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Research Article

# Free Fibula Flap in Head and Neck Reconstruction: Our Experience of 300 Cases

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## Abstract

**Purpose:** To demonstrate reliability and versatility of free fibula flap in head and neck reconstruction. Materials and Method: A total of 300 patients reconstructed over 4 years for both benign as well as malignant pathologies involving both maxillary and mandibular arches using the free fibula flap were evaluated for form, function, reliability, survival of the flap and early complications that occurred over first 3 weeks post operatively.

**Results:** A total of 300 patients were reconstructed using either osteocutaneous or osteomyocutaneous fibula free flaps. A male predilection of 63% to female predilection of 37% was seen. Mandibular reconstruction was needed in 246 patients and 54 patients needed maxillary reconstruction. The most common pathology being resected was squamous cell carcinomas(56%). Osteocutaneous free flaps were more commonly harvested over osteomyocutaneous flaps with at 2:1 ratio. Post operative complications were noted in 52 patients (17.3%) which included hardware failure in 16 patients, total or partial flap failure in 12 patients, flap dehiscence in 12 patients, recipient site infection in 7 patients, donor site infection in 5 patients. Donor site morbidity was noted in 6% of cases with calf paraesthesia and 13% showed a decrease in plantar flexion.

**Conclusion:** The versatility in reconstructing both intraoral and extraoral defects, the large quantity of bone that can be shaped and adapted to maintain the contour of both maxilla and mandible and the reliable harvesting technique leading to minimal donor site morbidity thus make the free fibula flap an integral part of reconstruction in head and neck defects.

**Keywords:** Free Fibula Flap; Head and Neck Reconstruction; Osteocutaneous Flaps; Osteomyocutaneous Flaps; Squamous Cell Carcinoma

## Introduction

Management of head and neck reconstruction has undergone many significant changes during the past two decades. Most of these changes have occurred because of technological advances, including better imaging, advances in surgical technique, a better understanding of anatomy, and digitalization. The improved understanding of anatomy has had its greatest impact on the development of better and more reliable reconstructive techniques that allow us to perform surgery that, in the past, would have been impossible. [1] hence reconstructive microsurgery has now become an integral part of head and neck reconstruction, allowing the completion of complex resections with predictable outcomes. The Fibula Osteocutaneous Flap for mandibular reconstruction was introduction by Hidalgo [2] in 1989, since then has become

the flap of choice in the reconstruction of both mandibular as well as maxillary defects. The aim for mandibular reconstruction is restoration of both form and function, necessitating the evaluation of appearance, mastication, deglutition, speech, and oral competence. [3] The main aims of maxillary reconstruction following tumour resection are to: close the oroantral communication; restore three-dimensional and skeletal structure support of the mid third that can provide adequate bony support for osteo-integrated implant prosthesis rehabilitation. [4] Maxillary defects were traditionally treated with a bulky dental prostheses or obturator. Although acceptable results can eventually be achieved in many cases, patients may become dissatisfied for several reasons. [5] Hence osteocutaneous/ osteomycutaneous grafts have become the gold standard for maxillary reconstruction as well as mandibular reconstruction.

The advantage of using this flap include a long length of available bone, adequate length and diameter of vascular pedicle which makes anastomosis easier, the ability to restore proper contours with the use of osteotomies and complete dental rehabilitation using osteointegrated implants. [6] In fact functional maxillary reconstruction with vascularized composite bone flap and osseointegrated implants is one of the most important improvements in head and neck reconstructive surgery. [5] Although the flap is versatile and relatively easy to perform, both early and long-term donor site morbidity have been reported with this flap. In addition to this, predisposing factors that may lead to wound complications such as pre existing medical conditions, nutritional status, operative parameters, and method of donor site closure plays a role in the success and failure of the flap. Post operative complications of hardware failures, flap dehiscence with total or partial flap loss and infections have also been seen as complications of this reconstructive technique. Notably, vascular anastomosis is required in a free tissue flap; therefore, it is of great importance to detect vascular crisis in the anastomotic blood vessels at the early stage, and to carry out surgical exploration and treatment immediately for achieving successful operation. The delayed discovery of vascular crisis or the presence of the more serious vascular crisis may result in complete necrosis of the free transplanted tissue flap, thereby inducing severe consequences [7].

