

Medial Patellofemoral Ligament Reconstruction

SURGICAL TECHNIQUE

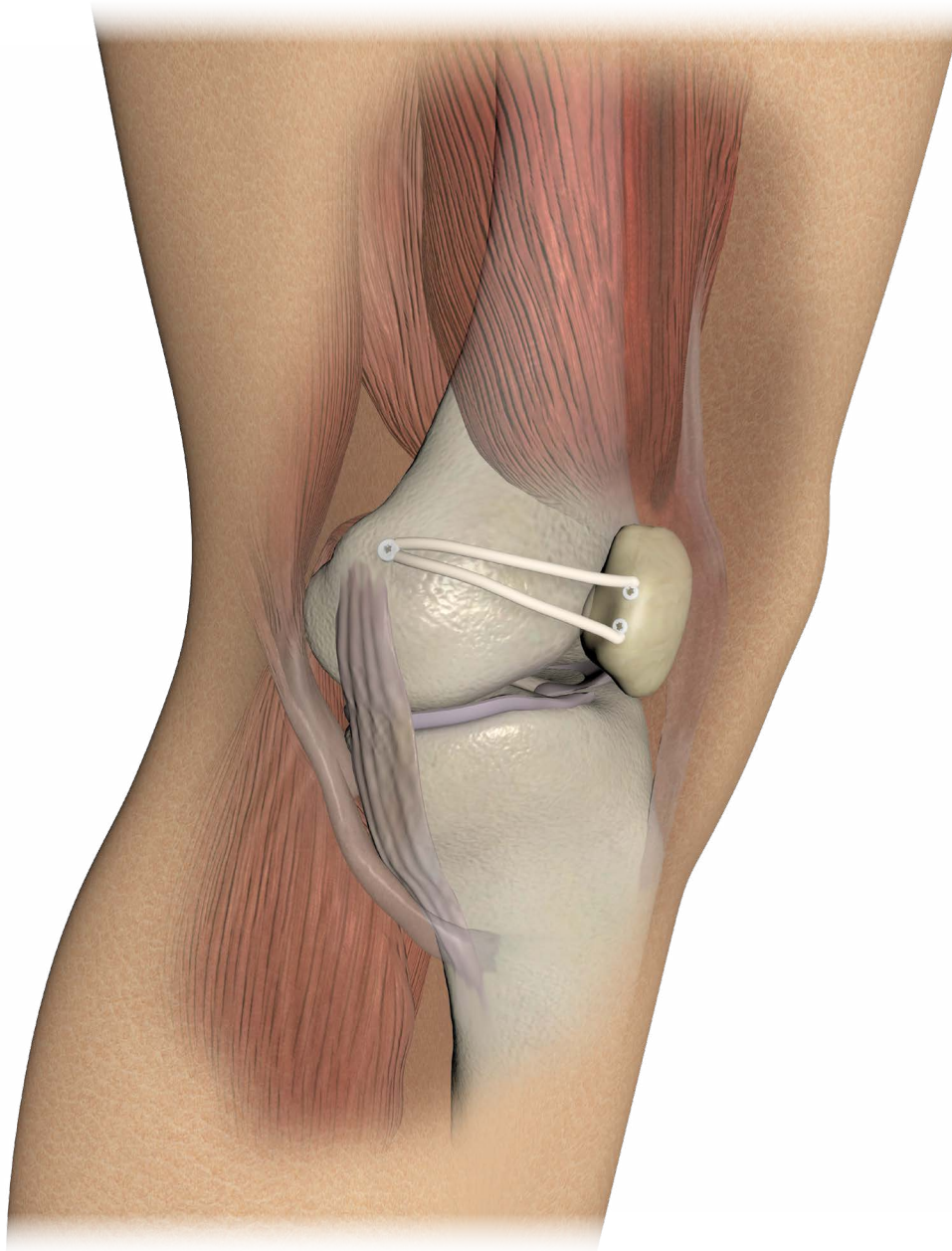




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INTRODUCTION

Patellofemoral dislocations occur nearly twice as frequently in children and adolescents than in adults. Patella dislocations can occur as result of a direct blow, fall onto the knee, or can occur without contact. Patella dislocations can also be the result of an abnormality in the anatomic structures of the knee.

