other reconstructive options in terms of postoperative functionality, complication rates, and future rehabilitation potential. Based on these criteria, the applicability of this technique was analyzed, and its use was recommended as a valid option in a determined percentage of cases.

### Case Description

This is the case of a 62-year-old female patient, with a history of relatively good health until approximately 10 years before the consultation when she began the habitual use of khat (Catha edulis), a chewable plant with psychoactive effects commonly used in some African countries.

The patient sought consultation due to the presence of a lesion on the inner side of the buccal mucosa, appearing verrucous, with an approximate size of 3.5 cm wide by 5 cm long. Located on the inner side of the right hemilabium, the floor of the vestibular sulcus, and the vestibular surface of the alveolar portion of the right hemimandible.

Clinical examination revealed infiltration of the buccinator muscle and, on that side, the skin, as well as infiltration of the inferior edge of the lesion and the right hemimandible in the premolar region.

Given the suspicion of a malignant neoplasm, the patient was admitted for incisional biopsy and preoperative studies to plan a possible surgical treatment.

### Preoperative Studies

### Computed tomography (CT) with 3D reconstruction

A head and neck CT scan with 3D reconstruction was performed to assess the involvement of the right hemimandible. The images revealed an osteolytic lesion with irregular margins, indicative of bone destruction, with possible extension into the adjacent soft tissues. Axial and coronal cuts helped determine the lesion's relationship with the mandibular canal and cortical bone integrity.

### Magnetic resonance imaging (MRI) with contrast (Optional depending on availability and suspicion of extension)

An MRI with gadolinium was considered for evaluating soft tissue tumor extension and possible perineural involvement. Contrast

enhancement allowed for distinguishing necrotic areas and delineating muscle and skin invasion.

### Histopathological study

An incisional biopsy of the lesion was performed, obtaining a tissue sample fixed in 10 % formalin for histopathological analysis using hematoxylin-eosin (H and E) staining.

### Microscopic findings

Histological examination revealed dysplastic squamous epithelium with loss of normal stratification, nuclear pleomorphism, and atypical mitoses. Neoplastic cells were organized into nests and cords infiltrating the underlying connective tissue, with focal keratinization and keratin pearl formation. Tumor differentiation was classified as moderate, characterized by areas with partial keratinization and intermediate cellular disorganization. Desmoplastic stroma with lymphoplasmacytic inflammatory infiltrate and prominent angiogenesis was observed.

Perineural invasion was noted in some areas, suggesting potentially aggressive behavior. No lymphovascular invasion was detected in the analyzed sections.

### Diagnosis

Histopathological findings were consistent with a moderately differentiated squamous cell carcinoma, confirming the malignant nature of the lesion and indicating the need for oncological surgical treatment with adequate safety margins.

### Surgical procedure

This case presents specific considerations for the treatment plan:

- The presence of moderately differentiated squamous cell carcinoma.
- Anatomical involvement of the right hemilabium, commissure, buccal mucosa, buccinator muscle, skin, and mandibular bone infiltration.
- Defect classified as Brown type IId (combined or complex bone defect).
- Preoperative evaluation and preservation of the facial artery and vein as the primary vascular supply to the hemilabium, preventing necrosis or flap complications.

### Tumor resection

A monoblock resection was performed with selective neck dissection in levels I, II, and III. The resection included the hemilabium, commissure, cheek, and mandibular bone. The oral incision was designed in a trapezoidal shape, respecting safety margins of 0.5 to 1 cm, resulting in a defect approximately 5 cm long by 3.5 cm wide (Figure 1,2).

**Figure 1**

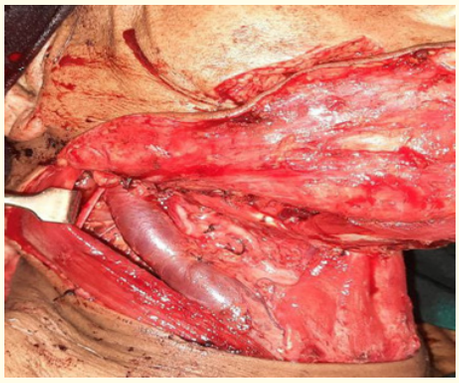

**Figure 2**

### Design and harvesting of the modified FAN-FLAP

After resection, the trapezoidal defect was defined by four edges

- **Medial side:** Near the midline.
- **Distal side:** Near the buccal commissure or cheek.
- **Base (lower edge):** The lowest part of the trapezoid.
- **Upper edge:** Corresponding to the new hemilabium.

