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RESEARCH ARTICLE

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.

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INTRODUCTION

The mandible is a horseshoe shaped bone divided into body, ramus and angle (Fonseca, 2000). It is an important structure for mastication, deglutition, aesthetics and speech (Mohamed Mounir *et al.,* 2015) and is the only bone which is movable and unpaired (Hidalgo, 1991). Mandibular reconstruction is indicated for loss of mandibular bone due to trauma injuries, benign or malignant tumours, osteoradionecrosis (Bee *et al.,* 2008; George Kokosis *et al.,* 2016). The goals of mandibular reconstruction is to restore aesthetics and functions (Cordeiro and Hidalgo, 1995). This includes restoration of mandibular defect, establishment of osseous alveolar base, correction of soft tissue defects, and to provide sufficient durability and strength (Stošić, 2005). 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 (Urken *et al.,* 1991). 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 (Harvey Chim *et al.,* 2010). Mandibular reconstruction can be done by autogenous bone grafts which includes avascular bone grafts, free vascularized osteomyocutaneous bone flaps and free fabricated grafts, alloplastic materials and tissue engineered grafts (Stošić *et al.,* 2008).

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Fibula graft is applied for most of the mandibular reconstruction surgeries (Hidalgo, 1991). It provides a successful bone graft with low complication rate (Chepeha *et al.,* 2004). The fibular graft offers a good length of dense cortical bone up to 25cm (George Kokosis *et al.,* 2016) that can tolerate multiple osteotomies without compromising its blood supply (Wei *et al.,* 1994). This article will enlighten the role of fibula in mandibular reconstruction.

Fibula flap

Taylor in 1975 developed the free fibula flap (Taylor *et al.,* 1975). Later Hidalgo in 1989 used free fibula for reconstruction of mandible associated with lesions of floor of mouth (Hidalgo, 1989) and in 1994 wei *et al* popularised the use of fibula osteocutaneous flap. Since then, fibula flap was most commonly used in mandibular reconstruction (Wei *et al.,* 1994). The fibula is a tubular structure with cortical bone, and is the longest microvascular bone available for mandible reconstruction (Papadopulos *et al.,* 2008; Anthony and Foster, 1996; Reychler and Ortabe, 1994). 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 (Hidalgo and Rekow, 1995; Wong *et al.,* 2009). 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 (Pao-Yuan Lin *et*

al., 2011). The calibre of the artery is 1.5mm and the veins are 3mm (Wei, 2009). 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 (Hidalgo, 1989). 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 (Terry Sua, 2014; RaminCarbiner *et al.,* 2012). Kramer *et al.* (2005) 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 (Smolka *et al.,* 2008).

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 (Mohamed Mounir *et al.,* 2015). 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 (Christian Head *et al.,* 2003). They allow the possibility of immediate reconstruction especially in case of hypo vascularised irradiated tissue beds (Wells, 1996). 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 (Genden *et al.,* 1996; Schuepbach *et al.,* 2007). Fibula has both endosteal and periosteal vascularisation. This aspect makes it possible to perform multiple segmental osteotomies without damaging the viability (Taylor *et al.,* 1975). 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 (Strauch and Yu, 1993). Studies show that arteriography should be mandatorily taken when planning the operation (DragosPieptu *et al.,* 2005). 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 (Kessler *et al.,* 2001). The non vascularised bone grafts are used for the reconstruction of the selective mandibular defect when the defect is <9cm (Pogrel *et al.,* 1997). 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 (Sathya Kumar Devireddy *et al.,* 2015). These are used for primary reconstruction of mandibular defects due to benign pathologies (Gadre *et al.,* 2011). 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 (Egyedi, 1986). Presence of dead space and prolonged surgical procedure may also increase the risk of wound infection and dehiscence (Sathya Kumar Devireddy *et al.,* 2015).

Double barrelling

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 (George Kokosis *et al.,* 2016). Horiuchi *et al.* (1995) 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 (He *et al.,* 2011).

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 (Terry Sua, 2014).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 (Wei, 2009).

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 (Yu *et al.,* 2011). 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 (Terry Sua, 2014).

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.

REFERENCES

Anthony, J.P., Foster, R.D. 1996. Mandibular reconstruction with the fibula osteocutaneous free flap. Operative Techniques in Plastic and Reconstructive Surgery, 3(4):233-240. 16.