Affected patients are at risk of acute osteochondral fractures, decreased performance in sports, and late patellofemoral arthritis. Historically, patients have been treated initially with conservative measures, followed by one of nearly 100 described surgical procedures should they develop recurrent instability.

More recently, attention has been directed to the medial patellofemoral ligament (MPFL). This structure extends from the medial femoral epicondyle to the superomedial patella. Studies have demonstrated that the MPFL is the primary static restraint to lateral translation of the patella prior to engagement of the patella within the trochlea with knee flexion. Therefore, reconstruction of the MPFL has generated substantial interest, and several studies have demonstrated that reconstruction of a torn MPFL after traumatic patellar dislocation results in improved outcomes compared to older plication type procedures.

Nonetheless, initial MPFL reconstruction techniques and implants were designed with skeletally mature patients in mind. This has resulted in a high complication rate in utilizing traditional, adult-based procedures in young patients. Therefore, many surgeons treating young athletes have developed and advocated for several technique modifications to potentially decrease the risk of complications, including several graft choice variations as well as differing fixation techniques.

Additionally, while MPFL reconstruction can result in excellent outcomes and restoration of normal patellofemoral stability in the correct patient with appropriate indications, it is important for the treating surgeon to consider the complexity of the patellofemoral joint. Many factors can affect patellofemoral stability and symptoms, including laterilization of the extensor mechanism, trochlear dysplasia, patella alta, and patellar tilt. Additionally, treatment options vary based on the degree of skeletal maturity of the affected patient. The indications for each concomitant procedure are beyond the scope of the technical guide; however, the treating surgeon must understand the alignment of the affected knee and carefully assess all contributors to instability before deciding upon the appropriate constellation of procedures.

OrthoPedic has partnered with pediatric orthopedic surgeons to develop an MPFL kit to specifically address the pediatric and adolescent populations. The OrthoPedic's MPFL kit allows the treating surgeon to approach each case on an individual basis, choosing the safest technique in consideration of a patient's age, skeletal maturity, size and concomitant pathology. Regardless of the specific technique chosen, the OrthoPedic's MPFL kit contains fixation options and tools to anatomically reconstruct the MPFL.

SYSTEM OVERVIEW

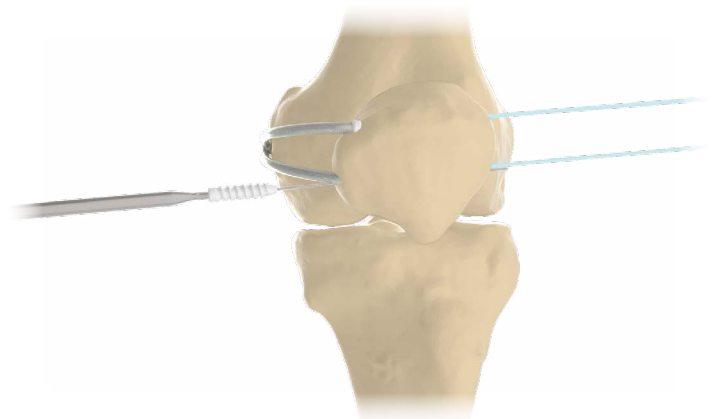
Intended Use

The ActivaScrew™ Interference Screw is indicated for fixation of tissue, including ligament or tendon to bone, or a bone-tendon to bone in the presence of appropriate immobilization/controlled mobilization. Interference fixation is intended for surgeries of knee, shoulder, elbow, ankle, foot and hand/wrist.

System Features

Pediatric-Focused: The small pins, 3.5mm drill and 4mm screws were designed with the pediatric and adolescent populations in mind, allowing for more anatomic placement.

In-line Tensioning: The graft is pulled in the same direction as the screw insertion to improve graft/tunnel tensioning and interface.



GRAFT SELECTION

Many graft choices have been described, each with benefits and limitations.

Certain techniques require a specific graft.