## Materials and Method

This was a retrospective study done over a four year period. 300 patients who were reconstructed for both maxillary and mandibular defects by the dept plastic faciomaxillary and reconstructive surgey were included in this study.

### Inclusion Criteria

- Patients with maxilla and mandibular defects being reconstructed using free fibula osteocutaneous / osteomyocutaneous flap.

### Exclusion Criteria

- Maxillofacial defects being reconstructed by soft tissue free flaps
- Maxillofacial defects being reconstructed by local flaps
- Maxillofacial defects that were not suitable for free flap reconstruction

### Methodology

Patients were first clinically and radiographically for assessed for the viability and need for free fibula flap reconstruction. Patients who fit the criteria needed for fibula free flap reconstruction were selected for the study. Patients were reconstructed post resection using either a fibula osteomyocutaneous or osteocutaneous flap and monitored for a period of 3 weeks post operatively. Patients were assessed for any post operative complications involving both recipient site as well as donor site. Donor site morbidity was checked at the time of discharge.

### Recipient site complications assessed were

- Hardware failure
- Total or Partial flap loss
- Flap dehiscence
- Site Infection

### Donor site complications assessed were

- Site infection
- Skin Graft Uptake
- Calf Paraesthesia
- Plantar Flexion
- Ability to bear weight on both lower limbs

## Results

A total of 300 patients were assessed in our study group. Of the total cases 63% of cases were male and 37% of cases were female. The average age group of patients were between 55-64 years pf age with average age being 57 years. Of the 300 patients 68% had malignant pathologies and 32% were benign. The most common pathology was seen to be squamous cell carcinoma (56%) followed by ameloblastoma (21%) (Table 1). 246 of the lesions involved the mandible whereas 54 lesions involved the maxilla. 200 patients were reconstructed using a osteocutaaneous flap and 100 patients were reconstructed using a osteomyocutaneous flap involving the flexor hallicus longus muscle. The patients were monitored in an in patient setting for a period of 3 weeks. All patients were on nasogastric tube feeds for the same time period.

While being monitored 52 patients showed post operative complications of which hardware failure was seen in 16 patients, 8 patients had partial flap loss, 4 patients had complete flap loss, 12 patients had flap dehiscence, 7 cases had recipient site infection and 5 patients have donor site infection (Figures 1-5).

| Variable | Category | n | % |
|---|---|---|---|
| Pathology Resected | Squamous Cell Carcinoma | 168 | 56% |
| | Ameloblastoma | 63 | 21% |
| | Adenoid Cystic Carcinoma | 25 | 8.3% |
| | Odontogenic Keratocyst | 25 | 8.3% |
| | Ewings Scarcoma | 9 | 3% |
| | Others | 10 | 6.3% |
| | Total | 300 | 100.0% |

**Table 1:** Distribution of study patients based on pathology resected.


**Figure 1:** Case of recurrent Ewings Scarcoma **A)** Preoperative profile picture **B)** Preoperative CT scan **C)** Intraoperative picture post reconstruction **D)** Intraoperative picture of flap inset **E)** Postoperative Radiograph **F)** Postoperative profile picture.


**Figure 2:** Case of Ameloblastoma **A)** Preoperative profile picture **B)** Preoperative Radiograph **C)** Intraoperative picture of flap inset **D)** Postoperative Radiograph **E)** Postoperative profile picture.

