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Sandwich flaps as a feasible solution for the management of huge mandibular composite tissue defects

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ABSTRACT

In the current therapy of head and neck defects, surgical reconstruction with the aid of pedicle or free flaps is common practice. Suitable single flaps are available to solve most reconstructive challenges. However, reconstruction can become a problem in extensive mandibular defects, as they are often caused by large primary tumors or osteoradionecrosis. These composite defects often lead to large intraoral or extraoral fistulas due to the involvement of mucosa, skin, mandible and soft tissue. These issues call for a double flap approach in order to achieve adequate reconstruction. Therefore, we developed a surgical sandwich technique as presented in this study. The procedure features the acquisition and use of two vascular flaps which can be freely combined according to their desired features (for example being of high tissue volume or osteomyocutaneous).

In our study we included 11 patients (ten male, one female) with a mean age of 57 years. Seven of the patients had defects due to osteoradionecrosis and four due to tumor resection. A sandwich technique was performed in a single operation in eight patients, whereas for three patients several operations were necessary. The flaps used included: fibula free flap (FFF); anterolateral thigh (ALT); radial forearm flap (RFF); deltopectoral flap (DPF) and tensor fascia lata (TFL). The following combinations were used: FFF and ALT (three cases), FFF and RFF (two), FFF and DPF (three), ALT and TFL (two), and two ALT flaps (one). The sandwich technique proved suitable for complex reconstructions and led to desirable esthetic and functional results. The flexibility in combining different free or pedicle flaps made it possible to address various defect situations and consequently offer satisfactory surgical reconstruction for complex cases.

1. Introduction

Surgical management of large lower jaw malignancies and severe mandibular osteoradionecrosis not only results in extensive bone loss, but also in broad extraoral and intraoral soft tissue loss (Fig. 1). Reconstruction of these defects poses an extreme challenge for surgeons because numerous pivotal factors need to be considered. These factors primarily concern the overall medical condition of the patient. Patients with a high anesthetic risk due to poor health status have to be excluded from extensive reconstructive procedures. Secondly, peripheral arterial occlusive disease and the cervical vessel status play an important role (Yazar, 2007; Chia et al., 2011). Feasibility of vascularized bone reconstruction and the choice of soft tissue transplants depend on peripheral and local vessel conditions. Preoperative imaging for donor and recipient site vessels is essential when fibula transplants are planned or the patient has previously received surgery or irradiation of the neck (Thurmuller et al., 2007; Wolff and Hölzle, 2011). In our view the ideal solution for the above-mentioned defect situation is a sandwich flap technique composed of a bony element and two soft tissue elements. A fibula osseoseptocutaneous flap combined with a radial forearm free flap (RFF) or an anterolateral thigh (ALT) myocutaneous vastus lateralis flap are the combinations of choice. Based on this strategy, an algorithm with alternative reconstructive procedures has been developed (Fig. 2) and its 'proof of concept' is shown in the current preliminary study.

In today's therapy of head and neck defects, surgical reconstruction with the aid of pedicle or microvascular free flaps is a standard procedure (Preidl et al., 2015; Wong and Wei, 2010). In specialized centers these are already routine techniques (Zhang et al., 2015; Neligan, 2013). Suitable pedicle and free flaps are available to solve almost every reconstructive challenge and are

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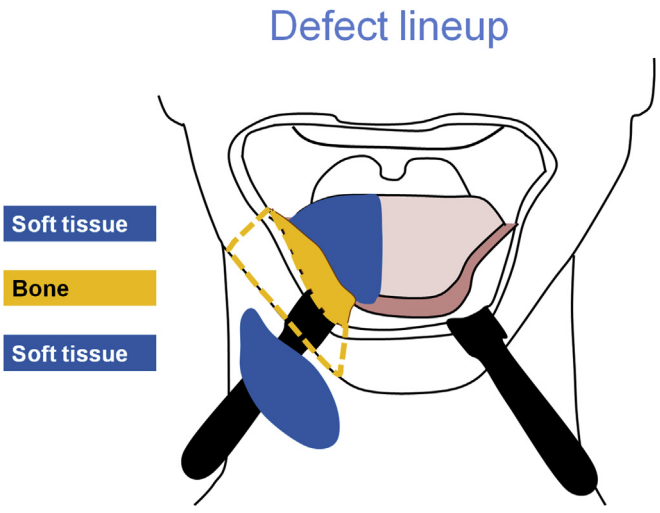

Fig. 1. Schematic drawing of defect lineup.