Hamstring Grafts

Typically, the Gracilis is chosen and of satisfactory size. However, in younger females, the Semitendinosus may be of better length and diameter.

Autograft versus Allograft: Both autograft and allograft hamstring grafts have been described. While failure rates with ACL reconstruction using allograft hamstrings in young patients have been quite high, the biomechanical stresses across the MPFL are less severe, and therefore allograft rates of failure are lower. Allografts, while avoiding donor site morbidity and potentially decreasing operative times, still carry a potential risk of infection, which must be considered.

Uses: Hamstring grafts can be used for all traditional MPFL double bundle reconstructions and their variants.

Quadriceps Grafts

A quadriceps autograft has been proposed as an alternative for MPFL reconstruction in younger athletes, primarily due to its benefit of not requiring bony fixation in the patella. In contrast to hamstring grafts, quadriceps grafts are a single limb graft. While minimally invasive harvest techniques have been described, incisions for this graft harvest have typically led to larger scars than hamstring autograft harvest. An additional potential downside to this technique is the meticulous dissection required to free the graft from the patellar periosteum.

Full Thickness versus Superficial Quadriceps:

Both a full thickness graft and a thinner graft harvesting only the superficial slip of the quadriceps tendon have been described with good results.

Uses: Quadriceps turndown MPFL reconstruction procedures.

Fascia Lata Graft

This graft more closely represents the non-tubular shape of the native MPFL. There also are theoretical benefits of a fascia lata graft, however, harvesting the graft requires a separate lateral incision on the thigh.

GRAFT PREPARATION

The required graft length varies based on patient age and knee morphology, but a length of at least 18cm will be sufficient in most cases. The graft length can be estimated by measuring the distance from the medial border of the patella to Schottle's point for each graft limb. Also consider that an additional 10-11cm of length is required for graft fixation (2.5cm to anchor in each patella socket, and 2.6cm on each limb to anchor in the femoral socket).

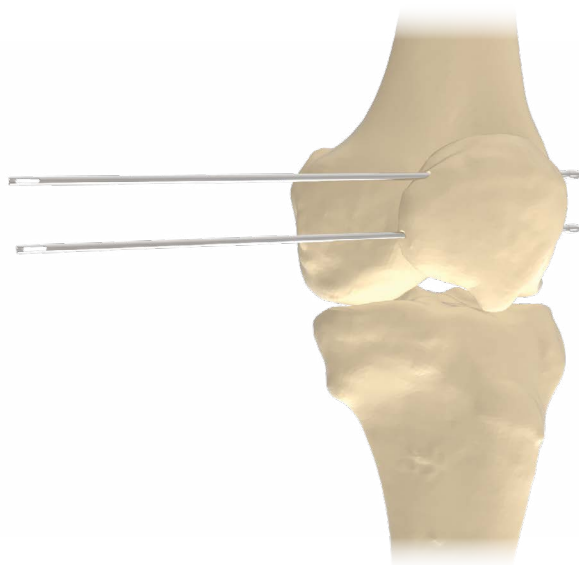
If using hamstring autograft, the gracilis is typically used and has been demonstrated to have sufficient strength for reconstruction. In certain patients, particularly younger females, the gracilis may be too small for a satisfactory graft (significantly less than 4mm diameter) and the semitendinosus should be harvested instead. Care should be taken to identify the best hamstring for the MPFL graft and avoid having to harvest both. Once the graft is freed from its insertion, this limb of the graft should be tapered to ensure fit into the patellar socket and then the distal 10-20mm of the graft is whipstitched with suture. The graft is then harvested with a full radius harvester. Excess muscle is then removed and the graft is cleaned. The proximal limb of the graft is then also tapered and whipstitched.

The graft size is then checked using the sizer block. Each end must fit within a 3.5mm socket in the patella. The width of the graft at the doubled-over midpoint should also be measured and noted to ensure that it can fit within either a 6mm or 7mm socket.



WARNING: Incorrect graft sizing/preparation can result in a poor fit/fixation between the graft, screw, and the tunnels.

