The Journal of Foot & Ankle Surgery 55 (2016) 263–266

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Management of Composite Tissue Defect of the Midfoot With a Free Anterolateral Thigh Flap and Iliac Bone Graft: A Case Report

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:
ALT fasciocutaneous flap
bone reconstructive surgery
bone scintigraphy
vacuum-assisted closure

ABSTRACT

Composite tissue defects of the midfoot with extensive bone and soft tissue loss represent a unique challenge because they can lead to primary amputation if not reconstructed. One should repair both the bone structure and the soft tissue to obtain satisfactory foot function for basic daily activities. In the present study, we report on a case in which we successfully reconstructed an extensive midfoot defect with iliac bone grafts for metatarsal reconstruction and an anterolateral thigh flap for soft tissue coverage. This technique is a safe, reliable, and functional method, offering single-stage reconstruction compared with other microsurgical techniques used for such defects.

Reconstruction of composite tissue defects due to severe trauma to the midfoot has been a challenging task for reconstructive surgeons. Microsurgical options have been increasingly used to reconstruct extensive injuries of the foot that would otherwise have led to primary amputation (1–3).

Many protocols have been described to treat severe tissue defects of the midfoot, including early aggressive and sequential debridement of necrotic tissue, fracture stabilization, immediate soft tissue coverage with local muscle flaps or free muscle transfers (4–6), and staged skeletal reconstruction (7–11). For bony defect reconstruction, various techniques have been described, including direct nonvascularized cancellous bone grafts (12,13), open cancellous Papineau grafting (14), vascularized bone grafts (15,16), and bone transport using the Ilizarov bone lengthening technique (17).

However, the timing of bone grafting remains controversial, because early bone grafting relies on adequate debridement and the confidence that the soft issue coverage will provide adequate vascularity to support the bone graft (18). Many investigators believe it is better to achieve wound control before bone grafting to avoid the risk of losing the limited bone stock for grafting. In addition, some investigators believe that composite bone and soft tissue defects of the lower extremity can be managed simultaneously in a single-stage procedure (19–21).

In the present report, we describe the unusual case of a 30-year-old male patient who had sustained extensive soft tissue and bone injury to his foot and responded well to treatment using a single-stage free anterolateral thigh (ALT) flap combined with a bone graft harvested from the iliac crest.

Case Report

A 30-year-old male patient had been involved in a traffic accident that resulted in a left foot crush injury. He had lost most of the soft tissue over the dorsum of the foot (10 × 8 cm), including the distal one third of the second, third, and fourth metatarsal bones, with an average of 2 cm in length (Figs. 1 and 2). The overall condition of the patient was well, and he was fully conscious. The patient had presented to the emergency room about 8 hours after the injury, and his neurovascular status was intact. The patient was taken to the operating room, and thorough debridement and irrigation was performed. All the necrotic tissues and foreign bodies were removed until healthy and viable tissue was obtained. Next, vacuum-assisted closure was applied for 8 days after wound debridement in each sequence. On the 10th day after the injury, the patient was returned to the operating room, and we planned a free ALT fasciocutaneous flap for soft tissue coverage and an iliac bone graft for the bony defect in the same session.

A 1.5 × 2 × 6 cm of bone graft from the right anterior iliac crest was harvested and sectioned into 3 pieces vertically. The grafts were inserted into the defects at the second, third, and fourth metatarsophalangeal joints using Kirschner wires (Figs. 3 and 4). The ALT

Financial Disclosure: None reported.
Conflict of Interest: None reported.

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http://dx.doi.org/10.1053/j.jfas.2014.06.021

Fig. 1. Preoperative view of the foot.

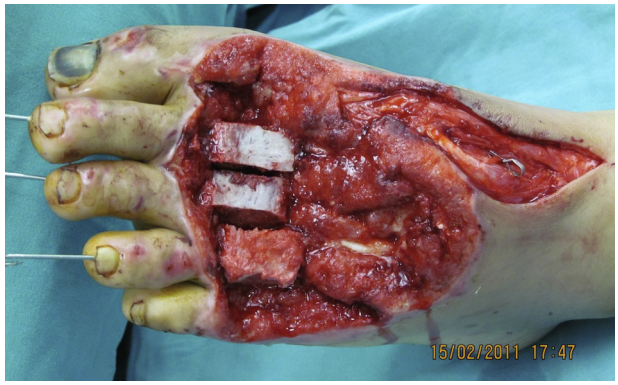

Fig. 3. Iliac bone grafts adapted to the metatarsal defects.

flap was elevated from the left (injured) thigh. A line was drawn between the anterior superior iliac spine and the midpoint of the lateral border on the patella. The location of the main perforators was detected using Doppler ultrasonography and was centered primarily at the midpoint of the line. The design of the skin paddle was centered over the 2 perforators. A pinch test was used to establish the size of the skin that could be harvested that would allow primary closure of the donor site. However, the required flap size to cover the defect was larger than the size that would allow primary closure. Next, a 12 × 10 cm of skin paddle was designed. Starting the incision on the medial border, meticulous dissection on the subfascial plane was performed until the descending branch of lateral circumflex femoral artery was visualized. The dissection of the perforators was continued toward the intermuscular septum between the rectus and vastus lateralis muscles (Fig. 5). The arterial anastomosis was performed in an end-to-end fashion to the anterior tibial artery at the ankle joint, followed by a vein anastomosis with the accompanying vein. Heparinized saline (100 U/mL) was used as a local irrigant, and an intravenous bolus of 80 U/kg was administered just before releasing the clamps.

The donor site was closed with a split-thickness skin graft, and a foot brace was applied to stabilize the ankle joint. During the postoperative period, the patient was instructed in the routine flap precautions, with strict leg elevation of the lower extremity above heart level to decrease the edema and avoid venous stasis.

The patient received dextran 40 at 20 mL/hr for 5 days, enoxaparin 0.4 mL/d for 3 weeks, and 100 mg of enteric-coated aspirin for 6 weeks. We observed no flap circulation problems, except for temporary congestion within the first 4 hours on the distal edge of the flap that healed spontaneously without any intervention (Fig. 6).

The patient was discharged from the hospital 10 days after the operation. The foot brace was kept for 5 weeks and weightbearing began at 12 weeks. The Kirschner wires were removed 6 months postoperatively after bone integration had been confirmed by plain radiography showing fusion of the metatarsophalangeal joints (Fig. 7). At the follow-up visit at 9 months, the patient was able to walk almost naturally despite the bulky soft tissue and fusion of the metatarsophalangeal and proximal interphalangeal joints that restricted the range of motion (Fig. 8). He had no signs of infection in the soft or osseous tissue, and bone scintigraphy revealed a viable bone graft on

Fig. 2. Plain radiograph of the foot taken in the emergency room.

Fig. 4. Postoperative plain radiograph of the foot at 1 month showing the bone grafts had adapted to the defects with the use of Kirschner wires.