Journal of Surgery
2014; 2(6-1): 1-5
Published online June 09, 2014 (http://www.sciencepublishinggroup.com/j/js)
doi: 10.11648/j.js.s.2014020601.11
ISSN: 2330-0914 (Print); ISSN: 2330-0930 (Online)

Vascularized free fibula flap for reconstruction of mandibular defects

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To cite this article:
Mohammad Akheel, Suryapratap Singh Tomar, Anuj Bhargava. Vascularized Free Fibula Flap for Reconstruction of Mandibular Defects. *Journal of Surgery.* Special Issue: Craniofacial Surgery. Vol. 2, No. 6-1, 2014, pp. 1-5. doi: 10.11648/j.js.s.2014020601.11

Abstract: Objective: To assess the versatility of vascularized free fibula flap in reconstruction of various defects of mandible. Study Design: Prospective study. Duration of Study: March 2009 to March 2012. Methodology: The study group consisted of 10 patients who underwent resection of mandible for various reasons and reconstruction of continuity defects using a vascularized free fibular flap. The mandible was resected for ameloblastoma in 4 cases, squamous cell carcinoma in 1 case, odontogenic keratocysts in 3 cases and ossifying fibroma in 2 cases. The type of reconstruction performed was primary in 9 patients in which osseous fibula flap was used and secondary in 1 patient in which osseocutaneous flap was used. Results: There were 10 patients which include 5 males and 5 females within age group of 20 to 50 years with mean age of 35 years. All flaps survived except in 1 patient who had donor site morbidity. Flap perfusion was seen immediately after anastomosis and was maintained throughout the follow-up period of minimum 6 months. All patients were kept in nasogastric feeding for 5 days and then began oral feeding and walking with some aid in 2nd week and became completely ambulant in 4th week postoperatively. Conclusion: In our study, we conclude that vascularized free fibula flap is a versatile option for reconstruction of large mandibular defects with its good quality and quantity of bone and ease of manipulation to restore the original anatomy of the mandible and permit implant based prosthetic rehabilitation.

Keywords: Fibula Reconstruction, Ameloblastoma, Odontogenic Keratocysts

1. Introduction

Pathologies predisposing to wide resection of mandible pose a great surgical challenge for head and neck surgeon for reconstruction and rehabilitation. Various techniques of flaps have been used since years. The goal of reconstructive surgery following ablation of soft and hard tissue loss is to reconstruct the defect at the time of surgery primarily to facilitate a good wound healing and cosmetic outcome[1].

Reconstructive options for maxillofacial defects have improved tremendously beyond the primary closure, stainless steel reconstruction plates and skin grafts to a wide variety of pedicled flaps. More recently, due to advancements in surgical technique, improved knowledge in anatomy and various complications reported in literature, the surgeons have introduced the use of micro vascular free flaps to reconstruct the composite defects in order to match the resected tissues and provide a better quality of life[2, 3].

The pedicled flaps which are anastomosed represent unique principle of transplantation, being suitable for reconstruction of a variety of complex and large defects. Among the various flaps used, vascularized free fibular flaps are considered to be a workhorse since hidalgo has used it for mandibular reconstruction[4, 5, 6].

The vascularized free fibula flap provides a good quality bone graft with a low complication rate[7, 8]. Multiple osteotomies can be made to reform the exact orientation of resected mandible. The presence of thick cortical bone makes it easy to rehabilitate the patient with implant based prosthesis when compared to other flaps and hence represents the first choice for head and neck surgeons[4, 5]. The current study was designed to determine the results of using vascularized free fibular flap for reconstruction of mandibular defects.

2. Materials & Methods

This prospective study was conducted in Department of Oral & Maxillofacial surgery in Sharad pawar dental college & hospital, India over a period of three years from march 2009 to march 2012 consisting of ten consecutive patients. Out of 10 patients, 5 patients were male and 5 patients were female within age group range from 20 to 50 years with mean age of 35 years. The mandible was resected for ameloblastoma in 4 cases, squamous cell carcinoma in 1 case, odontogenic keratocysts in 3 cases and ossifying fibroma in 2 cases. The type of reconstruction performed was primary in 9 patients in which osseous fibula flap was used and secondary in 1 patient in which osseocutaneous flap was used. (TABLE 1)

Table 1.

