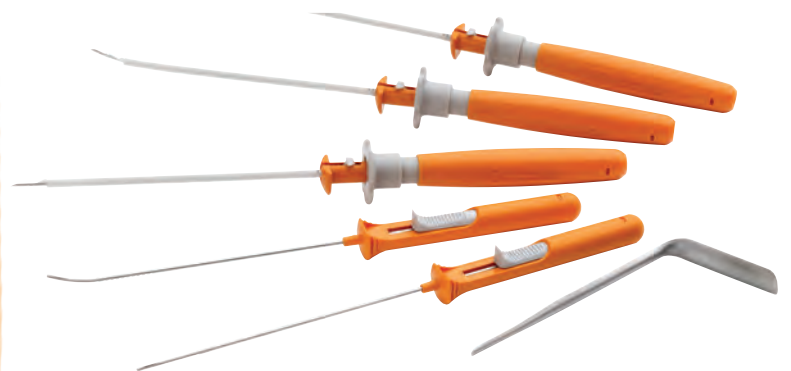


KNEE TECHNIQUE GUIDE

FAST-FIX[◇] 360 Meniscal Repair System All-Inside Meniscal Repair

Charles H. Brown, Jr., MD, Nicholas Sgaglione, MD



KNEE

HIP

SHOULDER

EXTREMITIES

All-Inside Meniscal Repair with the FAST-FIX[◇] 360 Meniscal Repair System

The following technique guide was prepared under the guidance of Drs. Charles H. Brown, Jr. and Nicholas Sgaglione. Created under close collaboration with each physician, it contains a summary of medical techniques and opinions based upon their training and expertise in the field, along with their knowledge of Smith & Nephew's FAST-FIX 360 Meniscal Repair System. Smith & Nephew does not provide medical advice and recommends that surgeons exercise their own professional judgment when determining a patient's course of treatment. This guide is presented for educational purposes only.

The meniscus contributes to optimal knee joint function because of its critical role in:

- Load transmission
- Joint stability
- Articular cartilage nutrition
- Shock absorption
- Lubrication
- Neuromuscular proprioception

Clinical studies have demonstrated that even partial meniscectomy can lead to early joint chondrosis and arthrosis.¹ As a result, repair of peripheral and red/white meniscal tears is now the standard of care.

Inside-Out Repair

Due to the ability to predictably place vertical or horizontal mattress sutures on the femoral or tibial surfaces of the meniscus, the **inside-out repair technique** is considered by many surgeons to be the “gold standard” for meniscal repair.

- Technique requires a posterior incision and dissection to avoid neurovascular complications, thereby adding morbidity and operative time to the procedure.
- Technique requires a trained assistant to retrieve and tie the repair sutures.

Outside-In Repair

The **outside-in repair technique** was introduced in an attempt to eliminate the need for a posterior incision and dissection.

- Technique offers limited access to tears in the posterior third of the meniscus.
- Limits the surgeon's ability to perform a vertical mattress suture and place sutures on the tibial surface of the meniscus.

All-Inside Repair

The **all-inside arthroscopic suture-based technique** addresses many of the limitations of the inside-out and outside-in techniques. This technique has gained popularity because of the following advantages:

- The repair can be safely performed without a posterior incision.
- The technique allows easy access to tears in the posterior and middle thirds of the meniscus.
- The repair can be performed without a trained assistant.
- The technique allows vertical or horizontal mattress sutures to be inserted on the femoral or tibial surface of the meniscus.

These advantages allow for minimally invasive meniscal repair, resulting in less postoperative pain and morbidity for patients.²

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Overview

The FAST-FIX[®] 360 Meniscal Repair System provides a strong, reproducible, and time-saving technique for meniscal repair. Biomechanical studies have demonstrated that a vertical mattress suture performed using the FAST-FIX 360 Meniscal Repair System has biomechanical properties equal to that of a vertical mattress suture performed using the open and inside-out repair techniques.

Building on the proven clinical success of the earlier FAST-FIX and ULTRA FAST-FIX Meniscal Repair Systems' techniques, the all new FAST-FIX 360 Meniscal Repair System offers the following advantages:

- Versatility to place horizontal or vertical mattress sutures on the femoral or tibial surfaces of the meniscus.
- Easier and faster implant deployment with added safety features:
 - Implants are pushed out of the delivery needle rather than being stripped away from the needle.
 - Minimizes the depth of needle penetration needed to successfully deploy the implants
 - Decreased risk of injury to nearby neurovascular structures
- Smaller insertion points, minimizing disruption to the meniscus
- A built-in depth penetration limiter
- Stiffer needle shaft for enhanced delivery control
- Ability to reposition the needle for optimal suture placement

As a result, the FAST-FIX 360 meniscal Repair System (Figure 1) helps optimize the chances of a successful repair.

