SwiveLock® Anchor System

The Knotless Surgical Technique for Ligament Reconstruction
Surgical Technique

The patient is positioned in lateral or dorsal recumbency under general anesthetic. A hanging limb technique with aseptic preparation and appropriate draping should be performed.

A lateral parapatellar approach with arthroscopy is performed and thorough exploration of the internal structures of the joint is completed. Pathologic ligament and meniscus should be treated appropriately. Using standard technique, lavage the joint and close the joint capsule incision.

1. A simulated joint specimen showing the isometric sites for suture anchorage in the femur and tibia. In the femur, the isometric position is located caudally below the level of the distal pole of the fabella (F2). In the tibia, the isometric site is located 2-4 mm caudal to the bony protuberance, which forms the caudal wall of the sulcus for the long digital extensor tendon.

2. Drill with the Spade Tip Drill at the F2 site. Advance the drill until the drill "bottoms-out". Drill at an angle towards the center of the trochlear groove to ensure the drill will not "blow-out" the back of the femoral condyle.

3. Use the Tap to thread the tunnel created with the Spade Tip Drill. Advance the Tap until the black laser line is flush with the surrounding bone.
4. Locate the T3 site by palpating the bony protuberance, which forms the caudal wall of the sulcus for the long digital extensor tendon. The T3 site is located at the peak of the LDE groove just caudal to the LDE. Drill a tunnel with a .041 Guide Wire, which will pass beneath the sulcus and exit the caudomedial cortex of the proximal tibia.

5. Place a 2.5 mm Cannulated Drill over the Guide Wire and drill over the Guide Wire. The Guide Wire is removed, leaving the Cannulated Drill in place.

6. Pass the Nitinol Suture Passing Wire into the cannulation of the drill, looped end first. Advance the Nitinol Suture Passing Wire through the cannulation of the drill until it just exits the tip of the drill. Remove the drill, but leave the passing wire in place.

7. Load the 3.5 mm Suture Button onto the FiberTape suture and advance it down to the middle of the suture. Take the tails of the FiberTape suture and pass up to one inch of suture into the loop of the Nitinol Suture Passing Wire.

8. Pull the suture through the tunnel and pull tight to ensure the button is taut against the bone. Note: It is important to ensure no soft tissue is between the button and the bone.
Take both limbs of the FiberTape suture and pass them through the anchor eyelet of the SwiveLock. Remove the excess slack in the suture and place the tip of the eyelet into the tunnel at the F2 site.

Advance the anchor by turning the handle clockwise until the anchor is a quarter way into the tunnel. Check for joint stability. If unstable, remove the anchor by turning the knob counter clockwise. Tension can be increased or decreased by repositioning the eyelet on the suture, either left or right of the marking on the suture.

Pull the FiberTape up the side of the anchor driver and with a sterile marking pen, mark the FiberTape at the black laser line.

Move the eyelet to the mark on the FiberTape and advance the anchor and FiberTape into the F2 tunnel. If necessary, use a mallet to advance the eyelet into the tunnel until the lip of the anchor is at the entrance of the femoral hole.

If the joint is secure, advance the anchor fully into the tunnel. Unwind the white suture around the handle of the inserter and pull the driver out of the anchor. Cut the excess suture flush at the anchor.
**Knotless SwiveLock Anchors and FiberTape® Provide our Strongest and Lowest Profile Constructs:**

- Strong, Knotless Constructs
- PEEK Anchor Material
  - PEEK (polyetheretherketone) is an inert, nonabsorbable, thermoplastic material
- Vented Anchor Bodies
  - Promotes bone marrow flow and allows for bony ingrowth
  - Canine pilot study shows evidence of bony ingrowth at eight weeks
- FiberTape Suture
  - High strength
  - More resistant to tissue cut-through than round sutures
  - Large footprint

**ORDERING INFORMATION**

**Implants/Disposables:**

PEEK Knotless SwiveLock Kit includes:
- PEEK SwiveLock, 5.5 mm x 19.1 mm, closed eyelet, qty. 5
  - PEEK SwiveLock, AR-2323PSLK
- FiberTape, 2 mm, 54 inches, qty. 6
  - FiberTape, AR-7237
- Suture Button, 3.5 mm x 11 mm, qty. 5
  - Suture Button, AR-8920
- Suture Passing Wire, Nitinol, 8’
  - Suture Passing Wire, AR-1255-08