S.no.	Case	Type of defect	Type of flap
1.	Ameloblastoma	L	Osseous
2.	Ameloblastoma	Lcl	Osseous
3.	Squamous cell carcinoma	Lc	Osseocutaneous
4.	Ossifying fibroma	L	Osseous
5.	Odontogenic keratocyst	Hl	Osseous
6.	Odontogenic keratocyst	Hl	Osseous
7.	Ameloblastoma	Hl	Osseous
8.	Odontogenic keratocyst	Hl	Osseous
9.	Ameloblastoma	L	Osseous
10.	Ossifying fibroma	L	Osseous

The patients included in this study were those needing mandibular resection and who were medically fit for surgery with no underlying systemic disorders. Pre operative CT angiography was done for all patients to rule out abnormalities of lower leg vascular anatomical variation like peroneus magnus and atherosclerotic blood vessels. The procedure was explained to all patients and their guardians with their postoperative complications and an informed consent was obtained preoperatively. Preoperative investigations like othopantomogram (Fig 1, 2), chest X-ray and a complete surgical profile were taken. All patients were evaluated by anesthetist and posted for surgical procedure under general anesthesia.

Fig 1. *facial profile of a patient with odontogenic keratocyst on left side.*

Fig 2. *preoperative orthopantamogram showing multilocular odontogenic keratocyst on left side involving the anterior mandible.*

All mandibular defects were classified according to HCL classification. In our study 4 patients had defects in head region, 2 in central region and 4 patients in lateral region. After assessing the size of the defect, the free fibular flap was harvested from the donor site following standard protocols. 1 patient had osseocutaneous flap and 9 patients had osseous flap.

3. Procedure

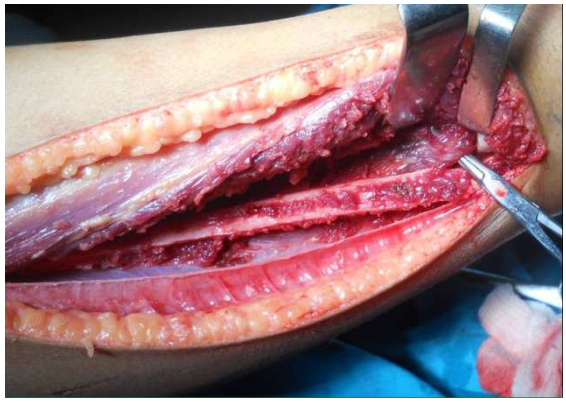


Fig 3. *dissection of vascularized fibula free flap.*

All the patients were operated in supine position and pneumatic tourniquet was placed proximally on the operated leg. Timing of the tourniquet was noted and leg was rotated internally with flexed at 60 degrees and stabilized. Painting and draping was done under strict aseptic conditions. A line was drawn from the fibular head to the lateral malleolus. A curvilinear incision is then marked along the lateral border of the peroneal muscles to access the posterior intermuscular septum. Dissection was done in layers and fibula was reached. The interosseous septum was dissected. Peroneal perforators were identified and ligated. Periosteum was dissected at the region of osteotomy cuts on either side. A 16 to 18 cms of fibula was resected in all patients from centre leaving 6 cms of bone proximally to avoid damage to common peroneal nerve and distally to avoid gait disturbances (Fig 3). After ensuring the recipient bed preparation, the fibular flap with the

pedicle was isolate and divided from the donor site. The flap insetting was done and fixed with titanium reconstruction plate and miniplates. The anastamosis was done using 8-0 ethilon for peroneal and facial artery and vein with 9-0 ethilon. Vaccum drains were secured and wound closure was done in layers both in donor and recipient sites. Postoperative orthopantomogram was taken on 2st postoperative day (Fig4).

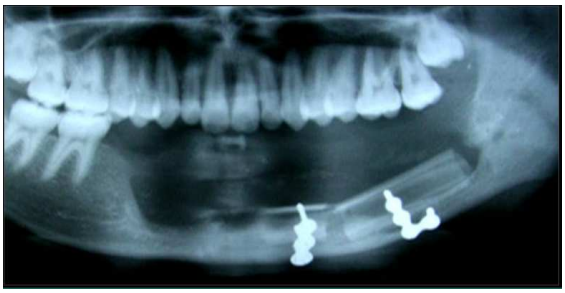
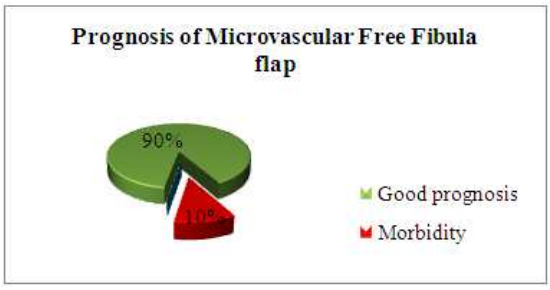


Fig 4. *postoperative orthopantomogram showing fixation of vascularized fibula free flap with miniplates.*

4. Results

This study was carried out in 10 patients who underwent reconstruction of mandible with free vascularized fibula flap. Among these, 5(50%) patients were males and 5(50%) were females with a male to female ratio of 1:1.

The mandible was resected for ameloblastoma in 4 cases (40%), squamous cell carcinoma in 1 case (10%), odontogenic keratocysts in 3 cases (30%) and ossifying fibroma in 2(20%) case. The type of reconstruction performed was primary in 9(90%) patients in which osseous fibula flap was used and secondary in 1(10%) patients in which osseocutaneous flap was used.



