

TECHNICAL NOTE

Reconstruction of partial maxillary defects with the double-barrel fibula free flap

La ricostruzione dei difetti parziali del mascellare mediante lembo libero di fibula double-barrel

A. BAJ, D. ALI YOUSSEF, R. MONTEVERDI, B. BIANCHI¹, V.A. COMBI, A.B. GIANNI

Department of Maxillo-Facial Surgery, IRCCS Istituto Ortopedico Galeazzi Milan, University of Milan; ¹ Department of Maxillo-Facial Surgery, Head and Neck Department, University of Parma, Italy

SUMMARY

Maxillary reconstruction still remains challenging for surgeons despite the fact that maxilla is a static structure. The correct shape and volume of the reconstruction can guarantee the best result in terms of soft tissue support and functional outcome for the patients restoring three-dimensional support of the mid third. The fibula free flap seems to be the best free flap to apply in this type of reconstruction, partial maxillectomy, in particular, can benefit from reconstruction with the double barrelled fibula free flap. In fact, this shape can provide the best support to cheek tissue and minimize the tendency of upper retraction of the alar base of the nose and lips. Moreover, the free flap, containing bone, can restore a skeletal structure that will provide adequate bony support for osteointegrated implant prosthesis rehabilitation. All these conditions can be achieved with the double barrel fibula flap that we consider a good approach for maxillary reconstruction

KEY WORDS: Bone reconstruction • Maxillary reconstruction • Fibula free flap

RIASSUNTO

La ricostruzione mascellare resta ancora una sfida per i chirurghi nonostante l'osso mascellare sia una struttura statica. La corretta ricostruzione di forma e volume, ripristinando il supporto tridimensionale del terzo medio del volto del paziente, è in grado di garantire il miglior risultato sia in termini funzionali che di sostegno dei tessuti molli. Il lembo libero di fibula sembra essere il migliore tra i lembi liberi da applicare a questo tipo di ricostruzione, in particolar modo la maxillectomia parziale può beneficiare della ricostruzione mediante lembo libero di perone a doppia barra. Questa forma infatti è in grado di dare un miglior supporto ai tessuti della guancia e di ridurre al minimo la tendenza alla retrazione superiore della base alare del naso e delle labbra. Inoltre un lembo libero contenente osso è in grado di ripristinare una struttura scheletrica che può fornire un adeguato supporto per una riabilitazione protesica su impianti osteointegrati. Tutte le suddette condizioni si possono ottenere mediante un lembo libero di fibula a doppia barra che noi consideriamo un'ottima soluzione per la ricostruzione del mascellare.

PAROLE CHIAVE: Ricostruzione ossea • Ricostruzione mascellare • Lembo libero di fibula

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Introduction

The three main aims of maxillary reconstruction following tumour resection are to: close the oroantral fistula; restore three-dimensional support of the mid third; restore a skeletal structure that can provide adequate bony support for osteo-integrated implant prosthesis rehabilitation¹⁻³. The use of free flaps containing a bony component is reportedly the best technique to achieve these objectives. The flaps most commonly used for maxillary reconstruction are the fibula free flap, the iliac crest free flap, and the scapula free flap⁴.

The fibula free flap is the micro-vascular flap most often employed in bone reconstruction⁵. In 1988, Jones et al. described a modified flap called the double-barrel flap⁶. With this technique, the thickness of the bony portion of

the flap can be doubled and it is normally used in mandibular reconstruction to obtain a flap size equal to the native mandible⁷.

Here a case of maxillary reconstruction with fibula double-barrel free flap is described and the advantages of its use in the reconstruction of partial maxillectomy are discussed.

Case report

A 53-year-old female was referred to the Department of Maxillofacial Surgery, Istituto Ortopedico Galeazzi, Milan, Italy, because of an adenocarcinoma with low-grade malignancy, of the left hard palate, cT4N0M0, pT4NxM0. The neoplasm was found to erode the transitional area between the palate and the cortex and extended anteriorly

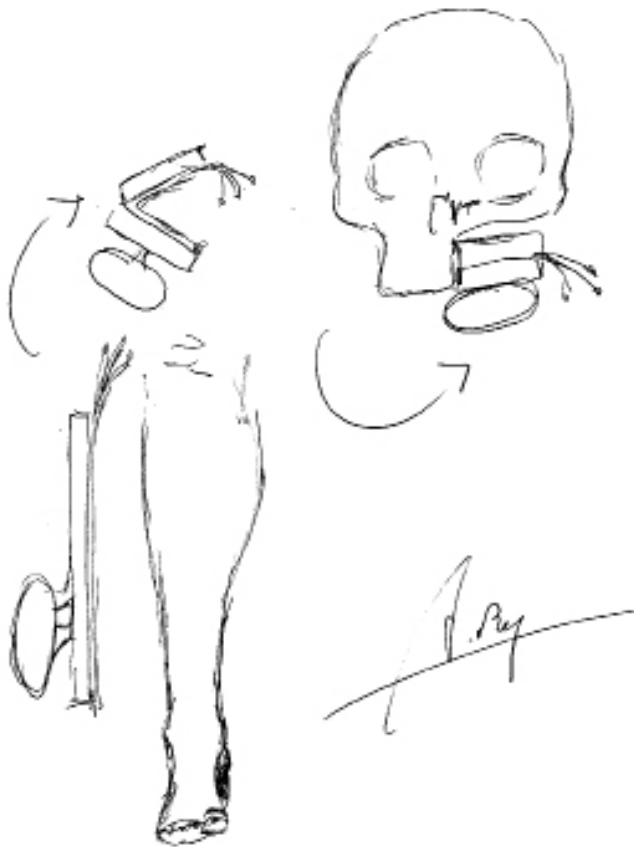


Fig. 1. Model of fibula free-flap modelled into a double-barrel flap.

