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CASE REPORT

Reconstruction of metatarsal bone defects with a free fibular osteomyocutaneous flap incorporating soleus muscle

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Summary Severe traumatic bone and soft-tissue defects are often treated by lower leg amputation. The amputation level becomes a very important factor with respect to the patient's basic daily activities. We report the case of a 51-year-old man who was referred to us with severe traumatic metatarsal bone and dorsum pedis skin and soft-tissue defects. To avoid amputation, a free fibular osteomyocutaneous flap incorporating the soleus muscle was used to reconstruct the second and third metatarsal bones and the soft-tissue defect, respectively. Now, 2 years after the procedure, the patient is able to walk independently. To the best of our knowledge, this is the first report of use of such a composite transfer for a complex midfoot defect.

High-energy midfoot trauma frequently results in serious defects of the metatarsal bones and dorsal soft tissue. The lack of local skin and muscle providing ample blood supply render the midfoot easily susceptible to soft-tissue infection and to osteomyelitis. The midfoot plays a key role in foot function, so reconstruction rather than amputation is important to patients' basic daily activities. The advent of micro-vascular free tissue transfer allowing for definitive reconstruction of soft tissue and bone defects has dramatically improved the lower extremity salvage rate.

The fibula, with its excellent medullar and periosteal blood supply, provides the longest bone segment available for harvest as a free flap. Originally, the main drawback of fibular transfer was the lack of soft-tissue coverage. In 1982, Baudet et al. proposed a composite osteomuscular free fibula and soleus transfer.[1] We describe successful

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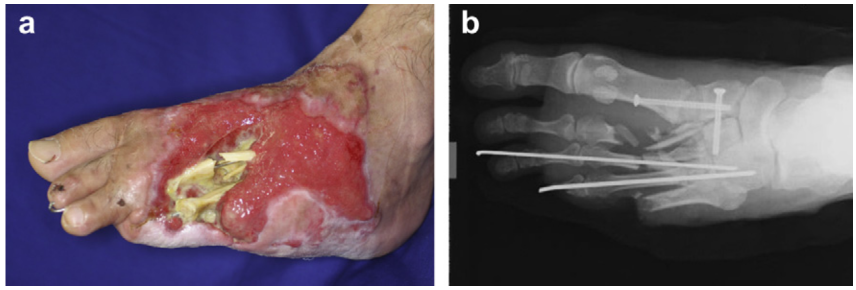

Figure 1 Appearance of the foot 2 months after injury. (a) Upon visual inspection, exposure of the third and fourth metatarsals and amputation of the fourth and fifth toes were observed. (b) Upon radiographic examination, fracture of the second and third metatarsals was observed, and the bones appeared fragmented.

reconstruction of metatarsal and midfoot soft-tissue defects with a free osteomyocutaneous flap consisting of fibular bone segments, a skin paddle and soleus muscle segment. To the best of our knowledge, this is the first report of such a flap for a complex midfoot defect.

Case report

The patient was a 51-year-old man who had suffered a work-related high-energy left leg injury. Debridement of injured soft tissue, amputation of the fourth and fifth toes and fixation of the tarsometatarsal joints were performed at another hospital, and the patient was referred to us for reconstruction of his left foot 2 months after the injury. The third and fourth metatarsals were exposed, the second and third metatarsals were fractured and a large soft-tissue defect was observed (Figure 1). *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus* (MRSA) were detected at the ulcer. We planned left foot reconstruction with a fibular osteomyocutaneous flap using the soleus muscle to preserve walking function.

During surgery, the second, third and fourth metatarsals were resected. The composite flap was elevated from the left (injured) leg. We found two perforators for the skin flap. One, the distal skin perforator, was contained in the lateral intermuscular septum of the lower leg, as expected. The other, the proximal skin perforator, branched from the vascular pedicle to the soleus muscle. A 5 × 10-cm segment of the soleus muscle was elevated with the fibular osteocutaneous flap. The fibula (11.5 cm in length) was sectioned into two segments (4.5 and 7 cm), leaving the peroneal artery intact (Figure 2). The two bone segments were grafted into the second and third metatarsal bone defects to preserve the second and third toes. The short segment of the fibula was fixed between the residual second metatarsal distally and the intermediate cuneiform proximally. The long segment was fixed between the third proximal phalanx distally and the lateral cuneiform proximally. Bone fixation was performed with Kirschner wires and titanium plates. Vascularised soleus muscle was used to fill dead space in the dorsal area, and the muscle was then covered with a skin graft from the thigh and the originally elevated skin flap. We dissected the anterior tibial artery at the ankle joint, but we could not confirm active bleeding at this point because the artery had been damaged by the injury. Thus, we further dissected the anterior tibial artery 7 cm proximally until we were able to see active bleeding. Arterial end-to-end bypass grafting (use of vein grafts as pedicle extenders) was performed at this site. One peroneal vein was anastomosed end-to-end to the anterior tibial vein and the other to the great saphenous vein. Antibiotics were administered after surgery: piperacillin sodium 1 g twice daily for 14 days and vancomycin hydrochloride 0.5 g twice daily for 7 days.

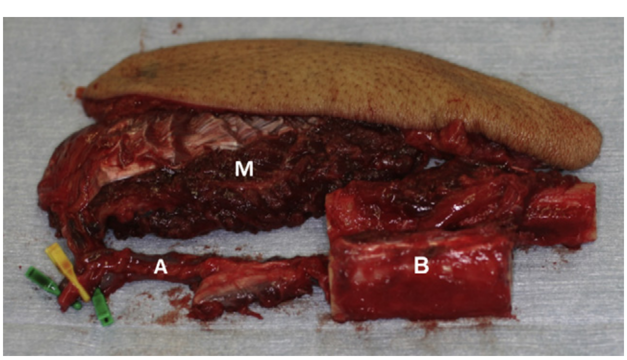

Figure 2 Fibular osteomyocutaneous flap incorporating soleus muscle. M: soleus muscle; A: peroneal artery; B: fibular bone.

Table 1 Range of motion of the ankle and metatarsophalangeal joints 2 years after surgery.

Joint	Left	Right
Ankle joint		
Flexion	45°	45°
Extension	5°	20°
Metatarsophalangeal joint		
1st toe		
Flexion	5°	35°
Extension	10°	60°
2nd toe		
Flexion	0°	35°
Extension	0°	40°
3rd toe		
Flexion	0°	35°
Extension	0°	40°