Arthroscopic Kirschner wire placement, cannulated screw insertion, and arthrodesis have been greatly facilitated by the Vector® Drill Guide System, a system specifically designed for use in large joints such as the knee. Occasionally, the system has been successfully applied during small joint surgery, however, in the majority of cases the design of the Vector Drill Guide System precludes its use in small joints.

To facilitate arthroscopic Kirschner wire placement, cannulated screw insertion, and arthrodesis in small joints such as the ankle, wrist, foot and elbow, the Micro Vector Drill Guide System has been developed by Smith & Nephew. This system features the original 170° rotational design of the Vector Drill Guide System and has been designed to ensure rapid, accurate pin placement in small joints.
Overview

Indications
The Micro Vector Drill Guide System is indicated for use whenever accurate Kirschner wire placement in a small joint is needed. Indications 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.

Note: The Micro Vector Drill Guide System is designed for use during arthroscopic procedures. However, the system can be readily utilized during open procedures. Further, although the system is small enough to fit in the great toe and could also be used in a variety of pediatric arthroscopic procedures, it is large enough to be used in the ankle, elbow and wrist.

Contraindications
Because the Micro Vector Drill Guide 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 risks injury.

The Micro Vector Drill Guide 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.

The Micro Vector Drill Guide System should never be bent or modified to be used in a manner for which it was not originally intended.

This system is not intended to substitute for x-ray or fluoroscopic verification of correct wire or pin placement.

Precautions
The Micro Vector Drill Guide 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 Drill Guide System is designed to accommodate .045” (1.1 mm), .062” (1.6 mm) and .125” (1/8”, 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 Drill Guide 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.
**Product Description**

The Micro Vector Drill Guide System was designed and developed in conjunction with Richard D. Ferkel, M.D., Southern California Orthopedic Institute.

The Micro Vector Drill Guide System (REF 4314) consists of the specific instruments required for accurate Kirschner wire placement in small joints. The system is supplied non-sterile and includes the following components, each of which may also be ordered individually:

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The components of the Micro Vector Drill Guide System allow the arthroscopist to precisely direct K-wire placement within the joint.

The system is designed with two articulating arms. This design ensures 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 (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" (1/8", 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.
Operative Technique as described by: Richard D. Ferkel, M.D.

The Micro Vector Drill Guide System is sterilized following standard technique.

The patient is prepared according to usual practice for arthroscopic Kirschner wire placement. Adequate anesthesia is established, the joint is positioned and the skin preparation is completed. The necessary arthroscopic portals are created.

**Micro Vector Drill Guide System Preparation**

The guide thumbscrew is rotated completely to retract the distal portion of the thumbscrew from the K-wire guide channel and provide for unobstructed K-wire guide insertion into the channel (Figure 2a). The .045" (1.1 mm), .062" (1.6 mm) or .125" (1/8", 3.2 mm) K-wire guide is selected. With the toothed end directed toward the probe, the K-wire guide is inserted into the K-wire guide channel in the Micro Vector drill guide (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, the guide is twisted until an audible click is heard, indicating that the guide is in proper position.

*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.*

At this point, the guide thumbscrew is left in the retracted position. The Micro Vector probe is then locked 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.*

Probe position is controlled by movement of the probe lever. When the lever is pushed forward into the grooved tab, the probe is locked in the forward position. In contrast, retraction of the lever retracts the probe.
Micro Vector® Drill Guide System

Micro Vector Drill Guide Positioning

The probe is inserted through a portal and into the joint space. Under arthroscopic visualization, the tip of the probe is positioned at the desired drill site. With the probe properly positioned, the entrance angle required for proper K-wire placement within the joint is determined and the entry site selected. A small incision is made in the skin. The guide arm of the Micro Vector drill is articulated to position the K-wire guide at the entry site (Figure 3).

Note: The Micro Vector Drill Guide is easily articulated by loosening the thumbscrew located at the junction of the K-wire guide arm and probe arm. Once the K-wire guide arm is in the desired position, the thumbscrew must be tightened to ensure stability of that position.

