PCL and Multiple Knee Ligament Reconstruction

Fanelli™ PCL-ACL System, Gentle Threads™ Interference Screw, Poly Suture Button, Fanelli Magellan™ Suture Retriever, Graft Tensioning Boot

Rationale and Surgical Technique
Gregory C. Fanelli, M.D.
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The Fanelli PCL-ACL Guide facilitates accurate and reproducible tunnel placement for PCL and ACL Reconstructions.

**Fanelli Magellan Suture Retriever**
- Facilitates suture retrieval during PCL and ACL reconstruction
- Promotes reproducible graft passage

**Fanelli System Instruments**
- Facilitates PCL and ACL reconstruction techniques

**Graft Tensioning Boot**
- Self retaining tensioner limits manual tensioning
- Allows surgeon to use both hands for tibial fixation
- Variable tension options

**Double Bundle Aimers**
- Size specific aimers for double bundle tunnel diameters
- Allows visualization of tunnel placement in double bundle PCL and ACL procedures to provide adequate bone bridge
Rationale and Surgical Technique for PCL and Multiple Knee Ligament Reconstruction

Overview
The combined anterior and posterior cruciate ligament (ACL PCL) injured (dislocated) knee is a severe injury that can result from high or low energy trauma. Both cruciates are torn plus one or both collateral ligament complexes. Arterial injuries, nerve injuries, associated fractures, other structural injuries, functional instability, and post traumatic arthrosis may all occur with this injury complex.

This manual contains the surgical technique for the transtibial tunnel posterior cruciate ligament (PCL) reconstruction, combined anterior cruciate ligament (ACL) and posterior cruciate ligament reconstruction using the Fanelli PCL-ACL System, and several methods of medial and lateral side reconstructions. The reference section contains a list of textbooks, and scientific articles on these subjects, and the reader is referred to these resources for a more in depth review of the subject material.

Graft Selection
My preferred graft for the posterior cruciate ligament reconstruction is the Achilles tendon allograft for single bundle PCL reconstructions, and an Achilles tendon and tibialis anterior allograft for double bundle PCL reconstructions. I prefer Achilles tendon allograft or other allograft for the ACL reconstruction. The preferred graft material for the posterolateral corner is allograft tissue combined with a primary repair, and or posterolateral capsular shift procedure. My preferred method for medial side injuries is a primary repair of all injured structures combined with posteromedial capsular shift and allograft tissue supplementation as needed.

Patient Positioning
The patient is placed on the operating room table in the supine position, and after satisfactory induction of anesthesia, the operative and nonoperative lower extremities are carefully examined. A tourniquet is applied to the upper thigh of the operative extremity, and that extremity is prepped and draped in a sterile fashion. Allograft tissue is prepared prior to bringing the patient into the operating room to minimize general anesthesia time for the patient. Autograft tissue is harvested prior to beginning the arthroscopic portion of the procedure.

The arthroscopic instruments are inserted with gravity inflow through the superolateral patellar portal. Instrumentation and visualization is achieved through inferomedial and inferolateral patellar portals, and can be interchanged as necessary. Additional portals are established as necessary. Exploration of the joint consists of evaluation of the patellofemoral joint, the medial and lateral compartments, medial and lateral menisci, and the intercondylar notch.

The residual stump of the PCL is debrided with the synovial shaver and hand tools as necessary. In the case of a combined ACL/PCL injury, the residual stumps of both the anterior and posterior cruciate ligaments are debrided. In patients with combined ACL/PCL injuries, the notchplasty for the ACL portion of the procedure is performed at this time. The posterior and anterior cruciate ligament insertion sites are preserved to serve as anatomic reference points for tibial and femoral tunnel creation.

Gentle Threads Interference Screw
- Resorbable interference screw made of LactoSorb® copolymer

Poly Suture Button
- Solid fixation for either primary or auxiliary fixation in ACL or PCL reconstruction
- Distal fixation allows circumferential healing of the ACL and/or PCL graft to the tunnel wall
Initial Incision

An extra capsular extra-articular posteromedial incision is made by creating an incision approximately 1.5 to 2 cm long starting at the posteromedial border of the tibia approximately one to two inches below the level of the joint line and extending distally (Figures 1 and 1A).