inside the maxillary sinus. Partial maxillectomy was performed via access established at the left side of the nose combined with medial upper labiotomy. Maxillectomy comprised the left premaxilla and extended posteriorly to the pterygoid tubercles, which were also resected. The defect was repaired by means of an osteomyocutaneous fibula free flap modelled into a double-barrel flap so that the fibula could be adequately shaped to fill the bony defect.

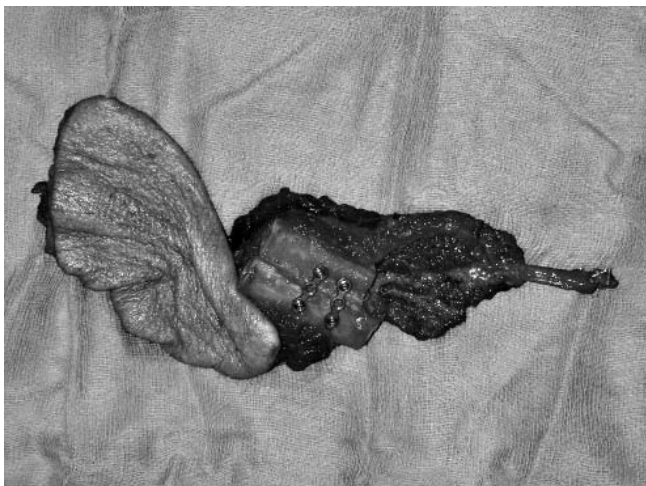


Fig. 2. Intra-operative view of fibula free-flap modelled into a double-barrel.



Fig. 3. Intra-operative view of anastomoses between flap pedicle and facial vessels.

In order to obtain accurate three-dimensional reconstruction and to exploit both flap components, the cutaneous portion was split from the bony component, and with blood supply provided by a single perforator, so that the two components could be more effectively used in the reconstruction of the hard and the soft palates. Shaped in this way, the flap filled the defect perfectly, thus allowing for a three-dimensional reconstruction very similar to the structure of the native maxilla.

Anastomoses were created between the peroneal artery and facial artery and between one of the *venae comitantes* and facial vein, after having tunnelled the cheek above the periosteum at the level of the mandibular ridge.

The patient was discharged after 21 days and, 6 weeks postoperatively, radiotherapy for perineural infiltration of a branch of palatine nerve was administered.

18 months postoperatively, a second operation, with forced dilatation combined with bilateral coronoidectomy was performed in order to achieve normal opening of the mouth. During that same session, four endosseous implants were placed in order to obtain adequate dental prosthesis insertion in the maxilla.

At 3 years' post-reconstruction the patient is in good health without local recurrence or distant metastases. The major sequelae were: limited mouth opening (2.8 cm) due to scarring and radiotherapy, which was resolved with bilateral coronoidectomy and forced mouth opening. The double-barrel fibula flap provided good support of the cheek and skeletal support for masticatory function rehabilitation with endosseous implants.

Discussion

If the aim of reconstruction of a maxillary defect were only a question of closing the oroantral fistula, then the solution would not be technically difficult, as a temporary mental or submental flap is the technique best indicated

for this purpose⁸. When the objectives are more ambitious and aim to correct a three-dimensional skeletal structure identical to the native anatomy and to ensure adequate replacement of the soft tissues removed, however, then the technique will be far more complex. With this situation in mind, a review of the literature showed that the best reconstructions are achieved with free composite flaps containing a bony component, and of these, the fibula free flap represents one of the most viable options for reconstruction⁹⁻¹¹. With the use of a fibula bone graft, the fibula can be osteotomized into several segments, thus permitting three-dimensional reconstruction of the excised maxilla very similar to the native anatomy. In addition, this technique permits the use of an osteomyocutaneous flap that provides both skin and, when needed, muscle tissue to repair the excised mucosal tissues.

Good outcome, after reconstruction of a static anatomic structure, accurately reflects the three-dimensional form of the removed maxilla. In this connection, Brown¹² has proposed algorithms that correlate the size of the defect with the best reconstruction technique. The two lines of reasoning highlight the objectives and techniques to be used in the repair of these types of defects and provide firm ground for treatment planning. However, since it is difficult to set standard rules for maxillectomy, the situations encountered in reconstruction differ considerably, often requiring adaptation to the defect created and to the objectives a surgeon is aiming to achieve in a specific case.

