

A&UMED[®]

Innovative Solutions



**Hammertoe
Fusion Set**

Hammertoe Fusion Set

Since 1988, Acumed has been designing solutions for the demanding situations facing orthopaedic surgeons, hospitals and their patients. Our strategy has been to know the indication, design a solution to fit and deliver quality products and instrumentation.



Current management of hammertoe reconstruction usually includes arthroplasty of the proximal interphalangeal joint (PIPJ). Especially in the case of rigid flexion deformities of the PIPJ, shortening of the bone and release of the PIPJ are required to realign the toe. Controversy exists regarding the most effective means of PIPJ arthroplasty. Several authors have suggested that solid bone fusion is not required and rely on arthrofibrosis of the joint. Recent research has suggested that procedures resulting in fibrous nonunion and malunion of the joint can lead to patient dissatisfaction. Fusion rate with simple pin fixation has been reported as low as 60%.

The Acutrak® Hammertoe Screw (30mm Acutrak Fusion Screw, 6mm nose. The threaded portion has a length of 24mm.) offers a new and effective technique to improve fixation and alignment which promises to enhance patient satisfaction. The Acutrak® Hammertoe Screw simultaneously provides intramedullary fixation and compression of the joint without leaving prominent hardware. The screw is designed to pass through the distal interphalangeal joint (DIPJ) leaving only the PIPJ fused.

The Hammertoe Fusion Set is an indication specific set that utilizes the unique patented design of the family of Acutrak® Headless Compression Screws. The variable thread design of the Acutrak® Screw compresses the bone across the PIPJ, and its headless design allows the screw to be implanted below the surface of the bone without impingement of the DIPJ. The Hammertoe Fusion Set includes a new 30mm Acutrak® screw with a tip that smoothly guides the screw across the joint. With the ease of screw insertion and a dedicated instrument set, Acumed's Hammertoe Fusion Set will save valuable time in the OR.



Indications:

This screw is indicated for use in arthrodesis of the PIP and DIP joints of the toes and fingers.

- Patients with rigid PIPJ contractures and deformities
- Rigid hammertoe deformities
- Revision hammertoe surgery
- In severe claw toe deformities the screw can be utilized for permanent fixation of both DIP and PIP joints

Contra-indications:

- Active infection
- Skin ulceration

Preoperative planning:

- Ulceration or excessive callouts should be treated prior to arthrodesis.
- Rigid deformity is documented.
- Radiographs are necessary to ensure adequate bone stock for screw fixation.
- Angular components to the deformity are identified as well.

Sizing:

This screw is non-cannulated so two measurements are made to ensure proper insertion.

- First the length of the screw is determined by preoperative measurements or the two wire method.
- Second the depth of insertion must also be determined by:
 - Preoperative radiographic measurement of the length of the distal phalanx. (be sure to include the soft tissue envelope distal to the bone)
 - Intraoperatively, the insertion depth can be determined by flexing the DIPJ and a direct measurement is made to estimate the depth of insertion. The hand drill can also be used to estimate insertion depth.

Need for additional procedures:

PIPJ fusion with the Acutrak® Hammertoe Screw creates a very straight toe. This can accentuate any residual deformity of the MTPJ.

Care should be taken to fully address any contractures of the MTPJ. This can be done by release, extensor tendon lengthening and/or metatarsal osteotomy.

Hammertoe Fusion Set Features

Built in Targeting - 6mm tip on 24mm Acutrak® Hammertoe Fusion Screw for an overall length of 30mm, the Acutrak® Hammertoe Fusion Screw provides ease of insertion and efficiency in the OR through its innovative design.



Indication Specific Set - Provides a compact, user-friendly system that requires minimal space. Set contains all the instrumentation needed for multiple hammertoe repairs in a single case. The Acutrak® Hammertoe Fusion driver has been modified and lengthened to ease insertion of the hammertoe screw across the PIPJ.