Dissection is carried down to the crural fascia, which is incised longitudinally. Care is taken to protect the neurovascular structures. An interval is developed between the medial head of the gastrocnemius muscle posterior, and the capsule of the knee joint anterior.

The surgeon’s gloved finger is able to position the neurovascular structures posterior to the finger and the capsule anterior to the finger (Figures 2 and 2A).

This is so that the surgeon can monitor tools such as the over-the-top PCL tools, and the Fanelli PCL/ACL drill guide as it is positioned in the posterior aspect of the knee. This also allows for accurate placement of the guide wire both in a medial lateral, and a proximal distal direction, as well as facilitating the flow of the surgical procedure. The PCL and ACL reconstructions are performed with the knee in approximately 70–110 degrees of knee flexion.
Elevating the Capsule

The curved over-the-top PCL instruments are used to sequentially lyse adhesions in the posterior aspect of the knee, and elevate the capsule from the tibial ridge posterior. This will allow accurate placement of the Fanelli PCL/ACL guide, and correct placement of the tibial tunnel (Figure 3).

Positioning of the Guide

The arm of the Fanelli PCL/ACL guide is inserted through the inferior medial patellar portal. The tip of the guide is positioned at the inferior lateral aspect of the PCL anatomic insertion site. This is below the tibial ridge posterior and in the lateral aspect of the PCL anatomic insertion site. The bullet portion of the guide contacts the anteromedial surface of the proximal tibia at a point midway between the posteromedial border of the tibia, and the tibial crest anterior approximately 1 cm below the tibial tubercle (Figures 4, 4A, 4B and 5).
Positioning of the Guide (cont.)

This will provide an angle of graft orientation such that the graft will turn two very smooth 45 degree angles on the posterior aspect of the tibia and will not have an acute 90 degree angle turn which may cause pressure necrosis of the graft (Figure 6).

The tip of the guide, in the posterior aspect of the tibia, is confirmed with the surgeon’s finger through the extracapsular extra-articular posteromedial safety incision. Intraoperative AP and lateral X-ray may also be used.

The Fanelli PCL/ACL guide may be adjusted so that the guide wire shoots to the tip or the elbow of the guide as the surgeon prefers. When the Fanelli PCL/ACL guide is positioned in the desired area, a blunt spade-tipped guide wire is drilled from anterior to posterior. The arthroscope may be positioned in the posterior medial portal to visualize the tip of the guide wire. The surgeon’s finger confirms the position of the guide wire through the posterior medial safety incision.

Drilling the Tibial Tunnel

The appropriately sized standard cannulated reamer is used to create the tibial tunnel. The curved PCL closed curette is positioned to cup the tip of the guide wire. The arthroscope may be positioned in the posterior medial portal to visualize the guide wire being cupped (Figure 7).
The surgeon’s finger through the extra capsular extraarticular posteromedial incision is monitoring the position of the guide wire (Figure 4B). When the drill is engaged in bone, the guide wire is reversed, blunt end pointing posterior, for additional patient safety.

The drill is advanced until it comes to the posterior cortex of the tibia (Figure 4B). The chuck is disengaged from the drill, and completion of the tibial tunnel is performed by hand (Figure 8).

This gives an additional margin of safety for completion of the tibial tunnel. The tunnel edges are then chamfered and rasped with the Fanelli PCL/ACL system rasp (Figure 9).
Drilling the Femoral Tunnel
Outside In: Single and Double Bundle PCL Reconstruction

The Fanelli PCL/ACL guide is positioned to create the femoral tunnel. The arm of the guide is introduced through the inferomedial patellar portal and is positioned such that the guide wire will exit through the center of the stump of the anterior lateral bundle of the posterior cruciate ligament (Figure 10).