In subtotal maxillectomies involving the premaxilla, the main objectives should be closure of the oroantral fistula and reproduction of a skeletal support that avoids the pitfalls of retraction of the nasal wing and the upper lip and that permits rehabilitation of masticatory function. One of the main technical challenges is to achieve the correct height of the structure reconstructed. Particularly challenging from a technical viewpoint is reconstruction of the vertical pillars with revascularized bone.

Reconstruction of the frontal processes of the maxilla and the pterygozygomatic area will sometimes combine bone reconstruction, with a free flap, with vertical bone grafts

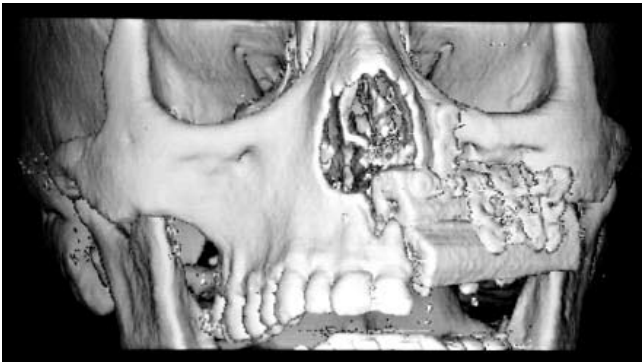


Fig. 4. Computed tomography showing 3D reconstruction of native maxilla with fibula free-flap.

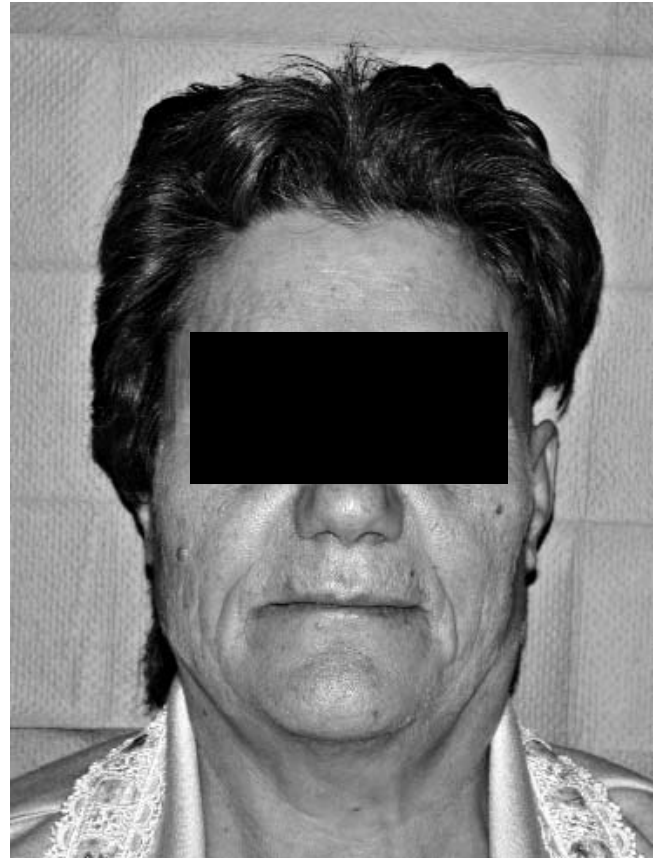


Fig. 5. Pre- and post-operative view of patient showing an optimal support for soft tissues of peri-nasal region and lip.

to obtain a correct three-dimensional structure of the reconstruction^{13 14}.

However, this technique places the graft at risk of infection due to exposure to air flow and to the effects of adjuvant radiotherapy.

In the present case, attempts were made to avoid these risks by using a double-barrel fibula flap that provided vascularized segments in the entire reconstructed area. With the use of this flap, correct height of the new alveolar bone was obtained, and albeit was possible to adapt the size to the reconstruction by cutting the anterior maxilla through the infra-orbital foramen in order to position the overlying fibula segment higher and to make sure that the height of the fibula was the same as that of the native maxilla or to position the upper segment as a V-shaped wedge insertion in order to achieve a vertical increase in the reconstruction and to ensure that the height of the native bone was equal

to that of the fibula. An important point in this technique is the choice of the leg from which the fibula flap is harvested. It is advisable to choose the leg ipsilateral to the defect in order to obtain pedicle egress from the lower segment of the fibula and to optimize pedicle geometry and make creation of microanastomoses easier¹⁵.

The main advantages of this technique are that no portions are reconstructed with bone grafts; instead the premaxilla is completely reconstructed and the anterior portion of the maxilla provides an optimal support for the soft tissues of the perinasal region and the lip.

This prevents retraction and provides an optimal bone base for rehabilitation with osteointegrated implants comprising the first molars¹⁶. In addition, the cutaneous portion can be sustained by a single perforator, thus making correct positioning in the oral cavity in order to close the oroantral fistula¹⁷.

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Address for correspondence: Dr. A. Baj, Divisione di Chirurgia Maxillo-Facciale, Istituto Ortopedico Galeazzi, Università degli Studi di Milano, Via Riccardo Galeazzi, 4, 20161 Milano, Italy. Fax: +39 02 66214770. E-mail: alessandro.baj@unimi.it