Journal of Cranio-Maxillofacial Surgery (2003) **31**, 296–298

doi:10.1016/S1010-5182(03)00041-6, available online at http://www.sciencedirect.com

Fibula microvascular free tissue reconstruction of the severely comminuted atrophic mandible fracture — case report

Michael F. Zide[1], Yadranko Ducic[2,3]

[1] Department of Oral and Maxillofacial Surgery, University of Texas Southwestern Medical Center in Dallas, TX, USA; [2] Department of Otolaryngology-Head and Neck Surgery, University of Texas Southwestern Medical Center in Dallas, TX, USA; [3] Division of Otolaryngology and Facial Plastic Surgery, John Peter Smith Hospital, Fort Worth, TX, USA

SUMMARY. **Severely atrophic comminuted fractures of the mandible often have inadequate bone stock available to allow for adequate rigid fixation and subsequent progression to union. Grafting with rib, iliac crest or a variety of allograft materials is required in order to increase the success rate of the repair in this patient population. In this article, we report our favourable experience in using a fibula microvascular free tissue transfer for the treatment of a particularly challenging patient with a fractured atrophic mandible. Secondary implant rehabilitation completed the reconstruction. This method may represent an alternative in the treatment of fractures of the severely atrophic mandible in select individuals. © 2003 European Association for Cranio-Maxillofacial Surgery.**

INTRODUCTION

Facial fractures in edentulous patients comprise approximately 5% of all fractures of the maxillofacial skeleton (*Zacharaides* et al., 1984). A progressive decrease in bone density is noted with aging. Cancellous bone is especially affected, with loss of trabeculae decreasing tensile strength and predisposing these patients to fractures. Edentulous patients experience an even more dramatic resorption of alveolar bone, leading to significant atrophy. Thus, it is not surprising that in the elderly, mandibular fractures are more often multiple, with a predilection for the body and angle regions (*Thaller*, 1993). A more conservative approach to this patient population is generally recommended, as even displaced fractures may be treated without surgical intervention if the functional disturbance is minimal. Any resultant minor occlusal changes in the edentulous patient may be overcome by prosthetic measures rather than any surgical intervention.

The aging process is also associated with narrowing and occlusion of the inferior alveolar artery (*Scott*, 1997), and an increased incidence of medically compromising conditions (diabetes mellitus, chronic obstructive pulmonary disease, atherosclerosis, usage of systemic steroids; *Pogrel* et al., 1987). Many of these factors contribute to an increased potential for delay or impairment of wound healing, leading to a non-union rate as high as 20% in fractures of the edentulous mandible irrespective of whether open or closed treatment techniques were applied (*Bruce* and *Strachen*, 1976).

In this article, we described our favourable experience with the use of a fibula microvascular free tissue transfer for the treatment of a severely comminuted atrophic mandibular fracture in an elderly edentulous patient.

CASE REPORT

A 74-year-old edentulous otherwise healthy Caucasian female suffered a comminuted mandibular body fracture following a fall at home (Fig. 1). The mandible was fractured in five places. Patient was noted to have anaesthesia in the distribution of the inferior alveolar nerve bilaterally.

Initially, she was treated at another institution with extraoral pin fixation technique but 12-weeks later there still was mobility of the fractured segments and a non-union. In addition, she had lost approximately 20 lb of weight secondary to poor oral intake and reactive depression regarding her condition. Therefore, a fibula vascularized free tissue transfer augmentation of her mandible was planned. Her fracture was broadly exposed via an external lip-splitting approach. Multiple non-healing mandibular body fragments were noted and preserved. A locking reconstruction plate (Stryker-Leibinger, Kalamazoo, Michigan) was adapted to the patient's mandible along the ascending ramus bilaterally. A right fibula osteomyocutaneous flap based on the peroneal artery and its venae comitantes was harvested. The fibular bone was rigidly fixed to the preadapted mandibular plate with 2.7 mm screws (two screws per osteotomized segment) and fixed semi-rigidly atop the native mandible.

Microvascular anastomosis was completed between the facial artery and peroneal artery, and the facial vein and one of the venae comitantes. Patient resumed oral intake on the fifth postoperative day.

