Stabilization of the Cranial Cruciate Deficient Stifle with the Arthrex Knotless System

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Surgical Approach

Position the dog in lateral recumbence with the affected limb upward. Make a skin incision adjacent to the lateral edge of the patellar tendon beginning 5 cm proximal to the patella and extending distally 5 cm below the tibial crest. Incise the subcutaneous tissue along the same line. This exposes the lateral edge of the patella, patellar tendon and the fascia lata. With the scalpel blade make an incision at the border of the patellar tendon and fascia lata. Make certain this incision is along the edge of the patellar tendon and not laterally within the fascia lata. This incision is begun I cm below the distal pole of the patella and extends distally to the tibial crest. This maneuver creates a tissue plane beneath the tendon/fascia and underlying fat pad. At the proximal extent of the incision/tissue plane beginning just below the distal pole of the patella, use the closed scissors to create a tunnel by forcing the closed scissor blades proximally between the fascia lata and underlying joint capsule. Continue this maneuver proximally the length of the incision. Withdraw the scissors and cut the fascia the length of the incision leaving 2-3 mm of tissue adjacent to the patella for future closure. Locate the cut fascia adjacent to the patella tendon at the distal extent of the incision near the tibial crest. At this point, use the closed scissors to create a tunnel from cranial to caudal at the joint line. The tunnel begins at the tibial crest and extends to the fibular head along the tibial plateau. Remove the scissors and cut the fascia from cranial to caudal. **Note do not extend this incision caudal to the fibular head to avoid damage to the peroneal nerve.** This maneuver creates a triangular section of fascia lata which is bluntly separated from the underlying joint capsule. When reflected caudally and proximally, excellent access is created to the lateral collateral ligament, joint capsule and fabella. The incision is carried distally to the tibial crest. Next extend the incision proximally. From the distal pole of the patella, cut cranial to caudal **along the border of the vastus lateralis (do not incise through the muscle fibers).** Reflect the patella medially to expose the cranial face of the joint.

Isometric Sites

Stabilization of the CCL deficient joint can be accomplished through a variety of methods. Surgical techniques have been developed including placement of intra-articular grafts, insertion of suture material and/or advancement of periarticular structures outside the joint (extracapsular), and tibial osteotomies that alter joint mechanics. The technique of choice is based on surgeon experience. Tibial plateau leveling techniques are preferred by the author in large athletic breeds, with early partial CCL injury, and in dogs/cats with excessive slope. Recent double blind study showed that in larger breeds of dogs, the Nylon crimp technique was not as effective in all outcome parameters as a leveling osteotomy. A number of reasons why the nylon / crimp technique is ineffective have been elucidated. The placement of the nylon (attachment sites at the femur/tibia) are very non-isometric and predispose to suture elongation/breakage. The nylon material itself undergoes stress relaxation/creep, ie, elongates under continual load. Newer materials (Arthrex FiberWire/Tape) have improved structural/mechanical properties. More isometric sites have been identified; note the ligament is very complex and there is no true one isometric site. Studies in our lab at TAMU have identified near isometric sites. A discussion of the site(s) location and technique of application are presented below. Additionally, a leveling osteotomy technique is described for those who wish to apply this method based upon personal preference/indications.
Recommended sites for isometric suture placement:

**Locating the F2 site:** The F2 site is located at the level of the distal pole of the fabella. Placement of the anchor is critical. The anchor must be placed in the femoral condyle as far distal and as far caudal as is possible. An anchor placed to far proximal or anterior is at risk for pull out or suture failure. To locate the correct placement site in the femoral condyle, palpate the distal pole of the fabella. Make a vertical incision through the capsular tissue to expose the joint line between the fabella and caudal margin of the femur. Locate the proper position for the anchor just distal to the fabella-femoral joint line and as far caudal as possible.

**Locate the T3 site at the proximal tibia.** First locate the protuberances cranial and caudal to the long digital extensor groove. Make a vertical incision through the capsular tissue overlying the extensor groove. Palpate and locate the protuberance just caudal to the extensor groove; this is the site for placement of the first drill hole.

