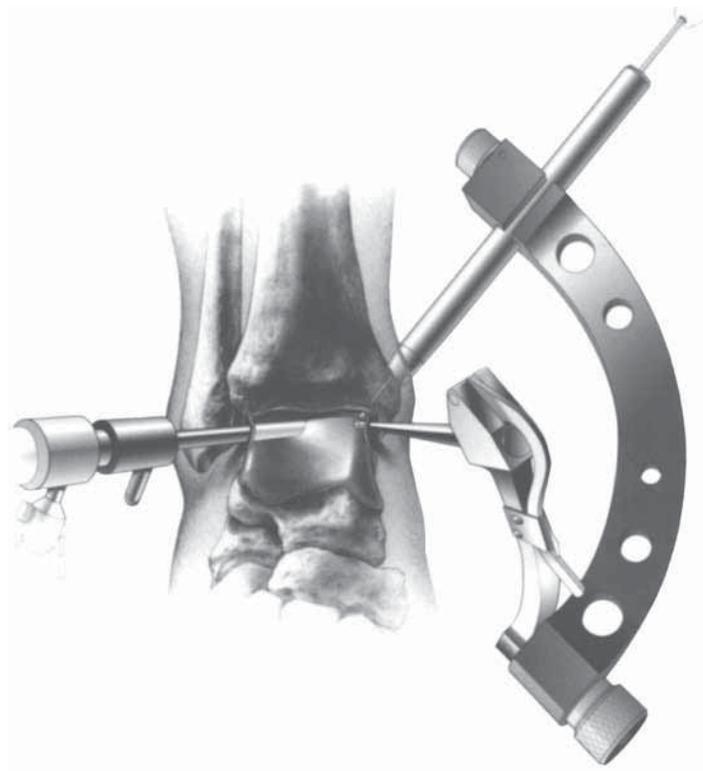


Arthroscopic Kirschner Wire Placement Using the Smith & Nephew MICRO VECTOR[◇] Drill Guide System

Richard D. Ferkel, MD



Surgical technique by:

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Introduction

The Smith & Nephew VECTOR[®] Drill Guide System, specifically designed for use in large joints such as the knee, has greatly facilitated arthroscopic Kirschner wire (K-wire) placement, cannulated screw insertion, and arthrodesis. Occasionally this system has been successfully applied during small joint surgery; however, in the majority of cases its design precludes its use in small joints.

The Smith & Nephew MICRO VECTOR[®] Drill Guide System was developed to facilitate arthroscopic Kirschner wire placement, cannulated screw insertion, and arthrodesis in small joints such as the ankle, wrist, foot, and elbow. This system features the original 170° rotational design of the VECTOR Drill Guide and is designed to ensure rapid, accurate pin placement in small joints.

Indications

The MICRO VECTOR System is intended for use in drill placement in a variety of small joint procedures.

Examples include, but are not limited to, the following:

1. Drilling osteochondral lesions of the talus.
2. Drilling osteochondritis dissecans of the capitellum.
3. Wrist arthrodesis and fracture stabilization.
4. Reattachment of osteochondral lesions with cannulated screws.
5. Arthroscopic internal fixation of ankle fractures utilizing Kirschner wires and/or cannulated screws.
6. Ankle arthrodesis via cannulated screws.
7. Pediatric anterior or posterior cruciate ligament reattachment of avulsion injuries.
8. Great toe arthrodesis.

Contraindications

Because the MICRO VECTOR System is indicated for use whenever accurate insertion of a Kirschner wire into a small joint is needed, its use is contraindicated when placement of drill holes is inappropriate, e.g., across pediatric growth plates, when infection is present in the joint, or when close proximity to neurovascular structures risk injury.

Warnings

- The MICRO VECTOR System was designed for the average-sized adult ankle and wrist, and its small size permits use in multiple joints. However, it should never be forced into joints too small to allow safe use.
- This system is not intended to substitute for x-ray or fluoroscopic verification of correct wire or pin placement.

