**FIBULAR GRAFTING IN MANDIBULAR RECONSTRUCTION**

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**Abstract**

The mandible plays a major role in mastication, phonetic function, and supports the teeth. Mandibular discontinuity produces cosmetic and functional deformities. Surgical reconstruction of mandibular bone defects is a routine procedure for rehabilitation of patients with deformities caused by trauma, infection or tumor resection. Bone grafting has been used in the reconstruction of the mandible. The fibula flap is a versatile method used in the reconstruction of the defects in the mandible.

**Key words**

Mandible, Fibular flap, Mandibular reconstruction

**Introduction**

The mandible is a horseshoe shaped bone divided into body, ramus and angle (1). It is an important structure for mastication, deglutition, aesthetics and speech (2) and is the only bone which is movable and unpaired (10). Mandibular reconstruction is indicated for loss of mandibular bone due to trauma injuries, benign or malignant tumours, osteoradionecrosis (3,4). The goals of mandibular reconstruction is to restore aesthetics and functions (5). This includes restoration of mandibular defect, establishment of osseous alveolar base, correction of soft tissue defects, and to provide sufficient durability and strength (6). The decision to perform reconstruction of mandible, the specific nature of technique is based on factors like size, location of the defect, distribution and quality of the remaining dentition (7). The defects can be divided based on location and extent into that involving the anterior mandible, lateral mandible and ramus/condyle. The significance of this is that a lateral defect can be reconstructed with a straight segment of bone whereas a central defect will require osteotomies (8). Mandibular reconstruction can be done by autogenous bone grafts which includes avascular bone grafts, free vascularized osteo myocutaneous bone flaps and free fabricated grafts, alloplastic materials and tissue engineered grafts (9).

Fibula graft is applied for most of the mandibular reconstruction surgeries (10). It provides a successful bone graft with low complication rate (11). The fibular graft offers a good length of dense cortical bone up to 25cm (4) that can tolerate multiple osteotomies without compromising its blood supply (12).

This article will enlighten the role of fibula in mandibular reconstruction.

**Fibula flap**

Taylor in 1975 developed the free fibula flap (13). Later Hidalgo in 1989 used free fibula for reconstruction of mandible associated with lesions of floor of mouth (14) and in 1994 wei et al popularised the use of fibula osteocutaneous flap. Since then, fibula flap was most commonly used in mandibular reconstruction (12).

The fibula is a tubular structure with cortical bone, and is the longest microvascular bone available for mandible reconstruction (15-17). It has a lengthy and sizable pedicle based on peroneal artery and its venae comitantes that is sufficient in most defects. It is harvested with accompanying skin paddle and can be harvested with flexor hallucis longus or soleus muscle for soft tissue defects (18,19). Clinically, the peroneal artery can supply the endosteal and periosteal circulation of the fibula sufficiently, thus making multiple osteotomies of the flap possible. This helps the surgeon to contour the bone according to the defect and reach maximum aesthetics (20). The calibre of the artery is 1.5mm and the veins are 3mm (21). The diameters of the vessels match closely with the diameters of most recipient vessels in the neck. This makes microanastomosis straightforward without the need for vessel modifications (14). Besides its length, another advantage of the free fibula flap is the trigonal diameter of the bone and a bicortical anatomy which helps in the placement of implants and facilitates osseointegraion thus restoring masticatory function. This fulfils the fundamental of reconstructive surgery of restoring both form and function (22,23). Kramer et al. (24) followed 16 patients with 51 dental implants placed in them over 3.5 years and found the success rate to be 96.1%. They also found that implants placed in fibulas have same success rate too those placed in healthy mandibles (25).

**Vascularised and non-vascularised bone grafts**

Mandibular reconstruction can be performed immediately at the time of resection or can be delayed. In mandibular reconstruction both vascularised and non vascularised bone grafts are accepted(26).

Vascularised bone grafts are widely used and are recognised as the most reliable method for immediate reconstruction of mandible and they are considered as gold standard when compared to other methods (27). They allow the possibility of immediate reconstruction especially in case of hypo vascularised irradiated tissue beds (28). The donor tissue should be of sufficient width, length , and height for reconstruction of the defect and should be well vascularised with a pedicel of adequate length (29,30). Fibula has both endosteal and periosteal vascularisation. This aspect makes it possible to perform multiple segmental osteotomies without damaging the viability (13). There are four types of vascular distribution of the peroneal artery: In 90% of the cases the peroneal artery is a branch of the posterior tibial artery, in 1% of the cases it arises from the anterior tibial artery , in 8% of the cases it takes the place of posterior tibial artery and in 1% of the cases it is a branch of popliteal artery (31). Studies show that arteriography should be mandatorily taken when planning the operation (32). Kessler performed angiographic assessment for 52 consecutive patients scheduled for fibular flaps for the assessment of arterial supply of foot. It was seen that only 21 patients had patent three vessel supply to both the feet. The other 31 patients had an atomic and atherosclerotic abnormalities (33).

The non vascularised bone grafts are used for the reconstruction of the selective mandibular defect when the defect is <9cm (34). These grafts give good aesthetics and contour and are successful in non irradiated patients where the defect is shorter and who have adequate soft tissue (35). These are used for primary reconstruction of mandibular defects due to benign pathologies (36). The common complications of the recipient site are dehiscence of Intra oral wound which results in graft failure . This is due to contamination of the wound with oral microorganisms (37). Presence of dead space and prolonged surgical procedure may also increase the risk of wound infection and dehiscence (35).

**Double barreling**

The height discrepancy between the mandible and the transplanted fibula is a disadvantage of this approach. The average height of the mandible including the dentition is 3-4cm and the average height of fibula is 10-12 mm . This presents a reconstructive dilemma as the height is inadequate for the placement of dental implants (4). Horiuchi et al (38) in 1995 recommended the ‘Double barreling’ of the fibula. This technique involves osteotomies and folding over the fibula graft to create equal struts and preserving the blood supply throughout the graft. A double-barrel fibula flap matches the height of the mandible of 3-4 cm resulting in better aesthetics and functions, and also helps in immediate osteointegrated dental implant placement (39).

**Limitations**

The main disadvantage of the fibula flap is its lack of height (40) making rehabilitations less ideal. Other disadvantages include insufficient soft tissue for large mandibular defects, unreliable skin perforators to support a skin paddle and presence of vascular anomalies which preludes its use.

Misconception of the fibula osteocutaneous free flap is that it possesses insufficient soft tissue for reconstruction of large composite oromandibular defects (22). The average dimension of the skin paddle of the fibula is 6 cm by 12 cm, while the maximum dimension is 14 cm by 32 cm (21). These skin paddle sizes allow for reconstruction of most composite oro-mandibular defects, including lining the floor of the mouth and near total glossectomy defects or large skin defects with mandibular reconstruction. If additional soft tissue is required, a cuff of soleus or flexor hallicus longus can be included with the flap (41).

Patients history of claudication or have a peripheral vascular disease should not have fibulaosteocutaneous free flaps performed. Alternative vascularised bone flaps such as the scapula or iliac crest free flaps should be considered (22).

**Conclusion**

From this review it can be conclude that the fibular flap shows a great versatility in mandibular reconstruction. It allows for a versatile maxillofacial osseous reconstruction and thus a better dental and prosthetic rehabilitation. Though fibula bone grafting has its own limitation ,still it serves as a flap of choice for majority of mandibular reconstruction cases.

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