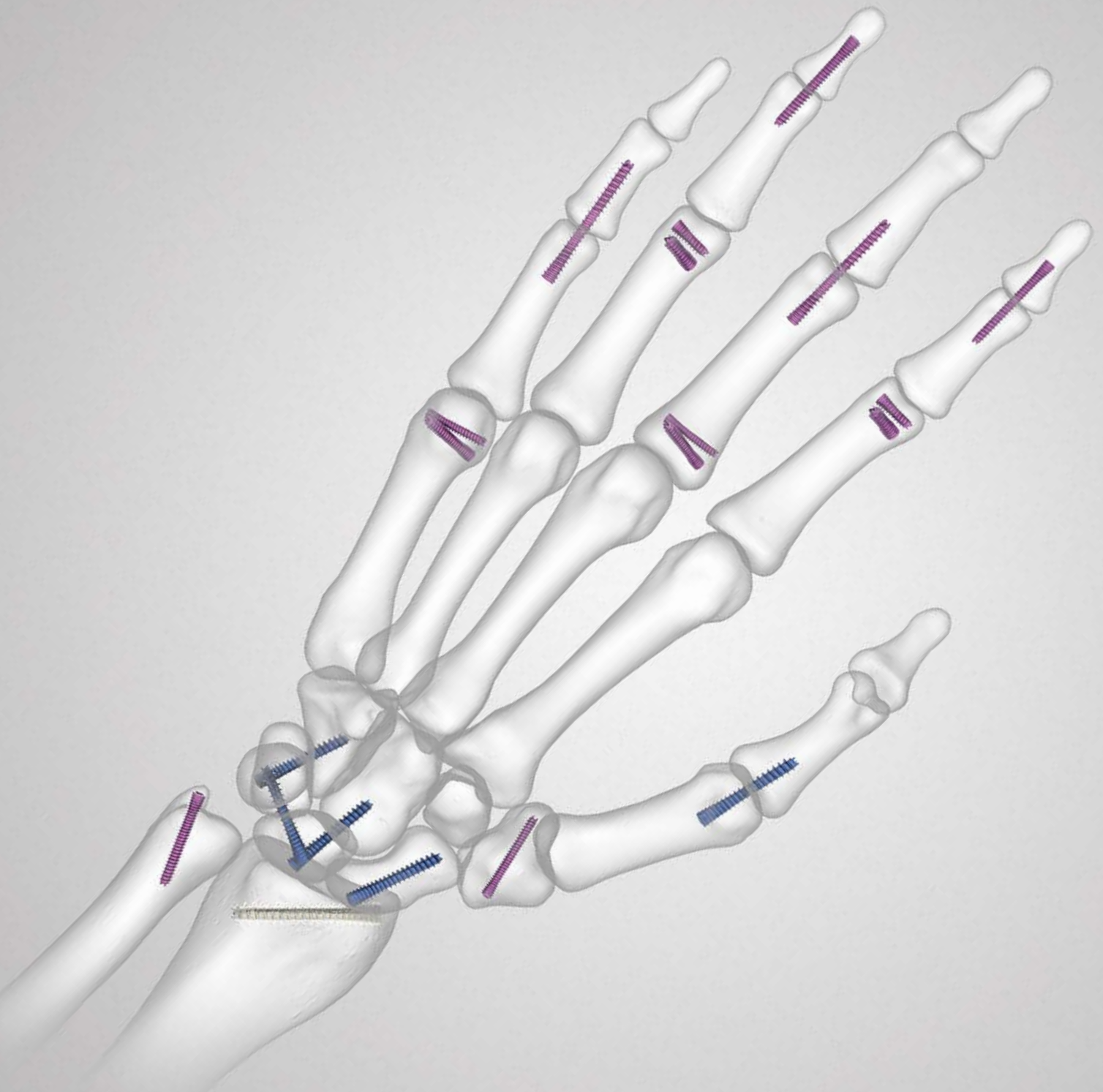


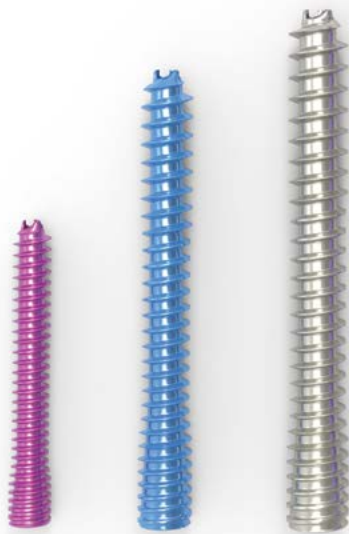
Supplemental Use Guide—Hand and Wrist





Acumed® is a global leader of innovative orthopaedic and medical solutions.

We are dedicated to developing products, service methods, and approaches that improve patient care.



Acutrak 2® Headless Compression Screw System

Since its introduction in 1994, the Acutrak® Headless Compression Screw technology has revolutionized the way surgeons treat fractures, fusions, and osteotomies. The Acutrak 2 is the next generation in fully threaded headless fixation, offering larger guide wires, larger hex drivers, and a tapered end, reducing drill depth sensitivity. Long-term surgeon feedback has helped develop this continuously variable, fully threaded, headless implant with instrumentation designed to simplify the surgical technique.

The Acutrak 2 family is composed of 67 unique screw size options to fit a wide variety of applications throughout the body, from 2 mm x 8 mm up to 7.5 mm x 120 mm.

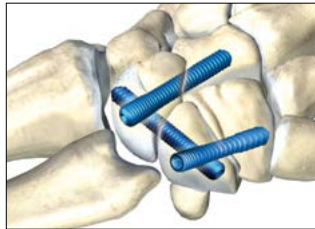
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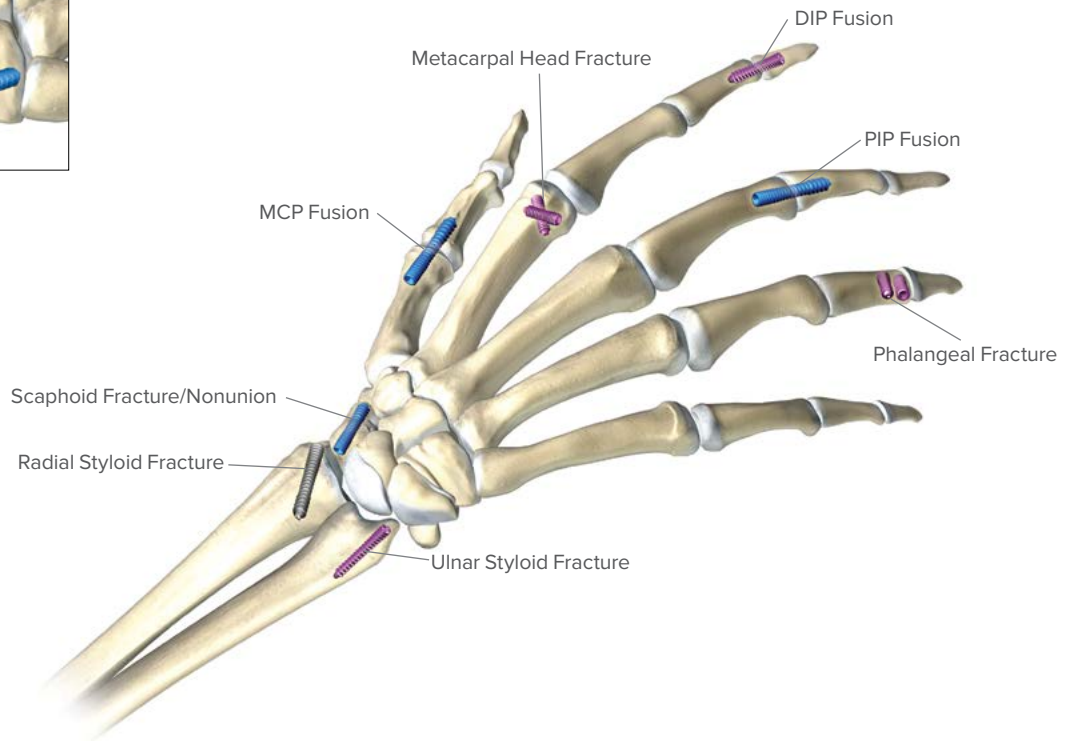
Hand and Wrist Indications

INDICATIONS FOR USE




Acutrak 2 Micro, Mini, and Standard are intended for use as fixation devices for small bones, bone fragments, and osteotomies. They are not intended for interference or soft tissue fixation.



