Delayed Mandibular Reconstruction Using an Osteocutaneous Free Vascularized Fibula Graft: A Case Report

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Abstract

Oro-facial defects, congenital or following a trauma or ablative surgery result in compromised function, form and aesthetic along with psychological suffering. Primary goal for mandibular reconstruction focus on establishing mandibular continuity and an osseous alveolar base for further dental rehabilitation and correction of soft tissue defect. Numerous surgical techniques have been implemented, mainly consisting of non-vascularized and vascularized grafts , the latter being preferred due to blood supply with better healing even in large defects. Thus , this paper highlights the utility of the osteocutaneous free vascularized fibula graft in delayed mandibular reconstruction.

Key words: mandibular reconstruction, free fibula graft , osteocutaneous.

Introduction

The reconstruction of the mandible is a nexus and challenging procedure in oral maxillofacial surgery with the primary goal being to restore both form and function including articulation, mastication, swallowing and esthetics. Oromandibular reconstruction as a result of benign or malignant tumors, osteomyelitis, osteoradionecrosis ,oncologic resections, traumatic injuries , although controversial but has been subjected to numerous techniques and continues to evolve with a variety of surgical techniques being implemented, mainly consisting of non-vascularized and vascularized grafts , the latter being preferred due to blood supply with better healing even incases of large defects.[1,2] The use of free vascularized fibula has become the "gold standard" for mandibular reconstruction ever since its introduction by Hidalgo, 1989.[3]

The goal of the reconstruction focuses on establishment of mandibular continuity and an osseous alveolar base for further dental rehabilitation and correction of soft tissue defect.[4] Utilization of microsurgery in management of the mandibular reconstruction, even though associated with adequate outcomes and low donor-site morbidity,remains challenging.[5] Future strategies include tissue engineering via collagen-based scaffolds ,bone marrow-derived stromal cells,growth factors and platelet-rich plasma (PRP).[6,7]

While the quest for the best technique continues, this case report describes a case of delayed mandibular reconstruction employing the use of a free vascularized fibular graft as the treatment modality.

Case History

A 36 year old male reported to the Department of Oral and Maxillofacial Surgery, Armed Forces Medical College, Pune, Maharashtra with chief complaint of pain and clicking sound on right side of the face in front of ear since one year. The pain was moderate in nature which aggravated on chewing and clenching and regressed on its own. His medical history revealed patient underwent operative procedure for appendicitis ten years ago. He was also diagnosed with odontogenic keratocyst on left side of mandible three years ago for which segmental mandibulectomy with disarticulation of left side under general anesthesia was performed at Command Hospital (Southern Command) followed by placement of distractor which was removed two years back. On examination, facial asymmetry was present in the middle and lower third of face. Neuromotor deficit was present in relation to temporal branch of facial nerve(fig no. 1).A depression was seen extending from the middle third to lower third of face in front of left pre-auricular region to lower border of mandible and in midline extending upto lateral to the left oral commissure. Also, dental midline did not match with facial midline and deviation of remaining mandible was seen to left on chewing.

Fig.no.1

Computerized Axial Tomography Scan and Orthopantomogram (fig no.2) revealed mandibular defect presenting on left side extending from left mandibular canine region to left condyle

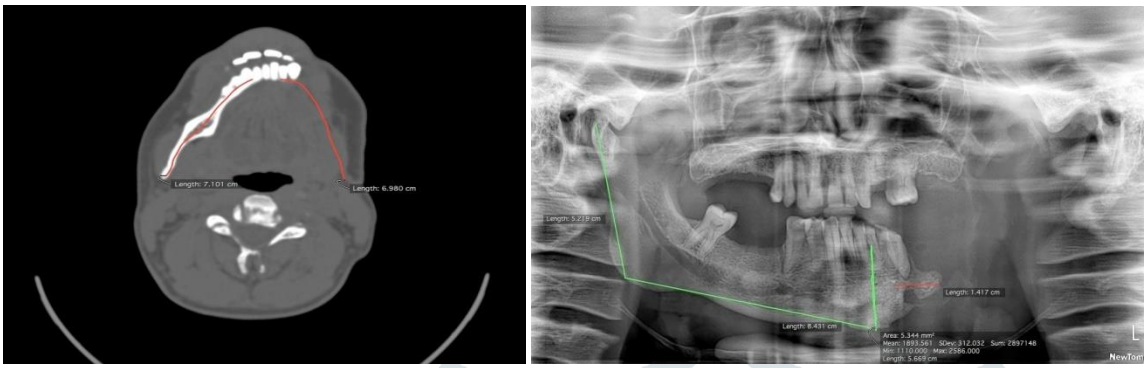

Fig no.2

Method

The patient underwent surgery as a case of facial asymmetry in an operated case of odontogenic keratocyst There were two teams employed to undertake the surgery of which one team exposed the recipient site by extending the existing scar and making into Schobhinger incision (fig no.3).