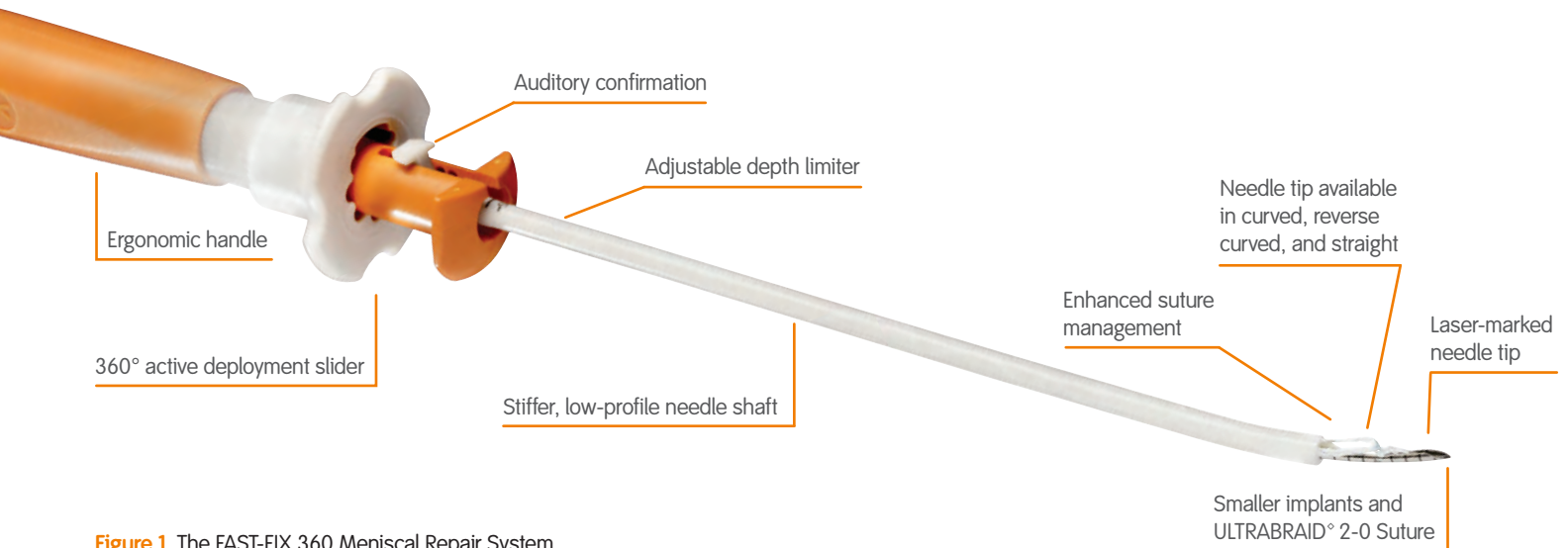


Figure 1. The FAST-FIX 360 Meniscal Repair System

The FAST-FIX 360 Meniscal Repair System

Each FAST-FIX[®] 360 Meniscal Repair System contains:

- Two 5 mm polymer integrated bio-inert PEEK anchors with a pre-tied, self-sliding knot
- 2-0, non-absorbable, UHMW polyethylene ULTRABRAID[®] Suture
- The delivery needles are available in curved, straight, and reverse curved designs (Figure 2).
 - The curved and reverse-curved designs allow the surgeon to rotate the needle tip away from the neurovascular structures when penetrating the meniscus, further reducing the risk of neurovascular injury.
 - The curved delivery needle is optimally shaped to allow vertical mattress sutures to be inserted on either the femoral or tibial surfaces of the meniscus.
 - The reverse-curved delivery needle is most useful for repairing tears on the tibial surface and more anterior located tears.
- The built-in, adjustable depth penetration limiter is adjustable from 10 mm to 18 mm from the tip of the needle.
- Use of the meniscal depth probe in conjunction with the adjustable depth penetration limiter (white plastic sheath) allows controlled delivery of the implants.



Figure 2. Delivery needle designs

Procedure Setup and Portal Placement

1. The operating room setup includes a lateral thigh post or Leg Holder (REF #012310) to allow application of valgus stress to the knee to open the medial or lateral compartments for easier access to the tear.
2. Use a surgical skin marker to outline the following surface landmarks: the patella, the medial and lateral borders of the patellar tendon, and the medial and lateral joint lines.
3. Create the anterolateral portal at the level of the inferior pole of the patella as close as possible to the lateral border of the patellar tendon. Perform diagnostic arthroscopy, identify the meniscal tear, and assess its suitability for repair.
4. Create the anteromedial portal under direct arthroscopic visualization. Insert an 18 gauge needle through the skin above the medial joint line. Adjust the needle position to allow optimal insertion of the FAST-FIX 360 delivery needle. Adjust the external starting position for the needle so that the needle can be placed perpendicular to the tear. Create the anteromedial portal in routine fashion using a #11 blade. It is important to dilate the portal with an arthroscopic conical tip obturator (REF# 4356) to allow for easier passage of the delivery needle into the joint.

