



T-Pin[®]

Fixation System
for Distal Radius & Distal Ulna Fractures

Surgical Technique

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The T-Pin®

Distal radius fractures are among the most common fractures treated by orthopaedic surgeons.

Numerous techniques and implants have been devised to stabilize these fractures.

The T-Pin® (Figure 1) is a novel instrument designed to stabilize extraarticular distal radius fractures utilizing minimal surgical dissection.

The T-Pin® allows for early active wrist range of motion promoting earlier return to functional activities.

This guide presents the instrumentation, the techniques of insertion and extraction, and postoperative care of the T-Pin® for the treatment of extraarticular distal radius and distal ulna fractures.

Historical Perspective

Fractures of the distal radius are one of the most common fractures treated by orthopedic surgeons. Owen stated that distal radius fractures represent 1 in 6 fractures in patients older than 50 years of age.¹ Various procedures and fixation techniques have evolved to treat this common fracture based on many considerations including the patient's:

- Age
- Bone quality
- Ability to tolerate the procedure
- Fracture type

Treatment modalities have included:

- Immobilization as originally described by Colles²
- Pins in plaster
- External fixation
- Percutaneous pinning with casting
- ORIF with a variety of different implants

Since Abraham Colles described the comminuted and displaced distal radius fracture in 1814, orthopedic surgeons have sought to stabilize the fracture after reduction³. Many fractures treated in plaster have a tendency to redisplace⁴. For this reason, percutaneous pinning evolved as a relatively simple fixation method for extraarticular fractures prone to redisplacement with cast treatment alone.

Various methods of pinning have been developed including:

- 2 pins placed through the radial styloid⁵
- 2 crossed pins; 1 pin inserted at the radial styloid just dorsal to the first extensor compartment and the second inserted on the dorsal ulnar aspect of the distal radius between the 4th and 5th extensor compartments^{3,6}
- 3 to 4 intrafocal pins within the fracture site⁷
- Transulnar oblique pinning in which a threaded wire is inserted in the distal ulna and passed obliquely through the distal ulna to the distal radius so that it engages the radial styloid fragment⁸
- 1 radial styloid pin and a second across the distal radioulnar joint⁹
- Multiple trans-ulnar to radius pins, including the distal radioulnar joint¹⁰

Despite improved maintenance of reduction with pinning, many of these series report 25 to 33% of patients having a significant loss of reduction. The T-Pin[®] is a new type of threaded pin designed specifically to treat acute distal radius fractures.^{11,12} Advantages include:

- Short operative time
- Relatively inexpensive
- Utility in patients with medical conditions for whom general anesthesia poses a risk
- Allowing early active wrist motion

The T-Pin[®] is threaded and affords better purchase of the fracture fragments than commonly used smooth pins.

Indications & Contraindications

Indications

- Unstable extraarticular dorsally displaced distal radius fracture.(Figures 2A,B)
- Displaced radial styloid fractures. (See Page 7)
- Displaced ulnar neck fractures. (See Page 9)