**Instruments:**

- Tap for 5.5 mm SwiveLock Anchor AR-1927CTB
- Spade Tip Drill for 5.5 mm SwiveLock Anchor AR-1927D
- Cannulated Drill, 2.5 mm AR-1530C-25
- Guide Wire, .041, qty. 4 AR-1530K
- Banana Knife VAR-5001
- Hook Knife VAR-5003
- Push Knife VAR-5005
- Handle for Knives VAR-5020
This description of technique is provided as an educational tool and clinical aid to assist properly licensed medical professionals in the usage of specific Arthrex Vet Systems products. As part of this professional usage, the medical professional must use their professional judgment in making any final determinations in product usage and technique. In doing so, the medical professional should rely on their own training and experience and should conduct a thorough review of pertinent medical literature and the product's Directions For Use.

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U.S. PATENT NO. 6,716,234 and PATENT PENDING
TightRope CCL Multicenter Clinical Outcomes Study

Cases Reported: 2,563 cases
Duration: 3 mo to > 5 yrs
Weight Range: 2-93 kg
Centers Reporting Data: 43

Reported Success Rate
94.9% Success rate

- 64.6% Full Function (restoration to, or maintenance of, full intended level and duration of activities and performance from pre-injury or pre-disease status without medication)
- 30.3% Acceptable Function (restoration to, or maintenance of, intended activities and performance from pre-injury or pre-disease status that is limited in level or duration and/or requires medication to achieve)

Complications
- 0.02% Catastrophic (resulting in permanent disability or death)
- 9.8% Major (requires further treatment based on current standard of care)
  - Subsequent Meniscal Tears – 5.2%
  - Instability/Failure – 2.9%
  - Infection – 1.7%
- 9.1% Minor (not requiring additional surgical or medical treatment to resolve)

*Reported complication rates for TPLO, lateral suture, TTA, and cranial closing wedge osteotomy range from 17-59% in the peer-reviewed veterinary literature
*An independent investigation by Dr. Rich Evans using Number Needed to Harm and Number Needed to Treat analyses showed TightRope to have the highest safety to efficacy ratio of all CCL procedures commonly used based on available data.

Surgeons contributing to the multicenter clinical study:

- Dr. Mark Albrecht – Gallatin Veterinary Hospital
- Dr. Jeff Baker – Crawford Animal Hospital
- Dr. Lori Barnes – Westside Veterinary Clinic
- Dr. Bert Blackburn – Buck Animal Hospital
- Dr. Lee Breshears – Animal Emergency & Spec. Center
- Dr. Cal Cadmus – Oakdale Veterinary Group
- Dr. Jimi Cook – University of Missouri
- Dr. Robert Cook - Animal Medical Center of St. Charles
- Dr. David Crouch – Western Carolina Veterinary Surgery
- Dr. Chad Devitt – Veterinary Referral Center of Colorado
- Dr. Felix Duerr – Aspen Meadows Veterinary Specialists
- Dr. Jay Erne – Affiliated Veterinary Specialists
- Dr. Mike Ferber – North Shore Animal Hospital
- Dr. Mark Freiberg – Rose Hill Animal Hospital
- Dr. Garrett – Animal Hospital of Fayetteville
- Dr. Caroline Garzotto – Willingboro Veterinary Clinic
- Dr. Mitch Gillick – Toronto Veterinary Emergency Hosp
- Dr. Charles Greco – Animal Medical Hospital
- Dr. Peter Haase – Arlington Veterinary Surg. Spec.
- Dr. Tom Hay
- Dr. Craig Hook – Mid-Michigan Veterinary Referral Center
- Dr. Jauernig
- Dr. Joanna Johansen – Linwood Animal Clinic
- Dr. Nick Kalafratis – Meridian Veterinary Hospital
- Dr. Garren Kelly – Byron Pet Clinic
- Dr. David Kydd – Kydd Veterinary Health Centre of London
- Dr. Tom Liebl – Clinton Parkway Animal Hospital
- Dr. Julius Liptak – Alta Vista Animal Hospital
- Dr. Dale Marker – Jackson Hwy Veterinary Clinic
- Dr. Thomas McNicholas – Affiliated Veterinary Specialists
- Dr. Sheri Morris – Willamette Valley Animal Hospital
- Dr. Paul Newman – Mobile Veterinary Surgical Services
- Dr. Frank Ogden – Bonita Springs Veterinary Hospital
- Dr. Antonio Pozzi – University of Florida
- Dr. Charles Pullen – Animal Medical and Surgical Center
- Dr. Patrick Ridge – Ridge Referrals
- Dr. Matt Rooney – Aspen Meadows Veterinary Specialists
- Dr. Jeff Schuett – Pewaukee Veterinary Services
- Dr. Abbie Tipler – Kydd Veterinary Health Centre
- Dr. Peter Veling – Caring Hands Pet Hospital
- Dr. Arathi Vinayak - Arlington Veterinary Surgery Specialist
- Dr. Ned Williams – Eastern Carolina Veterinary Referral
- Dr. Will Wright – Capitol Illini Veterinary Services
Advantages of TightRope CCL
- Bone to Bone fixation
- Helps ensure isometric implant placement
- Allows for minimally invasive technique
- Strength and Stiffness of Fibertape
- Low profile Implant with good handling
- Potential for addressing all abnormal forces