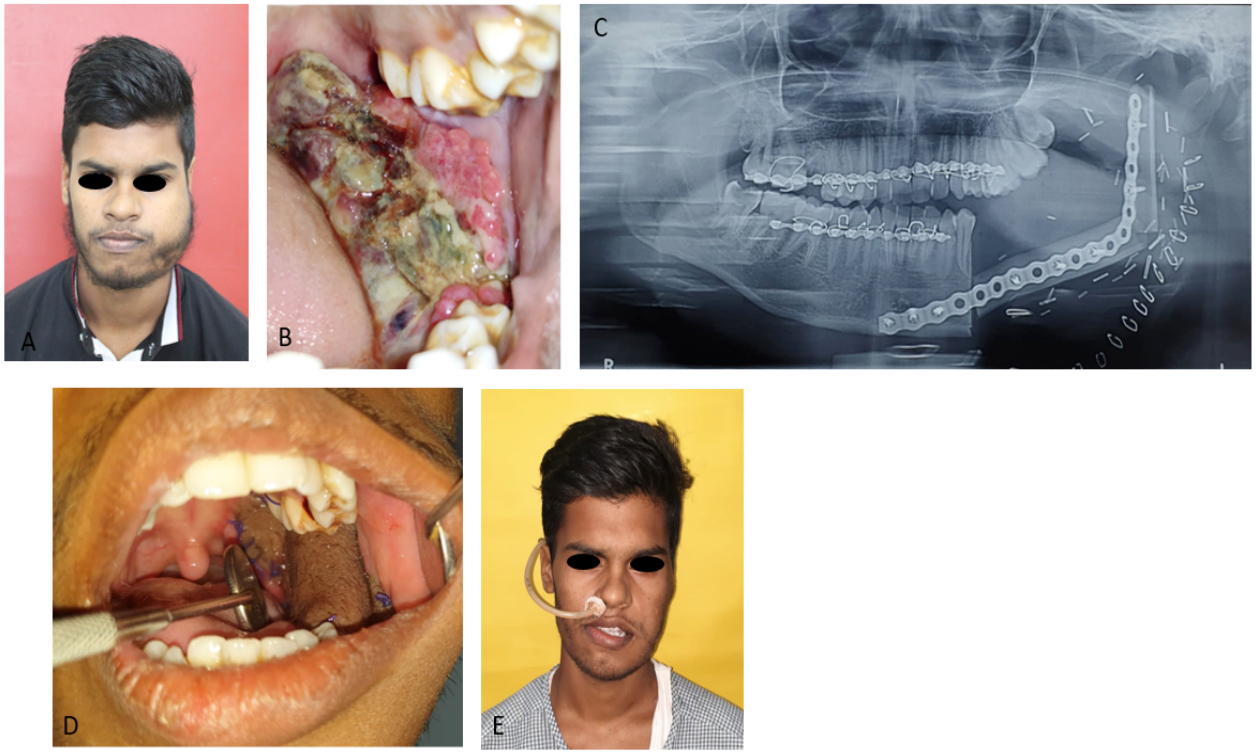


**Figure 3:** Case of Ameloblastic Fibroma **A)** Preoperative profile picture **B)** Preoperative Lesion **C)** Postoperative Radiograph **D)** Postoperative flap Inset **E)** Postoperative profile picture.