Precautions

- The MICRO VECTOR System should never be bent or modified to be used in a manner for which it was not originally intended.
- The MICRO VECTOR System should be carefully inspected prior to each use. Improper usage or “torquing” the guide can lead to inaccurate wire or pin placement and necessitate drilling of additional holes.
- The K-wire guide of the MICRO VECTOR System is designed to accommodate .045” (1.1 mm), .062” (1.6 mm) and .125” (3.2 mm) K-wires. If K-wires smaller than .045” (1.1 mm) are used, the precise wire/guide lumen fit is compromised. This may produce some loss of placement accuracy.
- With extremely posterior talar lesions, the convex curve of the talus may not allow the MICRO VECTOR System to reach the lesion. If this occurs, the surgeon may want to insert the guide through an accessory posterolateral portal for more accurate pin placement.
- For correct K-wire insertion guidance, it is essential that the probe be in the forward locked position before it is inserted into the joint space.
- To ensure that the K-wire does not impact the probe tip, retract the tip just before the K-wire reaches the tip. To accomplish this, pull back on the probe lever so that the lever is removed from the grooved tab. This retracts the probe tip slightly, removing it from the K-wire entry path (Figure 5).
- The probe tip precisely overlies the K-wire entry point. Therefore, the tip must be retracted slightly from that point to allow K-wire entry.
- The ankle should never be flexed or extended while K-wires are in both the distal tibia and talus since this can lead to wire bending or breakage.
- The position of both screws in the talus should be checked using the fluoroscope in both the anteriorposterior and lateral planes to ensure that they do not penetrate the subtalar joint.

Product Description

The Smith & Nephew MICRO VECTOR® Drill Guide System (REF 4314) was designed and developed in conjunction with Richard D. Ferkel, MD, Southern California Orthopedic Institute.

The MICRO VECTOR System consists of the specific instruments required for accurate K-wire placement in small joints. The system is supplied non-sterile and includes the following components, each of which may also be ordered individually:

REF	Description
4291	MICRO VECTOR Drill Guide
4295	K-wire guide for a .045" (1.1 mm) K-wire
4296	K-wire guide for a .062" (1.6 mm) K-wire
7204612	K-wire guide for a .125" (3.2 mm) K-wire
4297	Offset Drill Guide

The components of the MICRO VECTOR System allow the arthroscopist to precisely direct K-wire placement within the joint.

The system's two articulating arms ensure that as arm position changes, alignment between the distal ends remains constant. Movement of the arms is controlled by a thumbscrew (A) which can be rotated to allow or prevent arm rotation.

At the distal end of one arm is a tapered, stainless steel probe (B). This probe has a rounded tip and is designed to be placed within the joint space directly over the site of entry for the K-wire. Required advancement and retraction of the probe is controlled by the probe lever (C).

At the distal end of the other arm is a channel guide (D) which accommodates a K-wire guide. The K-wire guides (E) included in the system are designed to direct insertion of .045" (1.1 mm), .062" (1.6 mm) or .125" (3.2 mm) K-wires. Once the guide is inserted into the channel, the guide thumbscrew (F) is rotated to secure guide position.

In preparation for K-wire insertion, the guide is inserted into the K-wire guide channel. The guide arm of the MICRO VECTOR Drill is rotated to position the guide over the desired bone entry site for the K-wire. The constant alignment of the distal ends of the MICRO VECTOR Drill articulating arms ensures that the K-wire will be advanced precisely to the tip of the probe.

When multiple K-wire placement is indicated, the offset drill guide (G), included in the system, allows a precisely patterned series of drill holes to be made. This guide incorporates a dual-end design to accommodate the .045" (1.1 mm) and .062" (1.6 mm) K-wires.