Four Corner Fusion



Acutrak 2® Quick Reference Chart

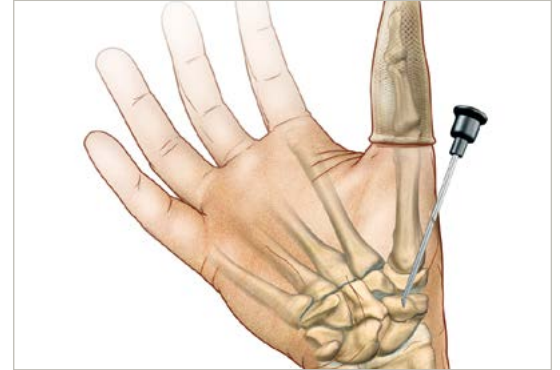
	Diameter	Lengths		Properties
Micro 	Tip: 2.5 mm Tail: 2.8 mm	8 mm 10 mm 12 mm 14 mm 18 mm 22 mm 26 mm 30 mm	9 mm 11 mm 13 mm 16 mm 20 mm 24 mm 28 mm	<ul style="list-style-type: none"> • Where used to treat the indications described on page 3, it may be possible to use an Acutrak screw of similar size instead of the screws listed here • Use in place of a 2–2.4 mm headed screw • 1.5 mm Hex Driver • .035" (.88 mm) Guide Wire
Mini 	Tip: 3.5 mm Tail: 3.6 mm	16 mm 20 mm 26 mm 30 mm	18 mm 24 mm 28 mm	<ul style="list-style-type: none"> • Where used to treat the indications described on page 3, it may be possible to use an Acutrak screw of similar size instead of the screws listed here • Use in place of a 3.5–4 mm headed screw • 2mm Hex Driver • .045" (1.1 mm) Guide Wire
Standard 	Tip: 4 mm Tail: 4.1 mm	16 mm 20 mm 28 mm 32 mm	18 mm 24 mm 30 mm 34 mm	<ul style="list-style-type: none"> • Where used to treat the indications described on page 3, it may be possible to use an Acutrak screw of similar size instead of the screws listed here • Use in place of a 3.5–4 mm headed screw • 2.5 mm Hex Driver • .054" (1.4 mm) Guide Wire

Volar Scaphoid Surgical Technique: Acutrak 2®—Micro, Mini, and Standard

1 APPROACH AND CANNULATED DEVICE INSERTION

The procedure can be carried out using the volar traction approach or using a conventional volar type approach with the arm supine on a hand table. The volar traction approach facilitates reduction of a displaced fracture and permits arthroscopy to ensure accuracy of the reduction. Fluoroscopy is used throughout.

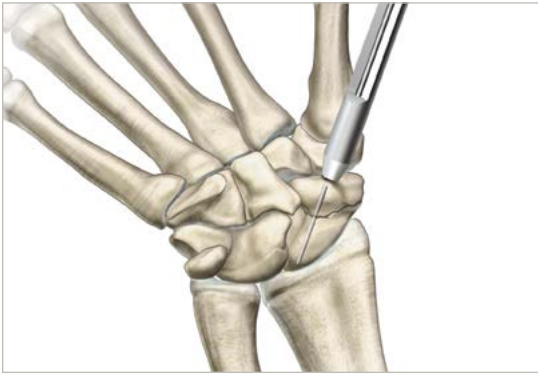
The entry point is then located using a cannulated device of appropriate gauge introduced on the antero-radial aspect of the wrist just radial to and distal to the scaphoid tuberosity. This serves as a trochar for the guide wire and is a directional aid to establish a central path along the scaphoid. The cannulated device is then insinuated into the scaphotrapezial joint, tilted into a more vertical position, and the position is checked on the image intensifier. By gently levering on the trapezium, this maneuver brings the distal pole of the scaphoid more radial and thus ultimately facilitates screw insertion. The entry point should be approximately one third of the way across the scaphoid from the tuberosity in the anterior/posterior (A/P) plane and central in the lateral plane.



2 GUIDE WIRE INSERTION

Pass the guide wire through the cannulated device and drill it across the fracture, continually checking the direction on the image intensifier and correcting as necessary, aiming for the radial aspect of the proximal pole. It is extremely important not to bend the guide wire, and any adjustments in direction should be made using the cannulated device as a guide rather than attempting to alter the line of the guide wire alone.

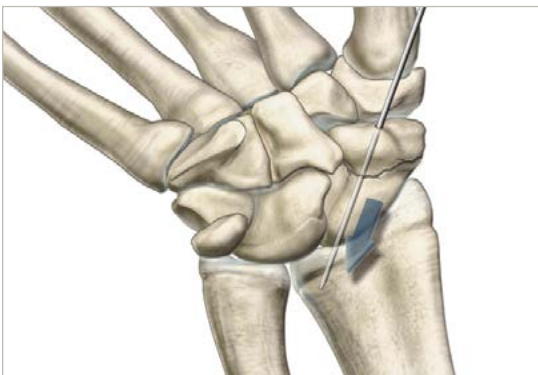




3 DETERMINE SCREW LENGTH

Advance the guide wire to stop just short of the articular surface, as the wire should not breach it at this stage. The position, alignment, and length are checked once more. Make a simple stab incision at the entry point of the wire, and deepen this down to the distal pole of the scaphoid using a small hemostat and blunt dissection.

Determine the length of the screw either with the appropriate depth gauge or by advancing a second guide wire of the same length up the distal cortex of the scaphoid and subtracting the difference between the two. When using the volar approach, the correct screw size is 2–4 mm shorter than the measured length so as to ensure that the proximal tip of the screw is fully buried below the cartilage and the cortical surface.

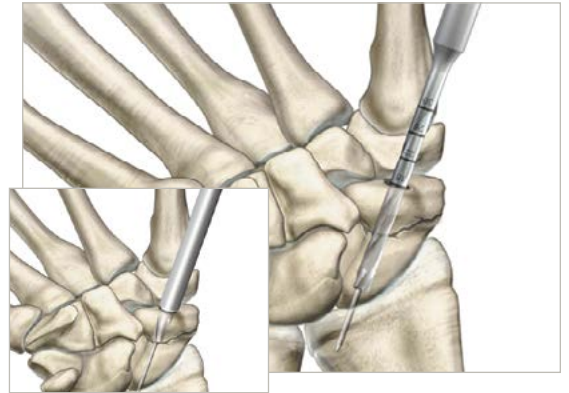


4 ADVANCE GUIDE WIRE

Advance the guide wire through the proximal pole of the scaphoid so as to exit on the dorsal aspect of the wrist. This is a precautionary measure to minimize the risk of inadvertent withdrawal of the wire during the drilling process and screw insertion and to facilitate removal of the proximal portion if the wire were to break. A second de-rotation wire can then be inserted in those cases where it is felt there is a possibility of rotational instability of the fracture.

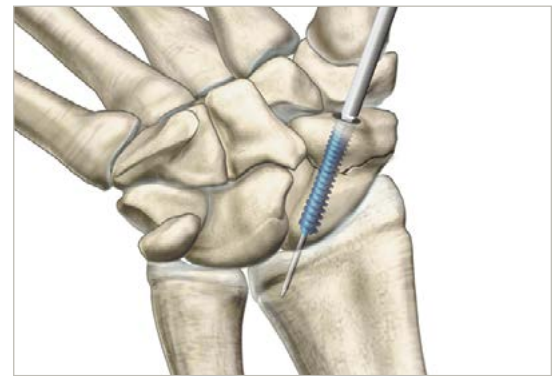
5 DRILL

Drill into the far fragment with the appropriate long drill. To be effective, the drill only has to advance 4–5 mm past the fracture site, as the screw is self-drilling and self-tapping. Following use of the long drill, open the near cortex with the appropriate profile drill.