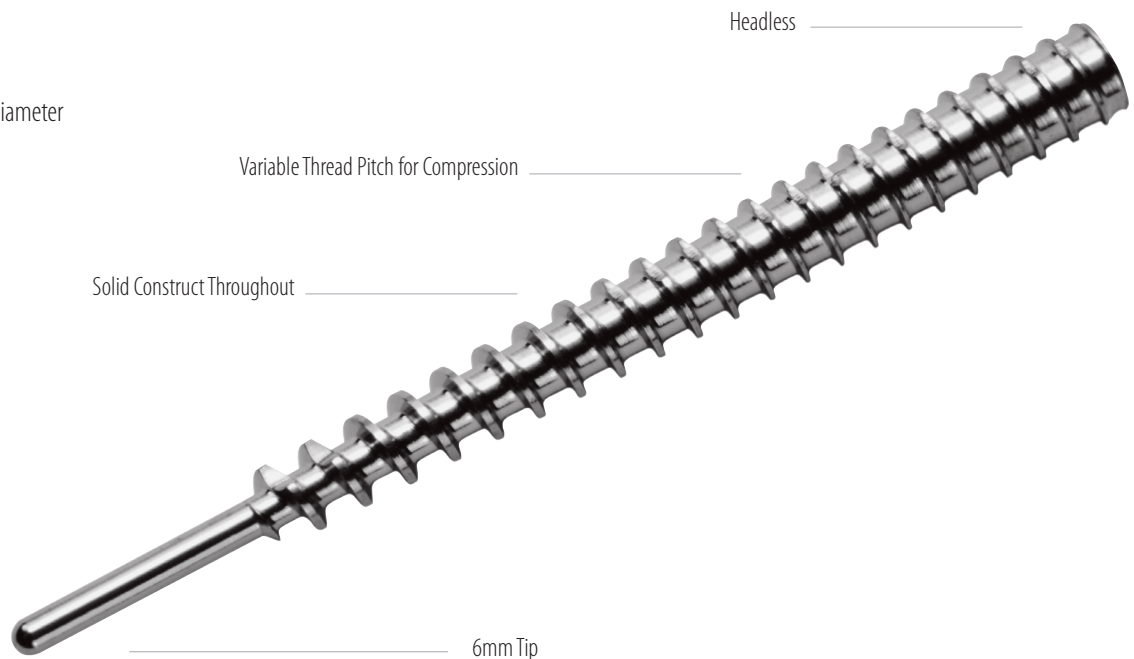


Optional Screw Lengths - The Acutrak® Hammertoe Fusion Screw Set was designed to house up to eight screws. Additional screw lengths between 14mm - 22mm can be used for smaller toes.

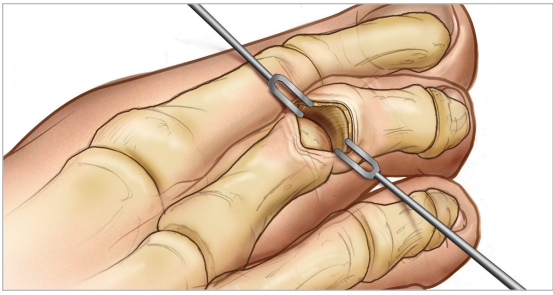


Screw Dimensions

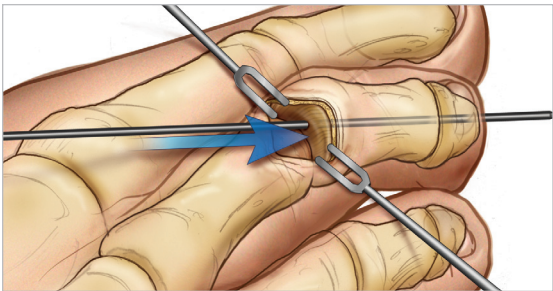
30mm Length
1.0mm Tip Diameter
2.0mm Threaded Tip Diameter
2.5mm Tail Diameter



