Reconstruction of the Mandible by Fibula Free Flap

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Key words: fibula, flap, vascularization, reconstruction, mandible

Abstract

Background: The most frequent cause of defect in the mandible is tumor-related surgery. Larger defects or anterior arch defects cause severe morbidity due to disturbances in function and esthetics.

Objectives: To assess the outcome of free tissue transfer for mandible reconstruction.

Methods: Since 1998 we operated on 11 patients with mandible defects using the fibula flap as the reconstruction method. We performed immediate reconstruction in eight patients after ablative surgery, and late reconstruction due to radiation-induced complications in three.

Results: All patients achieved good functional and esthetic outcome. During the follow-up period two patients died of their malignant disease and one patient died from a non-related cause. Although two patients underwent reoperation in the first 3 months after their primary operation due to fixation failure, there were no other major complications.

Conclusions: According to the literature and our limited experience, the fibula flap is a safe and reliable option for mandible reconstruction.

IMAJ 2002;4:600–602

For Editorial see page 629

While the etiology of defects in the mandible is variable, including trauma, radiation or congenital anomalies, the most frequent cause is tumor-related surgery [1,2]. The common classification [1,2] of mandible defects describes the defect as lateral (L), central (C), or hemi-mandible (H). Combined defects are described as HC, LCL, etc. Non-reconstructed mandible defects that are not a pure L defect usually lead to severe morbidity, including disturbances in mastication, speech and esthetics [1].

The history of mandible reconstruction began in the late nineteenth and early twentieth centuries with surgical reconstruction of post-traumatic defects using bone grafts and flaps [3,4]. Tumor-related reconstruction was described much later when new surgical and anesthetic techniques advanced the treatment of head and neck cancer [5]. Tumor resection, immediate reconstruction and postoperative radiotherapy became the gold standard in management of head and neck cancer [6,7]. The use of metal plates, pectoralis major muscle flaps and other alloplastic materials [5,8] widened the reconstruction armamentarium, offering a reasonable solution to patients in whom bone reconstruction was not performed. This approach is still indicated in traumatic and L-type defects. However, those methods did not provide the answer for large (> 5 cm) H and LC defects or the effects of radiation therapy [8,9]. Vascularized bone reconstruction of the mandible was already reported in the late 1970s, with the use of ileum, scapula and radius as vascularized bone sources [10–12]. Following its description for mandible reconstruction in 1989, the fibula – which was already documented as a vascularized bone source for extremity reconstruction – was popularized and became the workhorse of mandible reconstruction [13]. Since then, the fibula flap has been considered the first-line modality for mandible reconstruction [14].

In the last 3 years we operated on 11 patients for mandible reconstruction. Patient data and outcome are presented in Table 1. Eight patients with squamous cell carcinoma underwent resection with immediate mandible reconstruction using the fibula free flap. We performed secondary reconstruction in three of them due to

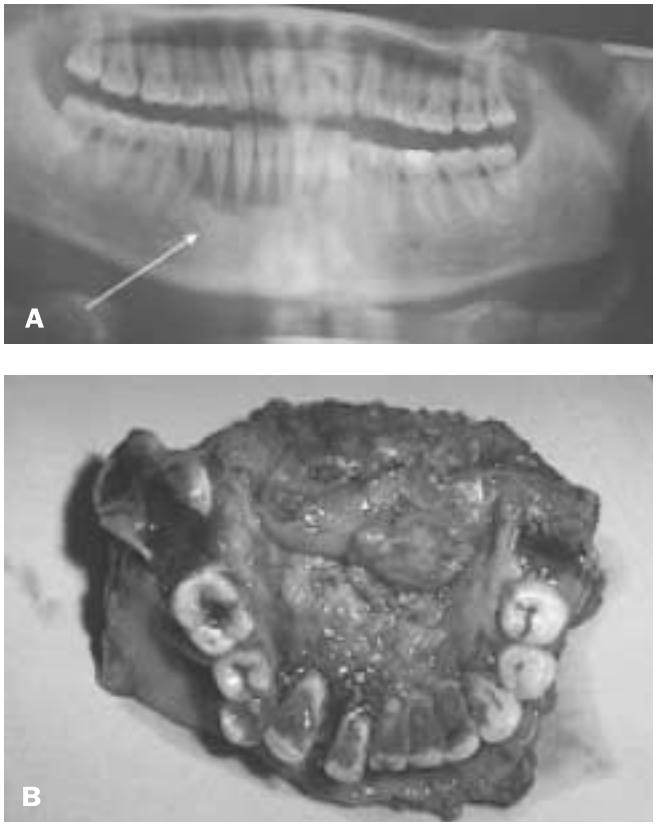

Figure 1. [A] Panoramic X-ray of the tumor. **[B]** The resected section.