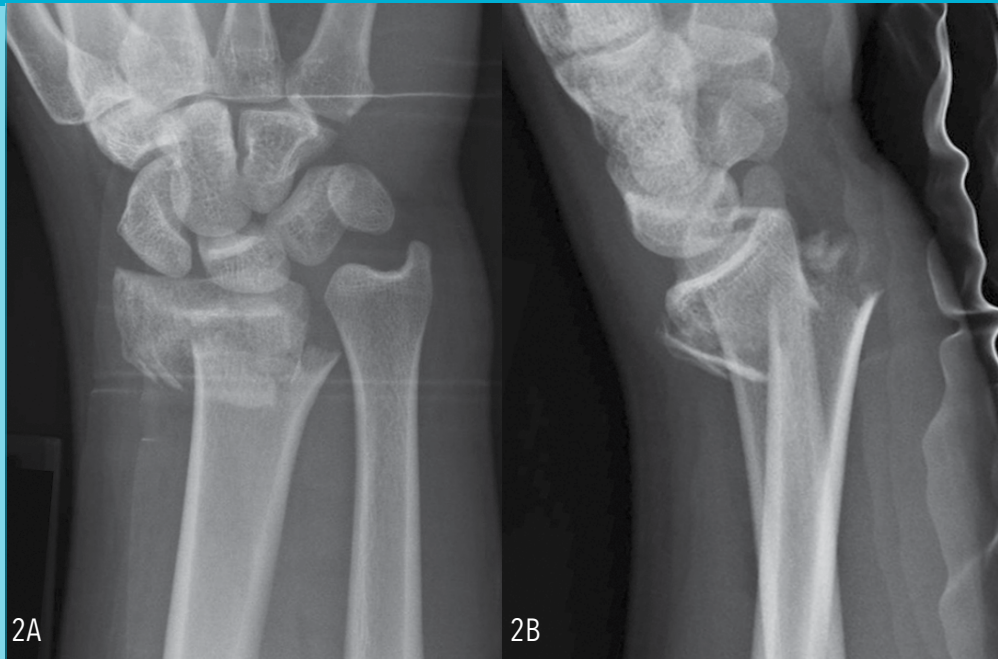
This technique is useful for active patients because it is a:

- Relatively brief procedure
- Allows for a quick return of function
- The brief nature of the procedure, especially the limited incisions (1-2 cm) required to insert the pins, makes this procedure useful in the elderly and medically unstable populations because it can be performed under local anesthesia with intravenous sedation.

Contraindications

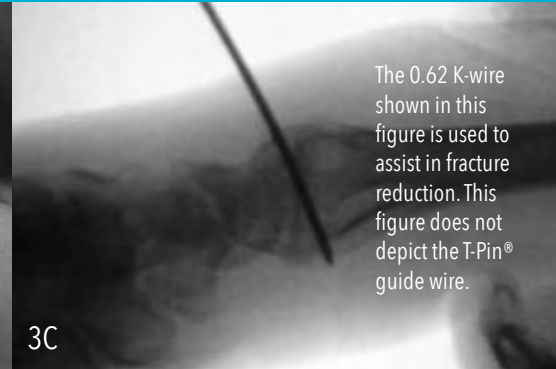
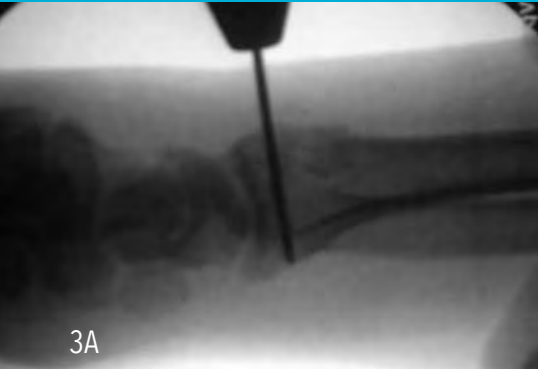
Intraarticular fractures having displacement and/or severe comminution

Low-demand patients who have fractures amenable to treatment by immobilization alone



Figures 2A,B. Preoperative views of a typical extraarticular fracture amenable to fixation with the T-Pin®. Refer to Figures 5A,B on Page 8 for postoperative views of this fracture.

Surgical Technique



The 0.62 K-wire shown in this figure is used to assist in fracture reduction. This figure does not depict the T-Pin® guide wire.

Figures 3A,B,C. A size 0.62 Kirschner wire can be placed percutaneously into the distal fragment to use as a joystick to regain the normal anatomical volar tilt.

- Patients are placed supine on the operating table.
- Typical anesthesia for the case is conscious sedation with a local field block and fracture hematoma block. We use bupivacaine 0.5% without epinephrine.
- A tourniquet is then applied to the operative extremity, and the extremity is prepped and draped in a sterile fashion.
- The limb is exsanguinated, and the tourniquet is inflated to 250 mm Hg. Our

typical tourniquet time is approximately 20 minutes.

- Under fluoroscopic guidance, closed reduction of the fracture is performed.
- A size 0.62 Kirschner wire can be placed percutaneously into the distal fragment to use as a joystick to regain the normal anatomical volar tilt. (Figures 3A,B,C) This can be followed by a K-wire driven across the fracture to maintain reduction while inserting the T-Pins®.