Lateral meniscal tear:

- View the tear through the anterolateral portal and use the anteromedial portal for the delivery needle.

Medial meniscal tear:

- Use the meniscal depth probe to determine if the sutures should be inserted through the anteromedial portal or if it is necessary to switch the scope to the anteromedial portal and insert the sutures through the anterolateral portal.
- In general, medial meniscal tears in the middle third zone are best repaired by inserting the sutures through the anterolateral portal, allowing the sutures to be inserted perpendicular to the tear.

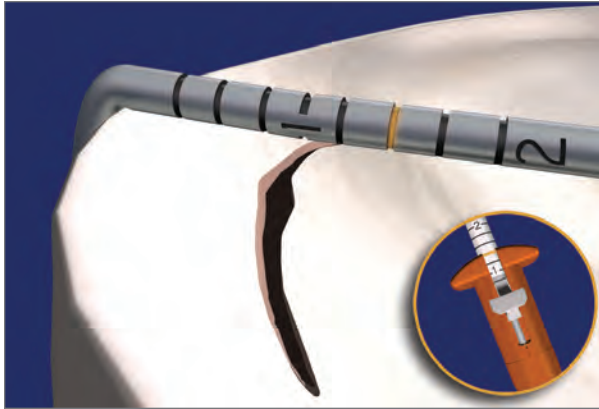


Figure 3. Establish depth limit using the adjustable depth limiter and depth probe.

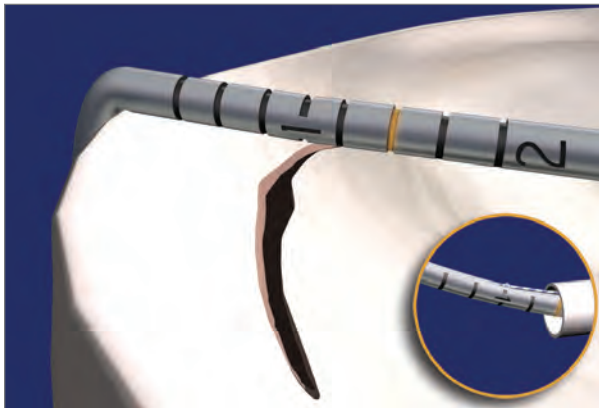


Figure 4. Use laser marks as a reference.

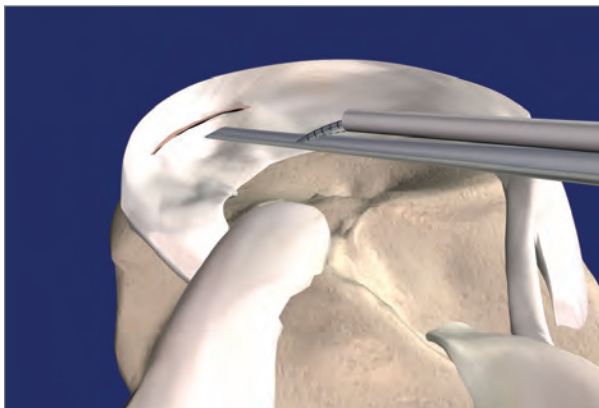


Figure 6. Introduce the delivery needle into the joint with the tip down against the slotted cannula.

Procedure

The FAST-FIX[®] 360 devices are manufactured with straight or curved delivery needles. The delivery needles are not intended to be bent by the user. The intentional bending of the delivery needle may make it difficult or impossible to deliver the T1 and T2 implants. If the delivery needle has been bent inadvertently, or if resistance is encountered during deployment, a new delivery device may be needed.

As with all arthroscopic procedures, adequate joint distention and visualization of the meniscus tear are essential for success. To minimize the potential for damage to neurovascular structures, it is strongly recommended that the surgeon use the built-in, adjustable depth penetration limiter to control the depth of penetration of the delivery needle.