Bee Tin Goh Shermin Lee Henk Tideman Paul J.W. Stoelinga, Mandibular reconstruction in adults: a review, *International Journal Of Oral And Maxillofacial Surgery,* July 2008 Vol.37(7):597:605

Chepeha, D.B., Annich, G., Pynnonen, M.A., Beck, J., Wolf, G.T., Teknos, T.N., *et al*. 2004. Pectolaris major myocutaneous flap vs. revascularized free tissue transfer: complications, gastotomy tube dependency, and

hospitalization. *Arch Otolaryngol Head and Neck Surg.,* 130:181-6.

Christian Head, MD, Daniel Alam, MD, Joel A. Sercarz, MD, Jivianne T. Lee, MD, Jeffrey D. Rawnsley, MD Gerald S. Berke, MD, and Keith E. Blackwell, MD. 2003. Microvascular flap reconstruction of the mandible: A comparison of bone grafts and bridging plates for restoration of mandibular continuity. Otolaryngology–Head and Neck Surgery., 48-54.

Cordeiro, P.G. and D.A. Hidalgo, 1995. "Conceptual considerations in mandibular reconstruction," *Clinics in Plastic Surgery,* vol. 22, no. 1, pp. 61–69.

DragosPieptu *et al*., 2005. Mandibular reconstruction using the free osteocutaneous fibula flap, TMJ, Vol.55, No. 1.

Egyedi, P. 1986 Wound infection after mandibular reconstruction with autogenous graft. *Ann Acad Med Singapore*, 15:340–345.

Fonseca, R.J. 2000. Reconstruction of the maxillofacial cancer patient. In: Quereshy FA, Powers MP, editors. Oral and maxillofacial surgery. Philadelphia: WB Saunders, p. 361.

Gadre, P.K. *et al*. 2011. Nonvascularized bone grafting for mandibular reconstruction: myth or reality? *J Craniofac Surg.* 22:5.

Genden, E., Haughey, B.H. 1996. Mandibular reconstruction by vascularized free tissue transfer. *Am J Otolaryngol.,* 17(4): 219−27.

George Kokosis, Robin Schmitz, David B. Powers, Detlev Erdmann, 2016. Mandibular Reconstruction Using the Free Vascularized Fibula Graft: An Overview of Different Modifications, *Arch PlastSurg.,* 43:3-9

Harvey Chim, Christopher J. Salgado, Samir Mardini, and Hung-Chi Chen, 2010. Reconstruction of Mandibular Defects, Seminars In Plastic Surgery/Volume 24, Number 2.

He, Y., Zhang, Z.Y., Zhu, H.G., *et al*. 2011. Double-barrel fibula vascularized free flap with dental rehabilitation for mandibular reconstruction. *J Oral Maxillofac Surg.,* 69:2663-9.

Hidalgo, D.A. 1989. Fibula free flap: A new method of mandible reconstruction. *PlastReconstr Surg.,* 84:71-8.

Hidalgo, D.A. 1991. Aesthetic improvements in free-flap mandible reconstruction. *PlastReconstr Surg.,* 88:574-85.

Hidalgo, D.A., Rekow, A. 1995. A review of 60 consecutive fibula free flap mandible reconstructions. *Plast Reconstr Surg.,* 96:585–596; discussion 597–602

Horiuchi, K., Hattori, A., Inada, I., *et al*. 1995. Mandibular reconstruction using the double barrel fibular graft. *Microsurgery*, 16:450-4.

Jones, N.F., Swartz, W.M., Mears, D.C., Jupiter, J.B., Grossman, A. 1988. The ''double barrel'' free vascularized fibular bone graft. *Plast Reconstr Surg.,* 81:378–385.

Kessler, P., Wiltfang, J., Schultze-Mosgau, S., *et al*. 2001. The role of angiography in lower extremity using free vascularized fibular transplants for mandible reconstruction. *J CranioMaxillofac Surg.,* 33:150-6.

Kramer, F.J., Dempf, R., Bremer, B. 2005. Efficacy of dental implantsplaced into fibula-free flaps for orofacial reconstruction. *ClinOral Implants Res.,* 16:80–8.7.

Mohamed Mounir, Adel Abou –ElFetouh, Waleed El-Beialy, Mohamed Faramawey, RagiaMounir, 2015. Vascularised versus Non Vascularised Autogenous Bone Grafts for Immediate Reconstruction of Segmental Mandibular Defects: A Systematic Review, OHDM - Vol. 14 - No. 6 – December.