The blunt spade-tipped guide wire is drilled through the guide, and just as it begins to emerge through the center of the stump of the PCL anterior lateral bundle, the drill guide is disengaged. The accuracy of the placement of the wire is confirmed arthroscopically with probing and visualization. Care must be taken to ensure the patellofemoral joint has not been violated by arthroscopically examining the patellofemoral joint prior to drilling.

The appropriately sized standard cannulated reamer is used to create the femoral tunnel. A curette is used to cap the tip of the guide wire so there is no inadvertent advancement of the guide wire, which may damage the anterior cruciate ligament, or articular surface. As the reamer is about to penetrate interiorly, the reamer is disengaged from the drill and the final reaming is completed by hand (Figure 11).

This adds an additional margin of safety. The reaming debris is evacuated with a synovial shaver to minimize fat pad inflammatory response with subsequent risk of arthrofibrosis. The tunnel edges are chamfered and rasped.
When the double bundle PCL reconstruction is performed, the Fanelli PCL/ACL guide is positioned to create the second femoral tunnel. The arm of the guide is introduced through the inferior medial patellar portal, and is positioned such that the guide wire will exit through the center of the stump of the posterior medial bundle of the PCL (Figure 12).

The blunt spade-tipped guide wire is drilled through the guide, and just as it begins to emerge through the center of the stump of the PCL posterior medial bundle, the drill guide is disengaged. The accuracy of the placement of the wire is confirmed arthroscopically with probing and visualization. Care must be taken to ensure that there will be an adequate bone bridge (approximately 5 mm) between the two femoral tunnels prior to drilling. This is accomplished using the calibrated probe, and direct arthroscopic visualization.

The appropriately sized standard cannulated reamer is used to create the posterior medial bundle femoral tunnel. A curette is used to cap the tip of the guide wire so there is no inadvertent advancement of the guide wire, which may damage the anterior cruciate ligament, or articular surface. As the reamer is about to penetrate interiorly, the reamer is disengaged from the drill and the final reaming is completed by hand (Figure 13).

This adds an additional margin of safety. The reaming debris is evacuated with a synovial shaver to minimize fat pad inflammatory response with subsequent risk of arthrofibrosis. The tunnel edges are chamfered and rasped.
Drilling the Femoral Tunnel Inside Out: Single and Double Bundle PCL Reconstruction

The PCL single bundle or double bundle femoral tunnels can be made from inside out using the Fanelli Double Bundle Aimers. Inserting the appropriately sized double bundle aimer through a low anterior lateral patellar arthroscopic portal creates the PCL anterior lateral bundle femoral tunnel. The double bundle aimer is positioned directly on the footprint of the femoral anterior lateral bundle PCL insertion site (Figure 14).

The appropriately sized guide wire is drilled through the aimer, through the bone, and out a small skin incision. Care is taken to ensure there is no compromise of the articular surface.

The double bundle aimer is removed, and an acorn reamer is used to endoscopically drill from inside out the anterior lateral PCL femoral tunnel (Figures 15 and 15A).
The tunnel edges are chamfered and rasped. The reaming debris is evacuated with a synovial shaver to minimize fat pad inflammatory response with subsequent risk of arthrofibrosis. When the surgeon chooses to perform a double bundle double femoral tunnel PCL reconstruction, the same process is repeated for the posterior medial bundle of the PCL (Figures 16, 17 and 17A).

Care must be taken to ensure that there will be an adequate bone bridge (approximately 5 mm) between the two femoral tunnels prior to drilling. This is accomplished using the calibrated probe, and direct arthroscopic visualization.
Tunnel Preparation, Graft Passage, and PCL Femoral Fixation

The Fanelli Magellan suture retriever is introduced through the tibial tunnel into the joint (Figures 18 and 18A), and retrieved through the femoral tunnel (Figures 19 and 19A). The traction sutures of the graft material are attached to the loop of the Magellan suture retriever, and the graft is pulled into position. The graft material is secured on the femoral side using the Gentle Threads Interference Screw for primary aperture opening fixation, and a Poly Suture Button for back up fixation.
PCL Graft Tensioning and Tibial Fixation

Tension is placed on the PCL graft distally using the Graft-Tensioning Boot, and the tension is gradually increased until the anatomic tibial step off is restored and the posterior drawer test is negative (Figures 20 and 20A). The knee is cycled through multiple sets of a full range of motion to allow pretensioning and settling of the graft. In double bundle PCL reconstructions, each bundle is individually tensioned. The process is repeated until there is no further change in the torque setting on the graft tensioner.

