

Delayed Rupture of the Flexor Pollicis Longus Tendon After Routine Volar Placement of a T-Plate on the Distal Radius

Scott F. M. Duncan, MD, and Andrew J. Weiland, MD

The standard low-contact, volar-angled, T-shaped buttress plate (Synthes Ltd, Paoli, PA) is used widely in the treatment of distal radius fractures. The angle of this stainless steel plate is designed to fit the angle of volar inclination of the distal radius. This design and application have been in use throughout the world for more than 20 years. Previous reports of flexor pollicis longus (FPL) tendon ruptures after placement of this type of plate have been described in patients who were chronic steroid users.¹ We report the case of a delayed rupture of the FPL after routine placement of a volar-angled T-plate for a distal radius fracture. The rupture may have occurred because of failure to conform the plate to the distal radius anatomy or because of shortening of the fracture under the buttress end of the plate, which results in a metallic edge that can chafe against the FPL.

CASE REPORT

A right-hand-dominant woman in her late 70s had sustained an intra-articular volarly displaced distal radius fracture after a fall onto her outstretched right hand. She was treated at another institution with open reduction and internal fixation (ORIF) using a standard T-plate in a flexor carpi radialis sheath-splitting approach. Screws were not placed in the distal aspect of the T-plate, which formed a buttress against the distal fracture fragments. The patient did well for 9 months before returning to the original surgeon and health care institution because of difficulty flexing her thumb at the interphalangeal joint. This reduced range of motion (ROM) was diagnosed as stenosing tenosynovitis at the A1 pulley. The patient was offered a cortisone injection but declined it and opted instead for another operation. At the time of the second surgical procedure, however, the patient reportedly was found to have an FPL rupture.

Dr. Duncan is Assistant Professor of Orthopaedic Surgery, Mayo Clinic, Scottsdale, Arizona. He was Senior Clinical Associate in Orthopaedic Surgery, Weill Medical College of Cornell University, New York, New York, at the time the article was written.

Dr. Weiland is Professor of Orthopaedic Surgery, Department of Orthopedics, Hospital for Special Surgery, New York, New York.

Requests for reprints: Scott F. M. Duncan, MD, Mayo Clinic Hospital, 5777 E Mayo Blvd, Scottsdale, AZ 85054.

Am J Orthop. 2007;36(12):669-670. Copyright Quadrant HealthCom Inc. 2007. All rights reserved.

The patient then referred herself to our institution (Hospital for Special Surgery) for a second opinion about treatment options. Lack of a diagnosis of the FPL rupture after the first operation resulted in a 3-month delay to the time of the second operation. When the patient presented to our institution, she was 11 months out from the initial ORIF. On evaluation, she was noted to have a medical history that included ulcer, kidney stones, coronary artery disease, and breast cancer. She did not smoke or drink. Her only medication was verapamil (Verelan), 120 mg/d orally. She also took guar gum as a health supplement. On examination, she could not flex the interphalangeal joint. All other flexor and extensor tendons were intact, and she had no sensory deficit. The anterior interosseous nerve appeared to be functioning. The distal radius had united in a satisfactory position. However, lateral x-rays (Figure 1) showed a gap between the distal edge of the T-plate and the volar surface of the radius. Plate removal and tendon transfer were performed, although the patient had been hesitant initially about any further operations.

This surgical plan was carried out almost 1 year to the day of the patient's initial operation. The FPL was indeed found to be ruptured at the level of the distal edge of the T-plate, and the proximal end of the FPL had retracted. Synovitis existed around the distal aspect of the T-plate and the remaining flexor tendons. The distal aspect of the FPL was freely mobile and did not require tenolysis. The T-plate was removed and tenosynovectomy performed. The flexor digitorum superficialis tendon from the ring finger was transferred to the FPL at a point proximal to the A1

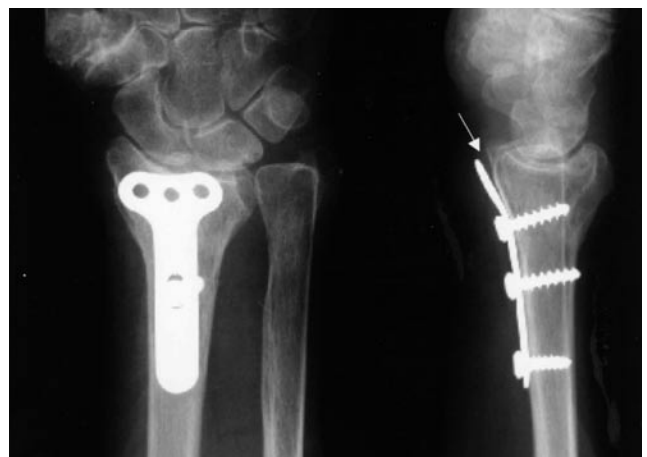


Figure 1. Anteroposterior (left) and lateral (right) x-rays of volar buttress plate over distal radius. Arrow (right) points to gap between plate and volar cortex.