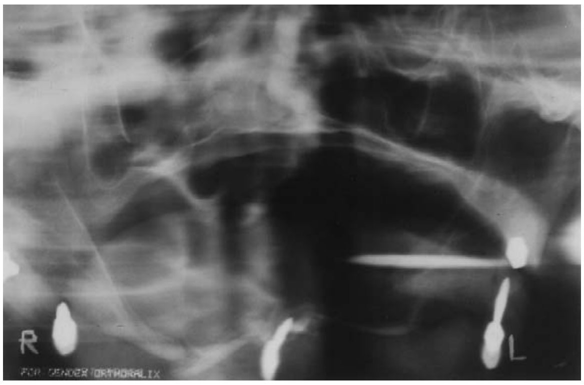

Fig. 1 – Pre-op panorex of patient with comminuted fracture of the atrophic mandible demonstrating non-union across multiple fracture sites with external fixator pins in position.

Fig. 2 – Postoperative X-ray demonstrating adequate contour following fibula free flap augmentation. Reconstruction plate and implants are in situ.

Her postoperative healing was uneventful, with a reasonable aesthetic and functional outcome having been achieved.

Approximately 1 year later, the patient returned for dental implants which were placed through the fibula and oriented to the upper denture. Abutment cylinders were placed on the implant heads through the soft tissue of the free flap. Four and one half months later the hybrid fixed prosthesis was seated without difficulty, enabling a full masticatory load (Figs. 2 and 3).

Fig. 3 – Postoperative result demonstrating adequate interincisal opening and reasonable restoration of the anterolateral mandibular arch.

DISCUSSION

Both difficulty and controversy surround treatment of the severely atrophic comminuted mandible fracture in the elderly edentulous patient (*Barber*, 2001; *Marciani*, 2001). Often, closed reduction techniques in conjunction with the limited masticatory load provided by a soft diet, will result in favourable outcomes in a number of these patients. Medical support for this limited therapeutic approach may be found in the elevated risk factors of the elderly, with anaesthesia morbidity at four times normal (*Jones*, 1989).

Various methods of treatment of this difficult patient population have been utilized including circumferential wiring with or without the adjunctive splinting provided by the patient's dentures or a fabricated Gunning splint, external pin fixation and open reduction with internal fixation (*Luhr* et al., 1996). Maxillomandibular wiring is poorly tolerated in elderly individuals due to potential compromise in already diminished respiratory functioning, and exacerbation of the pre-existing degenerative changes within the temporomandibular joint with prolonged immobilization. If there is not adequate osseous contact between the fragments after closed reduction or if such contact would not be reasonably expected, then open reduction and internal fixation is necessary. "Supra"periosteal plate placement via an external approach is often recommended (but more commonly fixated subperiosteally, in our experience) in order to preserve the dominant periosteal blood supply in this patient population. If there is inadequate bone stock present anterolaterally to accept plate osteosynthesis, then consideration may be given to free bone grafting (*Stoelinga* et al., 1986).

This would presumably improve fracture stability and healing, ameliorating the potential for post-treatment denture rehabilitation or dental implant placement by providing adequate alveolar ridge augmentation and bone stock (*Obwegeser* and *Sailer*, 1973; *Fazil* et al., 1986; *Quinn* et al., 1992).

Free bone grafting will often allow osseous healing to occur across any continuity gaps. In addition, it will often restore some alveolar ridge height to facilitate denture retention. Fibula microvascular free tissue transfer represents a good alternative with excellent predictable outcomes. In addition to providing adequate bone stock for primary or secondary implant placement, one may also harvest a cutaneous paddle to facilitate increase in the soft tissue coverage intraorally to coincide with an increase in osseous bulk deep to the alveolar ridge.

The second Chalmers J. Lyons investigation concluded that open reduction with large bone plate fixation may lead to improved results (*Bruce* and *Ellis*, 1993).

In the case of fracture of the atrophic edentulous mandible, grafting may be immediate or delayed. A delayed grafting technique is advantageous in three ways: (1) it allows the patient to recover from the acute traumatic event, (2) it allows the patient to focus on clearly explained advantages and disadvantages of methodology, and (3) it allows for intraoral tissue healing so that non-vascular grafts will not be contaminated by oral bacteria.