Potential Contraindications for TightRope CCL
- Tibial Plateau Angle > 32 degrees
- Angular Limb Deformity
- Connective tissue healing abnormalities
- Condyle < 12mm cranial to caudal
- Poor postop compliance

Biomechanical Testing Data

Subjectively measured stifle stability for TightRope (TR) vs TPLO

Client-based Outcomes Assessments for TightRope (TR) vs TPLO at 6 months after surgery


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(888) 215-3740 Phone ● (866) 898-2059 Fax
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Things to remember about your dog’s cruciate problem:

1. Your dog has, or will develop, arthritis associated with the cruciate ligament problem – this will not be cured with surgery or medications so we will need to manage this for the rest of your dog’s life.
2. What you do after surgery is more important that what is done in the operating room – you need to commit to all of the instructions in your discharge summary in order to optimize your dog’s outcome.
3. In dogs with one cruciate problem, there is a 50-70% chance that the other knee will have the same problem within weeks to years of the first one.
4. After surgery, complications or subsequent problems can occur – each procedure has varying complication rates ranging from less than 10% to over 50% depending on many factors. The overall complication rate for TightRope CCL is currently 18.6%, with 9.9% requiring further treatment which include:
   - Infection – 4.9%
   - Instability – 3.6%
   - Meniscal tears – 4.2%
5. The very best things you can do to minimize the chances and effects associated with 1-4 are:
   - Keep your dog at an ideal weight
   - Follow the discharge instructions exactly
   - Keep your follow-up appointments
   - Continue wellness care with your regular veterinarian

References

What is cranial cruciate ligament disease?

The cranial cruciate ligament (CCL) is one of the main stabilizing structures of the knee (stifle) joint in the hindlimbs of dogs. The CCL is a rope-like structure inside the joint that acts as a static (constant) stabilizer of the knee, preventing abnormal “slipping” of the two bones of the knee joint, the femur and tibia. Its main job is to hold the femur and tibia in proper alignment during all forms of activity.

Deficiency of the CCL is the most common orthopaedic problem in dogs and inevitably results in degenerative joint disease (arthritis) in the knee joint. It is referred to as a disease because it is typically the result of a degenerative process in dogs, rather than from athletic injury or trauma. Although it is often noticed after running, playing, or jumping, the disease process has been present for weeks to months when symptoms occur.

What are the symptoms of CCL disease?

Some of the symptoms your pet may display are:

- Limping
- Holding the hindlimb up
- Sitting with the leg stuck out to the side
- Stiffness, especially after exercise
- Not wanting to play or exercise
- Pain when the joint is touched or moved
- Swelling of the joint
- Clicking sound when walking

How is CCL disease diagnosed?