Flap perfusion was assessed intraoperatively and postoperatively and throughout the follow up period for a minimum of 6 months. All patients were kept in nasogastric feeding for 5 days and then began oral feeding and walking with some aid in 2nd week and became completely ambulant in 4th week. Out of 10 patients 1(10%) patient had donor site morbidity with mild infection which was controlled by antibiotics and local antiseptic measures.

5. Discussion

Reconstruction of mandible represents a surgical challenge to the head and neck surgeon and has been revolutionized by the modern microvascular techniques and complex anatomical landmarks. Ablative procedures of mandible warrants mandibular reconstruction mandatory for restoration of form and function. Other causes of mandibular defects include trauma, infection or inflammation, osteoradionecrosis, osteomyelitis and congenital deformities.

The anatomical location and size of the defect matters more in restoration of aesthetic and function of mandible reconstruction. The anterior mandibular reconstruction needs more skill and planning to mimic the original mandible to give function as well as aesthetics and is a prime concern when compared to the defect in posterior region of mandible. Restoration of functions like mastication, speech, deglutition and support for tongue and other tissues and muscles is lost. All these deformities warrants an appropriate procedure to address these problems. Hence mandibular reconstruction has become a mandatory procedure to address these problems[9, 10, 11, 12].

Various materials and techniques were put forward to reconstruct the mandible. Free bone grafts taken from calvarium, iliac, tibia, and fibula were used to restore small defects of mandible. Over the past 20 years vascularized flaps have become popular to reconstruct large defects of mandible. In our study we have used vascularized free fibula bone flaps to reconstruct the mandible.

Due to advances in surgical skills, microvascular flaps are used for spontaneous and immediate repair of the recipient site. Hoffman et al in his study showed histological evidence of the healing of vascularized free flaps with bone continuity similar to that of a fracture[13]. This favors new bone formation and either immediate or delayed rehabilitation can be done with implant prosthesis. For anterior mandibular defects they have the ability of forming vascularized bone flaps in order to provide a solid arch to restore the form and function. Therefore, reconstruction with vascularized bone is the preferred method of mandibular reconstruction.

During the past few years, a variety of flaps have been discovered for reconstruction of mandible. Out of which fibula has been considered as workhorse for mandibular reconstruction as it has all the ideal features like adequate length, width, bone quantity and quality to connect the resected part of the defect. This fibula can be made as single or double barrel depending upon the height of mandible required to reconstruct[14, 15,16,17,18].

According to the HCL mandibular defect classification[19], the mandibular defects which were reconstructed in our study were classified as head region (n =4), central region (n = 2) and lateral region (n = 4). In 1 patient who had squamous cell carcinoma reconstruction was done after 6 months when there was no evidence of recurrence.

In our study, 10 patients reported to the department were operated for vascularized free fibula flap. The type of reconstruction performed was primary in 9 patients in which osseous fibula flap was used and secondary in 1 patient in which osseocutaneous flap was used. All patients were followed for atleast 6 months after resection and

reconstruction of mandible. Reconstruction was planned only when no evidence of disease or recurrence was seen. The donor site complication is a very serious problem when planning a free tissue transfer. In our study the fibula free flap harvest had acceptable donor site morbidity with infection which was controlled by local antiseptic measures. And preservation of good foot and ankle function in most individuals. Garrett et al. in his study had increased talar tilt in one patient compared with the contralateral side but there was preservation of the ankle stability[20]. The results from our study regarding donor site morbidity are in accordance to the published studies, which also claim less donor site morbidity with vascularized free fibular graft[21, 22].

The advantages of vascularized free fibula flap are achieved at the cost of the procedure that is longer than other conventional reconstructive procedures. Foster et al in his study concluded that additional operative time is required for a free flap reconstruction[23]. In our study average time for resection and reconstruction was 3 hours 25 minutes. Average hospital stay was 7 to 16 days with an average of 11.5 days. According to literature and recent advancements, vascularized fibula flap remains the first choice for all the large mandibular defects and for poor recipient bed which do not favor uptake of free bone grafts[2, 15, 16,] Nonvascularized bone grafts are effective for short bony defects of mandible in non-irradiated tissue and in patients who are medically compromised to tolerate the additional operative time required for a free flap reconstruction.

6. Conclusion

Microvascular free flap recontruction is one of the modern means of restoring composite defects of the maxillofacial region. In our study the vascularized free fibula flap was a versatile and most appropriate option for microvascular reconstruction of large mandibular defects with low incidence of complication rates and good quality and quantity of bone stock to reconstruct defects in head and region. It also favors prosthetic rehabilitation and is always the first choice for the majority of mandibular reconstruction cases.

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