The knee is placed in 70 to 90 degrees of flexion, and fixation is achieved on the tibial side of the PCL graft with a Gentle Threads Interference Screw, and back up fixation with a bicortical screw and spiked ligament washer or Poly Suture Button (Figure 21).
ACL Reconstruction

With the knee in approximately 90 degrees of flexion, the ACL tunnels are created using the Fanelli PCL/ACL drill guide single incision endoscopic surgical technique. The arm of the Fanelli PCL/ACL drill guide enters the knee joint through the inferior medial patellar portal (Figure 22).

The bullet of the drill guide contacts the anterior medial proximal tibia externally at a point 1 cm proximal to the tibial tubercle midway between the posterior medial border of the tibia, and the tibial crest anteriorly. The guide wire is drilled through the guide to emerge through the center of the stump of the ACL tibial footprint. A standard cannulated reamer is used to create the tibial tunnel (Figure 23).

Reaming debris is evacuated, and the tunnel edges are chamfered and rasped.
With the knee in approximately 90 to 110 degrees of flexion, an over the top Femoral Aimer is introduced through the tibial tunnel, and used to position a guide wire on the medial wall of the lateral femoral condyle (Figure 24).

The femoral tunnel is created with an endoscopic cannulated reamer to approximate the ACL anatomic insertion site, and the offset of the Femoral Aimer will leave a 1–2 mm posterior cortical wall so interference fixation can be used (Figure 25). The ACL graft is positioned, and fixation achieved on the femoral side using a Gentle Threads Interference Screw, and back up fixation with a Poly Suture Button.
The ACL graft is tensioned on the tibial side using the Graft-Tensioning Boot. Traction is placed on the ACL graft sutures, and tension is gradually increased until the 30 degree anterior drawer and pivot shift tests become negative. The knee is then cycled through multiple full flexion and extension cycles to allow settling of the graft. The process is repeated until there is no further change in the torque setting on the graft tensioner.
The knee is placed in 30 degrees of flexion, and fixation is achieved on the tibial side of the ACL graft with a Gentle Threads Interference Screw, and back up fixation with a Poly Suture Button (Figures 26, 26A and 26B). The final ACL and PCL tunnel positions are demonstrated in Figures 27 and 28.

Lateral Posterolateral Reconstruction

My most commonly utilized surgical technique for posterolateral reconstruction is the free graft figure of eight technique utilizing semitendinosus allograft or other soft tissue allograft material (Figures 29 and 29A).
This procedure requires an intact proximal tibiofibular joint, and the absence of a severe hyperextension external rotation recurvatum deformity. This technique combined with capsular repair and posterolateral capsular shift procedures, mimics the function of the popliteofibular ligament and lateral collateral ligament, tightens the posterolateral capsule, and provides a post of strong allograft tissue to reinforce the posterolateral corner.

When there is a disrupted proximal tibiofibular joint, or severe hyperextension external rotation recurvatum deformity, a two-tailed (fibular head, proximal tibia) posterior lateral reconstruction is performed in addition to the posterolateral capsular shift procedure (Figure 30).

In acute cases, primary repair of all lateral side injured structures is performed with suture anchors, screws and washers, and permanent sutures through drill holes as indicated. The primary repair is then augmented with an allograft tissue reconstruction. Posterolateral reconstruction with the free graft figure of eight technique utilizes semitendinosus or other soft tissue allograft. A curvilinear incision is made in the lateral aspect of the knee extending from the interval between Gerdy’s tubercle and the fibular head to the lateral epicondyle and then proximal following the course of the iliotibial band. A peroneal nerve neurolysis is performed, and the peroneal nerve is protected throughout the procedure. The fibular head is identified and a tunnel is created in an anterior to posterior direction at the area of maximal fibular head diameter. The tunnel is created by passing a guide pin followed by a standard cannulated drill 7 mm in diameter. The peroneal nerve is protected during tunnel creation, and throughout the procedure. The free tendon graft is passed through the fibular head drill hole. An incision is then made in the iliotibial band in line with the fibers exposing the lateral femoral epicondyle area of the distal femur.

