ORIGINAL RESEARCH PAPER

Volume-7 | Issue-8 | August-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MANDIBULAR RECONSTRUCTION WITH FREE FIBULA FLAP: OUR EXPERIENCE OF 2 YEARS

Plastic Surgery

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ABSTRACT

Background- The reconstruction of the mandible is a complex procedure because various cosmetic as well as functional challenges must be addressed, including mastication and oral competence. Many surgical techniques have been described to address these challenges, including non-vascularized bone grafts, vascularized bone grafts, and approaches related to tissue engineering.

Materials and Methods- this is a prospective study in which the free vascularized fibula graft is used for reconstruction of various mandibular defects for benign and malignant conditions over a period of 2 years.

Observation- All the patients had good functional and cosmetic outcome

Conclusion- To conclude, the free fibula bone graft can currently be regarded as the "gold standard" for mandibular reconstruction in case of composite (inside and outside) oral cavity defects as well as a way of enabling the performance of one-stage dental implantation.

KEYWORDS

Mandibular Reconstruction, Fibula, Microsurgery, Flap

Introduction:

Mandible forms the profile and contour of the lower third of the face. It is the structural foundation for the lower dentition. It gives origin to the tongue muscles and insertion to the muscle of mastication. It is vital for crucial function like speech, mastication and swallowing.

History- Taylor et al were the first to report the transfer of free fibula flap. In 1989 ,this flap was adapted to the restoration of segmental mandibulectomy defects by Hidalgo[1]

Anatomy of the free osteocutaneous fibula flap - It is supplied by peroneal artery which arises from posterior tibial artery 4 cms from its bifurcation . The nutrient artery provides the endosteal supply and the periosteal branches of the peroneal artery prproviding 4–6 segmental, circular arterial branches around the fibula, nourishing the bone, periosteum, and surrounding muscles[1]

Advantages -

- In comparison with other free osteocutaneous flap ,it provides the largest bone length(20-26cms) that allows reconstructing even after complete jaw resection
- It is more suitable for accepting dental implants.
- It can be harvested with skin island for reconstruction of mucosa and skin defects along with muscle cuff of soleus and FHL
- Well-defined vascular supply allows for multiple osteotomies (2–3 cm bone segments), which is particularly important in craniofacial contouring procedures.
- Provides vascularized bone that is suitable for contaminated, scarred, radiated or poor vascularized recipent site.

MATERIALS AND METHODS:

- It is a prospective case study from December 2014 to December 2016. Inclusion criteria-total 9 patients with benign or malignant mandibular lesion were included. Exclusion criteria-The patients who were having the peripheral vascular disease, deep vein thrombosis, trauma or arteritis wre excluded as they were not the ideal candidate for a vascularized fibula transfer. Total 9 patients who were included in our study belonged to age group ranging from 12 -70 years. Out of which 8 patients were male and 1 female. Total 7 patients were having the malignant pathology while 2 were benign. 6 patients out of 9 were having oral carcinoma while 1 patient each with ewing'sarcoma, ameloblastoma and aneurysmal bone cyst. 4 patients were having the lesion involving central segment while in 5 patients the lateral segment of the mandible was involved.
- Operative procedure- The patient was supine on the operating table with
- the knee flexed 90° and the pelvic girdle internally rotated with a roll placed under the ipsilateral hip. A tourniquet is used around the thigh without exanguination. The head of the fibula, lateral malleolus, anterior and posterior border of the fibula, including the planned skin paddle centered over dopplered perforators , were included in the markings for flap design. 6cms of fibula preserved both proximally and distally. The skin island design is centered over Dopplered perforators located over the middle third of the fibula.The anterior incision is made. Care is taken to avoid injury to the superficial peroneal nerve and its branches which lie in this layer. Dissect the peroneal muscles off the anterior surface of the fibula. Then incise the anterior intermuscular septum to gain access to the anterior compartment. Posteriorly, a 3 mm cuff of muscles kept. With an electric saw or Gigli saw, we osteotomized the fibula.We harvested 10-12cms of bone in all cases. Care was taken to include a strip off the periosteum overlying the proximal and distal osteotomy sites. The peroneal vessels were identified between the tibialis posterior and flexor hallucis longus muscles. The vascular pedicle was dissected up to its origin at the level of the bifurcation from the posterior tibial artery. After complete excision of the specimen, pre –plating done at the remaining part of the mandible with the help of titanium recon plate and plate is contoured accordingly. Then pre-contoured recon plate fixed to the osteotomized fibula with help of screws. In 4 cases contouring and replating was done after pedicle ligation and in 5 cases contouring and plating was done in-situ. Then contoured fibula with the recon plate was fixed to the mandible with the screws. After that microvascular anastomosis done under microscope/surgical loupe, first vein then artery was anastomosed. Mainly we used facial artery and vein at recipient site for the anastomosis, but in 2 cases where it was injured we used superior thyroid artery and end to side internal jugular vein. The donor site was primarily closed in 5 cases and split thickness skin graft was used in 4 cases.