We feel that fibula microvascular free tissue transfer may represent an alternative in the treatment of such fractures. Fibula free flap is a large enough procedure to be considered as an isolated technique. Hence contemplation of this method should be discussed at the initial hospital visit. If the patient's injuries are solitary then a free flap might, indeed, be an option. Although dental implants may be placed at the same time as a free flap, there are several reasons not to do so. Firstly, orientation of implant position may be difficult. Secondly, implants may interfere with stabilization screws placed to hold the free flap adjacent to the reconstruction plate. Lastly, flap viability has not been assured, so implant dissection surgery may compromise the procedure. In this case the wait was close to one year, but it is felt now that a wait of 3 months would be acceptable. After incising directly through the middle of the cutaneous paddle of the free flap, dental implants may be oriented toward an upper denture and secured, without countersinking. In this case, standard Brånemark abutments were torqued to 20 N after the implants themselves were seated to 40 N. There are no plans to remove the reconstruction plate at this time. If removal is warranted, because of palpability or protuberance of the chin, we would be inclined to do so without concern a few months after implant loading. Stress shielding will reduce the diffuse cortication commonly associated with fixed implant prosthetics.

CONCLUSION

Fibula microvascular free tissue transfer provides a large amount of vascularized bone to allow for rigid fixation, progression to union and implant rehabilitation in the severely atrophic comminuted fracture. It appears to represent a treatment alternative in select individuals.

References

Barber HD: Conservative management of the fractured atrophic edentulous mandible. J Oral Maxillofac Surg 59: 789–791, 2001

Bruce R, Strachen D: Fracture of the edentulous mandible. J Oral Surg 34: 973–979, 1976

Bruce RA, Ellis E: The second Chalmers J. Lyons Academy Study of fractures of the edentulous mandible. J Oral Maxillofac Surg 51: 904–908, 1993

Fazil M, van der Dussen FM, van Wass MA: Long-term results of augmentation of the atrophic mandible. Int J Oral Maxillofac Surg 15: 513–520, 1986

Jones RL: Anesthesia risk in the geriatric patient. In: McLeskey CH (ed.), Perioperative Geriatrics: Problems in Anesthesia, vol. 3. Philadelphia, PA: Lippincott, 1989; 529

Luhr H, Reidick T, Merten H: Results of treatment of fractures of the atrophic edentulous mandible by compression plating. J Oral Maxillofac Surg 54: 250–254, 1996

Marciani RD: Invasive management of the fractured atrophic edentulous mandible. J Oral Maxillofac Surg 59: 792–795, 2001

Obwegeser H, Sailer H: Another way of treating fractures of the atrophic mandible. J Maxillofac Surg 1: 213–221, 1973

Pogrel MA, Dodson T, Tom W: Arteriographic patency of the inferior alveolar artery and its relevance to alveolar atrophy. J Oral Maxillofac Surg 45: 767–769, 1987

Quinn PD, Kent K, Macafee KA II: Reconstructing the atrophic mandible with inferior border grafting and implants: a preliminary report. Int J Oral Maxillofac Implants. 7: 87–93, 1992

Scott RF: Oral, maxillofacial trauma in the geriatric patient. In: Fonseca RJ, Walker RV, Betts NJ (eds.), Oral and Maxillofacial Trauma, vol.2. Philadelphia PA: Saunders, 1997; 1045–1072

Stoelinga PJ, Blijdorp PA, Ross RR, De Koomen HA, Huybers TJ: Augmentation of the atrophic mandible with interposed bone grafts and particulate hyproxylapatite. J Oral Maxillofac Surg 44: 353–360, 1986

Thaller SR: Fracture of the edentulous mandible: a retrospective review. J Craniofac Surg 4: 91–94, 1993

Zacharaides N, Papavassiliou D, Triantafyllou D: Fractures of the facial skeleton in the edentulous patient. J Maxillofac Surg 12: 262–266, 1984

Y. Ducic, MD, FRCS(C), FACS
Director, Otolaryngology and Facial Plastic Surgery
John Peter Smith Hospital
1500 South Main Street, Fort Worth, TX 76104, USA.
Fax: +1 817 927 1605
E-mail: yducic@aol.com

Paper received 9 September 2002
Accepted 16 May 2003