Meniscal tear site preparation is essential for biological healing of the tear. Meniscal rasps and/or arthroscopic shavers are used to abrade and excoriate both sides of the tear and the perimeniscal synovium. Once the optimal portal placement is determined and the meniscal tear site is prepared, perform the repair as follows:

1. Use the meniscal depth probe to determine the desired depth limit. Place the tip of the probe at the meniscosynovial junction and determine the width of the meniscus at the desired entry point for the delivery needle. In the average size knee, a depth of 14 mm is usually adequate. Adjust the depth penetration limiter to the desired length by pressing the depth limiter button (**Figure 3**). This length can be adjusted outside or inside of the joint. The laser marks on the tip of the needle can also be used as a reference (**Figure 4**).
2. Insert the FAST-FIX 360 delivery needle into the joint through the appropriate arthroscopic portal. Insertion is facilitated through the use of the slotted cannula (sold separately) (**Figure 5**).



Figure 5. Use a slotted cannula to ease insertion.

The slotted cannula eases passage through the fat pad, and the cannula can also be used to help position the tip of the delivery needle at the desired location on the meniscus. Introduce the delivery needle through the slotted cannula into the joint, ensuring that the tip of the needle is pointing down (**Figure 6**). Once the needle is inside the joint, the slotted cannula may be removed if desired.

Pearl: Hold the delivery needle at the handle and push the slider with the thumb to deploy the implants. Do not advance the deployment slider while introducing the delivery needle into the joint or the implant will deploy prematurely.

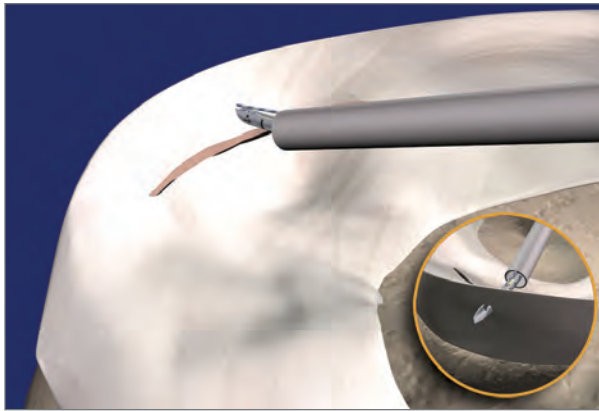


Figure 7. Insert the delivery needle into the meniscus through the capsule.

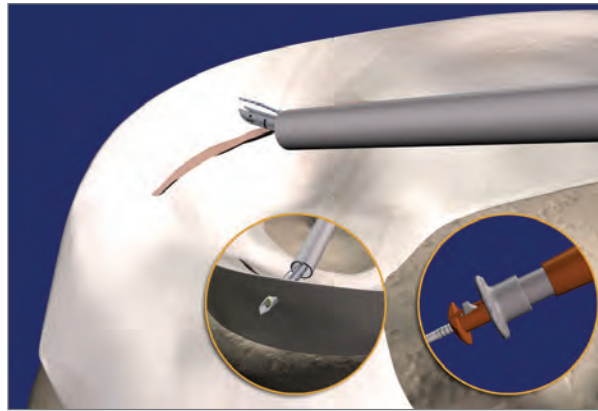


Figure 8. Keep the delivery needle in position during deployment of the implants.

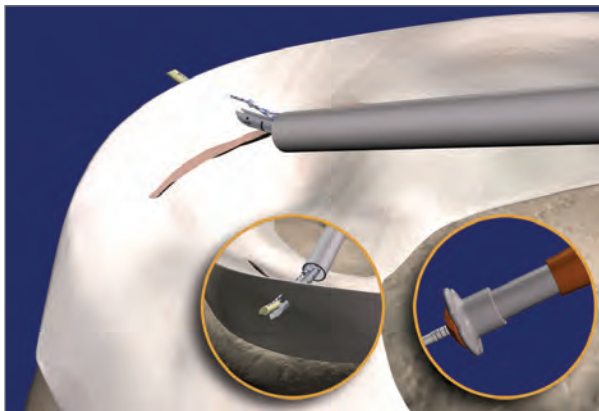


Figure 9. Push the deployment slider all the way forward to deploy T1.

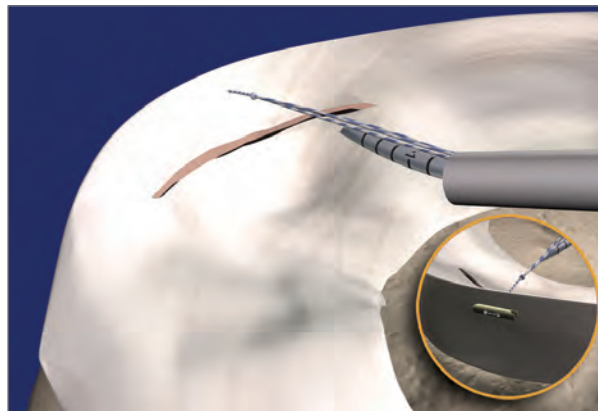


Figure 10. Withdraw the delivery needle from the meniscus slowly for better suture management.

