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Reconstruction of Traumatic Composite Tissue Defect of Medial Longitudinal Arch With Free Osteocutaneous Fibular Graft

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ABSTRACT

A 34-year-old male sustained a crush injury resulting in bone and soft tissue loss along the medial longitudinal arch of his left foot. Specifically, the injury resulted in loss of first metatarsal without injury to the medial cuneiform or proximal phalanx, fracture of the third metatarsal, and a 5-cm × 9-cm soft tissue defect overlying the dorsomedial aspect of the right foot. After debridement and daily wound care, the defect was subsequently reconstructed using a free osteocutaneous fibular graft. Approximately 6 months after reconstructive surgery, the patient returned to his job without pain, and his pedogram showed almost equal weightbearing distribution on both feet.

The medial longitudinal arch is composed of the calcaneus, talus, navicular, 3 cuneiforms, and the first 3 metatarsals. It supports most of the weight of the erect body. Among the anatomic structures of the medial arch, the first metatarsal and first cuneiform constitute most of the first ray, which is important because it bears approximately one third, or more, of the weight of the body during the late stance and push-off stages of walking (1). Therefore, after tumor resection, the treatment of osteomyelitis, and the repair of traumatic injuries, reconstruction of the structural integrity of the first ray is particularly important for optimal function of the foot. In the present report, we describe the successful treatment of an adult male who had sustained an open, crush injury with substantial loss of the first metatarsal and underwent reconstruction with a free osteocutaneous fibular graft.

Case Report

A 34-year-old male laborer who had sustained a crush injury resulting in bone and soft tissue loss from his left foot presented to our emergency service. The physical examination and radiographs revealed focal loss of the first metatarsal without injury to the medial cuneiform or proximal phalanx and a minimally displaced fracture of third metatarsal. The wound was complicated by a 5-cm × 9-cm skin defect overlying the first metatarsal. The dorsalis pedis artery had been severed with segmental loss, although the deep peroneal nerve was intact. The arterial supply and venous circulation were grossly adequate throughout the foot, including to the hallux. Initially, using general anesthesia, the patient underwent debridement of the necrotic soft tissues and remnants of the first metatarsal. A Kirschner wire was interposed between the medial cuneiform and the proximal phalanx in an effort to preserve the length of the first ray during the period that wound care and supportive measures would be used to prepare the patient for a secondary procedure, at which time definitive reconstruction would be undertaken (Fig. 1). The patient was hospitalized and monitored, with daily irrigation and wound dressing changes. Gentamicin (2 × 80 mg intravenously) and cefazolin (3 × 1 g intravenously) were used for prophylaxis, and the definitive reconstruction procedure was performed on 10 days after the initial injury.

At the second surgery, an osteocutaneous free fibular graft was harvested from the ipsilateral extremity, procuring 10 cm of the fibula and an accompanying 10-cm × 6-cm skin paddle (Fig. 2). The graft did not contain soleus muscle. The cartilaginous joint surfaces of both the medial cuneiform and the proximal phalanx were resected, and receptacle tunnels of the appropriate diameter were created to incorporate the corresponding ends of the fibular bone graft. The fibular bone graft was interposed and secured to the medial cuneiform and proximal phalanx, respectively, using a one third semitubular plate with 2 locking screws (Fig. 3).

After securing the bone, an arterial microanastomosis was performed between the peroneal and tibialis anterior arteries. Venous