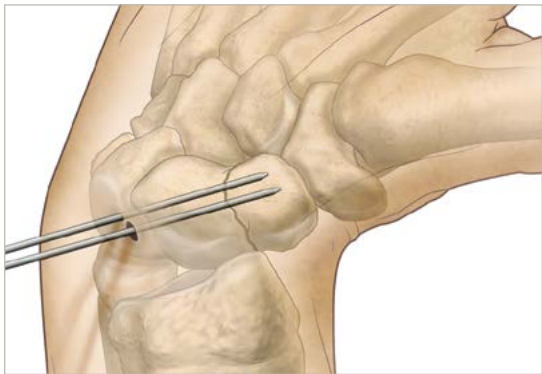


6 ADVANCE SELF-TAPPING SCREW

The self-tapping screw is then advanced over the guide wire and the wire removed. Compression should be confirmed radiographically on the image intensifier.



Dorsal Scaphoid Surgical Technique: Acutrak 2®—Micro, Mini, and Standard

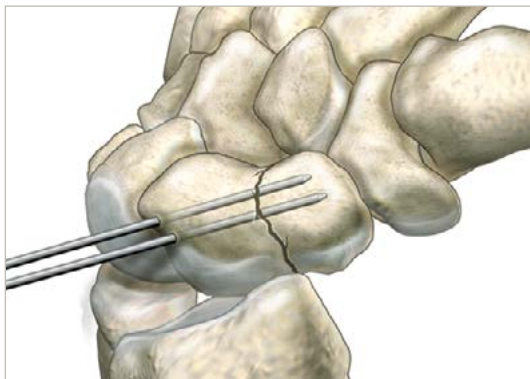


1 APPROACH AND NEEDLE INSERTION

The entry point in the proximal pole is at the tip of the scaphoid immediately adjacent to the scapholunate ligament. This can be located either using an arthroscopy or mini open dorsal approach between the third and fourth extensor compartments. Whichever approach is employed, it is essential to ensure that the guide wire does not transfix an extensor tendon.

Having established the entry point, introduce the appropriate guide wire, aiming for the base of the thumb, and check the position on the fluoroscope. Aim to place the leading edge of the guide wire, in the subchondral surface of the distal pole of the scaphoid. Confirm the wire placement and depth under fluoroscopy.

Optional: A cannulated device of appropriate gauge is a useful aid in determining the entry point and acts as both a guide and soft tissue protector.

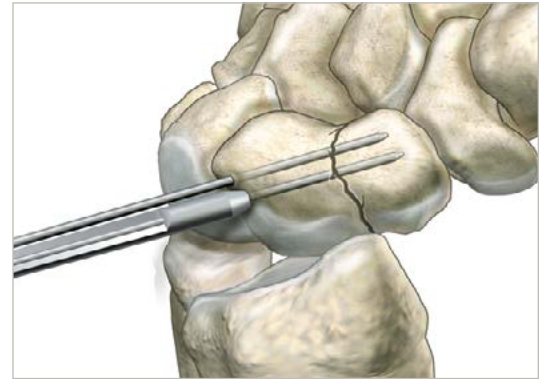


2 FRACTURE STABILIZATION

If the fracture is unstable, it may be helpful to place a second parallel guide wire using the parallel wire guides which are available for all three Acutrak 2 Screw families.

3 DETERMINE SCREW LENGTH

Measure guide wire length using either the percutaneous screw sizer or by placing a second wire at the entry point and subtracting the difference in length. The screw sizer cannot be used with the arthroscopic technique due to the limited access. Subtract 4 mm from the measured length to ensure that both ends of the screw are buried within the bone.



4 ADVANCE GUIDE WIRE

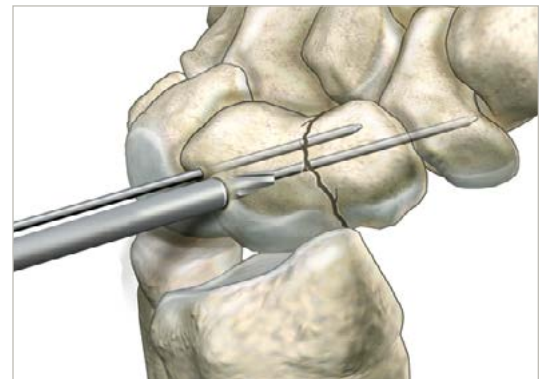
Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues. This minimizes the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.

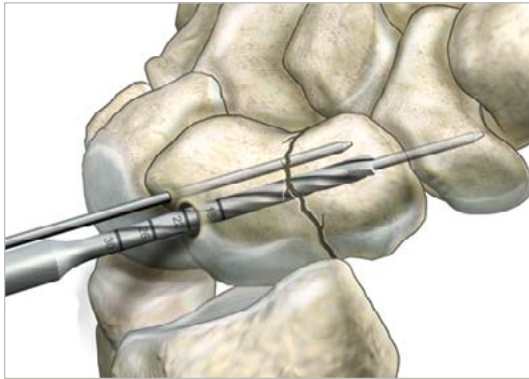
Tip: For most adult males, the screw should not be longer than 26 mm, and in females, not longer than 22 mm.



5 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill.





6 DRILL FAR FRAGMENT

Next, drill into the far fragment with the long drill. To be effective the drill only has to advance 4–5 mm past the fracture site.

Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion.



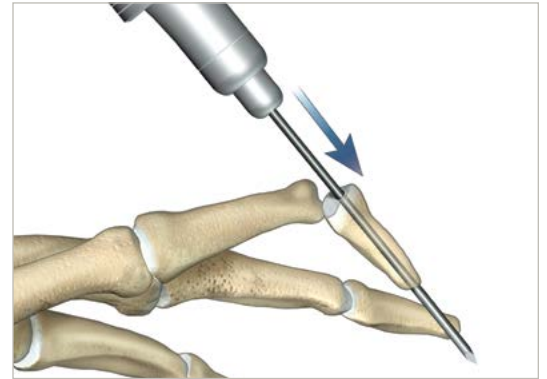
7 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, redrill with the long drill and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both leading and trailing edges of the screw are beneath the articular surfaces. Finally, remove the guide wires.

DIP Fusion Surgical Technique: Acutrak 2®—Micro Extended

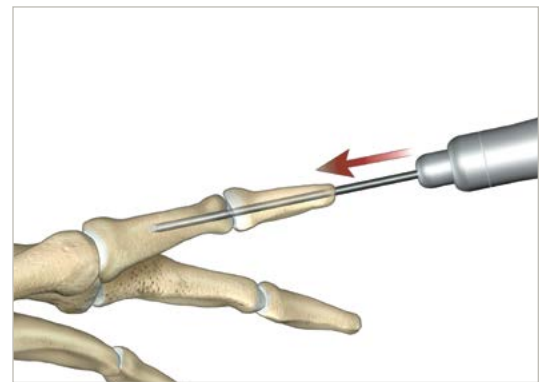
1 ADVANCE TROCAR GUIDE WIRE

A double trocar guide wire guide wire is advanced into the distal phalanx through a transverse incision over the distal interphalangeal joint.