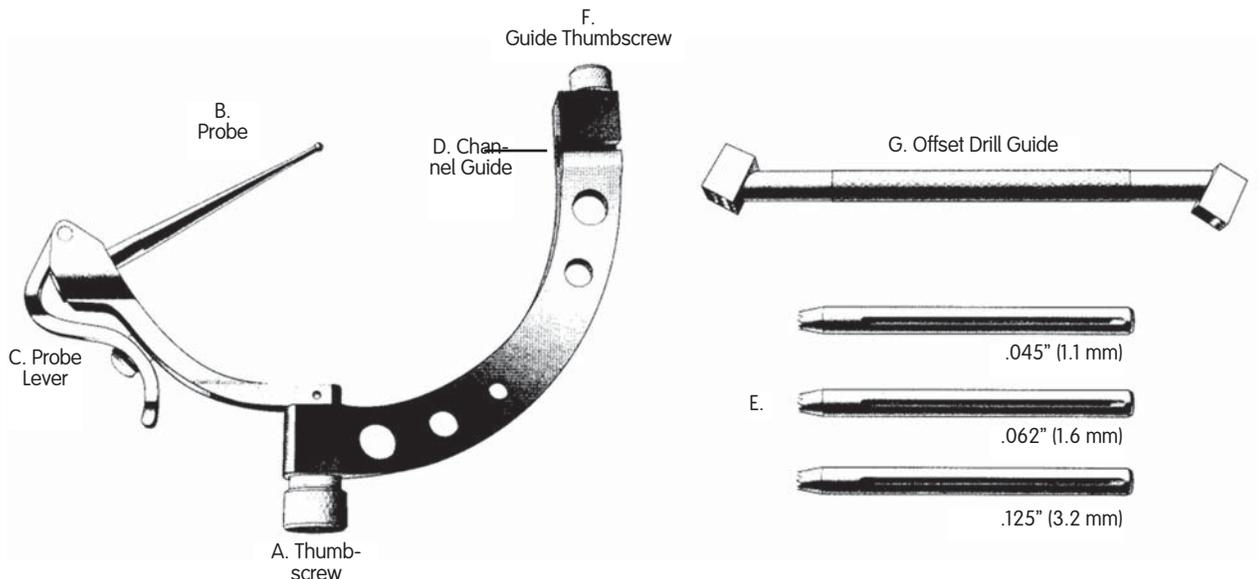


Figure 1. Smith & Nephew MICRO VECTOR Drill Guide System.

Operative Technique as described by
Richard D. Ferkel, MD

Patient Preparation

Sterilize the Smith & Nephew MICRO VECTOR Drill Guide System following the Instructions for Use (REF 1060355) included with the system.

Prepare the patient for arthroscopic K-wire placement using the standard practices for your institution. Establish the necessary arthroscopic portals.

MICRO VECTOR Drill Guide System Preparation

Rotate the guide thumbscrew to completely retract the distal portion of the thumbscrew from the channel guide and provide for unobstructed K-wire guide insertion into the channel (Figure 2A). Select the appropriately sided K-wire guide. Insert the K-wire guide into the K-wire guide channel in the MICRO VECTOR Drill Guide. Ensure the toothed end is directed toward the probe (Figure 2B).

The K-wire guide is designed with a shallow horizontal slot on its surface. This slot must be positioned directly under the guide thumbscrew for the guide to be properly secured. To achieve this, twist the guide until a click is heard, indicating that the guide is in proper position (Figure 2 inset).

Note: When the K-wire guide is properly positioned in the channel, the slot is located on a direct vertical axis from the guide thumbscrew.

Leave the guide thumbscrew in the retracted position and lock the MICRO VECTOR Probe in the forward position.

Caution: For correct K-wire insertion guidance, it is essential that the probe be in the forward locked position before it is inserted into the joint space.

The probe lever controls probe position. Push the lever forward into the grooved tab to lock the probe in the forward position. Retract the probe lever to retract the probe from the forward position.