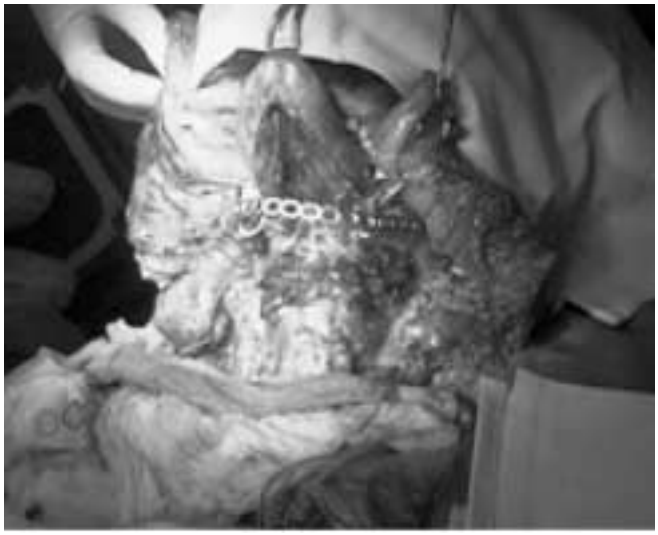

Figure 2. Patient 4 after resection of the anterior mandible and floor of mouth.

Figure 3. Patient 4 one month after the operation.

Table 1. Patients, procedures and outcome

Patient	Age/ Gender	Disease	Operation*	Reconstruction outcome + complications	Disease outcome
1.	76/F	Stage 4 SCC mandible (left)	Left hemi-madibulectomy, free fibula to left hemi-mandible & floor of mouth. CL – 8 cm + mucosa defect	Good function, esthetic, broken plate 2 mo post-op	DOD 8 mo post-op
2.	67/M	Stage 4 SCC floor of mouth (left)	Left hemi-mandibulectomy, free fibula to left hemi-mandible & floor of mouth. H – 10 cm + mucosa defect	Good function, esthetic	DOD 1 year post-op.
3.	76/M	Stage 4 SCC floor of mouth (right)	Left hemi-mandibulectomy, free fibula to right hemi-mandible & floor of mouth. CL – 7 cm + mucosa defect	Good function, esthetic	NED 2 years post- op
4.	31/M	Stage 4 SCC anterior floor of mouth	Resection anterior mandible & floor of mouth. Fibula to anterior mandibular arch & floor of mouth. C – 7 cm + floor of mouth defect	Good function, esthetic	Neck disease 6 mo post-op
5.	42/F	Breakdown of plate after hardware reconstruction post-osteoradionecrosis	Resection of the involved skin, free fibula reconstruction of the missing bone and cheek skin, H – 8 cm +skin	Good function, esthetic	NED
6.	42/M	Osteoradionecrosis left hemi-mandible	Resection of the involved bone and free fibula reconstruction, L – 7 cm defect	Broken plate due to inadequate resection	Excision of residual disease after 3 mo
7.	72/F	Stage 4 SCC of gingiva (left)	Resection of left hemi-mandible and floor of mouth. Fibula reconstruction of mandible and mouth. H – 8 cm + mucosa defect	Good function, esthetic	Neck recurrence, 3 mo post-op death
8.	40/F	Skin retraction over hardware-based mandibular reconstruction	Insertion of fibula into the reconstruction plate. Skin paddle cheek reconstruction. L – 7.5 cm + skin defect	Good function, esthetic	NED
9.	65/F	Stage 4, SCC of gingiva with bone invasion	Left hemi-mandibulectomy. L – 7 cm + mucosa defect	Good function, esthetic	NED
10.	50/M	Stage 4 SCC lip with bone invasion	Left hemi-mandibulectomy and lip excision. Reconstruction by free fibula. Skin paddle to lower lip. CL – 8 cm + full thickness lip	Good function, esthetic	Neck recurrence 1 year, local metastasis
11.	45/F	Stage 4 SCC of gingiva with bone invasion	Left hemi-mandibulectomy. L – 7 cm + floor of mouth	Good function, esthetic	NED

All ablative procedures included modified neck dissections as indicated. SCC = squamous cell carcinoma DOD = dead of the disease NED = no evidence of disease.

radiation therapy complications. All flaps survived with good functional and esthetic results. The functional result was considered adequate if speech and mastication returned to near-normal level. Our clinic paramedical staff evaluated esthetics. Complications [Table 1] did not influence the final outcome of the reconstruction, although two patients underwent reoperation in the first 3 months after their primary operation to replace broken hardware. During the follow-up period cancer progression was observed in four of the eight patients, three of whom died. We present one of the cases:

Patient 4

A 31 year old man had squamous cell carcinoma of the anterior floor of the mouth with bone invasion [Figure 1A]. After resection of the anterior floor of mouth including the bone (the resected specimen, Figure 1B], the surgical defect [Figure 2] was reconstructed using an osteocutaneous free fibula flap. At 2 weeks after the operation there was a good functional and esthetic outcome [Figure 3]. The patient suffered neck recurrence 6 months after the operation.

Discussion

The use of free bone flaps for mandible reconstruction has the obvious advantage of being a well-vascularized tissue that is durable to infection and radiation. The fibula, although not the ideal source for bone volume, is still sufficient for dental rehabilitation with implants [15]. The fibula is nourished by the peroneal vessels, which are large (2–4 mm in diameter) and convenient for micro-anastomosis. It is relatively easily shaped to the desired bone defect. Its skin paddle can replace intra-oral lining, skin or both [13]. The skin paddle is usually reliable [16], although some reports have questioned this clinical observation [17]. The donor site complication is a serious problem when planning free tissue transfer. According to the cumulated experience gathered from free fibula transfers done in the last decade, no compromise in lower limb function was observed [18].

In summary, the fibula flap appears to be a safe and a reliable option for mandible reconstruction, with excellent versatility and minimal donor site morbidity. Surgical experience with this flap in the last decade favors it as the first choice for the majority of mandible reconstruction cases.

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