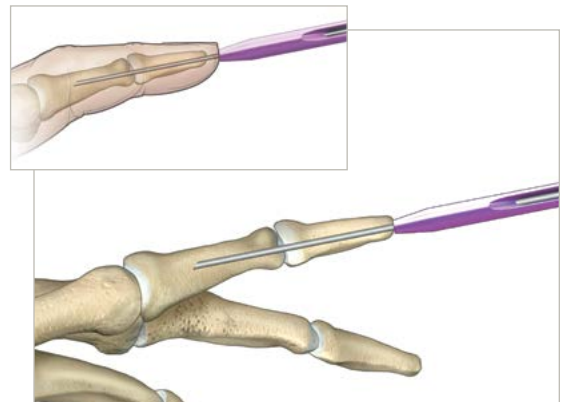
2 PROXIMAL MIDDLE PHALANX REDUCTION

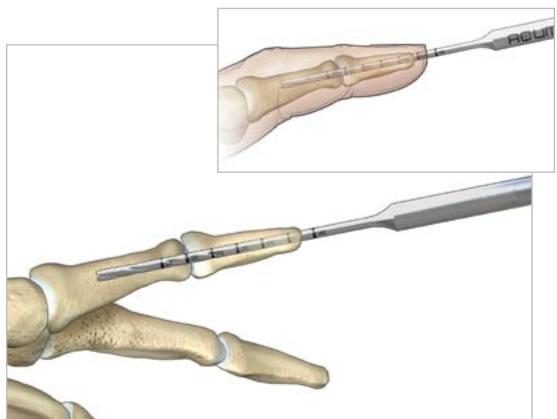
The joint is then reduced and the guide wire is driven proximally into the middle phalanx.



3 DETERMINE SCREW LENGTH

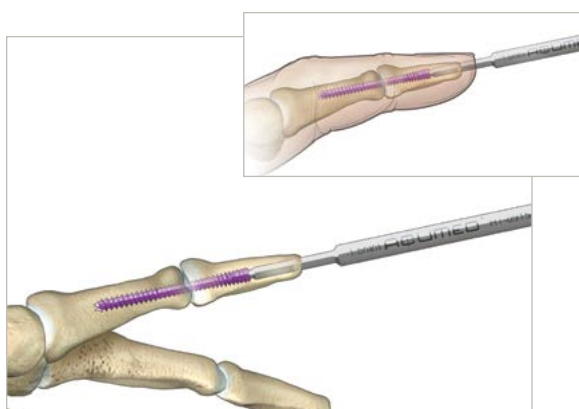
Make a short transverse (fish-mouth) incision in the tip of the distal phalanx and spread using a small (snap) clip. Measure guide wire length using either the percutaneous screw sizer or by placing a second wire at the entry point and subtracting the difference. If the surgeon intends to drive the screw below the surface of the distal phalanx, this must be accounted for in sizing the screw.





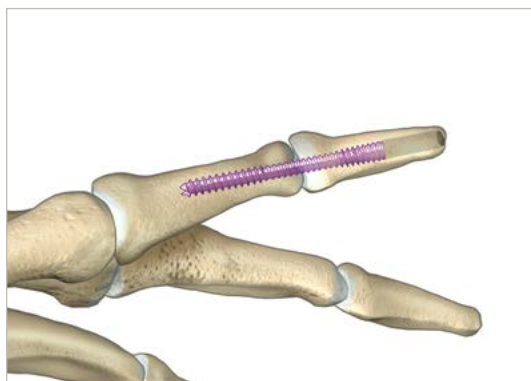
4 DRILL

Select the cannulated extended long drill and place over the wire. Drill by power drill or by hand reamer across the joint into the middle phalanx to the desired depth. If the surgeon intends to drive the screw below the surface of the distal phalanx, this must be accounted for in the depth of the prepared hole. Once finished with the long drill, open the near cortex with the appropriate profile drill. Having pre-drilled with long drill, profile drilling can usually be done by hand without any difficulty.



5 INSERT SCREW

Insert the correctly sized screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the extended long drill and re-insert the screw. Confirm placement and length of the screw and remove the guide wire.



Radial Styloid Surgical Technique: Acutrak 2® Standard

1 APPROACH AND GUIDE WIRE INSERTION

Make a small stab incision over the radial styloid process and deepen this down to bone, taking care to protect the superficial branch of the radial nerve. Reduce the fracture using traction and hold the position with the percutaneous pointed reduction forceps. If necessary, use the guide wire to aid in manipulation of the fracture and then drive the wire into the styloid fragment and across fracture site, gaining purchase in the medial cortex of the radius.

Tip: If using two guide wires, one should ideally be placed perpendicular to the line of the fracture and the second should lie in the subchondral bone beneath the articular surface of the radius.



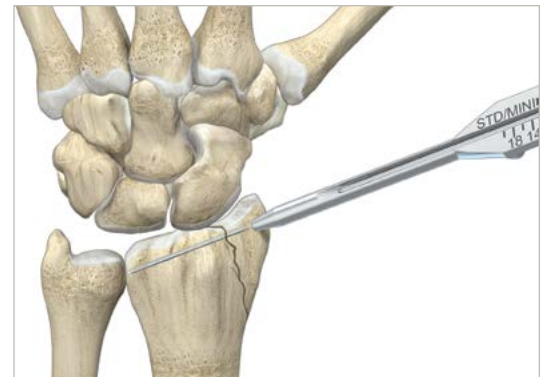
2 FRACTURE STABILIZATION

If the fracture is unstable or particularly large, it may be helpful to place a second guide wire to stabilize the fracture and surrounding anatomy.

3 DETERMINE SCREW LENGTH

Measure guide wire length using either the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second guide wire at the entry point and subtracting the difference in length. The screw sizer cannot always be used with the arthroscopic technique due to the limited access.

Tip: Leave the trailing edge of the Acutrak 2 in the radial cortex and ensure that the leading edge does not penetrate the sigmoid notch of the distal radial ulnar joint (DRUJ).



4 ADVANCE GUIDE WIRE

Advance the guide wire through the far cortex so as to minimize the risk of accidental withdrawal of the guide wire while drilling.



5 DRILL FAR FRAGMENT

Drill into the far fragment with the appropriate long drill. To be effective the drill only has to advance 4–5 mm past the fracture site, as the screw is self-drilling and self-tapping.

Tip: The long drill is recommended to mitigate the effects of varying bone density and the possibility of fracture distraction as the screw is inserted.



6 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill. This is not always necessary in styloid fracture fixation as the bone is relatively soft and forgiving.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.



7 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill slightly deeper with the long drill and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the leading edge of the screw has not penetrated the sigmoid notch. Repeat the process for the second screw and remove the guide wires.

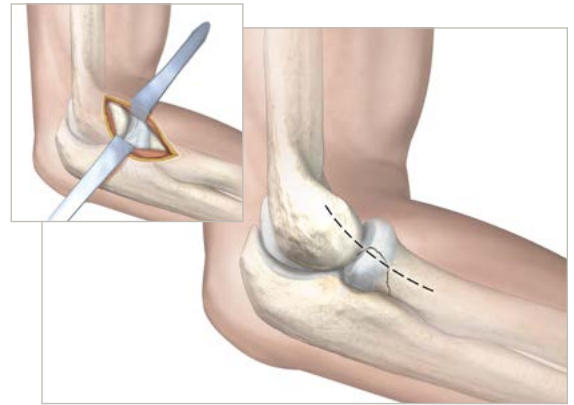


Radial Head Surgical Technique: Acutrak 2® Micro

1 APPROACH AND GUIDE WIRE INSERTION

Expose the fracture. Use an appropriate posterolateral approach or Kocher type approach. Evacuate hematoma and irrigate to facilitate the view. It may be necessary to divide the annular ligament to improve the exposure. Remove any interposed soft tissue and reduce the fracture under direct vision, holding the position with the appropriate guide wire.

Tip: if the fracture is excessively comminuted and/or irreducible, consider radial head replacement (see Acumed® Anatomic Radial Head Technique ELB10-01).



2 FRACTURE STABILIZATION

If the fracture is unstable or particularly large, it may be helpful to place a second guide wire in a radial configuration.

3 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length. Subtract 2 mm from the measured length to ensure that both ends of the screw remain buried beneath the articular surface.



4 ADVANCE GUIDE WIRE

Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.



5 DRILL FAR FRAGMENT

Drill into the far fragment with the appropriate size long drill.