Vertical Mattress Suture Repair

3. For a vertical mattress suture repair, place the first implant (T1) on the capsular side of the tear. Insert the FAST-FIX[®] 360 delivery needle into the capsule or into any remaining meniscal tissue on the capsular side of the tear (**Figure 7**). Use the slotted cannula to stabilize the meniscus, enhance visualization, and minimize skiving of the delivery needle to ensure more accurate placement of the implants. Position the tip of the slotted cannula at the desired entry point and rotate the cannula away from the direction of the neurovascular structures. Rotating the cannula allows better visualization of the delivery needle tip and directs the needle away from the neurovascular structures. Keeping the delivery needle in position, push the deployment slider all the way forward to deploy T1 (**Figures 8 and 9**). Proper deployment of the implant is accompanied by a “clicking” sound. For better suture management and to prevent pulling out the second implant (T2), release the deployment slider and slowly withdraw the needle out of the meniscus, keeping the needle inside the slotted cannula (if desired) and within arthroscopic view (**Figure 10**).

Pearl: Release the slider right after deployment of T1 to allow the “spring back” of the slider to its original position flush with the handle to pick up the T2 implant (**Figure 11**). Do not slowly release or hold the slider. If the slider does not spring back, the user may manually return the slider to its original position.



Figure 11. Make sure the trigger is flush to the handle prior to deploying T2.

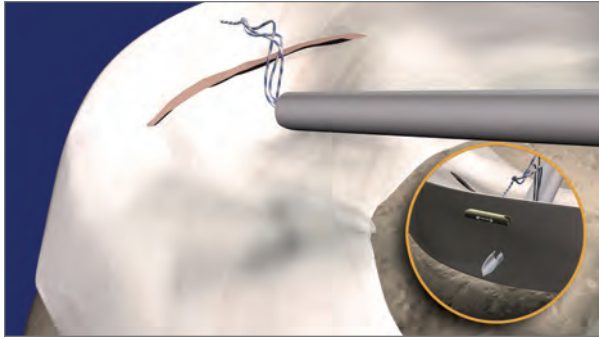


Figure 12. Advance the delivery needle to the preset needle depth limit.

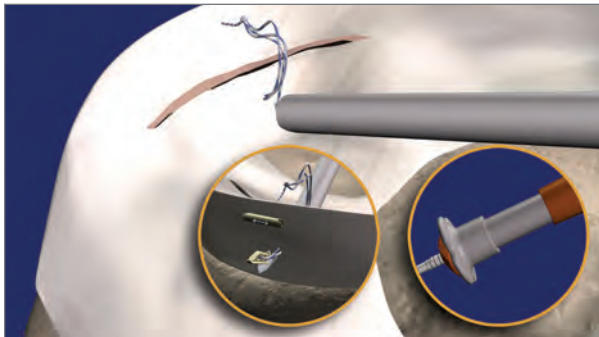


Figure 13. Push the deployment slider all the way forward to deploy T2.

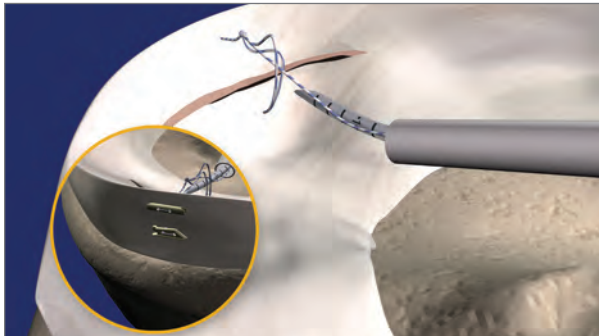


Figure 14. Withdraw the needle from the joint.

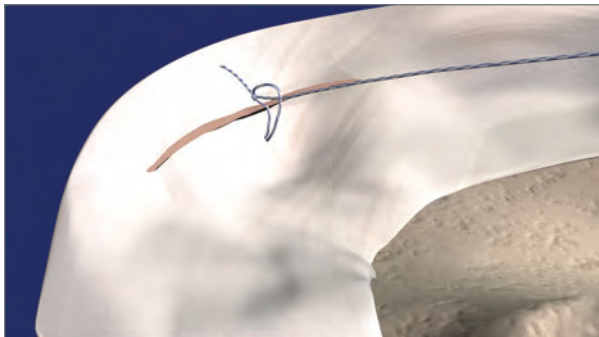


Figure 15. Pull the free end of the suture.