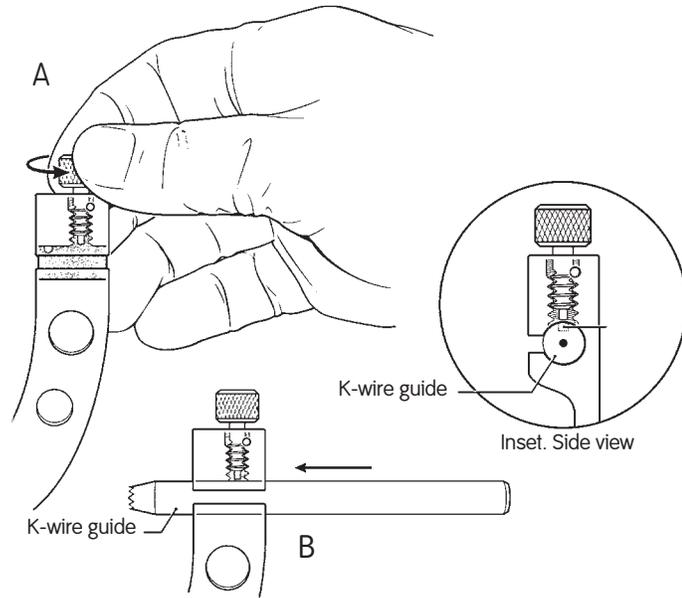


Figure 2. K-wire guide insertion.

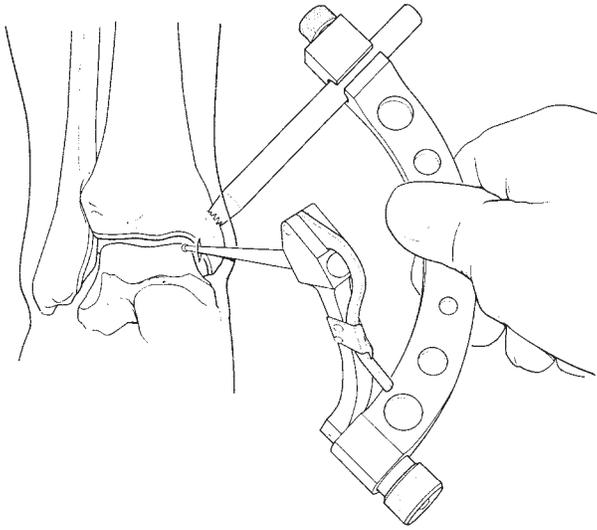


Figure 3. Anterior view.

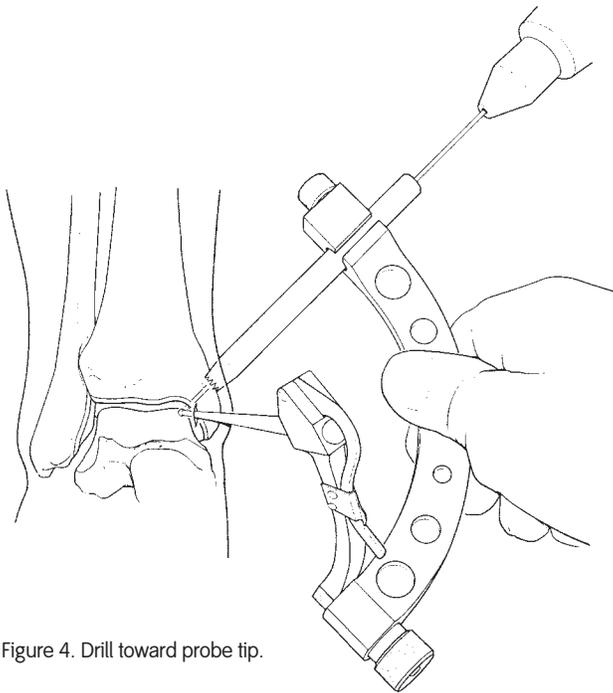


Figure 4. Drill toward probe tip.

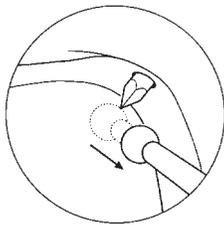


Figure 5. Probe tip retraction.