The graft material is passed medial to the iliotibial band for the fibular collateral ligament limb, and medial to the common biceps tendon and iliotibial band for the popliteus tendon popliteofibular ligament limb. The limbs of the graft are crossed to form a figure of eight with the fibular collateral ligament component being lateral to the popliteus tendon component. A 3.2 mm drill hole is made to accommodate a 6.5 mm diameter fully threaded cancellous screw that is approximately 30 mm to 35 mm in length. The drill hole is positioned in the lateral epicondylar region of the distal lateral femur so that after seating a 17–20 mm washer with the above mentioned screw, the washer will precisely secure the two limbs of the allograft tissue at the respective anatomic insertion sites of the fibular collateral ligament and popliteus tendon on
the distal lateral femoral condyle. This drill hole is approximately 1 cm anterior to the fibular collateral ligament femoral insertion. A longitudinal incision is made in the lateral capsule just posterior to the fibular collateral ligament. The graft material is tensioned at approximately 30 to 40 degrees of knee flexion, secured to the lateral femoral epicondylar region with a screw and spiked ligament washer at the above mentioned point. The posterolateral capsule that had been previously incised is then shifted and sewn into the strut of figure of eight graft tissue material to eliminate posterolateral capsular redundancy (Figure 31).

The anterior and posterior limbs of the figure of eight graft material are sewn to each other to reinforce and tighten the construct. The final graft tensioning position is approximately 30–40 degrees of knee flexion with a slight valgus force applied and slight internal tibial rotation. The iliotibial band incision is closed.

The procedures described are designed to eliminate posterolateral axial rotation and varus rotational instability. Number two permanent braided suture is used to sew the tails of the graft together proximal to the washer to prevent slipping, and also to sew the allograft to the deep capsular layers for additional reinforcement. When there is a disrupted proximal tibiofibular joint, or hyperextension external rotation recurvatum deformity, a two-tailed (fibular head, proximal tibia) posterior lateral reconstruction is utilized combined with a posterolateral capsular shift (Figures 30, 31). A seven or eight millimeter drill hole is made over a guide wire approximately two centimeters below the lateral tibial plateau. A tibialis anterior or other soft tissue allograft is passed through this tibial drill hole and follows the course of the popliteus tendon to its anatomic insertion site on the lateral femoral epicondylar region. Nerves and blood vessels must be protected. The tibialis anterior or other soft tissue allograft is secured with a suture anchor, and multiple number two braided non absorbable sutures at the popliteus tendon anatomic femoral insertion site. The knee is cycled through multiple sets of full flexion and extension cycles, placed in ninety degrees of flexion, the tibia slightly internally rotated, slight valgus force applied to the knee, and the graft tensioned, and secured in the tibial tunnel with a bioabsorbable interference screw, and polyethylene ligament fixation button. The fibular head based reconstruction and posterolateral capsular shift procedures are then carried out as described above. Number two permanent braided suture is used to sew the tails of the graft together proximal to the washer to prevent slipping, and also to sew the allograft to the deep capsular layers for additional reinforcement.
Medial Posteromedial Reconstruction

The surgical leg positioned on the extended operating room table in a supported flexed knee position, posteromedial and medial reconstructions are performed through a medial curved incision taking care to maintain adequate skin bridges between incisions. In acute cases, primary repair of all medial side injured structures is performed with suture anchors, screws and washers, and permanent sutures through drill holes as indicated. The primary repair is then augmented with an allograft tissue reconstruction (Figure 33). In chronic cases of posteromedial reconstruction, the Sartorius fascia is incised and retracted exposing the superficial medial collateral ligament and the posterior medial capsule. Nerves and blood vessels are protected throughout the procedure. A longitudinal incision is made just posterior to the posterior border of the superficial medial collateral ligament (Figure 32).