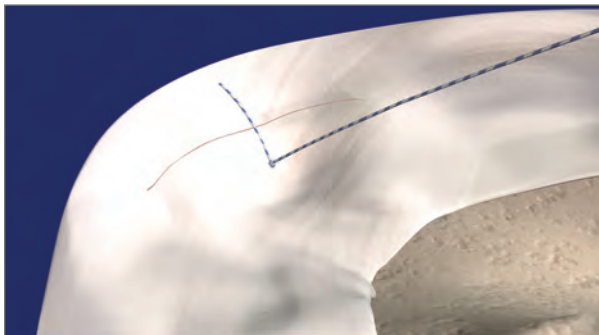


Figure 16. Apply tension to the suture to cinch the knot down.

Position the slotted cannula at the desired entry point on the inner meniscal fragment (if desired). The entry point for the second (T2) implant should be at least 5 mm from the tear site. Advance the delivery needle until the depth penetration limiter contacts the surface of the meniscus (Figure 12). Keeping the delivery needle in position, push the deployment slider all the way forward to deploy T2 (Figure 13). As with T1, proper deployment of T2 is accompanied by a “clicking” sound. Slowly withdraw the delivery needle from the joint after deployment of T2 (Figure 14).

Pearl: Do not push the deployment slider until the needle is fully penetrated through the meniscus to the preset depth limit or T2 will deploy prematurely.

Horizontal Mattress Suture Repair

4. For a horizontal mattress suture repair, place the first implant (T1) at the posterior location. Place the delivery needle perpendicular to the tear and a minimum of 5 mm from the tear site on the inner meniscal fragment. Advance the delivery needle until the depth penetration limiter contacts the surface of the meniscus. Keeping the delivery needle in position, push the deployment slider all the way forward to deploy T1. Proper deployment of the implant is accompanied by a “clicking” sound. Release the deployment slider and slowly withdraw the delivery needle out of the meniscus, keeping the needle within arthroscopic view. Position the delivery needle more anteriorly along the meniscal tear site for the insertion of the second limb of the horizontal mattress suture. In general, maintain a minimum width of 8 mm between the two insertion points. Advance the delivery needle until the depth penetration limiter contacts the surface of the meniscus. Keeping the delivery needle in position, push the deployment slider all the way forward to deploy T2. As with T1, proper deployment of T2 is accompanied by a “clicking” sound. Slowly withdraw the delivery needle from the joint after deployment of T2.

Pearl: Do not push the deployment slider until the needle is fully penetrated through the meniscus to the preset depth limit or T2 will deploy prematurely.

5. Remove the delivery needle from the knee, pulling the free end of the suture out of the joint. The free end of the suture is pulled to advance the sliding knot and reduce the meniscal tear (Figure 15). It is normal to encounter firm resistance as the knot is snugged down. It is important to pull the free end of the suture directly perpendicular to the tear site. Wrap the suture around several fingers and use the tibia as a fulcrum to provide a controlled method of tightening the knot. Slowly and steadily apply tension to the suture. In most cases, this steady pulling of the suture will cinch the knot down (Figure 16).

Pearl: If too much resistance is encountered while advancing the knot, use the Smith & Nephew Straight or Curved Knot Pusher/ Suture Cutter (sold separately) to help facilitate removing suture laxity.

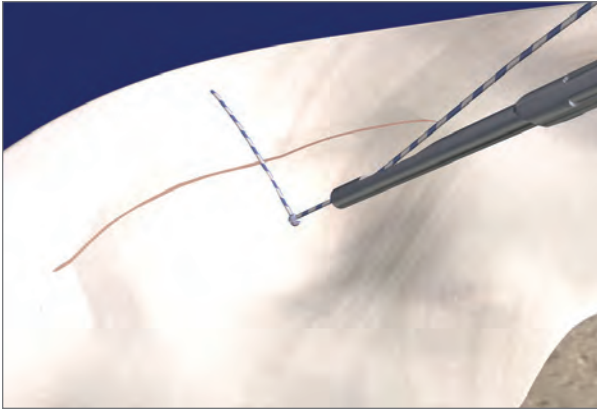


Figure 17. Slide the knot pusher/suture cutter to the knot.

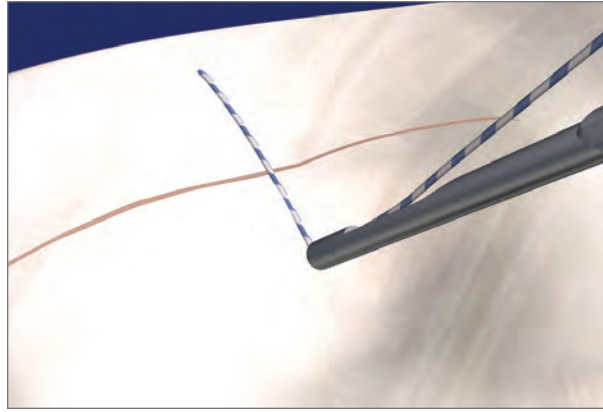


Figure 18. Push the knot pusher/suture cutter tip against the knot to recess the knot.