chosen according to patient's donor site status and the defect size (Wehage and Fansa, 2011). The selection of the right flap for the right patient is vital for the reconstructive success and outcome. The following general selection algorithm has proven helpful in addressing this issue: perforator flaps for example are beneficial for coverage of smaller-sized lesions (Hanasono et al., 2011); RFF for medium sized ones (Chen et al., 2005); and ALT are used for reconstructions needing larger volumes of tissue (Wei et al., 2002; Yu, 2004). This algorithm can support decision making in most common cases, but problems remain in patients with huge defects. In oral and maxillofacial surgery for example, these extensive mandibular lesions are often caused by surgical removal of large primary head and neck tumors or by osteoradionecrosis (ORN) after previous radiotherapy (Fig. 3). In these patients surgical reconstruction is often limited, because coverage with just one enlarged standard flap is not possible. In such complex defect situations (for example with oral-cervical fistulas) we often observe lesions in several different affected compartments, all of which have to be thoroughly addressed. These composite defects often involve the mucosa, skin, mandible and soft tissue. Here, for optimal reconstruction, a large volume of tissue is needed in combination with two skin islands for sufficient coverage of the intra- and extraoral defects. Additionally, if possible, it would be beneficial to replace the lost bone structure in between. Surgical reconstruction therefore calls for a double flap approach. This method allows the possibility of freely combining different flaps, according to their

Fig. 3. Preoperative view of patient with Osteoradionecrosis.

availability and the requirements in each patient; therefore surgical therapy can be specially geared to each patient. Defects for example could be addressed through a combination of different myocutaneous free flaps (such as ALT, RFF) for soft tissue reconstruction and an osteomyocutaneous flap (such as the fibula free flap (FFF)) for bone defects. In heavily irradiated patients with consequent wound healing disorders, or patients with poor blood vessels and/or medically compromised patients, local pedicle flaps such as the platysma myocutaneous flap, supraclavicular island flap or deltopectoral flap (DPF) can be used for extraoral, cervical and intraoral coverage (Bakamjian, 1965; Pallua and Magnus Noah, 2000; Tosco et al., 2012; Eckardt, 2013). They combine good esthetic and functional results along with less effort and donor site morbidity and can therefore be a good alternative to free flaps. Reconstruction plates are suitable for stabilization of osseous defects.

Reconstructive procedures featuring double flap techniques are, to this date, not yet sufficiently implemented. Inspired by this problematic issue and convinced by the advantages that a double-flap approach could have to offer, we developed our own two-flap technique for large mandibular defects. The complex situation is addressed in a sandwich fashion: the skin islands of the two flaps represent the outsides of the sandwich, whereas the soft tissue, muscle or bone constitute the inside or sandwich filling. The purpose of this study was therefore to implement this technique and evaluate it retrospectively.

2. Materials and methods

This study features a retrospective review of 11 patients treated at our department from 2011 to 2013. Only patients with large mandibular defects where sufficient defect coverage would need

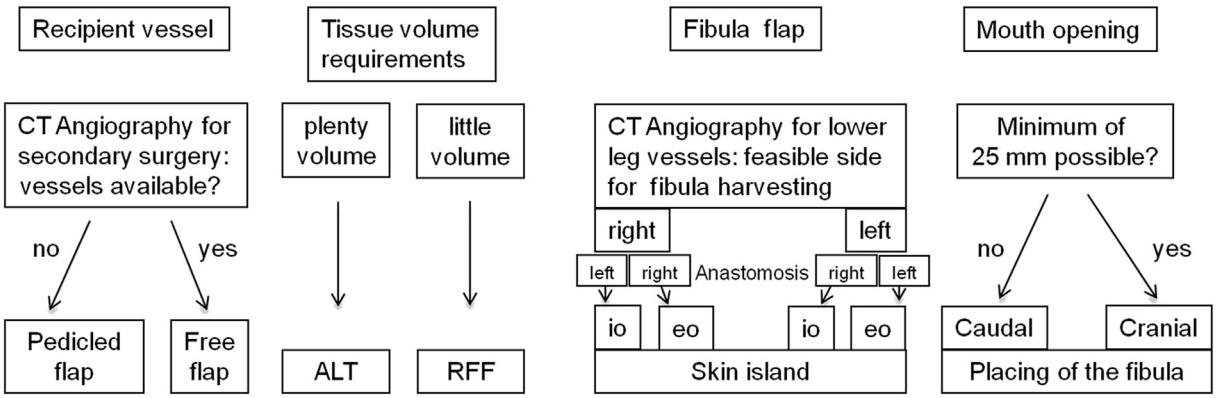

Fig. 2. Algorithm for sandwich technique.