Alternatively, a Kapandji pinning technique can be used to temporarily secure a reduction while the T-Pin® is placed. (Figures 4A,B,C)

The soft tissues are bluntly dissected to bone for safe placement of T-Pin® guide wires. At the incision over the radial styloid, the first dorsal extensor compartment can be released to facilitate pin placement (especially useful for fixing radial styloid fractures), but this is not required.

Dissection is carried down to visualize the T-Pin® insertion site, and adjacent extensor tendons are protected by retraction or by use of the tissue protection guide provided on the tray.

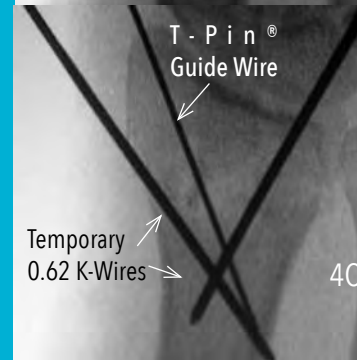
The selected T-Pin® site is initially stabilized with smooth 1 mm guide wires at the insertional sites, and placement is adjusted under fluoroscopic guidance.

A technical point to note is that the guide wire will deflect off the inner cortices and bend whereas the more rigid T-Pin® will not; therefore, guide wire insertion should stop when far cortical contact is made.

The T-Pin® is not designed to penetrate the far cortex. If this is attempted, then distraction of the fracture site may occur.

A measuring guide is then applied along each guide wire indicating the length of the T-Pin® required. The tray supplies T-Pin® lengths from 40 to 70 mm in 5 mm increments.

To avoid having the guide pin kink and bend near the tip, we back out the guide wire 10 mm after measuring its depth and before T-Pin® placement.



Figures 4A,B,C
Kapandji pinning
used to secure
reduction prior to
the T-Pin® for distal
radius fixation.



Typically, for the younger patient with good bone stock, 2 T-Pins® can be placed at the radial styloid through a single incision.

5A



Some surgeons prefer a crossed pin pattern, inserting 1 T-Pin® in the radial styloid and a 2nd T-Pin® placed from the dorsal ulnar corner.

6



A single T-Pin® is useful for isolated radial styloid fractures.

7A



5B

Most common T-Pin® placement pattern: 2 radial styloid pins.

Postoperative images of the fracture shown in Figures 2A,B.

For the common Colles' fracture, two pinning patterns are used.

2 T-Pins can be inserted at the radial styloid between the 1st and 2nd dorsal extensor compartment. (Figures 5A,B)

Alternately, some surgeons prefer a crossed pin pattern inserting 1 T-Pin® in the radial styloid and a 2nd T-Pin® placed from the dorsal ulnar corner. (Figure 6)

Radial styloid fractures are typically fixed with a single T-Pin® inserted perpendicular to the fracture line. (Figures 7A,B)

7B



A single T-Pin® inserted perpendicular to the fracture line.

7



- The cannulated T-Pin® is secured onto the power driver and inserted over the guide wire. (Figure 8)
- The T-Pin® is driven along the guide wire until the trailing threads are nearly flush with the bone.
- The split tissue protector opens to allow removal for final seating of the pin without having to disengage the driver.
- The surgeon disengages the power driver and removes the guide wire, leaving only the T-Pin® in place.

- The break-off driving mechanism of the pin is easily removed by bending the smooth shaft.
- This can be accomplished by hand bending, with care being taken to secure the bending point to ensure breaking at the juncture of threads and driver.
- The removal tool is usefully applied to this task by placing the knurled end down the smooth driver portion thus concentrating the bending forces at the point of break off.
- Stability of the fixation is checked under fluoroscopy. (Figures 9A,B)

- When placing a T-Pin® in the dorsal ulnar corner note that the 4th dorsal extensor compartment tendons are positioned closely to the radius, and care must be taken to place the T-Pin's threads so they are not outside the cortex; thus, preventing tendon irritation or impingement of the carpus with wrist extension.
- The tourniquet is deflated and the skin closed with nylon sutures. The postoperative dressing includes sterile gauze and a volar splint.
- Potential complications include infection, loss of reduction, nerve irritation, tendon rupture, and pin migration.