Your veterinarian should review your dog’s medical history and perform a complete examination using tests of the integrity of the CCL including the “cranial drawer” and “tibial thrust” tests. X-rays should be performed to assess the amount of arthritis present and aid in determining treatment options. Sedation or anesthesia is necessary for making the definitive diagnosis to avoid causing pain to your pet.

What are my treatment options?

First, it is important to know that there is no cure for CCL disease in dogs. The goals for all treatments are to relieve pain, improve function, and slow down the arthritis. With these realistic goals in mind, a number of treatment options can be very successful in accomplishing all of them.

Nonsurgical treatment entails rest and nonsteroidal anti-inflammatory medication for 6-8 weeks. Once the initial pain and inflammation have subsided, a strength-building exercise program and weight loss (if necessary) should be initiated. Nonsurgical treatment of CCL disease can be successful at accomplishing our goals, however, the success rate for accomplishing all of our treatment goals is not high and typically only small dogs weighing less than 30 lbs. may have good long-term results with this approach.

Surgical treatment options are numerous and no treatment has been proven to be better than another. It is vital to remember that complete assessment of the joint with treatment of damaged tissues such as the CCL and meniscus, as well as exceptional postoperative management and rehabilitation programs are as, or even more, important than the “CCL surgery” itself. The decision should be based on the best available data on safety and success, the surgeon’s experience with the techniques, and individualized for each patient using the information from the exam and discussion with you regarding your goals and concerns.

Most common CCL surgery techniques:

Tibial Plateau Leveling Osteotomy (TPLO) is one of the “bone-cutting” techniques and is designed to change the anatomy of the knee so that it no longer “slips” without having to try to replace the function of the CCL. A semicircular cut is made at the top of the tibia with a curved saw so that the tibial joint surface is “leveled out” to prevent forward slipping of the joint. A plate and screws are applied to stabilize the cut bone during healing.

Tibial Tuberosity Advancement (TTA) is the other “bone-cutting” technique which is designed to change the knee anatomy, so that muscle forces are rebalanced to limit the tibia from “slipping” forward. In this procedure, the bony attachment of the quadriceps muscles is cut, moved forward, and held in place with a spacer, plate, and screws during healing.

Lateral Suture Stabilization is the most common technique used to treat CCL disease in dogs. It is one of the “extracapsular” techniques which means the function of the CCL, which is inside the joint, is replaced by placing a suture outside the joint. The suture, most commonly a type of medical grade “fishing line,” is placed around the fabella and through the tibia providing a soft tissue-to-bone stabilizer of the joint during healing. The suture acts as a temporary stabilizer as the dog makes new functional scar tissue around the knee for long-term joint stability.

TightRope CCL was developed two years ago to provide a minimally invasive and improved method for extracapsular stabilization of the CCL. This technique does not require cutting of bone like the TPLO or TTA procedures. Instead, it uses small drill holes in the femur and tibia to pass a synthetic ligament-like biomaterial through a small incision to provide bone-to-bone stabilization during healing. The biomaterial used for the TightRope CCL is called FiberTape®. This is a kevlar-like material that is used extensively in human surgery for many orthopaedic applications. This material has properties that make it stronger and less prone to failure than any other suture materials currently being used for CCL reconstructions.

References:

Surgical Technique

The patient is positioned in lateral or dorsal recumbency under general anesthetic. A hanging limb technique with aseptic preparation and appropriate draping should be performed.

A lateral parapatellar approach with arthrotomy is performed and complete exploration of the stifle joint is completed. Pathologic ligament and meniscus should be treated appropriately. The joint is thoroughly lavaged and the joint capsule closed.

After the joint capsule is closed, a combination of sharp and blunt dissection is used to separate the vastus lateralis and biceps femoris muscles and retract the biceps caudally (Senn retractor) to allow for exposure and palpation of the lateral fabella (pin pointing to it).