OBSERVATION:

Out of the 9 patients who underwent free fibula flap, 3 patients had venous congestion post-operatively which was immediately re-explored. Two flaps recovered after that while one failed. Out of 9 patients we had only one patient with flap failure. The following are few of the pictures of patients reconstructed with free fibula flap.

Fig 1: preoperative picture of a 28 year male patient with ameloblast oma mandible.

Fig 2: postoperative picture and follow up picture of the same patient after r econstruction with free fibula osteocutaneous flap.

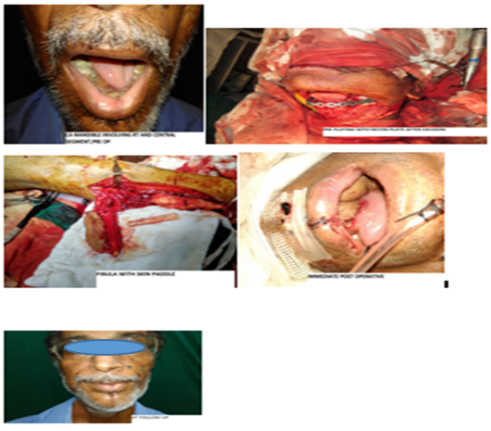

Fig 3: preoperative, intraoperative and postoperative picture of a 65 year old man with carcinoma of the alveolus involving the mandible. Growth resected and reconstruction done with a free fibula osteocutaneous flap.

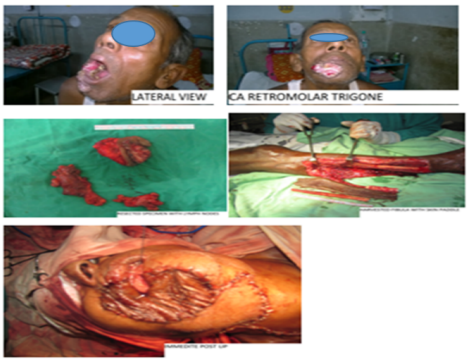

Fig 4: preoperative and intraoperative picture of a 52 year old man with carcinoma involving the retromolar trigone, reconstructed with a free fibula osteocutaneous flap after wide resection of the growth.

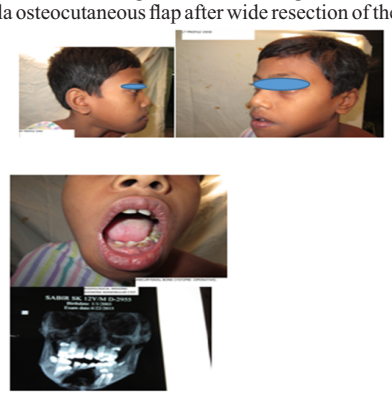

Fig 5: preoperative picture of a 11 year old boy with aneurysmal bone cyst involving the mandible.

Fig 6: intraoperative picture of free osteocutaneous fibula flap harvest and postoperative picture

Fig 7: follow up picture of the boy after 1 year.

All the patients had good functional and cosmetic outcome.