Figure 2. Anteroposterior x-ray of distal radius after plate removal.

pulley. Histologic examination of the FPL rupture site revealed reactive hyperplasia of the synovium, which was consistent with surgical findings. The patient's postoperative course proceeded without incident. At her last follow-up examination—6 months after the surgical procedure at our institution and 18 months after her index procedure—the tendon transfer was not functioning well. Active ROM at the interphalangeal joint was 0° of extension and 10° of flexion. The tendon transfer appeared to be scarred, thus preventing optimal tendon excursion. Carpometacarpal and metacarpophalangeal ROM was

limited because of severe degenerative changes (Figure 2). The patient was offered tenolysis but declined.

DISCUSSION

This case report illustrates how plate placement at fixation may lead to tendon rupture that requires surgical correction. Bell and colleagues¹ described 3 cases in which the FPL ruptured over a T-plate in patients who were chronic steroid users. In another case report, an isolated FPL rupture was described as a complication after osteosynthesis of the distal radius using the T-plate.² Of other plates used volarly, the Ellis plate also has been reported to cause an FPL rupture.³ In some of these cases, the plate had been placed too far distally; in others, either the plate did not conform to the patient's anatomy, or subsequent fracture collapse resulted in plate prominence.

Although the T-plate conforms only roughly to the shape of the volar anatomy of the distal radius, it has been used successfully as a buttress. In contrast to numerous reported cases of extensor tendons rupturing from contact with dorsal plates,^{4,5} only a few reported cases have been caused by volar plates. In our patient's case, delayed rupture of the FPL was associated with pain occurring before loss of active interphalangeal joint flexion. This pain was probably caused by tenosynovitis of the FPL and flexor digitorum profundus tendons resulting from mechanical friction from the distal edge of the T-plate. However, possible iatrogenic injury during the index procedure may have been contributory. Basal joint or pantrapezial arthritis may also have contributed to tendon disruption (vis-à-vis Mannerfelt rupture).

The clinical diagnosis of FPL rupture should be considered in any patient with previous operations on the wrist, especially those involving hardware. The diagnostic differential includes trigger finger or anterior

interosseous nerve lesion. A clinical test that is useful in determining whether the FPL is intact involves compression of the muscle belly, which usually will result in interphalangeal joint flexion.

For a plate to be an effective buttress, it must hold the distal fracture fragment against an intact cortex. Mechanically, such a buttress works only inasmuch as it has a stable foundation for the distal fragment. Comminution at the fracture site—volar, dorsal, or both—prevents this structural support. Keating and colleagues⁶ showed that a volarly displaced fracture in an older patient may be associated with a dorsal cortex fracture and comminution. Thus, applying a plate as a buttress risks translating, or moving, the entire distal fragment dorsally. Our case illustrates this process; the x-rays clearly show both loss of normal volar inclination and loss of dorsal movement of the distal fragment, which highlight the problems with instability of the distal fragment unless both the plate and its screws capture the fragment. Should the implant be offset volarly, then the plate may be removed before tendon rupture.

New plate designs and treatment strategies emphasize the importance of distal fragment fixation to reduce the chance of fracture collapse. However, even with these new designs, precise hardware placement is necessary to avoid tendon rupture of the FPL. Plates should be placed proximal to the distal radius volar lip to recess their prominence. The pronator quadratus also should be repaired to cover the plate. These techniques can reduce the risk for volar tendon rupture.

A buttress plate will not prevent the collapse and shortening of a distal radius fracture like that which occurred in the case reported here. Furthermore, we recommend that the plate be covered with the pronator quadratus muscle to minimize any tendon impingement.⁷ If the distal edge of the plate is prominent, because of either fracture collapse or surgical misplacement, then the T-plate should be removed as soon as bony union is achieved.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

REFERENCES

- Bell JS, Wollstein R, Citron ND. Rupture of the flexor pollicis longus tendon: a complication of volar plating of the distal radius. *J Bone Joint Surg Br.* 1998;80(2):225-226.
- Lugger LJ, Pechlaner S. Tendon rupture as a complication after osteosynthesis of distal radius [in German]. *Unfallchirurgie.* 1984;10(5):266-270.
- Fuller DJ. The Ellis plate operation for Smith's fracture. *J Bone Joint Surg Br.* 1973;55(1):173-178.
- Kambouroglou GK, Axelrod TS. Complications of the AO/ASIF titanium distal radius plate system (pi plate) in internal fixation of the distal radius: a brief report. *J Hand Surg Am.* 1998;23(4):737-741.
- Ring D, Jupiter JB, Brennwald J, Büchler U, Hastings H II. Prospective multicenter trial of a plate for dorsal fixation of distal radius fractures. *J Hand Surg Am.* 1997;22(5):777-784.
- Keating JF, Court-Brown CM, McQueen MM. Internal fixation of volar-displaced distal radial fractures. *J Bone Joint Surg Br.* 1994;76(3):401-405.
- Fernandez DL, Jupiter JB. Surgical Techniques. In: Fernandez DL, Jupiter JB, eds. *Fractures of the Distal Radius: A Practical Approach to Management.* New York, NY: Springer-Verlag; 1996:67-102.