To our knowledge, no report has been published of a flexor tendon rupture as a result of a closed phalangeal fracture.

A 58-year-old woman with multiple medical comorbidities presented with a closed, apex volar fracture of her long finger proximal phalynx with clinically intact flexor digitorum profundus and superficialis tendons in zone 2 of the flexor tendon sheath. After 5 weeks of nonoperative treatment, the patient reported hearing a pop in her finger, and clinical findings suggested rupture of the flexor digitorum profundus and superficialis tendons. Intraoperatively, the nonreparable attritional rupture was underneath the A2 pulley. A bony prominence in the tendon sheath floor from the healed phalynx fracture made rerupture a concern with a tendon graft. A Hunter Active Tendon Implant (Wright Medical Technology, Inc, Arlington, Tennessee) was used to reconstruct the flexor digitorum profundus tendon to avoid a second procedure. The patient progressed well and had regained a functional arc of active finger range of motion by 2 months postoperatively.

The Hunter Active Tendon Implant provided a suitable alternative to a 2-staged procedure, with the added benefit that a good tendon bed was developed in the event that a second procedure was needed.
Delayed flexor tendon rupture is associated with many fracture types and their associated treatments.1,4 A report has been published of acute extensor tendon rupture associated with a closed phalangeal fracture.4 To our knowledge, no report has been published of a flexor tendon rupture as a complication of a closed phalangeal fracture. This article describes a case of a closed phalangeal fracture that led to a delayed rupture of the flexor digitorum profundus and superficialis tendons in zone 2 of the flexor tendon sheath. Single-staged tendon reconstruction using a Hunter Active Tendon Implant (Wright Medical Technology, Inc, Arlington, Tennessee) is an atypical treatment option.

Case Report

A 58-year-old right-hand-dominant woman with multiple medical comorbidities presented to the emergency room after hyperextending her right middle finger at the metacarpophalangeal joint while falling. She reported pain and swelling localized to the base of the injured finger. Radiographs revealed an apex volar angulated fracture of the proximal phalanx (Figure 1). On initial presentation, she was fully neurovascularly intact and her flexor digitorum profundus and superficialis tendons were intact. After a digital block, closed reduction was performed, and a splint was placed.

The patient presented to the outpatient clinic 1 week after injury. Radiographs revealed persistent apex volar angulation at the fracture site. She demonstrated intact function of her flexor digitorum profundus and superficialis tendons. Nonoperative treatment of the fracture was selected because of her multiple medical conditions, including severe chronic obstructive pulmonary disease and diabetes mellitus type I. Her hand was casted for an additional month in an intrinsic plus posture, and tendon-gliding exercises for the exposed distal interphalangeal joints were started. At 1-month follow-up, she reported no pain to palpation of the fracture site, and the fracture appeared to be healing radiographically (Figure 2). She demonstrated adhesions of her flexor tendons and was referred to a hand therapist for removable splinting and tendon-gliding exercises.

One week after cast removal, she was unable to flex her middle finger after hearing a pop while holding a plate. Physical examination findings suggested rupture of the flexor digitorum profundus and superficialis tendons. Given the patient’s history, the rupture was likely attritional and would unlikely be amenable to primary repair.

The patient failed initial conservative management with buddy taping. Secondary to her chronic medical issues, general anesthesia was not a safe option for an elective case and, if possible, a staged procedure should be avoided. Instead, the patient underwent single-stage flexor digitorum superficialis tendon reconstruction with a palmaris longus tendon graft or with a synthetic tendon substitute depending on the condition of the flexor tendon sheath.

Intraoperatively, the site of the clinically healed fracture and flexor digitorum profundus and superficialis attritional ruptures was identified underneath the proximal portion of the A2 pulley (Figure 3). The healed fracture left a bony prominence in the floor of the tendon sheath that was the source of the tendon ruptures. Concern existed that friction from the bony prominence would make rerupture likely with a tendon graft; therefore, a synthetic tendon substitute was used instead.

To avoid a staged procedure, a Hunter Active Tendon Implant was used to reconstruct the flexor digitorum profundus tendon. The implant was secured to the distal phalanx with a 2.0-mm screw and augmented with suture repair to the remaining flexor digitorum profundus stump. The middle finger flexor digitorum profundus tendon in the forearm was used as the motor and to reestablish appropriate tension and finger posture (Figure 4).

Following reconstruction, appropriate long-finger gliding, motion, and posture were demonstrated intraoperatively.
Postoperatively, the patient was immobilized in a dorsal blocking splint for 1 week and then initiated into a rehabilitation program with passive flexion and early place and hold exercises. At 3 weeks postoperatively, she began unresisted active flexion, and splinting was initiated to address a proximal interphalangeal flexion contracture. Despite her admitted noncompliance with postoperative restrictions, she progressed well and was able to regain a functional arc of active finger range of motion by 2 months postoperatively (Figure 5), which was maintained at 1-year follow-up (Figure 6). She reported her satisfaction with her functional result at 1 year as good.

**DISCUSSION**

To our knowledge, no report has been published of a delayed flexor tendon rupture attributable to a phalangeal fracture. Other case reports have described attritional tendon rupture after closed fractures of other bones. These reports do not necessarily involve patients with inflammatory diseases or other preexisting conditions that compromise tendon integrity. Most reports attribute the rupture to the rough bony surface created by the fracture site. Although chronic steroids and diabetes mellitus type 1 may have played a role in our patient’s tendon rupture, the apex of the phalangeal fracture in the floor of the flexor sheath was likely responsible for the tendon ruptures. This case illustrates that tendon rupture should cause concern in a displaced phalangeal fracture. The treatment for an attritional rupture of this nature usually involves a correction of the bony protrusion followed by repair or reconstruction of the damaged tendon.

Active tendon implants for flexor tendon reconstruction with reasonable clinical results were first described by Hunter et al in 1988. In his initial protocol, active tendon implants were placed in the first stage of a 2-stage procedure to encourage the formation of a fluid-secreting pseudo-synovial sheath. Hunter et al suggested that the implant be left in place for 2 to 6 months to allow the development of a suitable tendon bed. The motion of the implant is critical in the development of a fluid-secreting microenvironment similar to the natural synovial lining of tendons. The developed tendon bed allows a tendon graft to be placed during the second procedure.
However, the second procedure is not always an option in chronically ill patients and other patient populations. Hunter et al’s initial study describing these results suggested that although the implant is not suitable for permanent implantation in younger patients, the implant can be considered permanent in appropriately selected elderly patients. After concerns related to the complication rates associated with the active implant were raised, the design was modified to a passive implant that was not connected to a motor in the forearm. This passive implant has become more popular for the first stage of tendon reconstruction. However, the active implant may still have a role as a tendon substitute in a select patient population.

**CONCLUSION**

Although our patient was 58 years old, a second elective surgery to complete the 2-staged reconstructive process presented too great a risk because of her multiple comorbidities. The use of the Hunter Active Tendon Implant provided a suitable alternative to a 2-staged procedure, with the added benefit that a good tendon bed was developed in the event that a second procedure was possible in the future.

**REFERENCES**