MICRO VECTOR Drill Guide Positioning

Insert the probe through a portal and into the joint space. Under arthroscopic visualization, position the tip of the probe at the desired drill site. With the probe properly positioned, determine the entrance angle required for proper K-wire placement within the joint and select the entry site. Make a small incision in the skin. Articulate the guide arm of the MICRO VECTOR Drill to position the K-wire guide at the entry site (Figure 3).

Note: Loosen the thumbscrew located at the junction of the K-wire guide arm and probe arm to easily articulate the MICRO VECTOR Drill Guide. Once the K-wire guide arm is in the desired position, tighten the thumbscrew to ensure the stability of the new position.

Advance the K-wire guide through the skin incision and into position against the bone to be drilled. If necessary, anchor the guide more rigidly by tapping the proximal end of the guide to imbed the distal teeth into the bone surface. Tighten the guide thumbscrew to lock the K-wire guide within the K-wire guide channel.

K-Wire Insertion

Insert the K-wire (or drill bit) through the K-wire guide and drill through the bone toward the probe tip (Figure 4).

Caution: To ensure that the K-wire does not impact the probe tip, retract the tip just before the K-wire reaches the tip. To accomplish this, pull back on the probe lever so that the lever is removed from the grooved tab. This retracts the probe tip slightly, removing it from the K-wire entry path (Figure 5).

Caution: The probe tip precisely overlies the K-wire entry point. Therefore, the tip must be retracted slightly from that point to allow K-wire entry.

At this point, the K-wire may be advanced through the joint and into cortical and cancellous bone to promote bleeding and subsequent healing of the articular cartilage surface.

With the K-wire properly positioned, retract the K-wire guide from the K-wire guide channel, leaving the K-wire in place. Guide the K-wire through the small opening lateral to the channel guide to free it from the drill guide (Figure 6). Withdraw the probe from the joint space and remove the entire system.

Joint Pinning

In addition to K-wire placement, the MICRO VECTOR System may be used to insert permanent pins for joint fixation. The pins are placed using the K-wire guide for precise guidance. The design of the MICRO VECTOR System then permits removal of the guide without altering the position of the pins.

Multiple K-Wire Joint Stabilization

In some cases, multiple K-wires are required for proper joint stabilization. The MICRO VECTOR System includes an offset drill guide to allow precise patterning of multiple K-wires.

After the initial K-wire is properly positioned, retract the K-wire guide from the K-wire guide channel, leaving the K-wire in place. Free the K-wire from the K-wire guide channel and withdraw the probe from the joint space. Remove the entire drill guide system.

Thread the proximal end of the imbedded K-wire through the center hole in the offset drill guide. Advance the offset drill guide over the K-wire to the bone surface. Drill additional K-wires through the holes in the offset drill guide, establishing a pattern around the initial K-wire (Figure 7).

Note: The dual-end design of the offset drill guide accommodates .045" (1.1 mm) and .062" (1.6 mm) K-wires. Each end is clearly labeled to indicate the respective hole aperture size.

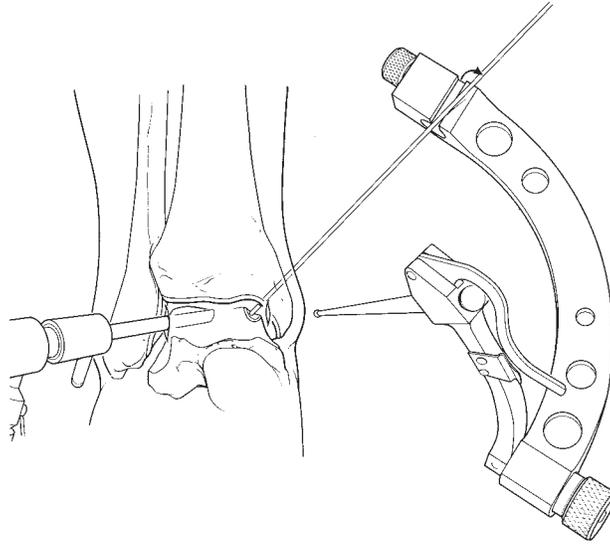


Figure 6. Free the K-wire from the channel guide and remove the system.