PATELLAR PREPARATION



Pin Placement

Make an incision along the medial border of the patella and expose the medial patella, taking care not to open the joint capsule.

Under fluoroscopy, identify a point approximately 3-5mm distal from the proximal pole of the patella. Be sure this point is centered on the ridge of the medial border of the patella.

Advance a 2.0mm Guide Pin transversely across the patella until the tip exits the central aspect of the lateral edge of the patella. Confirm a central, transverse trajectory under fluoroscopy while advancing the pin.

Drill a second 2.0mm Guide Pin parallel to the first at approximately the midpoint of the patella, or 15-20mm distal to the first pin.

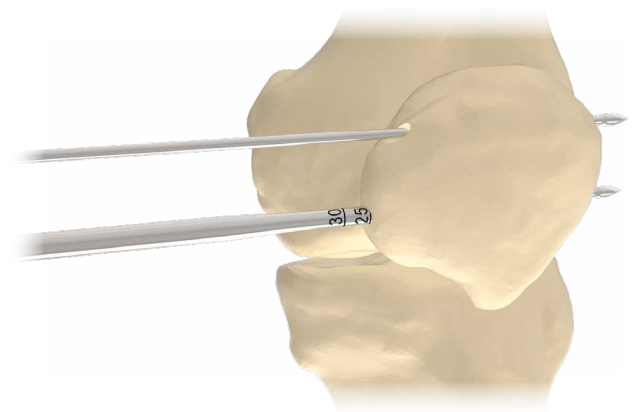
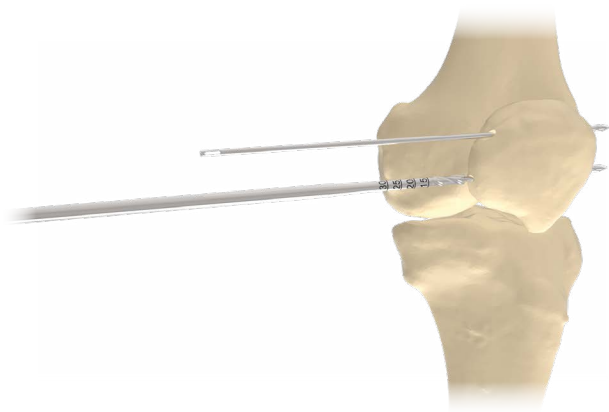
Make small, lateral incisions to deliver the guide pins through the skin.

NOTE: An adequate lateral view of the patella using fluoroscopy will reveal a cancellous tunnel to help position the guide pins.

CAUTION: If necessary, remove Guide Pins completely before redirecting.

WARNING: Incorrect pin size can damage the patella.

WARNING: Incorrect pin placement can cause improper biomechanics and/or tissue damage.



Drilling the Patella

Overdrill the 2.0mm Guide Pins with a 3.5mm Cannulated Drill. Calibrated depth markings are placed on the cannulated drill to measure depth. Keep the 2.0mm Guide Pins in the patella to deliver the graft.

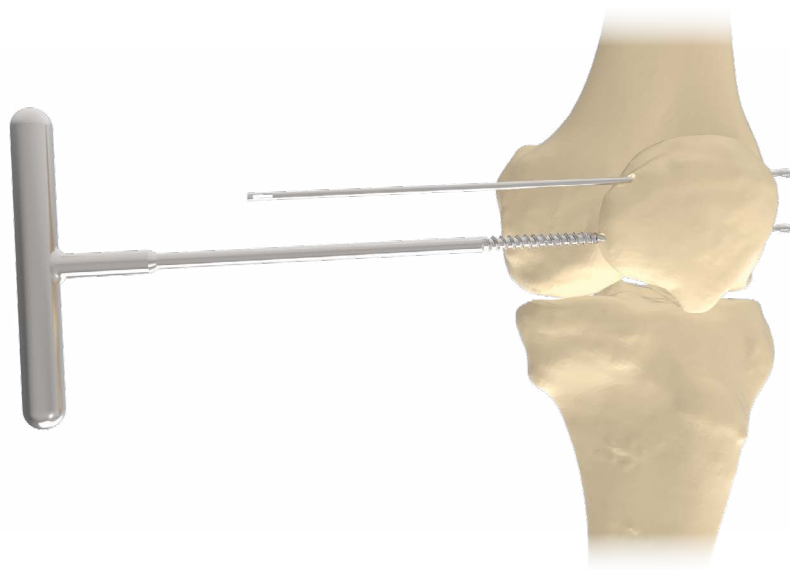
If using a 4mm x 15mm screw, drill to a depth of 20mm.