Care is taken not to damage the medial meniscus during the capsular incision. Avulsed capsular structures are primarily repaired using suture anchors and permanent braided number two permanent sutures. The interval between the posteromedial capsule and medial meniscus is developed. The posteromedial capsule is shifted in an anterior and superior direction. The medial meniscus is repaired to the new capsular position, and the shifted capsule is sewn into the medial collateral ligament using three number two permanent braided sutures in horizontal mattress fashion, and that suture line is reinforced using a running number two permanent braided suture.
When superficial MCL reconstruction is indicated, this is performed using allograft tissue after completion of the primary capsular repair, and posteromedial capsular shift procedures are performed as outlined above (Figures 33, 33A, 33B and 33C). This graft material is attached at the anatomic insertion sites of the superficial medial collateral ligament on the femur and tibia using a screw and spiked ligament washer, or suture anchors. The final graft tensioning position is approximately 30–40 degrees of knee flexion.

It is my preference to secure the tibial insertion site first, and to perform the final tensioning and fixation of the allograft tissue on the femoral side. Number two permanent braided suture is used to sew the tails of the graft together proximal to the washer to prevent slipping, and also to sew the allograft to the deep capsular layers for additional reinforcement.
Overview of Graft Tensioning and Fixation

The PCL is reconstructed first followed by the ACL followed by the posterolateral reconstruction, and finally the posterior medial reconstruction. Final fixation has been performed on the femoral side of the posterior and anterior cruciate ligament reconstruction grafts. Tension is placed on the PCL graft distally using the Graft Tensioning Boot with the knee in full extension. This reduces the tibia on the femur in full extension, and restores the anatomic tibial step off. The knee is cycled through a full range of motion multiple times to allow pretensioning and settling of the graft. The knee is placed in 70 to 90 degrees of flexion, and fixation is achieved on the tibial side of the PCL graft with a Gentle Threads Interference Screw, and screw and spiked ligament washer. The Graft Tensioning Boot is next applied to the ACL graft and tension is gradually applied at full extension reducing the tibia on the femur.

The knee is cycled through a full range of motion multiple times to allow pre-tensioning and settling of the graft. The knee is placed in 30 degrees of flexion, and final fixation is achieved of the anterior cruciate ligament graft with a Gentle Threads interference screw and polyethylene ligament fixation button. The posterior and anterior cruciate ligament incisions are thoroughly irrigated and closed in layers. Attention is now turned to the lateral side of the knee where lateral posterolateral reconstruction, tensioning, and fixation are performed as outlined above. The lateral side incision is thoroughly irrigated and closed in layers. Finally, the medial posteromedial reconstruction, tensioning, and fixation are performed as outlined above. Full range of motion is confirmed on the operating table to assure the knee is not “captured” by the reconstructions.

Additional Technical Ideas

The posteromedial incision protects the neurovascular structures, confirms the accuracy of the PCL tibial tunnel placement and enhances the flow of the surgical procedure. It is important to be aware of femoral and tibial tunnel directions, and to have an adequate bone bridges between tunnels. This will reduce the possibility of tibial fracture.

We have found it very important to use primary and back-up fixation. During cruciate ligament reconstruction, primary aperture fixation is achieved with bioabsorbable interference screws, and back-up fixation is performed with a screw and spiked ligament washer, and ligament fixation buttons.

Secure fixation is critical to the success of this surgical procedure. The medial and lateral side reconstruction primary fixation is achieved with screws and spiked ligament washers, and back up fixation is achieved with multiple number two permanent braided reinforcing sutures. Mechanical tensioning of the cruciate ligaments at zero degrees of knee flexion (full extension), and restoration of the normal anatomic tibial step-off at 70-90 degrees of flexion has provided the most reproducible method of establishing the neutral point of the tibia-femoral relationship in our experience. Full range of motion is confirmed on the operating table to assure the knee is not “captured” by the reconstruction.
Post Operative Rehabilitation