Tip: The long drill is recommended to mitigate the effects of varying bone density and the possibility of fracture distraction as the screw is inserted.



6 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.

7 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and the trailing edges of the screw are beneath the articular surfaces, and remove the guide wires.



8 LIGAMENT REPAIR

Repair the annular ligament using non-absorbable sutures. The lateral collateral ligament may have been avulsed from the lateral humeral epicondyle or torn in substance. It should be assessed and repaired as necessary.

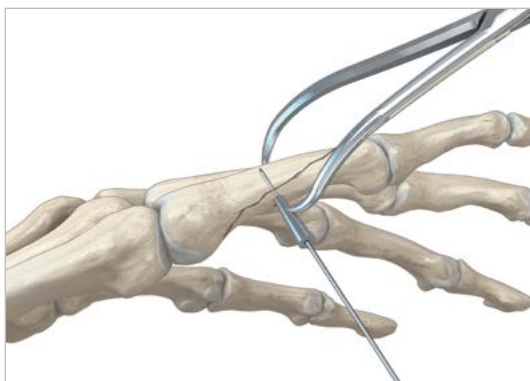
Proximal Phalangeal Fracture Fixation Surgical Technique: Acutrak 2® Micro



1 APPROACH AND GUIDE WIRE INSERTION

Reduce the fraction indirectly by traction. Occasionally it may be helpful to use the guide wire to manipulate or aid in the reduction. Make a small stab incision and deepen down to bone, taking care to protect the neurovascular bundles. Once fracture is reduced, hold the position using the percutaneous bone clamp and insert the appropriate size guide wire to hold the position. Advance the wire so that it just perforates the far cortex.

Tip: Finger traps are a useful reduction aid, especially the radiolucent designs, as it is possible to introduce the wire through the device.



2 FRACTURE STABILIZATION

If the fracture pattern is suitable (spiral or long oblique), it is often helpful to place a second parallel guide wire using the appropriate parallel wire guide.

Tip: Long oblique and spiral fractures frequently require two screws in order to provide adequate stability. It is biomechanically preferred to introduce these in opposite directions, leaving the trailing edge of the screw nearest the fracture line.



3 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length.

4 ADVANCE GUIDE WIRE

Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.

Tip: When using two guide wires, it is often easier to introduce both from the same side of the bone, then advance through the phalanx and out of the skin on the far side. If a second screw is required, drill back down the second guide wire from the opposite cortex and introduce the screw in the opposite direction.

5 DRILL FAR FRAGMENT

Drill across the fracture site and into the far cortex diameter with the appropriate long drill.

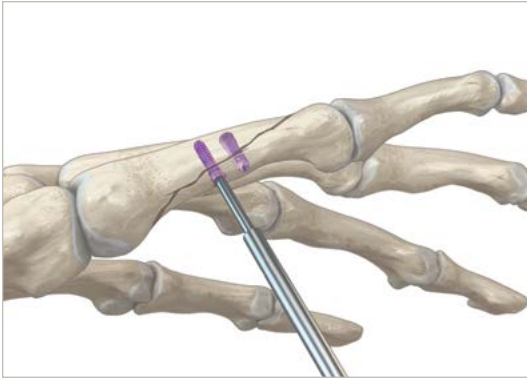


6 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill. This is an essential step so as to minimize the chance of cracking the thin cortical bone and propagating the fracture during screw insertion.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.



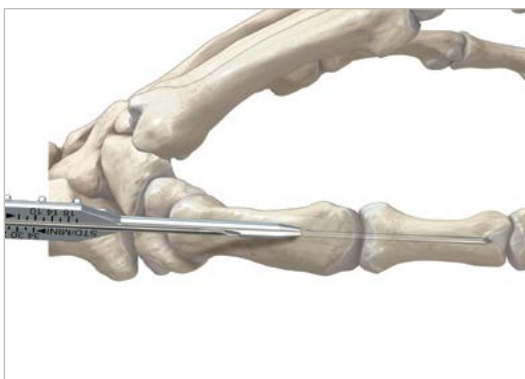
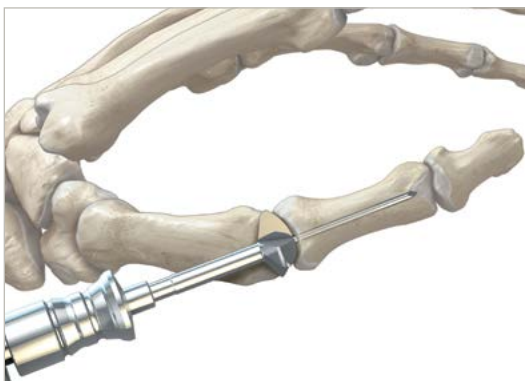
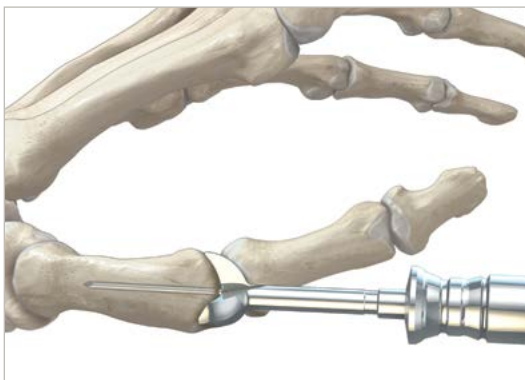


7 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met during insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and the trailing edges of the screw are within cortical bone. Insert any additional screws and then remove the guide wires.



MCP Fusion Surgical Technique: Acutrak 2® Standard



1 APPROACH AND GUIDE WIRE INSERTION

The entry point is through a dorsal longitudinal incision centered over the metacarpophalangeal (MCP or MP) joint. It is perhaps easier to approach the joint from the radial side, reflecting the extensor mechanism in an ulnar direction to expose the MP joint capsule. Reflect the joint capsule and strip back sufficiently to allow adequate exposure of the articular surfaces.

Denude the joint surfaces down to cancellous bone using the appropriate size Acumed concentric reamers (or preferred technique). If using Acumed reamers, Drive a .059" guide wire from the system through each bone to act as a guide for the reamers. While the wire for the proximal phalanx should be driven centrally, the wire for the metacarpal should be driven obliquely at an angle equal to the desired angle of flexion. This should begin centrally and exit through the dorsal midline of the metacarpal. Decorticate the articular surfaces of the joint using the cannulated concave/convex reamers within the system. This creates a complementary surface for the fusion with minimal shortening of the thumb.

Position the MCP joint in the appropriate degree of flexion (depending on the finger affected), taking care to maintain axial alignment and neutral rotation. Hold the position with a guide wire. This should be directed in the midline of the dorsal aspect of the metacarpal head, driving it across the joint to pass into the center of the proximal phalanx and into the medullary canal. Verify position of guide wire and joint position with fluoroscopy.

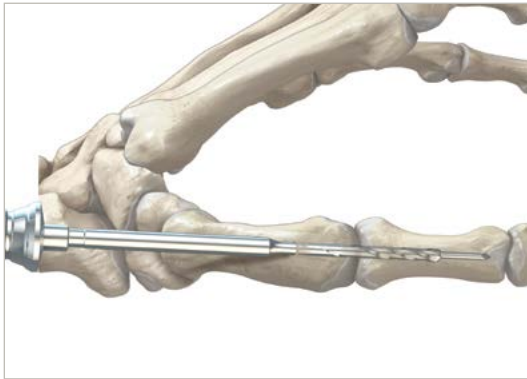
2 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length.

Tip: The screw should be as long as possible to provide sufficient stability of the joint during the fusion process. In order to ensure that the screw head is buried below the near cortex it may be necessary to subtract 2 mm from measurement taken as the sizer will be angled and not in direct contact with the bone.

3 ADVANCE GUIDE WIRE

Advance the guide wire slightly but do not perforate the volar cortex. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.



4 DRILL FAR FRAGMENT

Use the appropriate size long drill to drill across the fusion site nearly as far as the length of the chosen screw.

Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and minimizes the chances of inadvertent rotation of the proximal phalanx as the screw is advanced.



5 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.

6 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver, taking care that the fusion site does not rotate as the screw engages the far fragment. If excessive resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the trailing edge of the screw remains in sound cortical bone in the head of the metacarpal, and remove the guide wires.



Ulnar Styloid Fixation Surgical Technique: Acutrak 2® Micro or Mini



1 APPROACH AND GUIDE WIRE INSERTION

Ulnar styloid fixation can be carried out through traditional open or percutaneous approaches.

For an open approach, make a straight, longitudinal 2–3 cm incision over the distal ulna between the tendons of the extensor and flexor carpi ulnaris. The extensor retinaculum overlying the sixth compartment is then incised and reflected so as to expose the fracture site. Reduce the fracture and insert the guide wire through the tip of the styloid fragment into the distal ulnar. Confirm the position on fluoroscopy.

When using the percutaneous approach, suspend the hand using a single finger trap applied to the little finger in a similar fashion to scaphoid fixation. Make a small stab incision over the tip of the styloid and deepen down to bone using a small clip to reflect the superficial sensory branches of the ulnar nerve. Introduce the guide wire under fluoroscopic control, using it as a joystick to manipulate the fracture fragment as required and then advance into the distal ulna.

Tip: The open approach to the ulnar styloid is easier if the forearm is placed in supination with the arm across the patient's body rather than operating with the forearm in pronation on a hand table.

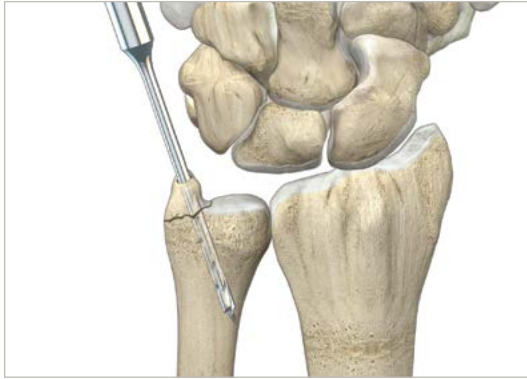


2 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length.

3 ADVANCE GUIDE WIRE

Advance the guide wire 5–6 mm further down the ulnar shaft so as to minimize the risk of accidental withdrawal of the guide wire while drilling.



4 DRILL FAR FRAGMENT

Use the appropriate size long drill to drill across the fracture site nearly as far as the length of the chosen screw.

Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and helps minimize the chances of inadvertent rotation of the styloid process as the screw is advanced.



5 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.



6 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the trailing edge of the screw remains just in the cortical bone at the tip of the styloid and remove the guide wire.



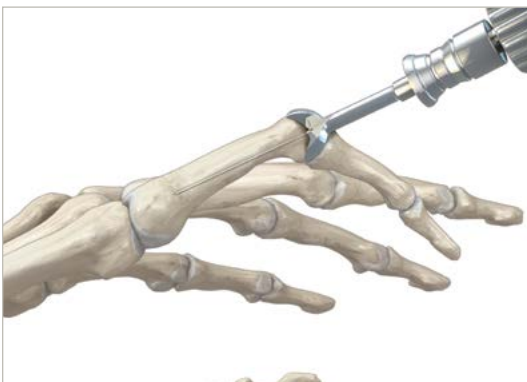
PIP Fusion Surgical Technique: Acutrak 2®—Micro or Mini



1 APPROACH AND GUIDE WIRE INSERTION

The entry point is through a dorsal longitudinal incision centered over the proximal interphalangeal (PIP) joint, reflecting the skin to expose the extensor mechanism. Split the extensor tendon in the midline and retract to either side to expose the PIP joint capsule. Reflect the joint capsule and strip back sufficiently to allow adequate exposure of the articular surfaces. Denude the joint surfaces down to cancellous bone using the appropriate size concentric reamers. Position the PIP joint in the chosen degree of flexion, taking care to maintain axial alignment and neutral rotation. Hold the position with a guide wire.

This should be directed in the midline of the just proximal to the dorsal aspect of the head of the proximal phalanx, driving it across the joint to pass the center of the middle phalanx and into the medullary canal. Verify position of the guide wire and joint position under fluoroscopy.



2 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2® Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length.

Tip: The screw should be as long as possible to provide sufficient stability of the joint during the fusion process.

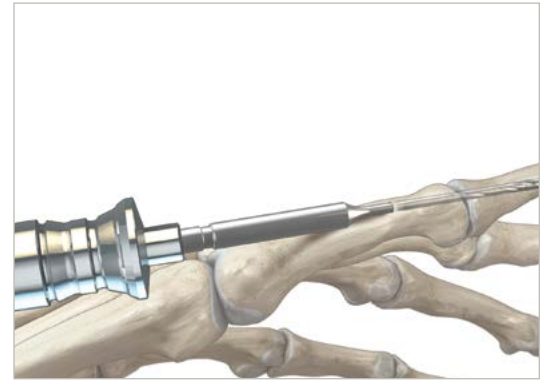
3 ADVANCE GUIDE WIRE

Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.

4 DRILL FAR FRAGMENT

Use the long drill to drill across the fusion site nearly as far as the length of the chosen screw.

Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and helps minimize the chance of inadvertent rotation of the fusion site as the screw is advanced.

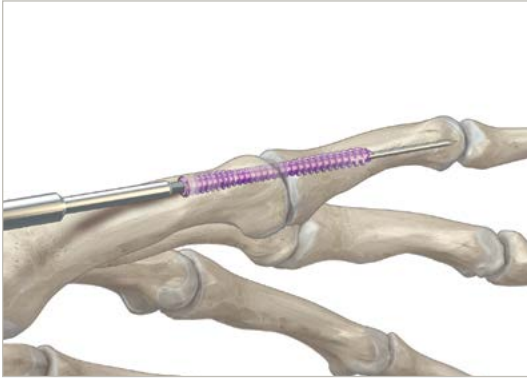


5 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill, taking great care not to crack the dorsal cortex, which can be very thin at this point.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.





6 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver, taking care that the fusion site does not rotate as the screw engages. If excessive resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the trailing edge of the screw remains in sound cortical bone in the proximal phalanx, and remove the guide wires.



Four Corner Fusion Technique: Acutrak 2® Mini

1 DORSAL APPROACH

Experience has shown that the dorsal Berger-Bishop approach provides excellent exposure, but the choice of approach is at the surgeon's discretion. It is essential to allow sufficient exposure to the radial side to allow for excision of the scaphoid and to the ulnar side in order to facilitate bone preparation for the ultimate fusion.



2 SCAPHOID EXCISION

The scaphoid is exposed with sharp dissection and is removed using osteotomes and rongeurs. It is often difficult to remove the more volar/distal portion, but care must be taken to ensure that every last bit is removed. Trim back any osteophytes or bone spurs from the radial dorsal lip and styloid process and save the pieces, along with the excised scaphoid, for use as bone graft later.



3 DECORTICATE BONE

Obtaining a solid fusion and minimizing the chances of non-union is dependent upon the preparation of the bone surfaces prior to fixation. This must be meticulous and all articular surfaces must be denuded of any remnant of articular cartilage down to bleeding cancellous bone. Small fine osteotomes, fine rongeurs, and a power burr are indispensable. Temporary guide wires can be used as joysticks to facilitate exposure.

Begin with the mid-carpal joint, preparing the opposing articular surfaces between capitate and lunate, then prepare the adjacent surfaces of the triquetrum and hamate.

Tip: It may not always be necessary to include the ulnar column and some surgeons prefer to restrict the fusion to the central column alone (capitate/lunate).



4 CAPITO-LUNATE SCREW FIXATION

Before fixation it is essential to ensure that the dorsal intercalated segment instability (DISI) deformity is corrected. The lunate must be reduced from its dorsiflexed position into a more volar, or at least neutral, angulation. In addition, the capitate must be brought back from its position of dorsal subluxation to align with the reduced position of the lunate. This is intended to maximize the post-operative range of motion. Hold the position of the lunate with a wire introduced through the distal radius into the lunate and then provisionally pin the capitate.