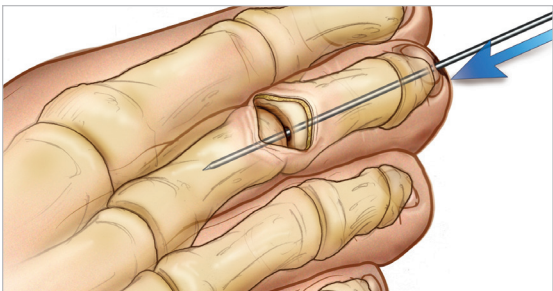
Hammertoe Fusion Set Surgical Technique by Armen Kelikian M.D.



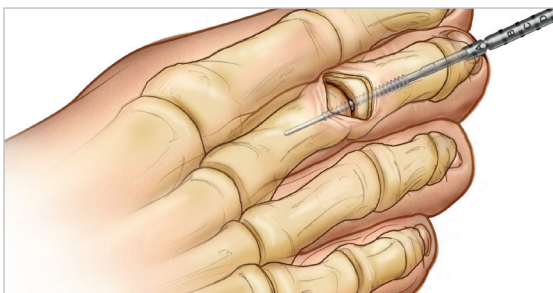
1 A transverse incision is made centered over the PIP joint. Alternatively for mallet toes it is over the DIP joint. If there is a combination mallet and hammertoe then a T incision is made. (Short horizontal portion over the DIP joint and the vertical portion residing proximal to the PIP joint.) The collateral ligament at the PIP joint on the proximal phalanx are incised. The extensor tendon is transected prior to this step in a horizontal fashion. It is peeled back sharply to expose the condyles as well as the juxtaarticular surfaces with a microsagittal small saw blade. 3mm are resected proximally and 1-2mm distally.



2 Under fluoroscopy the 1.6mm K-wire is then used to pre-drill. The wire is drilled antigrade through the center of the middle phalanx exiting the top of the toe resting plantar to the nail. The IP joint is aligned in neutral extension while the PIP joint is reduced into neutral extension and translation.



3 The wire is driven retrograde to provide provisional fixation. Its position is checked with imaging in both planes to ensure proper alignment and wire position.

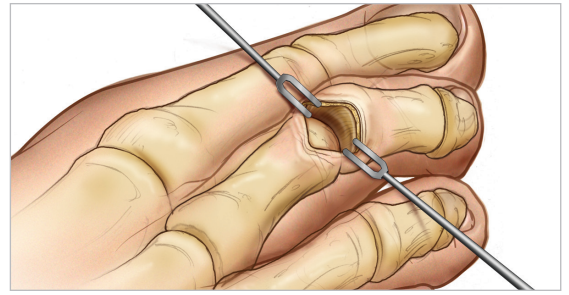


4 The guide wire is removed and the Acutrak® Hammertoe Screw is inserted. Reduce one joint at a time. Observe the tip as it passes through the middle phalanx until it protrudes 2-3mm. Then engage it into the proximal phalanx with the screwdriver in place and advance the screw. If only the PIP joint is being fused, the screw should be advanced to ensure proximal end is buried proximal to the IP joint. Otherwise for mallet as well as combination mallet and hammertoes, the screw should be flush with the distal tuft.

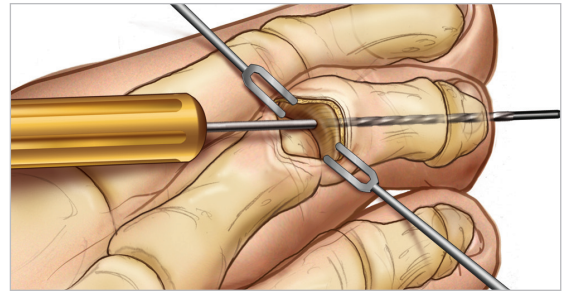


5 The extensor tendon is closed with a horizontal 2-0 vicryl mattress suture and the skin with a 4-0 nylon. A bulky compression dressing is applied. The dressing and sutures are removed at 10-14 days postoperatively. A stiff sole postoperative shoe is used for 4 weeks. The smaller 24mm screw without tip may be used for the shorter 4th and 5th toes. Also for isolated DIP fusions a shorter screw is used.