The knee is maintained in full extension for four weeks non-weight bearing. Progressive range of motion occurs during postoperative weeks five through eight. Progressive weight bearing occurs at the beginning of postoperative week five progressing at a rate of twenty five percent body-weight per week during postoperative weeks five through eight. Progressive closed kinetic chain strength training, proprioceptive training, and continued motion exercises are initiated very slowly beginning at postoperative week nine. Return to sports and heavy labor occurs after the ninth postoperative month when sufficient strength, range of motion, and proprioceptive skills have returned. It is very important to carefully observe these complex knee ligament injury patients, and get a feel for the “personality of the knee.” The surgeon may need to make adjustments and individualize the postoperative rehabilitation program as necessary. Careful and gentle range of motion under general anesthesia is a very useful tool in the treatment of these complex cases, and is utilized as necessary.

Results

The Fanelli Sports Injury Clinic results for our PCL and multiple ligament knee reconstructions are detailed in the references listed in this technique manual. The reader is referred to these resources.
References

PCL and Multiple Knee Ligament Injury
Text Books by Gregory C. Fanelli, M.D.


PCL and Multiple Knee Ligament Injury
Related Peer Reviewed Articles by Gregory C. Fanelli, M.D.


*The literature cited here is intended to serve as a comprehensive reference list for the user; it should not be misconstrued as promotion or advertising.

Dr. Fanelli is a paid consultant of Zimmer Biomet.
# Implants

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## Instruments

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**WasherLoc™ Tibial Fixation Devices and the No-Profile Screw and Washer System**

**INDICATIONS**
Soft tissue fixation to bone, specifically during ligament reconstructive procedures.

**CONTRAINDICATIONS**
1. Infection.
2. Patient conditions including blood supply limitations, and insufficient quantity or quality of bone or soft tissue.
3. Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.
4. Foreign body sensitivity. Where material sensitivity is suspected, testing is to be completed prior to implantation of the device.

**Zimmer Biomet Sports Medicine Internal Fixation Devices**

**INDICATIONS**
Bone Mulch™ Screws are intended for use in fixation of semitendinous and/or gracile tendon grafts in ACL reconstruction only.

Interference Screws and Set Screws are intended for use in fixation of patellar bone-tendon-bone grafts in ACL reconstruction.

Screws and washers are indicated for soft tissue fixation to bone and bone-to-bone fixation in orthopedic procedures specifically during ligament reconstruction.

Toggle anchors (i.e., ToggleLoc™, ToggleLoc buttons and EZLoc™) are indicated for use for fixation of tendons and ligaments during orthopedic reconstruction procedures such as Anterior Cruciate Ligament (ACL) reconstruction.

**CONTRAINDICATIONS**
1. Infection.
2. Patient conditions including blood supply limitations, and insufficient quantity or quality of bone or soft tissue.
3. Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.
4. Foreign body sensitivity. Where material sensitivity is suspected or unknown, testing is to be completed prior to implantation of the device.
Resorbable Interference Screw

INDICATIONS:
Indications for the Gentle Threads™ Interference Screw include use in soft tissue reattachment procedures in the knee. Specific indications include the following:

**Knee:** Medial collateral ligament (MCL) repair, lateral collateral ligament (LCL) repair, posterior oblique ligament repair, and patellar ligament/tendon repair.

In addition to the above indications, 7.0mm, 8.0mm, 9.0mm, 10.0mm, 11.0mm, and 12.0mm screws are indicated for the following uses:

1. To provide interference fixation of patellar bone-tendon-bone grafts in anterior cruciate ligament (ACL) reconstruction.
2. To provide interference fixation during femoral and/or tibial fixation in anterior cruciate ligament reconstruction using a soft tissue graft (semitendinosus, gracilis).
3. To provide interference fixation during posterior cruciate ligament (PCL) reconstruction.

CONTRAINDICATIONS

1. Active infection.
2. Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.
3. Patient conditions including: blood supply limitations, insufficient quantity or quality of bone for attachment or latent infections.
4. Pathologic soft tissue conditions, which may prevent secure fixations.