SCIENTIFIC ARTICLE

Arthrodesis of the Thumb Interphalangeal Joint and Finger Distal Interphalangeal Joints With a Headless Compression Screw

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Purpose To study the results of using a small, headless compression screw (AcuTwist) for thumb interphalangeal (IP) joint and finger distal interphalangeal (DIP) joint arthrodeses.

Methods Between November 2007 and January 2012, 48 primary arthrodeses of the thumb IP joint or DIP joint in the other digits were performed in 29 consecutive patients with AcuTwist devices. Indications for arthrodesis included 19 cases of osteoarthritis in 25 fingers, 3 cases of lupus in 9 fingers, 2 cases of post-traumatic osteoarthritis in 2 fingers, and 1 case and finger each of acute trauma, neuromuscular disorder, postinfectious osteoarthritis, boutonniere deformity, and Dupuytren contracture. Charts were reviewed for clinical data, and radiographs were assessed for alignment and healing.

Results Age averaged 59 years and follow-up averaged 12 months (range, 2–50 mo). Union occurred in 43 out of 46 fingers (94%). There were no cases of nail deformity, wound complications, tip hypersensitivity, or clinically notable malalignment. Three arthrodeses failed to fuse, including 2 asymptomatic nonunions and 1 fixation loss requiring revision with autograft. The complication rate was 9%.

Conclusions Distal digital joint arthrodesis with the AcuTwist resulted in a fusion rate of 94% with a complication rate of 9%. Our rate of fusion compares favorably with prior series using other methods of fixation. *(J Hand Surg Am. 2014;39(1):24–28. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic IV.

Key words Arthritis, arthrodesis, DIP, distal interphalangeal, variable pitch.

DISTAL INTERPHALANGEAL (DIP) joint and thumb interphalangeal (IP) joint arthrodeses are well-accepted procedures for the treatment of painful or unstable joints. Numerous techniques for arthrodesis have been described including K-wires, interosseous wiring,[1] standard bone screws,[2–4] bioabsorbable implants,[5] plates,[6] external fixators,[7] and headless variable-pitch screws such as Herbert (Zimmer, Warsaw, IN)[8–12] or Acutrak (Acumed USA, Hillsboro, OR)[13–16] screws.

Implant size plays an important role in fixation of DIP joint arthrodeses in light of the small size of the distal phalanx, particularly in the small finger. Wyrsch et al[17] noted that the average dorsopalmar diameter of the distal phalangeal neck (3.6 mm) was smaller than the diameter of the trailing threads of the Herbert screw (3.9 mm). In 10 of 15 male cadaveric specimens and 15 of 15 female specimens, these threads penetrated either the volar or the dorsal cortex. This could lead to nail matrix injury in those penetrating dorsally.

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TABLE 1. Selected Commercially Available Headless Screws

Implant	Leading Thread Diameter (mm)	Trailing Thread Diameter (mm)
AcuTwist (Acumed)	1.5	2.0
Acutrak Micro (cannulated)	2.5	2.8
SBI AutoFix (cannulated)	2.0	3.0
Synthes 2.4 mm (cannulated)	2.4	3.1
Zimmer Herbert Mini	2.5	3.2
Acutrak Mini (cannulated)	2.8	3.2
Synthes 3.0 mm (cannulated) Headless Screw	3.0	3.5
Zimmer Herbert Screw	3.0	3.9

Commercially headless variable-pitch screws are now available in smaller sizes than previous implants (Table 1). These devices theoretically decrease the risks of nail injury and distal phalanx fracture, are more technically forgiving, and permit a greater bone-to-bone contact area by decreasing the diameter of the implant at the arthrodesis site. We present a retrospective case series summarizing our experience with AcuTwist (Acumed, Hillsboro, OR) implants for DIP and IP joint arthrodeses along with our technique and observed complications.

MATERIALS AND METHODS

Patients were located by querying our billing database for Current Procedural Terminology codes 29860 or 29862 in compliance with an institutional review board–approved protocol. Between July 2007 and January 2012, 48 digits in 28 consecutive patients were treated with arthrodesis of the DIP or thumb IP joint using the Acutrak AcuTwist (Fig. 1). Revision arthrodeses were excluded.

Radiographic fusion of the arthrodesis site was defined as bridging callus on 2 or more cortices on plain radiographs (Fig. 2). All procedures were performed by 1 of 2 attending full-time, certified hand surgeons. Hospital charts were reviewed for clinical data, and radiographs were evaluated for alignment and healing.

Surgical technique

Preoperative antibiotics were administered. A transverse incision was made at the DIP joint and the terminal tendon was divided exposing the joint. Remaining cartilage was curetted, and osteophytes were removed with a rongeur. The bone was contoured as necessary to correct coronal or sagittal plane deformity. A 0.9-mm (0.035-in) K-wire was used to penetrate the subchondral surface of the distal phalanx in areas of dense sclerotic bone.

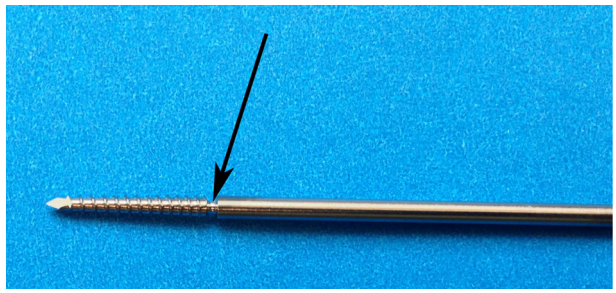

FIGURE 1: Acutrak AcuTwist implant. The arrow points to the implant's intended breakage site.

Then, a 1.1-mm 0.045-in) double-tipped wire was advanced antegrade through the flexed distal phalanx, exiting through the tip of the finger in the midline just volar to the nail plate. The finger was then reduced to a position of neutral coronal plane alignment and 0° to 10° of flexion, and the wire was driven retrograde into the middle phalanx. Biplanar alignment and K-wire position were confirmed fluoroscopically. The length was then measured, either with a supplied depth gauge or with a second guidewire and ruler. Next, while holding the reduction, the wire was removed and the track tapped when necessary; in our series, tapping was used only when the surgeon felt the bone was particularly dense. The appropriate-length AcuTwist device was inserted with care taken to maintain the reduction of the arthrodesis site, thus allowing the screw to follow the proper wire track. Once seated to the desired depth, the implant placement and clinical alignment were again confirmed. The device was then toggled in the anteroposterior and mediolateral planes while securing the arthrodesis site. The shaft of the device then would break off from the screw at the machined snap-off groove. Final fluoroscopic images were taken. Bone grafting was not used. A protective orthosis was applied, leaving the more proximal joints free. The orthosis was left in place for 6 weeks.

Sutures were removed at 10 to 14 days after surgery. Therapy was not typically necessary unless there was a concomitant procedure. Patients were followed with interval clinical visits and radiographs to assess for bony and clinical union.

RESULTS

There were 5 men and 24 women with an average age of 59 years (range, 35–80 y). Arthrodesis was