It is easier to perform the capito-lunate screw fixation in a distal to proximal manner. The access is more straightforward and it avoids violating the articular cartilage of the lunate. Reduce and align the capitate onto the lunate and then advance the guide wire through the distal pole of the capitate into the lunate and the length measured using the Acutrak 2 Percutaneous Screw Sizer (AT2-AMCZ). The guide wire may then be advanced distally into the radius to enhance stability. Pack any gaps in the fusion site with the harvested cancellous bone graft from the excised scaphoid. Drill to appropriate length and insert appropriate size screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and the trailing edges of the screw are beneath the articular surfaces, and remove the guide wires.

Tip: If access to the distal capitate is difficult and/or the wires are going too volar, it may be easier to introduce the wire on either side of the base of the third metacarpal (middle finger). This is especially so when using a minimally invasive (or arthroscopic) technique as described by Joe Slade (*Atlas of Hand Clinics* 2003) for a central column fusion when two screws are required. Essentially make a small incision over the second web space dorsally, deepen this down to the base of the second/third metacarpals, and retract the soft tissues to allow the drill sleeve to be inserted on the radial side of the third metacarpal. Advance the guide wire down the central axis of the capitate, correct the DISI deformity of the lunate and then pass the wire into the lunate in its reduced position. Check the length of the screw, advance the guide wire into the distal radius to enhance stability, drill and prepare the bones in the standard way, and insert the appropriate length screw.

5 TRIQUETRUM-HAMATE SCREW FIXATION

The triquetrum-hamate screw fixation is performed distally to proximally using either an open or percutaneous technique. If using the percutaneous method, make a 1 cm incision over the dorsal aspect of the triquetrum just distal to the ulnar styloid. Deepen this down to bone using a small clip, taking care to protect the dorsal branches of the ulnar sensory nerve. Advance the guide wire through the central portion of the triquetrum and into the center of the hamate and measure the length using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ). Drill to appropriate length, pack cancellous bone graft into any gaps, and insert appropriate size screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and trailing edges of the screw are beneath the articular surfaces, and remove the guide wires.

It has been shown that a two-column (capitate/lunate and triquetrum/hamate) fusion combined with grafting of the articular surfaces is generally sufficient and transverse fixation screws are not always necessary.^{1,2} If however it is felt that additional screws are required, then proceed to a lunate/triquetrum fusion.

1. Ozyurekoglu T, Turker T. Results of a method of 4-corner arthrodesis using headless compression screws. *J Hand Surg.* 2012;37(3):486-492.
2. Slade III JF, Bomback DA. Percutaneous capitolunate arthrodesis using arthroscopic or limited approach. *Atlas Hand Clin.* 2003;8:149-162.

6 LUNATE-TRIQUETRUM SCREW FIXATION

The lunate to triquetrum screw fixation is performed transversely. Access to the radial side of the lunate is relatively easy following the scaphoid excision and a guide wire can be advanced through the lunate and into the triquetrum, taking care to avoid intersecting the capito-lunate screw. Measure the length using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) and advance the wire through the triquetrum and skin on the ulnar side. Make a small stab incision and protect the cutaneous nerves and then drill from the ulnar side in preparation for screw insertion. By introducing the screw from this direction, it avoids traversing the full width of the lunate, thereby reducing the chance of impinging on the capito-lunate screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and the trailing edges of the screw are beneath the articular surfaces, and remove the guide wires.



Chamay Technique: Acutrak 2® Mini



1 APPROACH AND GUIDE WIRE INSERTION

Use the 3–4 extensor compartment approach, followed by a ligament-sparing incision to the wrist capsule. Remove the dorsal lip of the radius over the lunate to facilitate visualization. Maintaining general bony contours, decorticate the lunate facet of the radius and the proximal lunate articular surface using curettes, rongeurs, and curved osteotomes.



2 DETERMINE SCREW LENGTH

Under fluoroscopy, correct any preoperative volar intercalated segmental instability (VISI) or dorsal intercalated segment instability (DISI) deformity. A guide wire inserted into the dorsal lunate may be used as a joystick to effect correction. Stabilize the lunate in the reduced position with provisional guide wires from the radius into the lunate. Measure guide wire length either by using the appropriate screw size or by placing a second wire at the entry point and subtracting the difference in length.

3 ADVANCE GUIDE WIRE

Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.



4 DRILL FAR FRAGMENT

Use the appropriate size long drill to drill across the fusion site nearly as far as the length of the chosen screw.

Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and minimizes the chance of inadvertent rotation of the fusion site as the screw is advanced.

5 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill, taking great care not to crack the dorsal cortex, which can be very thin at this point.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.

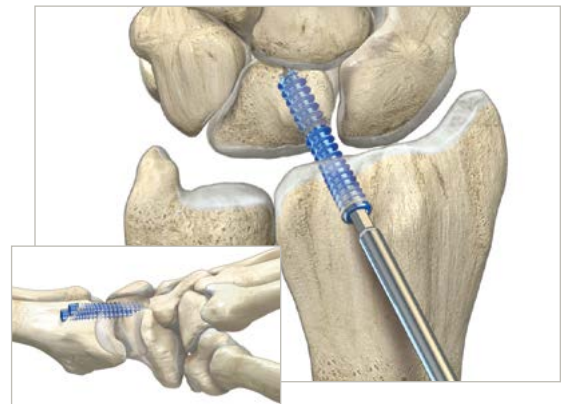


6 BONE GRAFT

Harvest bone graft from the distal radius or iliac crest and pack the graft tightly into the radio-lunate joint. Pack the remaining bone graft into the dorsal radiolunate joint.

7 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver, taking care that bone does not rotate as the screw engages. If excessive resistance is met upon insertion or if distraction occurs: Stop, remove the screw, redrill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the trailing edge of the screw remains in sound cortical bone in the proximal phalanx, and remove the guide wires.



Capitate-Hamate Fusion Technique: Acutrak 2® Mini



1 APPROACH

A dorsal transverse approach typically provides excellent exposure to the capitate-hamate joint, but the choice of approach is at the surgeon's discretion. It is essential to allow exposure of the distal two-thirds of the capitate-hamate joint in order to facilitate bone preparation for the ultimate fusion.

2 DECORTICATE BONE

Obtaining a solid fusion and minimizing the chances of non-union is dependent upon the preparation of the bone surfaces prior to fixation. This must be meticulous and all articular surfaces must be denuded of any remnant of articular cartilage down to bleeding cancellous bone. Small fine osteotomes, fine rongeurs, and a power burr are indispensable. Temporary guide wires can be used as joysticks to facilitate exposure.

Prepare the mid-carpal joint and opposing articular surfaces between capitate and hamate.

3 GUIDE WIRE INSERTION

The capitate-hamate screw fixation is performed laterally to medially using either an open or percutaneous technique. If using the percutaneous method, make a small incision over the dorsal aspect of the hamate just distal to the ulnar styloid. Advance the guide wire through the central portion of the hamate and into the center of the capitate.



4 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second wire at the entry point and subtracting the difference in length.

5 ADVANCE GUIDE WIRE

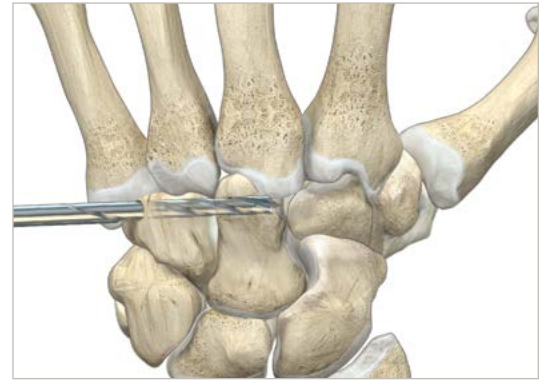
Advance the guide wire through the far cortex so that it lies in the subcutaneous tissues.