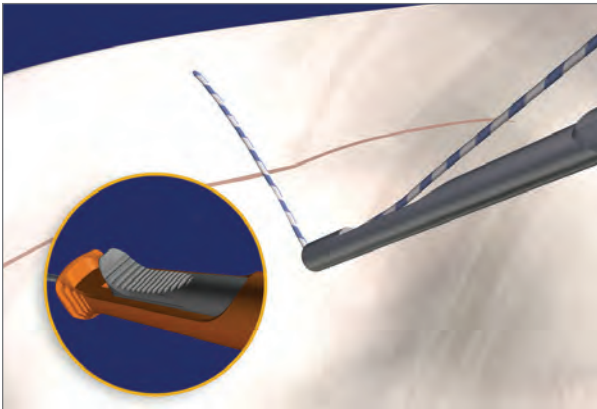


Figure 19. Push the trigger to cut the suture.

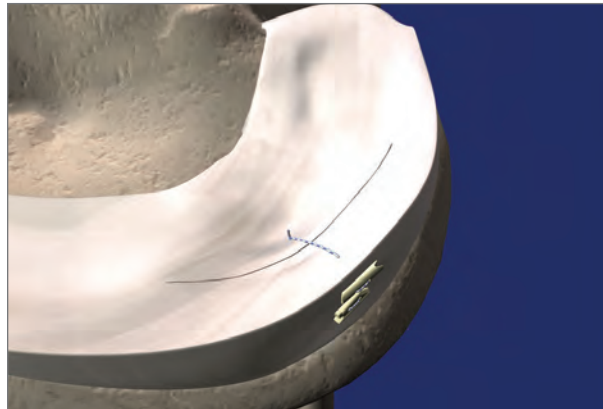


Figure 20. Completed vertical mattress stitch.

6. To further tighten the knot and further compress the tear site, thread the free end of the suture through the knot pusher/suture cutter. Both curved and straight knot pushers/suture cutters are available. Use a suture funnel to facilitate threading of the suture.
7. While holding the suture taut, gently slide the knot pusher/suture cutter to the knot (**Figure 17**). The knot pusher should engage the suture in a direct line perpendicular to the repair. A manual suture “pull”/“push” maneuver is suggested, and the knot should be tightened until the desired amount of compression is generated at the tear site.
8. Position the tip of the knot pusher/suture cutter against the knot to ensure a 2–3 mm suture tail when the suture is cut. Continuing to hold the suture taut, push the knot pusher/suture cutter tip against the knot. In some cases it is possible to recess the knot into the surface of the meniscus, leaving the tail of the suture flush with the surface of the meniscus (**Figure 18**). Cut the suture by pushing the trigger forward (**Figures 19 and 20**). Because of the high strength of the suture, using a small arthroscopic basket punch or scissors to cut the suture often results in the tail of the suture being frayed.
9. Place sutures on the tibial side of the tear as well as the femoral side of the tear to reduce puckering of the meniscus. The reverse curved delivery needle is especially useful for placing sutures on the tibial side of the tear.

Technique Pearls

- Choose the portal which most easily allows the delivery needle to be inserted perpendicular to the tear site.
- User-initiated bending of the device needle may result in implant non-deployment. If resistance to deploy an implant is encountered, or if needle bending is observed during use, a new delivery device may be needed.
- Vertical mattress suture: T1 inserted into the capsular side of the tear; T2 inserted on the meniscal side of the tear.
- The pre-tied, self-sliding knot included in the FAST-FIX 360 Meniscal Repair System slides from (T1) to (T2). Therefore, placing T1 further away than T2 facilitates sliding of the knot.
- Hold the device at the handle and push the slider with the thumb to deploy T1 and T2.
- Release slider after deployment of T1 to allow “spring back” of the slider to pick up T2.
- For better suture management and to prevent pulling out T2, release the deployment slider and slowly draw the needle out of the meniscus while maintaining the needle tip within the arthroscopic view at all times.
- If the knot does not cinch smoothly, it usually requires a steady and more forceful pull, which is facilitated by wrapping the suture around several fingers, like a pulley, and applying tension.
- Avoid over-cinching the knot, which can result in puckering of the meniscus or the suture cutting through the meniscus and weakening the repair.
- Alternate divergent femoral side and tibial (tensile) side suture placement optimizes the strength of the repair and helps achieve an anatomic repair.
- Consider the reverse-curved delivery needle for placing sutures on the tibial surface of the meniscus.
- Place the FAST-FIX 360 delivery needle either through the inferior (tibial) or superior (femoral) surface of the meniscus for optimal strength.
- For the easiest knot sliding and avoidance of the neurovascular bundles, insert the needle perpendicular to the tear using a contralateral approach. Use portals placed adjacent to the patella tendon to facilitate this procedure.