If using a 4mm x 20mm screw, drill to a depth of 25mm.

CAUTION: Incorrect drill depth can result in the screw not seating and/or tissue damage.

CAUTION: Do not allow the Cannulated Drill Bit to contact the flared tip of the Guide Pin.

WARNING: Incorrect drill selection can result in damage to the patella.



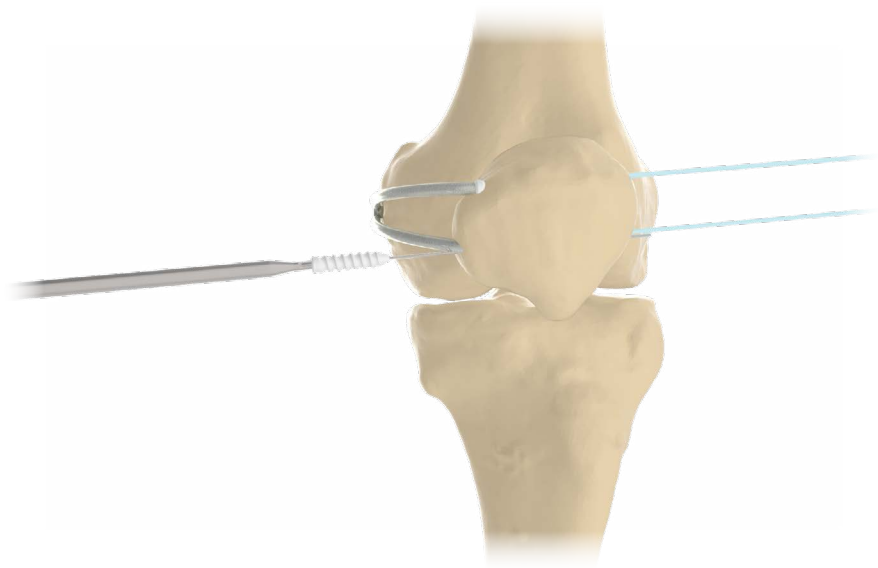
Tapping the Patella

As the patella is a dense, thick bone, tapping prior to screw insertion is recommended. Tap each socket to a depth of approximately 10mm with the 4.0mm Cannulated Tap. Keep the 2.0mm Guide Pins in the patella to deliver the graft.

WARNING: Incorrect tapping technique can result in damage to the patella and/or poor screw fixation and/or screw damage upon insertion.

WARNING: Improper patella preparation can result in damage to the patella and/or poor fixation.

SECURING THE GRAFT TO THE PATELLA



Pass the suture from one of the whipstitched suture limbs through the eyelet of the proximal 2.0mm Guide Pin. Pass the proximal 2.0mm Guide Pin through the patella such that it exits laterally through the skin incision. Pulling lateral tension on the suture, securely dock the graft limb into the socket.

While maintaining tension on the suture, place the 0.8mm K-Wire in the hole in the patella. Deliver the appropriate length 4mm ActivaScrew™ Interference Screw using the modular driver over the 0.8mm K-Wire until flush.

This process is repeated for the other graft limb and the distal patellar socket.

NOTE: Verify that the suture is looped through the pin eyelet before passing the pin.

NOTE: Verify that the driver is locked in the handle prior to use.

NOTE: Verify correct K-Wire and driver are chosen for 4mm screw.

