We report the case of a 26 year-old right-handed butcher who sustained near-total amputation of his right index finger when he slipped while cutting pork chops. Physical examination showed an open fracture of the proximal phalanx, with compromised vascularity of the digit. Radiography confirmed a mildly comminuted, displaced fracture through the proximal phalanx of the index finger (Fig. 1). At surgical exploration, the radial and ulnar digital arteries and nerves were found to be lacerated, as were the flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) tendons. In addition, the A2 pulley was torn.

The ends of the lacerated flexor tendons were identified. Distally, the tendons had retracted beneath the distal extent of the A4 pulley and could not be pulled into the wound to

![Figure 1. 26-year-old male with injury to the hand from cutting meat. Lateral and oblique radiograph of the right index finger demonstrates partial amputation of the digit through the proximal phalanx. Displaced oblique fracture through the proximal phalanx and soft tissue defect are noted.](image)
allow primary repair. Further dissection distally to free the
tendons was avoided because of concern for the viability of
the distal soft tissues of the finger. The decision was made
to pursue a staged flexor tendon reconstruction.

The proximal phalanx fracture was reduced and fixed
with Kirschner wires (K-wires). The ulnar and radial arter-
ies and digital nerves were directly repaired. A 4-mm
Hunter rod was passed under the A4, A2, and A1 pulleys of
the finger. The rod was secured to the tendon stump distally
and left free proximally. The A2 pulley was repaired. The
proximal FDP and FDS tendon stumps were debrided.

Postoperative radiographs demonstrate K-wires spanning
the reduced phalanx fracture (Fig. 2). The Hunter tendon
rod is visualized as a uniform-caliber rod along the palmar
aspect of the finger that is slightly denser than adjacent soft
tissue. The rod passes from the palm across the metacar-
phalangeal joint and distally across the distal interphalan-
geal joint along the expected course of the flexor tendon
sheath.

The patient subsequently developed reduced motion of
the injured digit despite rigorous hand physical therapy. He
then underwent a second stage of surgical treatment, but
unfortunately he progressively lost range of motion and
function in the digit and eventually required amputation.

Discussion
Severe tendon injuries and partial amputations of the
fingers can result in significant functional impairment. One
procedure for salvaging fingers with tendon injuries is
staged flexor tendon and pulley reconstruction as described
by Hunter (1). Indications for this procedure include scar-
ing of the tendon bed such that primary repair is contra-
dindicated, extensive damage of the tendon sheath, and fail-
ure of primary repair (2). Best results are achieved in pa-
tients who are motivated to actively participate in hand
therapy to preserve motion, and in the absence of infection,
muscle paralysis, and contractures (3).

During the first stage of reconstruction, the flexor pulley
system is repaired. A reinforced silicone passive tendon
implant, often called a Hunter tendon rod, is placed along
the expected course of the injured flexor tendon sheath to
courage formation of a new pseudotendon sheath
around the implant. Repair of injuries to the flexor tendon
pulleys, particularly the A2 and A4 pulleys, is vital to pre-
serving flexor function of the finger. These pulleys maintain
the tendon in proper position to adequately transmit forces
from the flexor muscles of the forearm to the bones of the
finger.

The temporary implant is secured only at the distal end,
often to the FDP tendon stump, to allow passive movement
of the digit. The proximal portion ends in the palm or dis-
tal forearm, up to several cm above the wrist crease. The
distal portion is fixed, but the proximal portion should glide
freely with movement of the digit with a range of motion of
3-4 cm at the proximal end (1). This allows for hand ther-
apy, with the goal of preserving or improving range of mo-
tion in the interim between the first and second stages of
the procedure.

During the second stage of tendon repair, at least three
months later (3, 4), the implant is removed and replaced
with a tendon graft. Active patient involvement in rehabili-
tation is vital to the success of this operation.