Postoperative Care

The FAST-FIX[®] 360 Meniscal Repair System utilizes a high strength non-absorbable suture and allows the repair to be performed with a vertical mattress suture, which has been shown to be the strongest meniscal repair technique. As a result, the standard rehabilitation protocol used with inside-out repairs can be followed.

Additional Instruction

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

REFERENCES

1. Ak. Joy Singh, Nilachandra L, Y. Nandabir Singh, Brogen Ak. “Rehabilitation Following Arthroscopic Partial Meniscectomy - A Neglected Issue.” *IJPMR* 15, April 2004: 1-6.
2. Sgaglione, Nicholas A. “Meniscus Repair: Update on New Techniques.” *Techniques in Knee Surgery* 1(2) December 2002: 113-127.

Ordering Information

To order the instruments used in this technique guide, call +1 800 343 5717 in the U.S. or contact an authorized Smith & Nephew representative.

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

Reference #	Description
72202467	FAST-FIX® 360 Straight Needle
72202468	FAST-FIX 360 Curved Needle
72202469	FAST-FIX 360 Reverse Curved Needle
72202674	Straight knot pusher/suture cutter and slotted cannula set, single use
72202675	Curved knot pusher/suture cutter and slotted cannula set, single use

Accessories:

015186	Meniscal depth probe, reusable
014549	45° Diamond rasp, reusable
014550	90° Diamond rasp, reusable
7210977	Slotted cannula, reusable
7210450	Suture funnel, sterile, box of 10
7209950	Suture threaders, sterile, box of 10

Patient Positioning:

012310	Leg Holder (Table Clamp not included)
013227	Table Clamp
012311	Replacement Lateral Leg Pad (included with REF 012310)
354010	Faucet knob

Platinum Blades and Shaver Systems:

72202530	DYONICS® INCISOR® Plus PLATINUM 4.5 mm Blade
72203523	DYONICS SYNOVATOR® PLATINUM 4.5 mm Blade
72200873	DYONICS POWER II Shaver System Control Unit (Control Unit only) All units 100-240 VAC, 50/60 Hz
72200616	DYONICS POWERMAX® ELITE® Handpiece with blade multi-positioning, hand controls, suction lever, 10 ft. (3 m) cord
7205399	DYONICS POWER Footswitch, low profile, on/off

Reference #	Description
DYONICS 25 Fluid Management System Control Unit and Accessories:	

7211010	DYONICS 25 Fluid management Control Unit (Control Unit only)
7211004	DYONICS 25 Inflow Tube Set, 3 per box
7211005	DYONICS 25 Inflow/Outflow Tube Set, single suction, 3 per box
7211006	DYONICS 25 Inflow/Outflow Tube Set, forked suction, 3 per box
7211007	DYONICS 25 Day Tube Set (must be used with 7211008), 3 per box
7211008	DYONICS 25 Patient Tube Set (must be used with 7211007), 12 per box

Refer to product catalog for DYONICS 25 Fluid Management Control Systems (includes DYONICS 25 Control Unit, country-specific power cord, shaver interface cable, biomed test key, user manual and quick start guide).

Visualization:

72202087	Direct-View Arthroscope, Autoclavable, 30°, 4.0 mm outer diameter, 160 mm length
72202088	Direct-View Arthroscope, Autoclavable, 70°, 4.0 mm outer diameter, 160 mm length
72201919	560P Camera Control Unit, High Definition Camera System (Control Unit only)

Refer to product catalog for 560P Camera Control Unit Systems (includes 560P Camera Control Unit, power cord, HD-SDI cable, RG-59 10' and country specific manual)

72200571	560 Camera System
72200561	560H Non-autoclavable Camera Head, HD
72203388	HD1200 Autoclavable Camera System, US
72201635	Coupler, High Definition, Non-autoclavable, 19.5 mm, Black ring

Arthroscopic Cannula System:

3868	6.0 mm High Flow Diagnostic Cannula Set, double-valve, rotatable
<i>Set Includes</i>	
72200829	6.0 mm High Flow Diagnostic Cannula, double-valve, rotatable
4356	Obturator, contical tip

CAUTION: U.S. Federal law restricts these devices to sale by or on the order of a physician.



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