Fig no.3

Dissection was carried out in layers till the zygomatic arch. The Facial artery, Internal jugular vein, Common facial vein, greater auricular nerve were identified(fig no.4). Sternocleidomastoid muscle and Greater auricular nerve were sacrificed on left side. The facial artery and vein were secured with vascular clips for future vascular anastomosis. 33 tooth was extracted and osteotomy cut was placed through socket of 33.

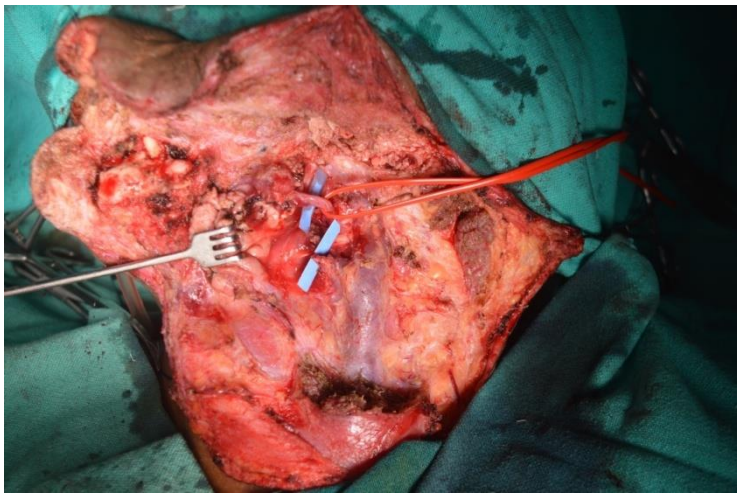

Fig no.4

On the donor site the second team simultaneously exposed the ipsilateral fibula via posterior approach. A line was drawn from the fibular head to the lateral malleolus indicating the submuscular and subcutaneous course of fibula(fig no.5)

Fig no.5

Two markings were made on the line. First was 7 cm distal from the fibular head which indicate approximate insertion of peroneal vessels within the intermuscular septum. Second marking was made 14 cm distal from the fibular head indicating the approximate location of nutrient vessels. A curvilinear incision was made along the lateral border of the peroneal muscles. The posterior intermuscular septum was identified separating the peroneal muscle from soleus muscle. The septum was separated from its attachments to the fibula along its posterior border. Dissection proceededanteriorly towards the anterior intermuscular septum which seperates the peroneal muscle from the extensor muscle. Extraperiosteal dissection was done, about 1cm cuff of flexor hallucis muscle with associated peroneal vessels was left attached to the fibula. The peroneal vessels were identified at the distal osteotomy site and were ligated. The peroneal vessel was identified from posterior tibial artery. The first osteotomy cut was done 4cm distal to the nutrient vessel by gigli saw with 1 cm excess periosteum. The second

osteotomy cut was made 4cm proximal to the nutrient vessels with 1cm excess periosteum. The osseous tissue attached only by its vascular pedicle was observed for balanced perfusion after deflating the torniquet. Osteotomy cut was placed on graft using aluminium foil template. Load bearing four hole plate was placed on newly made angle region on graft and stabilized using 4 screws (fig no.6).