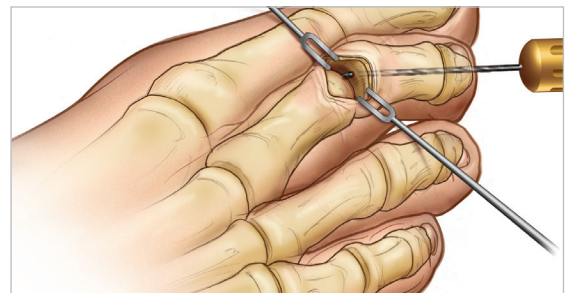
1 Arthroplasty of the PIPJ can be performed in any manner that includes adequate resection to allow for realignment and removal of the cartilage from both proximal and middle phalanges. The recommended procedure includes a longitudinal incision with resection of the distal end of the proximal phalanx and removal of the middle phalanx cartilage with a curette or rongeur. Care should be taken not to remove excessive bone from the middle phalanx, as this bone is typically very short and over-resection will compromise fixation.



2 The toe is cannulated to accept the screw. First insert the hand drill retrograde into the proximal phalanx. Care should be taken to insure that the reamer stays in the intramedullary canal and does not break the cortex. Next the hand drill is driven prograde from the middle phalanx out the tip of the toe distally. The proper exit point on the toe is at the apex just under the nail.

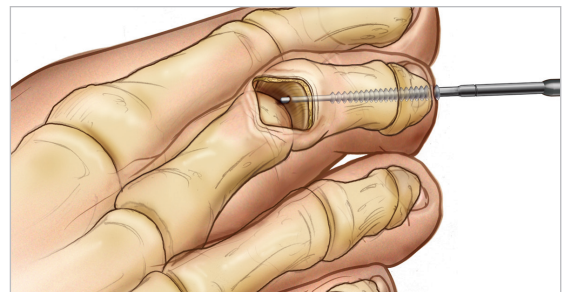


3 The hand drill is now used to realign the toe by inserting it retrograde from the exit point on the tip of the toe across the PIPJ into the proximal phalanx. During this step the alignment of the toe is assessed. Screw length is then determined by directly reading the measurement from the drill shaft. Be sure to fully insert the drill (and not over insert) to insure a proper length measurement. The drill bit has markings that account for the overinsertion necessary for the hammertoe application. Fluoroscopy can be used at this point to document proper insertion of the drill.

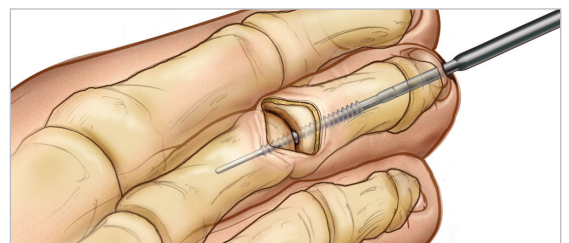


Note: As the hand drill is removed, the insertion depth is determined. Carefully remove the drill from the toe and as the drill is almost fully removed, begin moving the DIPJ. As the drill passes out of the joint, it will begin to move freely. At this point, the insertion depth can be determined by the markings on the drill shaft.

4 Screw insertion. Once the appropriate screw size is determined, the drill is removed and the screw is inserted. The screw is driven retrograde until the tip is visible exiting the middle phalanx. Once the tip is protruding into the joint, it is inserted into the proximal phalanx and the toe aligned. Now the screw is fully inserted. During insertion, significant torque can be generated; this may require firm stabilization of the toe to prevent rotation of the fragments.