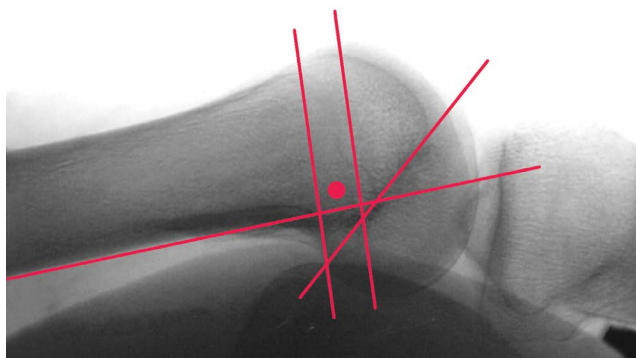
NOTE: Improper screw length, too long for drilled depth, may prevent the screw from seating.

WARNING: Failure to fully seat graft in tunnel can result in poor fixation.

WARNING: Incorrect screw size, too short for drill depth or incorrect diameter, can result in damage to the patella or poor fixation.

WARNING: Verify final screw position to prevent soft tissue irritation.

FEMORAL PREPARATION



Pin Placement

The correct femoral insertion of the MPFL is essential to maintain proper biomechanics of the patellofemoral joint.

Using fluoroscopy, obtain a perfect lateral of the knee and identify Schottle's point on the distal femur. Palpate the area between the medial epicondyle and adductor tubercle. The femoral insertion of the MPFL is anterior to the posterior cortex extension line and between the perpendicular lines created by the the posterior border of the medial femoral condyle and the posterior point of Blumensaat's line.

Anatomic landmarks that can be used for positioning:

- 1mm anterior to posterior cortex extension line

- 2mm below posterior border of the medial femoral condyle

- Proximal to Blumensaat's line

Under fluoroscopic visualization, make a small incision on the medial aspect of the knee.

Dissect to bone, and advance a 3.2mm Guide Pin across the femur.

In skeletally mature patients, direct the pin proximal and anterior to avoid the intercondylar notch.

In skeletally immature patients, the location of Schottle's point and corresponding Guide Pin path may be very close to the distal femoral physis. Ensure your trajectory is clear of, and distal to, the physis in all planes prior to Guide Pin insertion. Cadaveric studies suggest angling the Guide Pin 15° to 20° distally and anteriorly to avoid the physis, notch, and distal femoral cartilage.

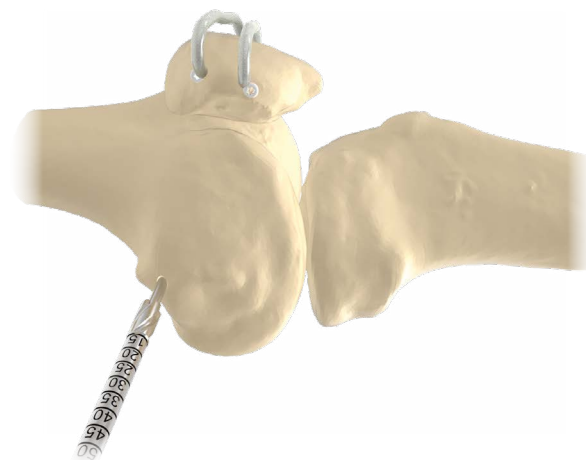
Make a small, lateral incision to deliver the guide pin through the skin once the tip exits the lateral condyle.

CAUTION: Incorrect pin placement can damage the physis.

CAUTION: If necessary, remove Guide Pin completely before redirecting.

WARNING: Incorrect pin placement can cause improper biomechanics and/or tissue damage.

WARNING: Placing an interference screw near the physis may cause growth disturbance. Alternative methods of fixation should be considered.



Drilling the Femur

Once the 3.2mm Guide Pin is in a safe, satisfactory position, prepare a socket for the femoral limb of the graft based on its previously measured, doubled width. Under fluoroscopy, over-drill the femoral pin up to, but not including lateral cortex of the femur. This will ensure that the socket is deep enough to adequately tension the construct. Keep the 3.2mm Guide Pin in the femur to deliver the graft. The depth markings on the drill bit are for reference only.

Use the 6mm Cannulated Drill Bit for the 6mm ActiveScrew™ Interference Screw.

Use the 7mm Cannulated Drill Bit for the 7mm ActiveScrew™ Interference Screw.

