Thumb Proximal Phalanx Reconstruction With Nonvascularized Corticocancellous Olecranon Bone Graft

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abstract

Large segmental bone defects of the phalanges reportedly have been treated with free vascularized grafts from the hand, foot, or knee, or with nonvascularized grafts from the iliac crest. A nonvascularized structural corticocancellous graft from a local site would be advantageous. The olecranon has been used as a source of both cancellous and corticocancellous graft. The authors describe a unique case of the use of nonvascularized corticocancellous olecranon bone graft for structural purposes in a mutilating thumb injury. The patient injured the left thumb with a miter saw, resulting in a large degloving wound over a severely comminuted fracture of the proximal phalanx, with segmental bone loss between a base fragment and displaced condylar fragments. Provisional pin fixation was performed at the time of initial emergent irrigation and debridement, along with repairs of the extensor pollicis longus, radial digital nerve, and dorsal digital nerve. This was followed 3 weeks later by nonvascularized corticocancellous bone grafting from the olecranon to the proximal phalanx under regional anesthesia. The thumb was mobilized at 11 weeks, and solid union was radiographically confirmed at 6 months. The patient achieved moderate active range of motion and was able to return to work as a physical therapist. The elbow healed uneventfully and without pain or fracture at the donor site. This case shows that robust structural bone graft for the phalanges may be obtained from the nearby olecranon, under regional anesthesia, without microsurgery, and with potential advantages over the iliac crest. [Orthopedics. 2015; 38(1):58-61].

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Large segmental bone defects of the proximal or middle phalanges reportedly have been treated with free vascularized grafts from the hand,\(^1\) foot,\(^2\) or medial femoral condyle,\(^3\) or with nonvascularized grafts from the iliac crest.\(^4\)-\(^6\) A nonvascularized structural corticocancellous graft from a local site would be advantageous. The olecranon has been used as a source of cancellous graft\(^7\) and recently was reported as a source of corticocancellous graft for the treatment of scaphoid nonunion.\(^8\) The author presents a case showing the successful use of nonvascularized structural corticocancellous olecranon bone graft for a severe thumb proximal phalanx defect. To the author’s knowledge, this is a unique description of the use of corticocancellous olecranon bone graft for structural purposes in the phalanges. The author obtained the patient’s informed written consent for print and electronic publication of this case report.

**CASE REPORT**

A 53-year-old female physical therapist injured the nondominant left thumb with a miter saw (electric circular saw on a pivoting arm). She was seen in the emergency department and was found to have a large dorsal degloving wound over the thumb proximal phalanx (Figure 1). The thumb tip was warm and well perfused. Radiographs showed a severe comminuted fracture of the thumb proximal phalanx with segmental bone loss, leaving a base fragment and displaced condylar fragments (Figure 2). The patient underwent emergent irrigation and debridement. Provisional fixation was performed with a longitudinal K-wire driven retrograde from the thumb tip through the phalanges, spanning the bone defect, and into the metacarpal head. The extensor pollicis longus, radial digital nerve, and dorsal digital nerve were repaired.

Three weeks later, the patient underwent bone grafting under regional anesthesia. The longitudinal K-wire was exchanged for a shorter K-wire, again spanning the bone defect, although without entering the metacarpal head, and a transverse K-wire was placed to secure the condylar fragments. Through a posterior longitudinal incision directly over the olecranon, a 10×15-mm rectangular corticocancellous graft was harvested with a sagittal saw and curved osteotomes (Figure 3A), as previously described.\(^8\) A groove was made in the cancellous portion with a small rongeur that allowed placement over the longitudinal K-wire with the cortical side facing dorsally (Figure 3B). The graft was seated with a bone tamp, and the periosteal tissues were sutured over the cortical bone. The longitudinal K-wire was buried to facilitate prolonged placement. The hand was placed in.
a forearm-based thumb spica cast, including the interphalangeal joint. The elbow was placed in a soft bulky dressing.

At 5 weeks, the transverse K-wire was removed and the forearm-based thumb spica cast was changed to a hand-based thumb spica cast. At 11 weeks, the buried longitudinal K-wire was removed and the cast was changed to a thermoplastic hand-based thumb spica orthosis. Active range of motion exercises were initiated. At 15 weeks, computed tomography scan showed bony bridging at both ends of the graft. At 6 months, radiographs showed solid bony union (Figure 4). The patient had moderate active extension and flexion of the metacarpophalangeal and interphalangeal joints. She was able to reach the thumb tip to the small finger metacarpophalangeal joint crease. Overall function was very good, with a QuickDASH score of 18, and the orthosis was discontinued. Telephone follow-up at 8 months showed that the patient had returned to work as a physical therapist. The elbow healed uneventfully and without donor site pain.

**DISCUSSION**

For large segmental bone defects in a viable digit, structural bone graft may be needed. Saalabian et al described the use of a free vascularized bone graft from the second metacarpal bone to treat an open middle phalanx fracture, and del Piñal et al reported 8 cases of the use of free vascularized grafts from the toes to reconstruct bony defects of the fingers, mostly after debridement for osteomyelitis. Iorio et al described use of the medial femoral condyle after trauma to a proximal phalanx. However, these techniques require microsurgical expertise, which may not be readily available.

Nonvascularized iliac crest has been used successfully for structural purposes in the phalanges. Sabapathy et al reported a series of 20 injured digits, mostly involving the proximal and middle phalanges, treated with these grafts and combined with abdominal flap coverage. Barron et al treated 2 middle phalanges after acute trauma, and Chalidis and Dimitriou treated a proximal and middle phalanx with disappearing bone disease. However, iliac crest bone graft requires separate preparation and violation of a distant site and also risks complications, including prolonged donor site pain, lateral femoral cutaneous nerve injury, avulsion fracture of the anterior-superior iliac spine, and hernia.

A nonvascularized structural bone graft within the same extremity as the injury would be advantageous, allowing use of a single surgical field and regional anesthesia. Although the distal radius could be used, it might be within the zone of injury or might affect immobilization and rehabilitation of the injured digits. The olecranon has been used as a source of cancellous graft, with less pain and equal volume compared with the iliac crest. The olecranon also has been used for “tubular” (ie, shaped) cancellous graft for distal phalanx nonunion. Corticocancellous olecranon bone graft was recently reported for the treatment of scaphoid nonunion in 21 patients. Nineteen healed by 3 months, and 2 nonunions occurred. The authors reported less pain and greater mobility compared with their experience with the iliac crest. Potential complications, such as hematoma, olecranon fracture, or pain from resting on the elbow, were not encountered in this series and did not occur in the current case. The author recommends avoiding this procedure in patients with osteoporosis.

**CONCLUSION**

For large segmental bone defects of the phalanges, the current case shows that nonvascularized structural corticocancellous bone grafting may be performed with the nearby olecranon under regional anesthesia, without microsurgery and with potential advantages over the iliac crest.
Further study of the use of this type of graft is warranted.

REFERENCES