5 The stabilization of the PIPJ is assessed by manual manipulation of the toe. Lack of movement indicates adequate fixation. The screw driver is then disengaged without full removal from the toe. The DIPJ is then manipulated to insure that the screw is fully inserted past the DIPJ. Complete insertion is determined when there is fluid motion of the DIPJ without crepitus.



Hammertoe Surgical Technique Tips

Technique tips:

Firmly grasp toe. Insertion of the screw into healthy bone can create significant torque. This can produce a rotational deformity of the toe during fusion. Firmly grasp the toe along the entire length to avoid rotation. Power drilling: Occasionally the quality of the bone may be dense or there may be other deformities that might limit ability to cannulate the toe with the hand drill. This may require pre-drilling of the bone with a 0.0625 K-wire prior to hand drilling.

Modifications:

PIPJ flexion: Some flexion of the joint may be desirable. This can be accomplished during cannulation, by starting the drill toward the plantar aspect of both the middle and proximal phalanges. Additionally the DIPJ can be held in extension during insertion of the drill. An alternative method to create more flexion is to begin the cannulation toward the plantar aspect of the middle phalanx and plantarflex the DIPJ. The drill is passed through the dorsal skin proximal to the nail bed. The screw is then inserted through this exit site in the dorsal skin. Care must be taken to avoid over insertion of the screw.

Cautions:

MTP Arthroplasty: Rigid PIPJ fixation accentuates any deformity at the MTPJ. Joint release followed by osteotomy or tendon transfer can be done to ensure proper alignment.

Oblique pinning or strapping:

Conventional temporary pin fixation of the MTP is possible by starting the pin in the metaphyseal region and crossing the joint obliquely. An alternative to pin fixation in less severe deformities is postoperative strapping.

Appearance of hyperextension:

In the immediate postoperative period, the toe will appear hyperextended. This usually resolves with time.

Removal Technique:

The Acutrak® Hammertoe Fusion Screw Set includes a removal system. If the screw is removed shortly after insertion, simply insert the reverse threading driver into the hexagonal hole in the screw. If soft tissue or bone has filled in behind the screw, then the hand drill may be required to recreate the original drill hole. The reverse thread driver can then be used.

Hammertoe Abstract By William M. Granberry M.D.

Presented at the 2007 AOFAS Annual Summer Meeting Toronto, Canada Arthrodesis of the PIP Joint Using a Headless Intramedullary Screw

Introduction: Standard fixation for arthrodesis of the PIPJ in hammertoe surgery has been a smooth K-wire. Reliable arthrodesis is difficult using a smooth wire alone. Nonunion and malunion rates vary from 20% to 60%. Dissatisfaction with surgery is primarily related to nonunion and malunion. This report describes an intramedullary fixation technique that provides reliable maintenance of alignment and ultimate fusion of the PIPJ. This study explores the viability of more permanent fixation to ensure alignment and a higher fusion rate to improve patient satisfaction.

Conclusions: Intramedullary fixation of the PIPJ using a headless self-compression screw provides reliable radiographic and subjective results when used for hammertoe reconstruction. Refinement in techniques and screw design will make fixation of the PIPJ even more simple and reliable.

Methods: A consecutive series of 19 patients who had hammertoe surgery from July 2004 through December 2005 using intramedullary fixation of the PIPJ were included in this study. All patients had resection of the distal end of the proximal phalanx and removal of the articular cartilage from the middle phalanx. A headless self-compression screw was then used to fixate and compress the joint. The screw was placed retrograde using a specially designed screwdriver. It was inserted past the distal phalanx and DIPJ to immobilize only the PIPJ. Additional procedures were done in each patient as determined by the deformities present. Postoperative management allowed for immediate weight bearing and the use of a hammertoe splint to prevent MTP extension for 6 weeks. Follow up examination included clinical and radiographic exam.