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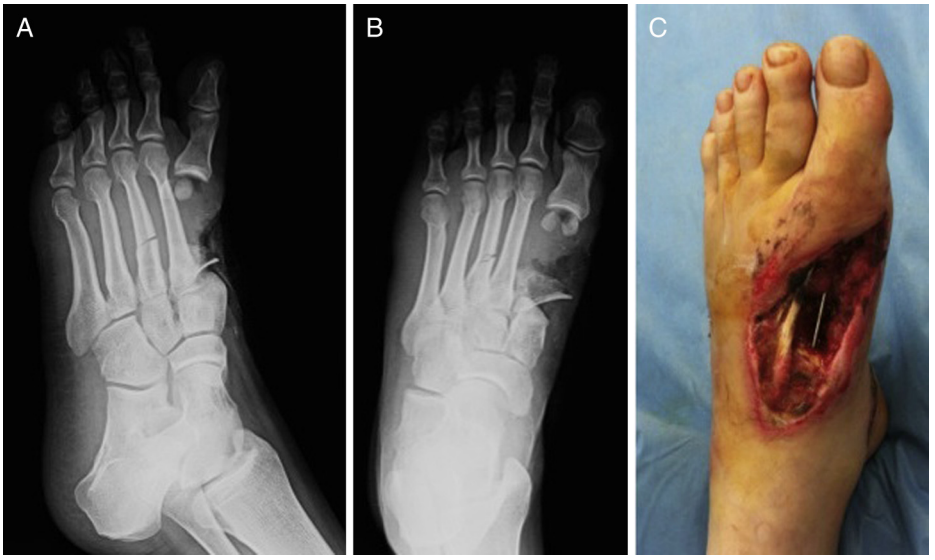

Fig. 1. Preoperative (*A*) oblique and (*B*) anteroposterior radiographs and (*C*) dorsal clinical view of the injured left foot after initial debridement and Kirschner wire fixation.

anastomosis was performed between satellite peroneal and saphenous veins. Because of the relatively large skin paddle and the edematous extremity due to the trauma, we covered the donor site with a split-thickness skin graft harvested from the anterolateral aspect of the ipsilateral thigh. The left foot recipient graft site also required some additional coverage, which was achieved with an additional split-thickness skin graft from the ipsilateral anterolateral thigh. The patient was discharged from the hospital on the tenth postoperative day, having recuperated and undergone dressing changes.

At no time during the postoperative period did we ever encounter any problem related to venous congestion, arterial occlusion, or skin paddle necrosis. The skin grafts of the donor and recipient sites healed uneventfully. Bony union at both ends of the fibular graft was detected at 8 weeks after surgery, after which, gradually increasing weightbearing was allowed. The patient returned to his job 6 months after reconstructive surgery. Pedobarographic analyses were performed at 6 and 13 months postoperatively. The first test showed little weightbearing through the first metatarsal head and excessive weightbearing throughout the lateral arch, indicative of antalgic guarding of the medial column. By the second pedobarographic analysis, the weightbearing distribution had improved such that the distribution of the left foot appeared similar to that of the right (uninjured) foot (Fig. 4). During the follow-up period, the reconstruction remained uncomplicated, and the patient was satisfied with the results of the surgery (Figs. 5 and 6). After a 13-month follow-up period, the patient's overall satisfaction was scored as 95.2 points using the foot and ankle disability index (2).

Discussion

The arrangement of the bones of the foot form the medial, lateral, and transverse pedal arches, which share the weight of the body

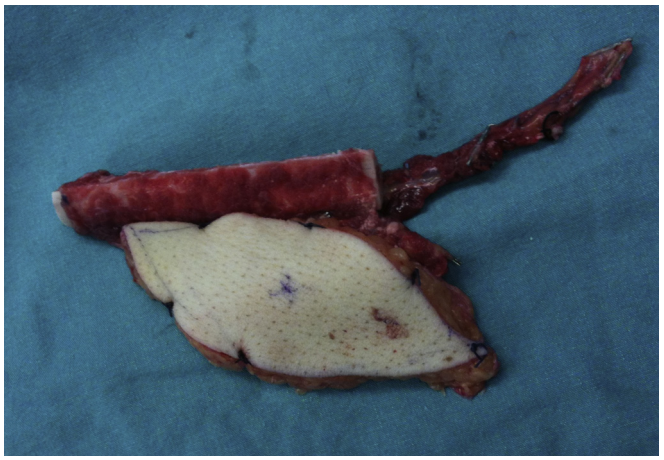

Fig. 2. The osteocutaneous flap after harvest and before transplantation.

Fig. 3. The appearance of the foot after graft transplantation and internal fixation.