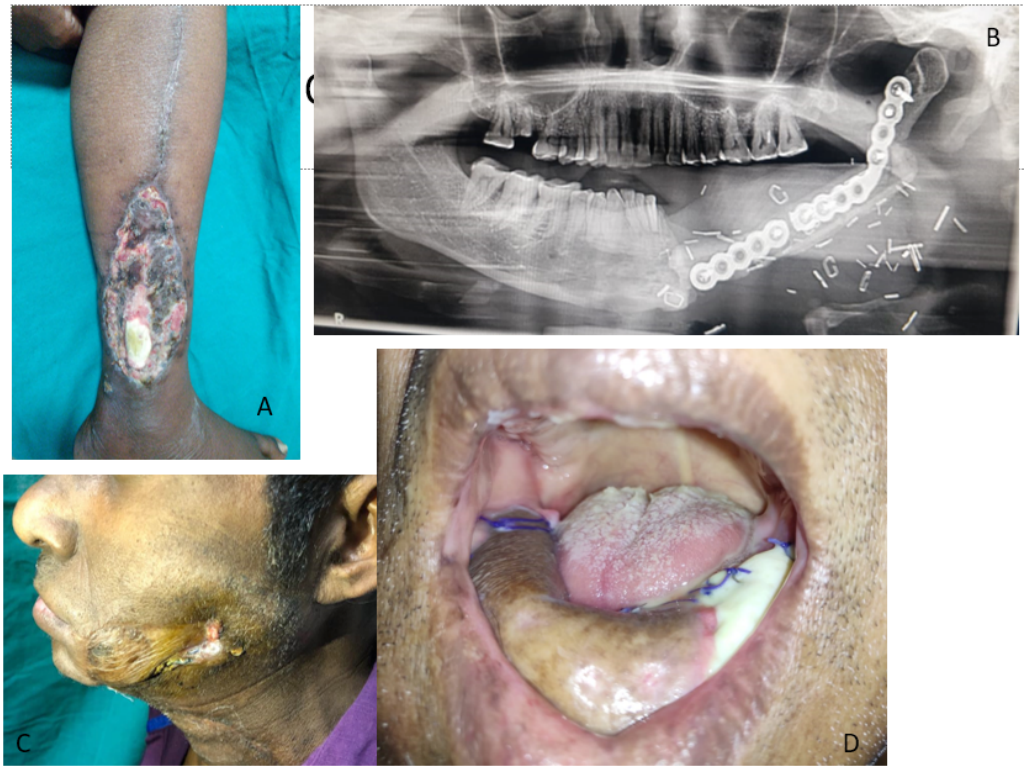


**Figure 4:** Complications seen: **A)** Skin graft failure at donor site **B)** Fracture of reconstruction plate **C)** Wound Dehiscence **D)** Partial Flap Loss.

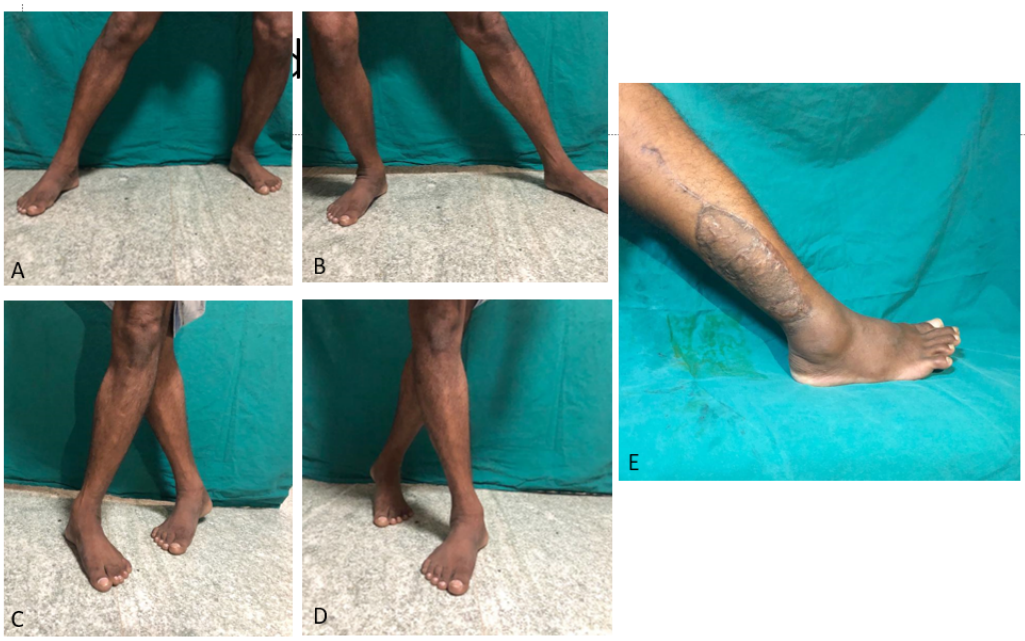


**Figure 5:** Donor site evaluation. **A-D)** Ability for the patient to bear weight on both donor leg and contralateral leg **E)** Healed donor site.