DISCUSSION:

The fibula was first recognized as a vascularized bone graft donor site for long bone reconstruction in 1975[2]. It was found to be ideally suited to replace segmental defects of the radius, ulna, humerus, and femur as a "double-barrel" graft.[3-7] It was subsequently adapted to mandibular reconstruction when it was demonstrated that the bone could be safely osteotomized multiple times to simulate the subtle nuances of mandible shape.[8] The fibula has up to 25 cm of useful length, enough to reconstruct any mandible defect. It has a consistent shape throughout its length, which makes it the ideal bone stock for duplicating mandible shape.[9] It has a robust segmental blood supply by the large-diameter peroneal artery that parallels the course of the bone and can allow it to function as a flow-through flap to supply a second free flap in tandem. This segmental blood supply allows the bone to be osteotomized as many times as necessary to reproduce mandible shape accurately. The osteotomized segments can be as short as 1 cm and survive completely. The fibula has adequate dimensions to support the use of osseointegrated implants.[10]

The bone can be harvested to include the flexor hallucis longus muscle. This muscle can be sacrificed without significant functional deficit at the donor site. It is conveniently located on the graft to fill in the submental soft tissue defect that typically accompanies mandible resection. Another advantage of this donor site is its distant location from the head and neck area. Although flap dissection was originally described from a posterior approach, the lateral approach is more popular and allows a simultaneous two team approach to resection and reconstruction.[11]

The fibula can be harvested with a skin island based on a septocutaneous blood supply.[12,13] Initial reports were somewhat skeptical about the reliability of the skin vascularity, but subsequent investigation and experience demonstrated that the skin island is reliable in more than 90% of patients.[14] It has become established

that the skin island blood supply is most reliable when the skin island is designed over the distal half of the leg because most of the septocutaneous vessels reach the skin in this area.[15] Whereas it was previously reported that inclusion of a significant cuff of muscle was important to ensure adequate blood supply to the skin, later reports confirmed the general perception that the skin island can be harvested with a reliable blood supply based on the septocutaneous supply alone.[16,17] Rarely, when vascularity is in doubt, it is possible to preserve the musculocutaneous branches until adequate septocutaneous supply is confirmed. The musculocutaneous perforators require intramuscular dissection and may prove to arise from the anterior tibial vessels and not the peroneal vessels. This can complicate the graft revascularization process.[18] This problem occurs only when the septum appears to be completely devoid of vessels or when the skin island is designed proximally on the leg. The former situation is unusual and the latter can be avoided. Harvesting a longer segment of bone and preserving maximum septum length even after shortening of the bone can contribute to the maximum preservation of septocutaneous blood supply.[19] In any event, large skin islands can be reliably harvested with the fibula, although those wider than 6 cm typically require skin graft closure of the donor site. More recent developments in skin island technology include restoration of sensation by neural anastomosis o the lateral sural cutaneous nerve contained within the skin island and separation of the skin island into two independent parts for improved insetting flexibility [20,21]. Although the skin island of the fibula is thicker than that of the forearm, it works well for both mucosal and external skin replacement. The fibula has great flexibility in terms of design. The ipsilateral leg is usually chosen for a lateral mandible defect. The angle of the mandible is positioned where the peroneal artery enters the bone. This maximizes pedicle length. Anterior reconstructions have the design shifted farther down the bone to effectively lengthen the pedicle. When the contralateral neck vessels will be used for anastomosis, the contralateral leg is chosen. In this case, the design is shifted to the most distal part of the bone to lengthen the pedicle maximally. There are few disadvantages of the fibula donor site. Skin island viability problems are rare. Patients who have peroneal artery-dominant legs are not candidates for use of the fibula.

CONCLUSION:

- Free fibula osteocutaneous flap is a good option for reconstruction of mandible after resection as it provides the longest bone length that allows the reconstruction even after complete jaw resection.
- It is very suitable for young patients who underwent resection and who would need dental implants for further rehabilitation.
- It can be combined with skin island for reconstruction of associated mucosal or skin defect,thus very good choice for oral defects who always presents with skin or mucosa defects.
- Good length of vascular pedicle can be harvested with ease for the anastomosis.
- Provides vascularized bone that is suitable in cases of recipient site wound contamination, scarring, radiation or poor vascularization.
- As an osteoseptocutaneous flap, the overlying skin connected to the bone by the posterior crural septum may be readily manipulated, allowing greater versatility in wound closure compared to other osteocutaneous flaps (i.e. iliac crest and scapular osteocutaneous flaps).
- Well-defined vascular supply allows for multiple osteotomies (2–3 cm bone segments), which is particularly important in craniofacial contouring procedures.
- Suitable donor vessels allow for anastomoses to large vessels in the head and neck and upper and lower extremities.

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