To optimize anatomical and functional closure, the base was extended at a 35° angle to the distal side, increasing the contact surface for reconstruction (Figure 3,4).

### Postoperative follow-up

The postoperative course proceeded without complications. In the first 72 hours, the flap showed adequate perfusion, with no signs of ischemia or infection. The scar healed favorably, and the patient tolerated a soft diet well. During the first week, a satisfactory recovery was evident (Figure 5).

**Figure 3**

**Figure 4**

**Figure 5**

## Results

The patient progressed well in the immediate postoperative period. There were no hemorrhagic complications or vascular function alterations in the reconstructed area.

At 7 days, the healing showed good tissue integration, with progressive reduction of edema and no evidence of suture dehiscence. The patient tolerated a soft diet without significant functional difficulties.

At the 4-week follow-up, the reconstruction of the lip and alveolar mucosa showed good adaptation and functionality, with no limitations in lip mobility or speech alterations. The 3-month follow-up revealed flap stability, with no signs of tumor recurrence or aesthetic or functional complications.

Postoperative imaging confirmed the correct integration of the flap and the absence of local recurrence. The patient continues in oncological follow-up and functional rehabilitation with satisfactory results.

## Discussion

This case addresses the reconstruction of a mandibular defect classified as Type IId according to the Brown classification, characterized by the combined involvement of both soft tissues and bone. Traditionally, reconstruction of such defects has been approached with microvascular flaps, which are considered the gold standard due to their ability to restore both bone continuity and affected soft tissues. However, the choice of optimal reconstructive technique depends on multiple factors, including tumor biology, clinical stage, surgeon experience, and available resources at the institution [6-8].

In this context, a modified locoregional flap was chosen, specifically a FAN-FLAP, which allowed for primary closure of the defect without the need for complex microsurgical techniques. This choice was based on a detailed assessment of the defect's characteristics and the preservation of the facial artery and vein, ensuring adequate flap vascularization and minimizing the risk of complications such as necrosis [9,10].

The employed technique consisted of extending the base of the trapezoidal flap, forming a 35-degree angle with the distal side, and making strategic incisions that facilitated the rotation and adaptation of the flap to the defect. This approach allowed for functional and aesthetic reconstruction of the hemilabium, the buccal commissure, and the alveolar mucosa, achieving harmonious integration with the surrounding tissues.

It is important to note that while microvascular flaps offer significant advantages in terms of versatility and the ability to reconstruct large defects, their implementation may be limited by factors such as the availability of specialized resources and the surgical team's experience. In institutions where these resources are limited, techniques like the one employed in this case represent a viable alternative, provided meticulous planning is performed, and adequate vascularization of the flap is ensured [11-13].

In conclusion, the reconstruction of Type IId mandibular defects can be effectively addressed using modified locoregional flaps, tailored to the specific characteristics of the defect and the patient. The choice of reconstructive technique should be individualized, considering factors such as tumor biology, clinical stage, available resources, and the experience of the surgical team, with the goal of achieving optimal functional and aesthetic results.

## Conclusion

Mandibular reconstruction in complex defects, such as those classified as Type IId according to the Brown classification, represents a significant challenge in maxillofacial surgery. Traditionally, the free fibula flap has been considered the gold standard for these procedures due to its versatility and reliability.

However, the choice of the reconstructive method must adapt to the specific characteristics of each patient, considering factors such as tumor biology, clinical stage, surgeon experience, and available resources at the institution.

In this context, alternative techniques like the modified FAN-FLAP have proven to be viable options for certain mandibular defects, allowing for adequate primary closure without the need for vascular microanastomosis. Careful selection of the reconstructive method, based on a comprehensive evaluation of the patient and the defect, is essential to optimize functional and aesthetic outcomes while minimizing associated morbidity.

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