Refer to page 18 for implant options.

NOTE: Under fluoroscopy over-drill the femur up to, but not including lateral cortex. This will ensure that the socket is deep enough for tension.

NOTE: Incorrect drill selection can result in the drill not functioning with the pin.

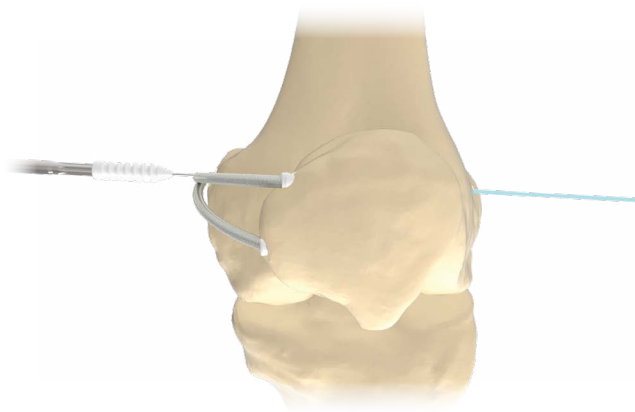
CAUTION: Incorrect drill depth can result in the screw not seating flush with cortex and/or tissue damage.

CAUTION: Incorrect drill depth can cause the graft to bottom out before it is tensioned.

CAUTION: Do not allow the Cannulated Drill Bit to contact the flared tip of the Guide Pin.

WARNING: Improper femur preparation can result in damage to the femur and/or poor fixation.

SECURING THE GRAFT TO THE FEMUR



Identify the space between the vastus medialis and the capsule of the medial knee. Dissect the vastus medialis off of the capsule bluntly, taking care not to violate the capsule. Develop this interval between the medial patellar incision and the femoral socket. When developing the interval, make sure to dissect all the way down to the guide wire. This will prevent soft tissue interposition when delivering the graft.

A suture without a needle is placed around the graft. A right angle clamp is then used to pass suture down the prepared layer and out of the medial incision. The graft is then pulled down to the medial epicondyle, pulling with equal tension on both limbs.

A K-Wire is then placed along the 3.2mm Guide Pin. Use the 0.8mm K-Wire for the 6mm ActivaScrew™ Interference screw. Use the 1.6mm K-Wire for the 7mm ActivaScrew™ Interference screw.

Pass the femoral suture tails through the eyelet of the 3.2mm Guide Pin. Pull the 3.2mm Guide Pin through the femur laterally to deliver the femoral suture. While using the right angle clamp to hold equal tension on both limbs, deliver the femoral graft double bundle into the femoral socket by tensioning the suture laterally.

With the knee at 30 degrees of flexion, position the lateral patellar facet flush with the lateral femoral condyle.

Cycle the knee while holding tension on the graft to ensure that the patella has physiologic motion. While maintaining final tension and knee position, insert the appropriately sized screw and corresponding driver over the K-Wire. Seat the screw until it is flush with the femoral cortex.

Check final motion of the knee, patellar translation, and final radiographs. Close the wound and rehabilitate according to surgeon preference.

NOTE: Verify that the suture is looped through the pin eyelet before passing the pin.

NOTE: Verify that the driver is locked in the handle prior to use.

NOTE: Verify correct K-Wire and driver are chosen for 6mm or 7mm screws.

NOTE: Improper screw length, too long for drilled depth, may prevent the screw from seating.

WARNING: Incorrect graft length, too short, can result in poor fixation.

WARNING: Incorrect screw size can result in damage to the femur or poor fixation.

WARNING: Incorrect tensioning can result in graft failure and/or poor biomechanics.

TECHNIQUE VARIATIONS

Quadriceps Turndown

For a younger patient with a smaller patella, the treating surgeon may consider a quadriceps turndown procedure to reconstruct the MPFL. It also is docked isometrically at Schottle's point on the femur, but it carries the advantage of not requiring bony fixation through the patella, thereby eliminating the need to prepare the patella.