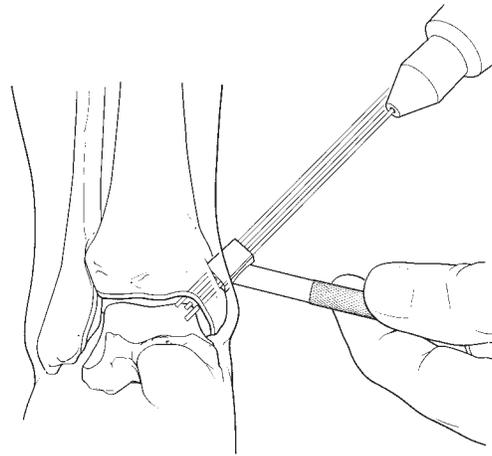


Figure 7. Multiple K-wire placement using the offset drill guide.

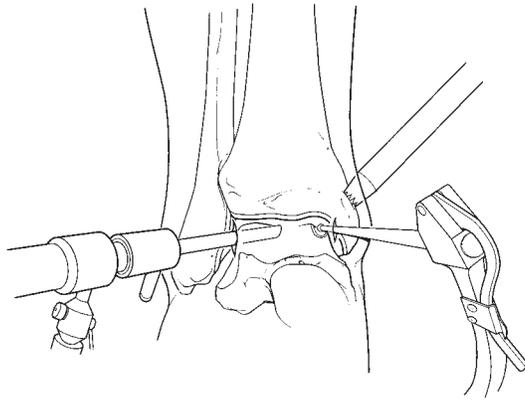


Figure 8. Anteromedial portal.

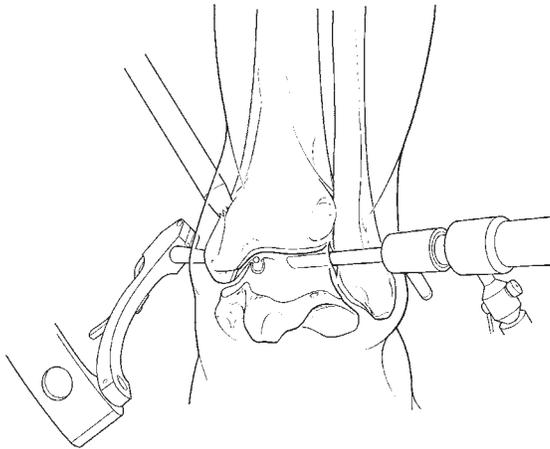


Figure 9. Posterior view.

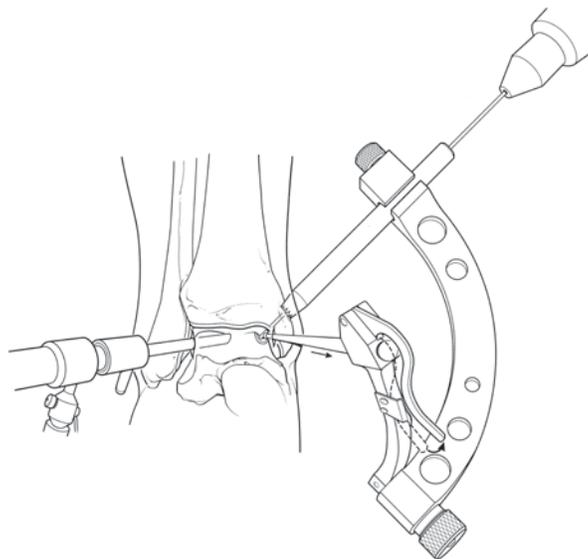


Figure 10. Probe tip retraction.

