

# Fibula free flap splitting for mandible reconstruction: A technical note

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**Abstract** Conformation of the fibula flap to passively adapt to the remaining mandible may be indeed challenging. A review of the ‘axial splitting’ technique for fibula free flaps is presented with a novel method of osteosynthesis. Adequate mandibular angle shape is achieved by performing this type of osteotomy with a minimal use of titanium hardware for flap inseting.

**Keywords** Fibula free flap · Mandible reconstruction · Head and neck reconstruction · Microvascular reconstruction · Fibula osteotomies

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## Introduction

Microsurgical techniques have improved functional and cosmetic outcomes following the reconstruction of extensive mandible defects. Taylor [1] and Gilbert [2] described a technique for harvesting a fibula free flap. Following the experience of Hidalgo [3], the flap came into widespread use for mandible microsurgical reconstruction. Subsequently, several refinements for flap harvesting and inseting have been described for better adjusting and contouring of the bone.

Usually, the flap is tailored to adjust to the remaining mandible or to replace it by performing several ‘wedge’ osteotomies, which allow the angulation of the different segments. However, this technique has some disadvantages, which include bone loss of 1–3 cm, difficulty making an optimal wedge according to the formula of Kahler and Manders, [4] and increased risk of damaging the vascular pedicle of the flap. To overcome these drawbacks of the wedge osteotomy, Guyot et al. [5] published their initial experience with an axial splitting technique for the fibula flap to shape the angle of the neo-mandible in 2001. Since then, little attention [6] has been given to this elegant, useful technique in the literature. The axial splitting technique used at the Oral and Maxillofacial Department, University Hospital La Paz in Madrid (Spain), with



**Fig. 1** Osteotomy designed for an axial splitting technique



**Fig. 2** Osteotomy completed with adequate movement of both fragments

an innovative modification in the method of fixation, is presented.

## Operative technique

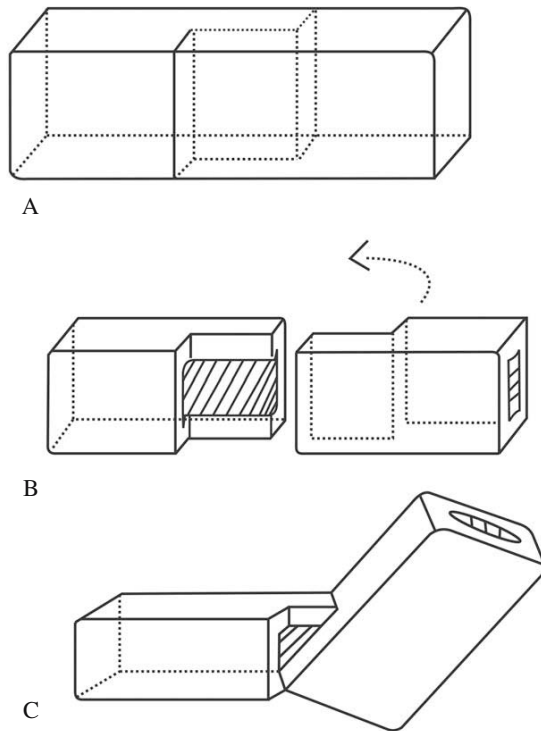
Once the flap has been harvested, the length of the defect in the body of the mandible is measured and the expected position of the new angle of the mandible is determined with the aid of a template, three-



**Fig. 3** Osteosynthesis with two bicortical compression screws

dimensional model, or visually. Next, an axial osteotomy is performed, mimicking the mandible sagittal split procedure in orthognathic surgery.

First, the periosteum at the osteotomy site is carefully stripped. Then, the osteotomy, as described by Guyot et al. [5], is performed with an oscillating saw, making three cuts: (1) First is on the external surface of the fibula, perpendicular to the main axis of the bone



**Fig. 4** The model of the axial split osteotomy. A) Design of the osteotomy, B) Osteotomy completed, C) Contouring of the mandibular angle (Reproduced from (Li J, Sun J, He Y, Weng YQ, Jiang JD (2005) Axial split osteotomy of free fibular flap for mandibular angle reconstruction: A clinical study. *Shanghai Kou Qiang Yi Xue* 14(4): 355–358, 369)

down to the level of the medullary canal; (2) the second is made along the main axis of the bone and is between 3 and 5 cm long; and (3) the last is made perpendicular to the internal surface at the junction of the anterolateral and posteromedial surfaces down to the medullary canal, as was done for the first cut. The vascular pedicle is protected by placing a blunt dissector in the subperiosteal plane. If necessary, the osteotomy can be finished using a chisel.

Next, the surgeon slides the two overlapping bone segments, adjusting their angulation to shape the new mandibular angle precisely.

Osteosynthesis can be performed using a standard technique with miniplates or a reconstruction plate, although a simpler method with two compression screws is preferred, once again, mimicking the fixation methods of orthognathic surgery, as two overlapping bony surfaces are available. In this sense,

the amount of titanium hardware inserted is reduced, lowering the risk of complications related to osteosynthesis and reducing the cost.

In summary, the axial splitting technique for a free fibula flap is an effective, safe and cost saving way to shape a new mandibular angle during microsurgical reconstruction. We have used this technique in 4 cases, without problems. In two cases we used a reconstruction plate to fixate the segments and in the other two we used the bicortical screws.

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