Distal Ulna Fractures

Figure 10A. Preoperative PA and lateral radiographs of an unstable ulnar neck fracture with 25 degrees angulation. Negative ulnar variance is noted on the uninjured extremity.

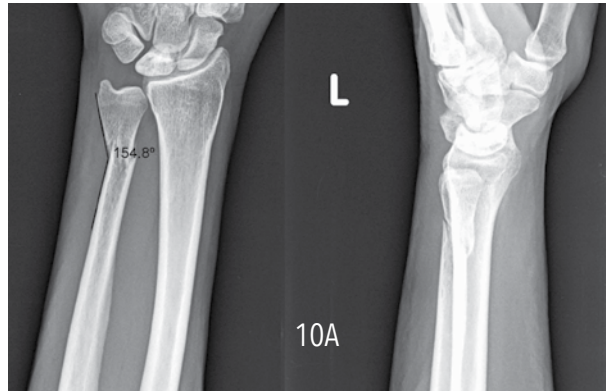
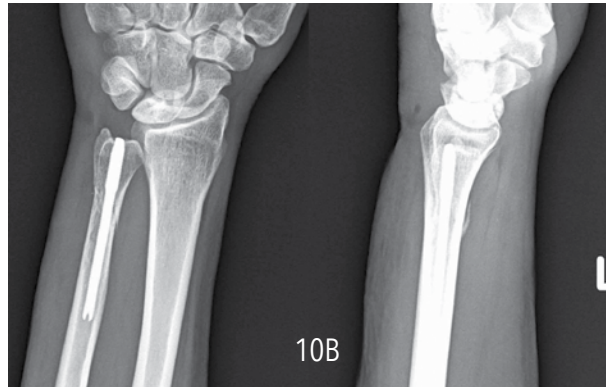


Figure 10B. Postoperative PA and lateral radiographs of the fracture stabilized with a T-Pin® utilizing minimal surgical dissection. Intramedullary position of the hardware eliminates the frequent painful subcutaneous location of a plate.



This 66-year-old, right-hand-dominant female fell from a stool onto a tile floor injuring her left wrist. X-rays showed a left distal ulnar shaft fracture with 25 degrees angulation and mild ulnar shortening. (Figure 10A). There was no instability of the distal radioulnar joint.¹³

A common surgical method of fixation involves plating the fracture. A frequent limitation of plating distal ulna fractures is the prominence of hardware in this location often necessitating a second procedure for hardware removal. An alternative method of fixation employs the T-Pin® to stabilize this type of ulna fracture.

The surgical approach is a small incision over the dorsal ulnar head adjacent to the ulnar styloid for placement of the guide wire followed by the implant pin. Figure 10B shows the postoperative x-ray of this case with the T-Pin® implant in place.

All of the fractures have healed uneventfully in this small series. As the implants are intramedullary, and there have been no hardware irritation problems.

Rehabilitation

The postoperative dressing is a plaster volar short arm splint which allows for unrestricted finger range of motion. Following the usual instructions of elevation, icing and splint care, the patient returns for a follow-up visit on postoperative day 1 to 3. At this first postoperative visit the patient is fitted with a custom molded, removable forearm based static wrist splint, which can be removed for bathing and exercises. Therapy is initiated under the guidance of a hand therapist for active and passive digital range of motion, edema control, and gentle wrist active range of motion.

For severely osteoporotic bone, or significant cortical comminution wrist range of motion is

deferred until 2-3 weeks postoperatively. By initiating wrist range of motion on or before the third postoperative day, we feel it is possible to restore a greater degree of motion and quicker restoration of function compared to results achieved from delayed initiation of range of motion.

At 2 weeks postoperative, sutures are removed and the patient is advanced to a program of active, active assisted, and gentle passive wrist extension and flexion. Initial recommended wrist range of motion limits are 30⁰ of extension and 30⁰ of flexion. At this point, the patient may also begin pain-free light resisted grip exercises.