Two different variations of graft harvest have been described. The technique initially was described with harvesting a full thickness quadriceps graft. A 5cm incision is made about the medial border of the proximal patella, extending to the quadriceps tendon. Skin flaps are developed. The medial 8 x 70mm full thickness quadriceps graft is harvested with the help of an Army-Navy for retraction. The distal tendon is carefully dissected subperiosteally to about 40% of the patellar height from the proximal pole. To allow for socket fixation, harvest as long of a graft as is possible given the tendon anatomy.

A variation of this technique has been proposed, harvesting only the superficial slip of the quadriceps tendon rather than a full thickness graft.

The end of the tendon is then similarly whipstitched. The corner of the periosteum and the graft may also be sutured to prevent tearing.

Refer to the Double Bundle technique for femoral fixation.

Using the Fascia Lata as an MPFL Autograft

Fascia lata autograft has also been proposed for MPFL reconstruction. This graft may particularly be useful in patients who require a revision reconstruction, though it has also been proposed for primary cases.

The iliotibial band is harvested through a 6cm lateral thigh incision one palm above the superior patella. A graft 1cm wide and 12cm long is then sharply harvested with a scalpel. The donor site is then closed in layers.

The graft is then divided into two 5 mm wide grafts. The limbs are then whipstitched.

One limb of each graft is then fixed within a patellar socket as described previously.

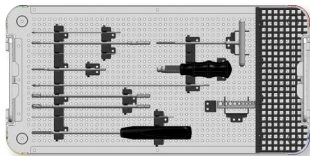
The free ends of the graft are then both passed into a femoral socket and anchored under appropriate tension, using an ActivaScrew™ Interference Screw.

PRODUCT AND SET INFORMATION

Implants

Product	Item Number	Description
	B-AI-0415	ActivaScrew Interference 4 x 15 mm
	B-AI-0420	ActivaScrew Interference 4 x 20 mm
	B-AI-0620	ActivaScrew Interference 6 x 20 mm
	B-AI-0626	ActivaScrew Interference 6 x 26 mm
	B-AI-0720	ActivaScrew Interference 7 x 20 mm
	B-AI-0726	ActivaScrew Interference 7 x 26 mm

Instruments

Product	Item Number	Description
	01-1150-0010	2.0mm x 150mm Flared Tip Guide Pin, CoCr
	01-9473-9015	2.0mm x 150mm Flared Tip Guide Pin, SS
	01-1150-0020	3.5mm Cannulated Drill, Calibrated, Trilobe Drive
	01-1150-0030	4mm Cannulated Tap
	01-1150-0040	3.2mm x 300mm Flared Tip Guide Pin, CoCr
	01-9473-9030	3.2mm x 300mm Flared Tip Guide Pin, SS
	01-1150-0060	6mm Cannulated Drill, Calibrated, Trilobe Drive
	01-1150-0070	7mm Cannulated Drill, Calibrated, Trilobe Drive
	01-1150-0100	3mm-7mm Graft Sizing Block
	B-II-0815B	K-Wire Ø0.8mm, Length 150mm, Blunt Ends, For 4/5/6mm Interference Screw
	B-II-1624B	K-Wire Ø1.6mm, Length 240mm, Blunt Ends, For 7/8/9/10mm Interference Screw
	B-II-9031	Torx Driver For 7/8/9/10mm Interference Screw, Cannulated
	B-II-9032	Torx Shaft For 4/5/6mm Interference Screw With Quick Coupling, Cannulated
	B-ISC-9013	Large Handle, Cannulated, Quick Coupling
	01-1150-0150	MPFL Instrument Case
	01-1150-0151	MPFL Instrument Case Lid

Notes



CAUTION: Federal law restricts this device to sale by or the order of a Physician.

CAUTION: Devices are supplied Non-Sterile. Clean and sterilize before use according to instructions.

CAUTION: Implants components are single-use. Do not reuse.

CAUTION: Only those instruments and implants contained within this system are recommended for use with this technique. Other instruments or implants used in combination or in place of those contained within this system is not recommended.

NOTE: This technique has been provided by one of our medical advisors only as guidance and it is not intended to limit the methods used by trained and experienced surgeons.

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