The curved needle on the Canine Cruciate Suture is then placed with the tip on the midpoint of the lateral fabella and “walked” proximally until it can be inserted between the fabella and femur and passed completely around the fabella from proximal to distal.
It is important to make sure the needle is around the fabella and not caudal to it. This can be verified after suture placement by pulling on both strands of the suture to ensure they are around the bone of the fabella and not soft tissues caudal to it. It is also important to minimize the amount of soft tissue encompassed in the suture throw, paying particular attention to the peroneal nerve distally. The curved needle on the Canine Cruciate Suture is designed to help promote correct placement.

The straight needle on the Canine Cruciate Suture is passed deep to the patellar ligament from lateral to medial at the most distal point possible. The suture should be caudal to the ligament and cranial to the fat pad.

A 2-3 mm hole is drilled in the proximal tibia using a pin and Jacob’s chuck or drill bit and drill. The location of the hole should be immediately distal to Gerdy’s tubercle and immediately proximal to the point of origin of the cranial tibial muscle. The hole should be slightly angled caudoproximal to craniodistal to match the final direction of the suture.

As the pin or drill is removed, the straight needle on the Canine Cruciate Suture is inserted in the tibial hole from medial to lateral, and the suture is advanced to allow for easy tying.

Both needles are cut off of the Canine Cruciate Suture and the suture is tied at the desired tension so as to prevent abnormal cranial drawer and internal rotation. The stifle is then put through a range of motion to ensure the suture has been placed correctly and is not impinging on periarticular structures. The area is lavaged.

The lateral fascia is closed with the imbricating pattern of choice. Routine subcutaneous tissue and skin closures are performed.

Postoperatively, the patient is typically bandaged for a minimum of 24 hours. Exercise restriction with controlled physical rehabilitation is recommended through 12 weeks after surgery.
Revolutionizing Orthopaedic Surgery

FiberWire suture is constructed of a multi-stranded long chain ultra-high molecular weight polyethylene core with a polyester braided jacket that gives FiberWire superior strength, soft feel and abrasion resistance that is unequaled in orthopaedic surgery. Suture breakage during knot tying is virtually eliminated, especially critical during arthroscopic procedures. FiberWire represents a major advancement in orthopaedic surgery.

Strength
FiberWire has greater strength than comparable size standard polyester suture. Multiple independent scientific studies document significant increases in strength to failure, stiffness, knot strength and knot slippage with much less elongation.

Tie Ability and Knot Profile
Superior strength allows tighter loop security during knot tying, increasing knot integrity while reducing the knot profile compared to standard polyester suture.

Abrasion Resistance
The multi-strand long chain ultra-high molecular weight polyethylene core dramatically increases FiberWire abrasion resistance. Surgical procedures that create bone edges, tunnel edges, and articulating surface abrasion areas are appropriate indications for FiberWire. FiberWire is over five times more abrasion resistant than standard polyester suture.

Safety in Numbers
Trusted by leading orthopedic surgeons worldwide since its introduction in 2002, FiberWire has contributed to successful surgical outcomes in over one million orthopaedic surgical procedures. Extensive biocompatibility, animal and clinical testing prove that FiberWire demonstrates biocompatibility characteristics equivalent to standard polyester suture.
FiberWire Scissor
The FiberWire Scissor was designed to cut any size or style suture, especially FiberWire, in open surgical cases where an arthroscopic suture cutter is not necessary. With its specially designed cutting edges, it can cut FiberWire cleanly and effortlessly without frayed edges.

FiberWire Tensioner
The FiberWire Tensioner provides controlled tensioning option of FiberWire loops during knot tying. When reapproximating soft tissue, the blunt tip keeps the knot in place while the tensioning wheel and spring mechanism gently tension the loop to tighten the repair.

The tensioning wheel is then turned in a counter-clockwise fashion as the tension meter is read. Once the desired amount of tension/reduction is achieved, three reverse half-hitches can be thrown down the barrel of the tensioner to secure the fixation.

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ORDERING INFORMATION
Canine Cruciate Suture VAR-2000
FiberWire Tensioner AR-1929
FiberWire Scissor AR-11796

References:
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U.S. PATENT NOS. 6,716,234 and PATENT PENDING
Canine Cranial Cruciate Ligament Repair Kit