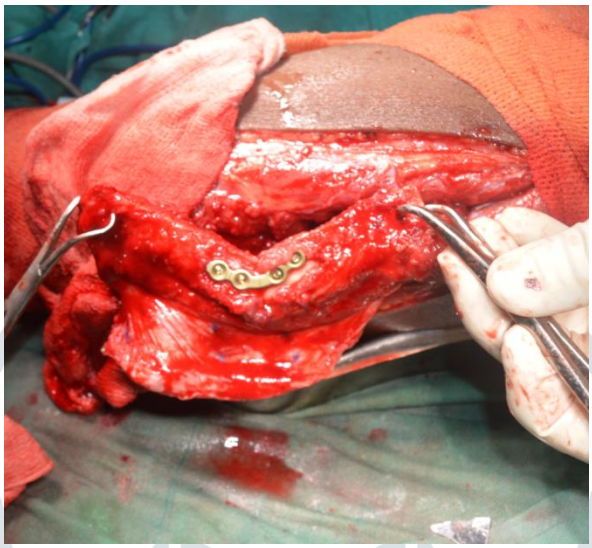

Fig no.6

Then, the proximal peroneal vessel was ligated and cut. The graft was adapted to the defect as per size and shape and stabilized by five hole load bearing plate with screws. The end to end anastomosis was done in between peroneal artery and facial artery and common facial vein and internal jugular vein commitans with peroneal vein with 7/0 prolene under aided vision of loop in a convetionalmanner. The clamps were released and patency of the anastomosed vessel was observed . Thewound was closed in layers with water tight seal in the oral cavity. Drains(no.14)were placed at donor and recipient site. Plaster dressing was given over donor site.

The patient was kept under post operative intensive care unit for 4 days. He was put on broad spectrum antibiotic, analgesicspost surgery. However, second day of post-operative care, graft came out of recipient site. Re-exploration was done under general anesthesia, one bleeder was identified , suturing was done and hemostasis achieved closure was done in layers. Followed by monitoring in intensive care unit for two more days and after that patient was shifted to wards.

Discussion

The mandible serves various important functions in the head and neck. Its reconstruction is complex keeping in mind cosmetic and functional challenges posed. Many surgical techniques have been described including non-vascularized bone grafts, vascularized bone grafts, and approaches related to tissue engineering. Yet the look out

for the perfect procedure continues with ultimate goal being restoration of both form and function, necessitating the evaluation of appearance, mastication, deglutition, speech, and oral competence.

While non-vascularized bone grafts (NVBGs) (common donor being the rib and iliac crest),may be used for delayed reconstruction of small traumatic bony defects but the lack of blood supply results in slow and incomplete healing, subjecting to increased rates of infection, non-union, fracture and osteoradionecrosis in conjunction with radiation therapy.[8,9,10]

On the contrary, vascularized bone grafts (VBGs) contain an intrinsic blood supply, thus, a shortened union time and healing independent of a compromised recipient bed.[8,9] Among the various sites of VBGs ,the fibula, radial forearm, scapula, and iliac crest,[11-14]use of free vascularized fibula has become the "gold standard" for mandibular reconstruction since its introduction by Hidalgo in 1989.[3]

In comparison with the iliac graft, the fibula is easier to harvest, more reliable regarding anastomosis, and is associated with less postoperative morbidity.[15]

On comparison between NVBGs and Vascularized fibula, the latter remains superior in context of bony union (69% for NVBGs vs. 96% of VBFs), functional and esthetic scores for diet, speech, and midline symmetry.[16]Another advantage of the free vascularized fibula graft is the ability to have two teams working simultaneously with the patient in the supine position by reducing operating time, which is associated with reduced blood loss and lesser rates of infection.[17]

Outcomes from free vascularized bone grafts, more specifically free fibula grafts, have been proved to be markedly superior than non-vascularized options, including reconstruction plates and bone grafts, with defects of the mandible exceeding 6 cm in length.[8,9]However, due to limited diameter of the fibula compared with the height of the mandible, the vertical distance between the reconstructed segment and the occlusal plane can be substantially large. There can also be height discrepancy between the native mandible and the transplanted fibula, especially at the anterior segment however the ‘double-barreling’ of the fibula to create equal struts is a useful modification with good aesthetic and functional outcomes.[18]

There are various retrospective studies and clinical reports that indicate vascularized fibula flap in combination with endosseous implants to be a viable treatment option in the functional dental rehabilitation of mandibular discontinuity defects despite the recent approaches and interests towards tissue engineering techniques which still need more research and application.[3,8,11,19-28]

The patients with unrestored mandible have cosmetic disfigurement, compromised function, and psychological impact. The osseous requirements for an optimal reconstruction include adequate bone length, consistent shape throughout the length of the bone, and adequate blood supply.The real challenge is for the surgeon to strike a

balance to achieve desired cosmetic appearance with reliable function. It is imperative to restore bony continuity, facial contour, tongue mobility and speech all at the same time.

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