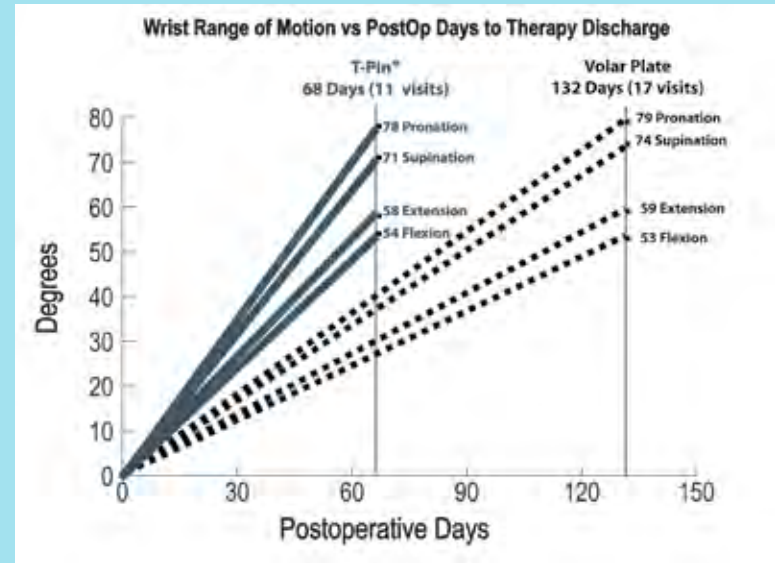
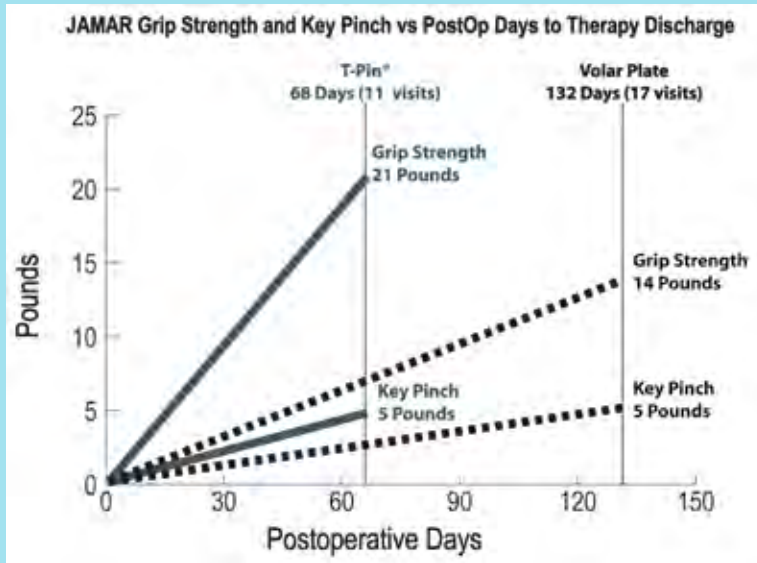
Visit Union Surgical at www.unionsurgical.com to download a copy of the T-Pin® Postoperative Protocol.

Removal

Generally, T-Pins® do not require removal and are left in place. Some patients; however, desire removal. Pins are removed with a removal tool designed to fit the flutes in the distal threads of the T-Pin®, which is included in the pinning tray. (Figures 11A,B)

A 4.0 mm hollow mill is useful for cleaning scar tissue or bone from the distal threads of the T-Pin® to allow easy placement of the removal tool. Once full fracture healing has occurred after the pin has been removed as assessed by no tenderness from palpation at the fracture site an unrestricted program of range of motion and strengthening can begin. The protective splint is discontinued at this time.





T-Pin®: 68 Days to therapy discharge

Volar Plate: 132 Days to therapy discharge

1Threaded distal radius pin and volar plate fixation of distal radius fractures: early functional recovery. Taras JS, Kessler MW et al. ePoster ASSH Annual Meeting, Chicago, IL, September 2012.

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