The K-wire guide is advanced through the skin incision into position against the bone to be drilled. If necessary, the guide may be anchored more rigidly by tapping the proximal end of the guide to imbed the distal teeth into the bone surface. Now, the K-wire guide is locked within the K-wire guide channel by tightening the guide thumbscrew.

K-Wire Insertion

The K-wire (or drill bit) is inserted through the K-wire guide and drilled through the bone toward the probe tip (Figure 4).

Caution: To ensure that the K-wire does not impact the probe tip, the tip is retracted just before the K-wire reaches the tip. This is accomplished by pulling 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).

Figure 3: Anterior View

Figure 4

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, the K-wire guide is retracted from the K-wire guide channel, leaving the K-wire in place. The K-wire is removed from the K-wire guide channel through the small opening lateral to the channel (Figure 6). The probe is withdrawn from the joint space and the entire system removed.

**Joint Pinning**

In addition to K-wire placement, the Micro Vector Drill Guide 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 Drill Guide 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 Drill Guide System includes an offset drill guide to allow precise patterning of multiple K-wires.

After the initial K-wire is properly positioned, the K-wire guide is retracted from the K-wire guide channel, leaving the K-wire in place. The K-wire is removed from the K-wire guide channel and the probe withdrawn from the joint space. The entire system is removed.

Then, the proximal end of the imbedded K-wire is threaded through the center hole in the offset drill guide. The offset drill guide is advanced over the K-wire to the bone surface. Additional K-wires are then drilled 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.*
In addition to placement of K-wires and permanent pins, the Micro Vector Drill Guide 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 Drill Guide System can be used to allow precise drill hole placement.

*Note: If the lesion is anteromedial on the talus, the arthroscope is placed through the anterolateral portal and the probe inserted 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).*

A small skin incision is made over the junction of the medial malleolus and distal tibia, avoiding the saphenous vein and nerve. The probe is inserted through the appropriate portal and the tip is placed on the osteochondral lesion of the talus where the hole is desired. A .045” (1.1 mm) or a .062” (1.6 mm) K-wire guide is selected, inserted through the skin incision and positioned against the bone. The K-wire guide is locked in place.
The K-wire is then drilled through the malleolus into the ankle joint. Prior to drilling into the talus, the probe tip is retracted so that it is not damaged or bent as the K-wire advances (Figure 10).

Multiple holes can be made by repositioning the probe and repeating the above sequence. Alternatively, additional holes can be quickly drilled in any direction using the offset drill guide supplied with the Micro Vector Drill Guide System. The offset guide also allows for fine adjustments in pin location (Figure 11).

*Note: Prior to drilling additional holes through the offset drill guide, it is critical that the drill tip be repositioned into its original location.*

A third way to place multiple drill holes is to insert an initial K-wire into the talus using the K-wire guide. Then, the K-wire is retracted into the joint. With the K-wire safely positioned within the joint, the ankle is flexed and extended, 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 Drill Guide 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 Drill Guide 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).

**Arthroscopic Arthrodesis**

During arthroscopic arthrodesis, the joint is debrided 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, the Micro Vector Drill Guide System is used in conjunction with a “small joint” cannulated system, e.g., 3.5-4.0 mm cannulated screws. The .045” (1.1 mm) K-wire guide is selected and the system is used to guide K-wire placement across the joint. If necessary, a cannulated screw can then be introduced over the K-wire for stabilization.

In the ankle, the .125” (1/8”, 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, the K-wires are initially brought through the distal tibial and distal fibular articular surfaces, but not across the joint, under arthroscopic visualization. Accurate K-wire placement is best achieved through use of the Micro Vector Drill Guide System (Figure 13).

After appropriate K-wire placement is obtained, the foot should be put in the neutral position for dorsiflexion and plantar flexion. The medial K-wire is drilled across the tibiotalar joint into the talus. After its position is checked under fluoroscopy, the lateral K-wire is then drilled across the joint and the two cannulated screws are inserted over the K-wires (Figure 14).

**Conclusion**

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