Surgical Applications

In addition to placement of K-wires and permanent pins, the MICRO VECTOR System can be used to facilitate various surgical procedures. The following discusses specific surgical applications for the system.

Osteochondral Lesions of the Talus

After the loose osteochondral lesion of the talus (OLT) is excised, arthroscopically-assisted drilling may be indicated. The MICRO VECTOR System can be used to allow precise drill hole placement.

Note: If the lesion is anteromedial on the talus, place the arthroscope through the anterolateral portal and insert the probe through the anteromedial portal (Figure 8). If the lesion is more posteromedial, it may be necessary to insert the arthroscope through the posterolateral portal and the probe through the anteromedial portal (Figure 9).

Make a small skin incision over the junction of the medial malleolus and distal tibia, avoiding the saphenous vein and nerve. Insert the probe through the appropriate portal and place the tip on the osteochondral lesion of the talus where the hole is desired. Select a .045" (1.1 mm) or a .062" (1.6 mm) K-wire guide. Insert the K-wire through the skin incision and position it against the bone. Lock the K-wire guide in place.

Drill the K-wire through the malleolus into the ankle joint. Retract the probe tip prior to drilling into the talus so that it is not damaged or bent as the K-wire advances (Figure 10).

Reposition the probe and repeat the prior sequence to create multiple holes. Alternatively, use the offset drill guide supplied with the MICRO VECTOR System to quickly drill additional holes in any direction. The offset guide also allows for fine adjustments in pin location (Figure 11).

Note: It is critical that the drill tip be repositioned into its original location prior to drilling additional holes through the offset drill guide.

A third way to place multiple drill holes is to insert an initial K-wire into the talus using the K-wire guide. Then retract the K-wire into the joint. With the K-wire safely positioned within the joint, flex and extend the ankle, allowing the tip of the K-wire to be positioned at different locations on the talar surface for subsequent drilling.

Caution: The ankle should never be flexed or extended while K-wires are in both the distal tibia and talus since this can lead to wire bending or breakage.

Arthroscopic Fracture Fixation with Cannulated Screws

Internal fixation with cannulated screws may be an appropriate surgical approach with some small joint fractures. The MICRO VECTOR System can be used to facilitate this approach.

To illustrate, in the ankle a fracture of the distal tibia can be arthroscopically reduced and pinned with a K-wire utilizing the MICRO VECTOR System. If cannulated screws are necessary to stabilize the fracture, they can be inserted over the K-wire.

Fluoroscopic visualization may occasionally be indicated to assist in verifying appropriate fracture reduction and screw position (Figure 12).

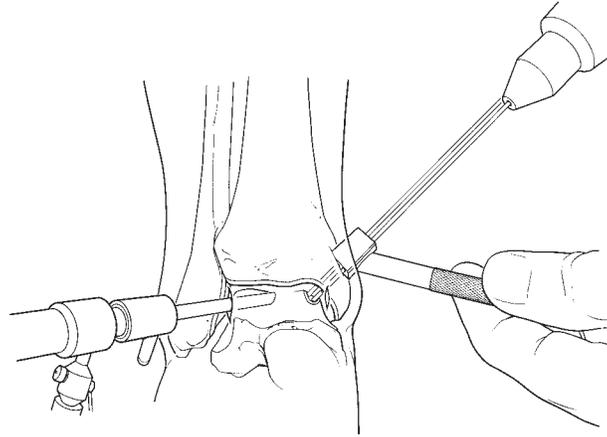


Figure 11. Drill additional holes with the offset guide.

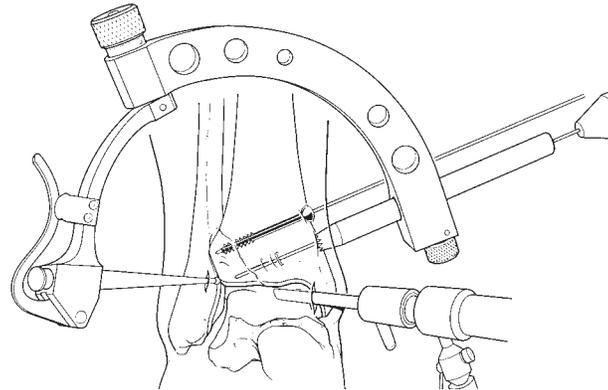


Figure 12. Fracture reduction.