Donor site morbidity was checked post operatively and assessed on their day of discharge. Skin graft loss was seen in a total of 8 patients. A total of 6% of all operated patients had calf paraesthesia and 13% showed a decrease in plantar flexion. Changes in the patients gait was seen to be in 9.3% of our patients with the other 90.7% of patients able to bear their own weight on both donor leg as well as contralateral leg. It was seen of the 28 patients with gait alterations 20 of them were females and 8 were males.

## Discussion

The free fibula flap has been one of the workhorses of oral and maxillofacial reconstruction because of its septocutaneous perforators and its periosteal blood supply, it can be osteotomized and shaped to fit the anatomy of the defect that needs reconstruction. [8] The use of free flap reconstruction in malignancies are common as adequate margins with resection is the accepted treatment protocol where as for many years, the therapeutic options for benign tumours and cysts are broadly being categorized into either as a conservative approach incorporating enucleation, curettage, cryotherapy, marsupialization, etc. or as radical surgery that involves the complete removal of diseased portion of the bone. It has been seen that conservative treatments, even though less morbid, have lesser predictable outcomes and hence resection and reconstruction using a free flap can reduce both recurrence and morbidity. [9] In a study by Ou et al, it was seen that the mini-plate has also been suspected of less strength thus to cause fracture and screw loosening. Moreover, the mini-plate was more sensitive to varied loads than the reconstruction plate, and has less flexibility to absorb external forces. Mini-plates also caused high strain values, indicating hypertrophy risk in bone around the screw holes. [10] This was seen similarly in our study as hardware failure occurred in our patients where the graft bone was supported by mini plates whereas reconstruction with the help of reconstruction plates gave better stability as well form in mandibular reconstructions. In the cases where maxillary reconstruction was done miniplates were seen to bear the load better with a lesser incidence of implant failure.

A partial flap loss of 8 patients was seen with complete flap loss seen in 4 patients. This is similar to literature published by Johannes T.M. van Gemert et al, [11] they was also found the bilateral reconstruction of mandible crossing the midline caused more severe complications but that wasn't found to be so in our study. Our study found 12 patients with recipient site infection and 7 cases with wound dehiscence which required reintervention. Other studies have shown that two third of late reinterventions were due to flap dehiscence and infection. [11] Donor site infection was seen 5 patients and calf paraesthesia was noted in 6% of cases when evaluated 3 weeks post operatively. This was significantly lower when compared to literature published by Jose M et al. [12] A total of 13% of patients had decreased plantar flexion and 9.3% of patients had an altered gait post operatively. In our study 90.7% of our patients had no problem in bearing weight as well as movements on both operated as well as contralateral legs. This was also seen to be similar to other published literature [13].

We see that over our study period the use of digital planning with the use of steriolithograpahic models has enabled us to decreased operating time as well as give more predictable results. It has been seen that the three-dimensional position of the fibula flap in the computer-assisted surgeries was significantly more accurate and as close to the ideal position than that in the conventional surgery group. This proved application of computer-assisted techniques such as virtual planning and surgical navigation significantly improve the clinical outcomes of maxillary reconstruction with free fibula flaps. [14] Although virtual planning has become helpful in head and neck reconstruction, its routine use may be limited by logistic challenges, increased acquisition costs, and limited flexibility for intraoperative modifications. Nevertheless, it is believed that the aesthetic and superior functional results achieved with virtual planning outweigh its limitations. [15] The retrospective nature of this study and inability to have long term follow ups due to a significant attrition rate were the limitations of this study, a prospective study would allow for a more structured protocol in which more variables could be assessed. A long term follow-up of patients can help assess the long term complications involved in this type of reconstruction. As most of our patients were treated for malignancies the effects of radiotherapy after a microvascular reconstruction could not be assessed due attrition of our sample size.

## Conclusion

The versatility in reconstructing both intraoral and extraoral defects, the large quantity of bone that can be shaped and adapted to maintain the contour of both maxilla and mandible and the reliable harvesting technique leading to minimal donor site morbidity thus make the free fibula flap an integral part of reconstruction in head and neck defects.

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