Results: A total of 19 patients (32 toes) were available for review. The average age was 62 years (range 58 to 72). Average follow up was 11 months (minimum 6 months). There were 22 second toes, 6 third toes and 4 fourth toes. Preoperatively, patients complained primarily of pain, callusing and difficulty with shoes. Additional surgery was performed on 18 feet. There were 6 bunionectomies, one MTP fusion, 2 plantar condylectomies and 9 Weil metatarsal shortening osteotomies. There were no acute postoperative complications. All but one of the toes were solidly fused by 3 months. Alignment improved in all of the cases. Preoperative flexion of the PIPJ averaged 53.5° (range 20° to 115°). Postoperatively the average alignment was 3° of flexion (range 0° to 18°). The average correction was 50° (range 20° to 115°). Axial alignment improved as well. The deviation in the AP plane ranged from 45° of varus to 68° of valgus. Postoperatively only one toe was more than 10° (28° of valgus) from straight. MTP hyperextension averaged 23° (range 10° to 48°) and improved in all the toes as well. One patient had frank dislocation of the MTP preoperatively. Only 4 toes had 20° or more of residual MTP extension. All patients were satisfied with the postoperative result. The appearance of hyperextension of the PIPJ was noted in 4 patients, however they remained satisfied and no additional surgery was required.

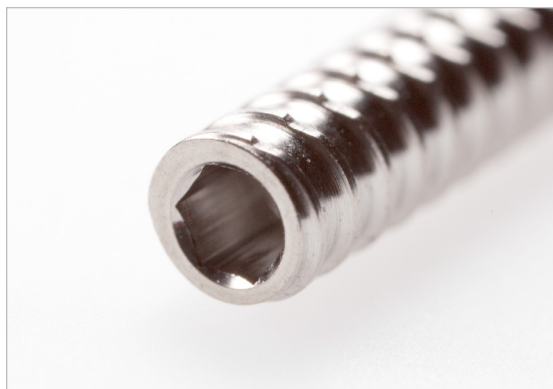
Hammertoe Fusion Screws

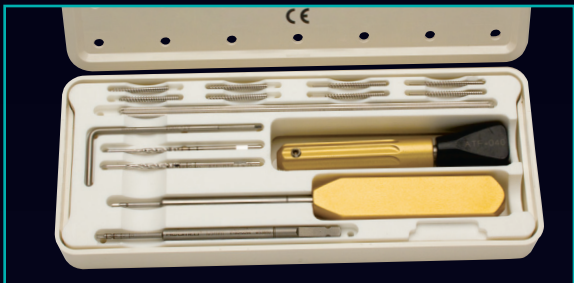
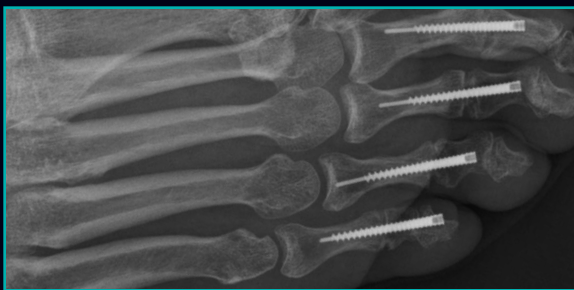
30mm Acutrak Fusion Screw; 6mm Nose	30-0033-S
24mm Acutrak Fusion Screw	ATF-240-S

Hammertoe Fusion Instrumentation

1.5mm Narrow Solid Hex Driver Tip AO	80-0094
1.5mm Narrow Solid Hex Driver Assembly	80-0098
Hammertoe Tray Screw and Instrument Caddy	80-0258
Hammertoe Fusion Set Tray	80-0259
Hex Wrench	AT-7004
24mm Fusion Screw Drill	ATF-024
Drill Handle Assembly	ATF-040
.062" Double Trocar Guide Wire	WS-1606DT

Use part number 15-0008 to order the complete Hammertoe Fusion Set, including instrumentation and screws.





REFERENCES

1. Hammertoe Abstract by William M. Granberry, M.D. as presented at the 2007 AOFAS Annual Summer Meeting in Toronto, Canada.

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