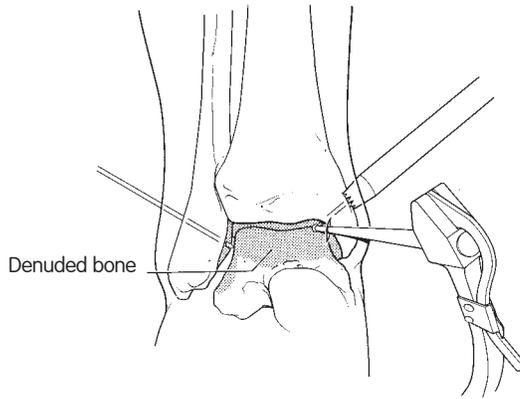


Figure 13. K-wire placement.

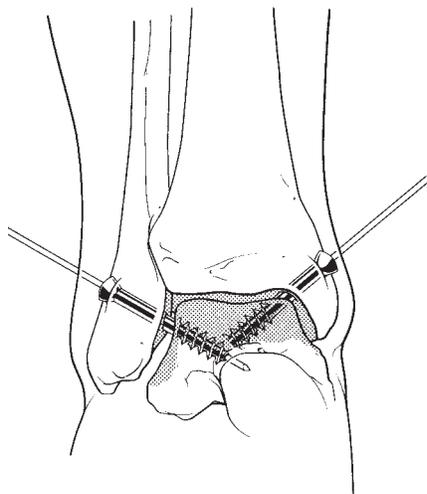


Figure 14. Screw insertion over K-wire.

Arthroscopic Arthrodesis

During arthroscopic arthrodesis, debride the joint with curettes, shavers and burrs to bleeding bone. Once this is accomplished, internal fixation of the joint with cannulated screws may be necessary.

In wrist arthrodesis, use the MICRO VECTOR System in conjunction with a “small joint” cannulated system, e.g., 3.5–4.0 mm cannulated screws. Select the .045” (1.1 mm) K-wire guide and use the system to guide K-wire placement across the joint. If necessary, introduce a cannulated screw over the K-wire for stabilization.

In the ankle, the .125” (3.2 mm) K-wire guide included in the Micro Vector Drill Guide System allows precise K-wire insertion prior to use of the 6.5 mm cannulated screw system. During ankle arthrodesis and while under arthroscopic visualization, first bring the K-wires through the distal tibial and distal fibular articular surfaces, but not across the joint. Accurate K-wire placement is best achieved through use of the MICRO VECTOR System (Figure 13).

After appropriate K-wire placement is obtained, place the foot in the neutral position for dorsiflexion and plantar flexion. Drill the medial K-wire across the tibiotalar joint into the talus. Confirm its position under fluoroscopy, then drill the lateral K-wire across the joint and insert the two cannulated screws over the K-wires (Figure 14).

Caution: The position of both screws in the talus should be checked using the fluoroscope in both the anteriorposterior and lateral planes to ensure that they do not penetrate the subtalar joint.

Conclusion

The MICRO VECTOR System will help provide accurate wire and pin placement within the small joint. However, because the wire or pin is frequently passed through areas adjacent to neurovascular structures, a thorough knowledge of joint anatomy is critical to avoid injury. Further, appropriate indications and contraindications must be observed and the surgeon should meticulously adhere to technique detail.

Additional Instruction

Prior to performing this technique, consult the Instructions for Use documentation provided with individual components — including indications, contraindications, warnings, cautions, and instructions.

Courtesy of Smith & Nephew, Inc.,
Endoscopy Division

Caution: U.S. Federal law restricts this device to sale by or on the order of a physician.

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