Mohamed Mounir, Adel Abou –ElFetouh, Waleed El-Beialy, Mohamed Faramawey, RagiaMounir, 2015. Vascularised versus Non Vascularised Autogenous Bone Grafts for Immediate Reconstruction of Segmental Mandibular Defects: A Systematic Review, OHDM - Vol. 14 - No. 6 – December.

Pao-Yuan, Lin, Kevin C. Lin, and Seng-Feng Jeng, 2011. "Oromandibular Reconstruction: The History, Operative Options and Strategies, and Our Experience," ISRN Surgery, vol. 2011, Article ID 824251, 10 pages, doi:10. 5402/ 2011/824251

Papadopulos, N.A., Schaff, J., Sader, R., Kovacs, L., Deppe, H., Kolk, A., Biemer, E. 2008. Mandibular reconstruction with free osteofasciocutaneous fibula flap: a 10 years experience. Injury, 39(3):75-82.

Pogrel, M.A., Podlesh, S., Anthony, J.P. *et al*. 1997. A comparison of vascularized and nonvascularized bone grafts for reconstruction of mandibular continuity defects. *J Oral Maxillofac. Surg.,* 55:1200–1206.

RaminCarbiner, Waseem Jerjes, KavehShakib, Peter V Giannoudis, and Colin Hopper, 2012. Analysis of the compatibility of dental implant systems in fibula free flap reconstruction, Carbiner *et al*. Head & Neck Oncology, 4:37

Reychler, H., Ortabe, J.I. 1994. Mandibular reconstruction with the free f ibula osteocutaneous flap. *International Journal of Oral and Maxillofacial Surgery,* 23(4):209-213.

Sathya Kumar Devireddy, M. SenthilMurugan, R. V. Kishore Kumar, RajasekharGali, Sridhar Reddy Kanubaddy, M. Sunayana, 2015. Evaluation of Non-vascular Fibula Graft for Mandibular Reconstruction, J. Maxillofac. Oral Surg. (Apr–June) 14(2):299–307.

Schuepbach, J., Dassonville, O., Poissonnet, G., Demard, F. 2007. Early postoperative bone scintigraphy in the evaluation of microvascular bone grafts in head and neck reconstruction. *Head Face Med.,* 3: 20.

Smolka, K., Kraehenbuehl, M., Eggensperger, N., Hallermann, W., Thoren, H., Lizuka, T., *et al*. 2008. Fibula free flap reconstruction of themandible in cancer patients: Evaluation of a combinedsurgical and prosthodontics treatment concept. *Oral Oncol.,* 44:571–81.

Stošić, S. 2005. Mandibular reconstruction. Belgrade: Rubikon, (Serbian)

Stošić, S. 2008. Vojnosanit Pregl, Mandibular reconstruction − state of the art and perspectives, 65(5): 397–403.

Strauch, B., Yu, H.L. 1993. Atlas of microvascular surgery. Thieme Medical Publishers, New York, p. 218-243.

Taylor, G.I., Miller, G.D., Ham, F.J. 1975. The free vascularized bone graft: aclinical extension of microvascular techniques. *Plast Reconstr Surg.,* 55:533.

Terry Sua, RuiFernandesb, 2014. Microvascular reconstruction of the mandible: An argumentfor the fibula osteocutaneous free flap, rev espcir oral maxilofac, 3 6(2):1–8

Urken, M.L., Weinberg, H., Vickery C. *et al*. 1991. Oromandibular reconstruction using microvascular composite free flaps. *Arch Otolaryngol Head Neck Surg.,* 117:733–744

Wei, F.C., Mardini, S. 2009. Flaps and reconstructive surgery. Saunders; p. 439–55.

Wei, F.C., Seah, C.S., Tsai, Y.C., Liu, S.J., Tsai, M.S. 1994. Fibula osteoseptocutaneous flap for reconstruction of composite mandibular defects. *Plast Reconstr Surg.,* 93:294–304; discussion 305–306

Wells, MD. 1996. Part I. Mandibular reconstruction using vascularized bone grafts. Journal of Oral and Maxillofacial Surgery, 54: 883-8.

Wong, C. H., Ong, Y.S., Chew, K.Y., Tan, B.K., Song, C. 2009. The fibula osteoseptocutaneous flap incorporating the hemisoleus muscle for complex head and neck defects: anatomical study and clinical applications. *Plast Reconstr Surg.,* 2009;124: 1956–1964

Yu, P., Chang, E.I., Hanasono, M.M. 2011. Design of a reliable skin paddlefor the fibula osteocutaneous flap: perforator anatomyrevisited. *PlastReconstr Surg.,* 128: 440–6.

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