This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.

6 DRILL FAR FRAGMENT

Use the appropriate size long drill to drill across the fusion site nearly as far as the length of the chosen screw.

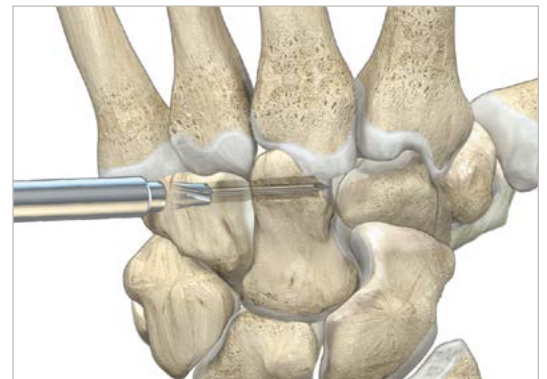
Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and minimizes the chances of inadvertent rotation of the fusion site as the screw is advanced.

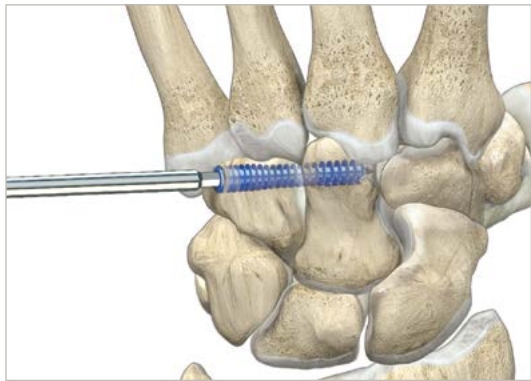


7 DRILL NEAR CORTEX

Open the near cortex with the appropriate profile drill, taking great care not to crack the dorsal cortex, which can be very thin at this point.

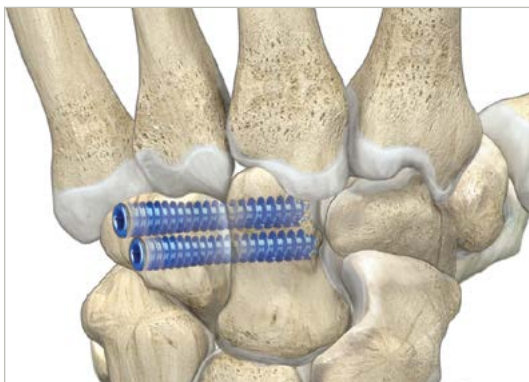
Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.





8 SCREW INSERTION

Following drilling, pack cancellous bone graft into any gaps and insert appropriate size screw. Confirm placement and length of the screw under fluoroscopy, ensuring that both the leading and the trailing edges of the screw are beneath the articular surfaces, and remove the guide wires.



Bennet's Fracture: Acutrak 2® Mini

1 JOINT INSPECTION, REDUCTION, AND GUIDE WIRE INSERTION

A Bennett's fracture is a fracture of the base of the first metacarpal bone which extends into the carpometacarpal joint, which may have various fracture geometries.

Reduce the fracture with simple traction and closed manipulation. Occasionally it may be necessary to open the fracture to ensure an accurate reduction.

Once the fracture is reduced, hold the position using a temporary guide wire introduced from the metacarpal into the trapezium. When the fracture is stable, it is then safe to insert the appropriate guide wire across the base of the metacarpal into the medial fracture fragment, trying to cross the fracture line in a perpendicular direction or almost parallel to the articular surface.



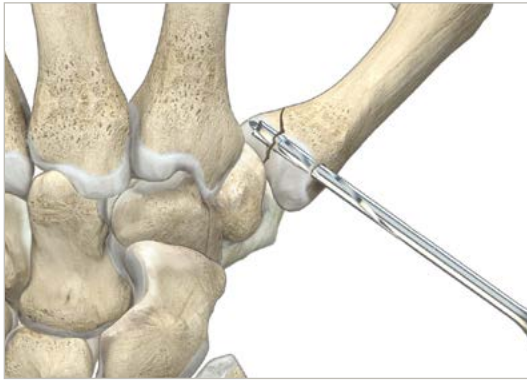
2 DETERMINE SCREW LENGTH

Measure guide wire length either by using the Acutrak 2 Percutaneous Screw Sizer (AT2-SMCZ) or by placing a second guide wire at the entry point and subtracting the difference in length.



3 ADVANCE GUIDE WIRE

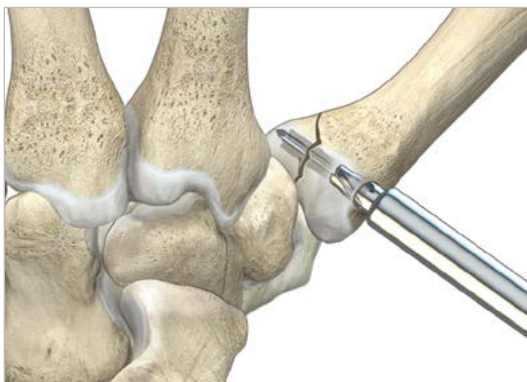
Advance the guide wire slightly but do not perforate the volar cortex. This is intended to minimize the risk of accidental withdrawal of the guide wire while drilling and facilitates wire removal if it should break.



4 DRILL FAR FRAGMENT

Use the appropriate size long drill to drill across the fusion site almost as far as the length of the chosen screw.

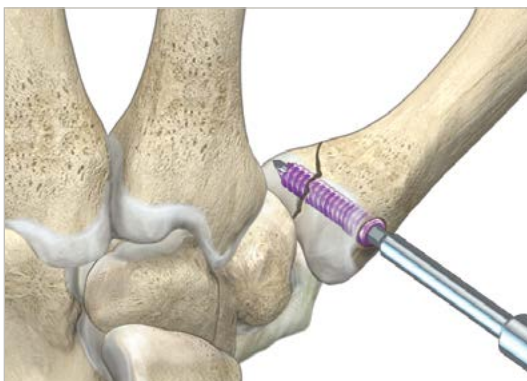
Tip: The long drill is recommended to mitigate the effects of varying bone density and distraction upon screw insertion and minimizes the chances of inadvertent rotation of the fragment as the screw is advanced.



5 DRILL NEAR CORTEX

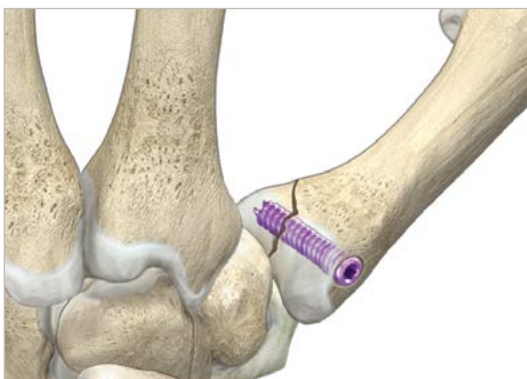
Open the near cortex with the appropriate profile drill.

Tip: Having pre-drilled with the long drill, profile drilling can usually be done by hand without any difficulty.



6 SCREW INSERTION

Insert the correct size screw with the appropriate hex driver. If resistance is met upon insertion or if distraction occurs: Stop, remove the screw, re-drill with the long drill, and re-insert the screw. Confirm placement and length of the screw under fluoroscopy, ensuring that the trailing edge of the screw remains just in the cortical bone of the metacarpal base, and remove the guide wire.



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Non-Sterile 28 mm Mini Acutrak 2	AT2-M28
Non-Sterile 30 mm Mini Acutrak 2	AT2-M30

Acutrak 2® Mini Instrumentation

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.045" x 6" Guide Wire	WS-1106ST
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2 mm Cannulated Hex Driver	HT-1120

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Acutrak 2 Arthroscopic Probe	AT2-0402
Acutrak 2 Percutaneous Screw Sizer (Standard, Mini, Micro)	AT2-SMCZ
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Standard Acutrak 2 Long Drill	At2-L2515
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