The passive tendon rod implant is a tube composed of
silicone elastomer that may be reinforced with polyester
mesh. The implant is available in diameters ranging from 2
to 6 mm, depending on the size of the planned final tendon
graft (3). The graft can be cut to length. The implant is
constructed of radiopaque material. The passive tendon
rod implant is FDA-approved for use during staged recon-
struction of the flexor tendons of the fingers, thumb, and
wrist. The device is approved as a temporary implant, to be
removed after 2 to 6 months.

Radiographs are obtained during the course of treatment
to monitor healing of fractures, and it is important to rec-
ognize the presence of the tendon rod implant. The Hunter
tendon rod is visible radiographically as a moderate-density
tube extending down the expected course of the flexor
tendon. The tendon rod implant may terminate in the palm or
forearm. There should be no buckling or discontinuity of
the rod. Particular attention should be paid to the proximal

Figure 2. 26-year-old male with injury to the hand from cut-
ting meat. Two views of the right index finger demonstrate
reduction and K-wire fixation of the oblique proximal pha-
lanx fracture. Silicon Hunter tendon rod (arrows) along the
volar surface of the index finger are best seen on the lateral
view.
and distal placement of the tendon rod, which latter should extend to the fingertip.

Complications of the first stage of the procedure include skin necrosis, infection, and synovitis. Radiographically evident complications include rod buckling, rupture of the distal end of the silicon implant, and rod migration (2, 4-6). Rod buckling can occur if the reconstructed pulleys are too tight, preventing smooth passage of the tendon rod (2). Rod migration occurs if the distal attachment fails, allowing the rod to migrate up the palm or forearm due to finger motion. If this happens, the rod can be found curled up in the palm or proximally displaced into the forearm, sometimes completely (4, 5). If the rod migrates too far proximally, it is no longer in a position to facilitate pseudotendon formation in the digit. In addition, it can be difficult to retrieve at the time of the second operation.

Patients are sometimes lost to followup between first and second stages (7), and the Hunter tendon rod implant can remain in place for some time. In fact, one case report describes a silicon tendon rod implant that was removed 25 years after insertion, after it eroded through the soft tissues of the finger tip (8). In these circumstances, it may be useful for the radiologist to properly identify the Hunter tendon rod if it is discovered on radiograph to evaluate as a foreign body.

Awareness of the purpose and radiographic appearance of silicon flexor tendon sheath implants in the repair of flexor tendon injuries is important to allow recognition of possible complications. This case report demonstrates the typical appearance of a Hunter tendon rod insert used in a patient with near amputation of the index finger and flexor tendon injury.

References
1. Hunter JM. Staged flexor tendon reconstruction. The Journal of Hand Surgery 1983; 8(5):789-93. [PubMed]
2. Soucacos PN, Beris AE, Malizos KN, Xenakis T, Trouliatos A, Soucacos PK. Two-stage treatment of flexor tendon ruptures: Silicon rod complications analyzed in 109 digits. Acta Orthop Scand Suppl 1997; Suppl 275:48-51. [PubMed]
3. Taras JS, Hankins SM, Mastella DJ. Staged flexor tendon and pulley reconstruction. 2 ed. Strickland JW, Graham T, editors. Philadelphia: Lippincott Williams & Wilkins; 2005.
4. Finsen V. Two-stage grafting of digital flexor tendons: A review of 43 patients after 3 to 15 years. Scand J Plast Reconstr Surg Hand Surg 2003; 37(3):159-62. [PubMed]
5. Wilson GR, Watson JS. Migration of silicone rods. J Hand Surg Br 1994;19(2):199-201. [PubMed]
6. Wehbé MA, Mawr B, Hunter JM, Schneider LH, Goodwyn BL. Two-stage flexor-tendon reconstruction. Ten-year experience. J Bone Joint Surg Am 1986;68(5):752-63. [PubMed]
7. Schneider LH. Staged flexor tendon reconstruction using the method of Hunter. Hand Clin 1982;1(1):109-20. [PubMed]
8. Basheer MH. Removal of a silicon rod 25 years after insertion for flexor tendon reconstruction. J Hand Surg Eur Vol 2007;32(5):591. [PubMed]