**Decision Making for Treatment of the Cranial Cruciate Deficient Stifle**

The Arthrex System is applicable to all size and breeds of dogs and cats. The attending Veterinarian should consider a number of factors when treating the patient with an ACL injury. The activity level and function of the patient should be taken into account. Greater stabilization is required in the large active athletic dog (4 arm reconstruction rather than 2 arm reconstruction). The attending surgeon should determine the degree of tibial plateau slope. If excessive (34 degrees or more) the attending should consult with the client relative to a leveling osteotomy. If the client wishes to proceed with an extra-articular procedure, greater stabilization is required (4 arm reconstruction rather than 2 arm reconstruction). Giant breeds of dogs require a larger anchor (6.2mm or 7 mm) and minimum 4 arm reconstruction.
Knotless Swivelock.

There are a number of different size anchors and suture. The choice of anchor/suture is dependent upon size, activity, tibial anatomy. In general, for the small dog (25 to 40lbs) a 3.5mm Swivelock preloaded with Labral tape is recommended. For the 40 to 80 lb dog a 4.75mm or 5.5mm anchor with 2 arms or 4 arms of Fibertape are recommended. In Giant breeds of dogs one may choose a 6mm or 7mm anchor with 4 arms of Fibertape. Important to note that the femoral and tibial sites remain the same; only the size of anchor and suture change.

3.5mm Swivelock with Labral tape. Expose the femoral/tibial site as described previously. Drill the femoral site with the 2.7mm drill bit and tape the drill hole with the 3.5mm tape. Drill the tibial site with the 2mm cannulated drill bit over the .045 K-wire. Secure the Labral tape onto a SS button and with the aid of a nytinol suture passer, bring the Labral tape from medial to lateral so the SS button lies firmly against the medial cortex. Tension the Labral tape such that the tape lies over the femoral drill site and all but 2-3mm of cranial translation remain. Mark the Labral tape at the center of the femoral drill hole. Next, load the Labral tape through the eye of the SwiveLock. Place the Labral tape such that the mark lies in the eye of the Swivelock. The 2 limbs of the Labral Tape are aligned adjacent to and parallel to the shaft of the Swivelock. A mark is made in the Labral tape at the laser line just distal to the interference anchor. This second mark now replaces the first mark which still lies within the eye. Note the suture is no longer tight when the second mark is placed in the eye of the SwiveLock. The eye is placed in the femoral drill site and a mallet used to insert the eye into the depth of the tunnel. Notice when the eye is in the depth of the tunnel, the Labral tape is once again tight. The square handle on the shaft is held and the knob turned clockwise to engage and advance the interference screw. The interference screw is driven/screwed into the femoral drill hole until it is flush with the bone surface. The inserter is screwed counterclockwise to release the inserter from the anchor.

Single strand 2mm Fibertape (this is referred to as two limbs since the single strand FiberTape is folded on itself): The T3 site is located and a .045 guide wire inserted from lateral to medial to exit the medial cortex. The 2mm cannulated drill bit is placed over the guide wire and drilled to exit medially. The guide wire is removed and nytinol suture passer placed through the cannulated drill bit with the loop exiting medially. The drill bit is removed leaving the suture passer in place. The Fibertape is passed through the two hole button (making two limbs). The free ends of the FiberTape are loaded into the suture passer and pulled to exit T3 laterally. The F2 site is located and the spade drill bit used to drill a tunnel to the stop on the shaft of the drill bit. The tunnel is then tapped with the appropriate tap (5.5mm tap in this exercise). The free ends of the Fibertape are loaded into the eye of the SwiveLock and the Eye placed into the F2 tunnel (3-4 mm into the tunnel). Abnormal craniocaudal laxity is eliminated (leaving 2-3 mm normal laxity) by tensioning each limb of the FiberTape separately (alternatively eliminate tension and follow steps above). When satisfactory stability is achieved, the limbs of the FiberTape are aligned adjacent to and parallel to the shaft of the Swivelock. A mark is made in the Fibertape where the limbs of the Fibertape are at the same level as the laser line at the distal end of the interference screw. The Eye of the SwiveLock is retracted from the tunnel and the FiberTape pulled back through the Eye so that the mark is located within the Eye of the SwiveLock. The Eye is now re-inserted into the tunnel and a mallet used to drive the Eye into the tunnel until the interference screw is flush with the bone. The square handle on the shaft is held and the knob turned clockwise to engage the interference screw. The interference screw is driven to be flush with the bone surface. The strand of Fiberwire used to hold the Eye in place is unwrapped from the knob and the SwiveLock handle removed. One arm of the Fiberwire (used to hold the Eye) is pulled to remove the FiberWire. The FiberTape is now cut.
Two strand 2mm Fibertape (this is referred to as 4 limbs since the strands of FiberTape are folded on themselves): The T3 site is located and a .045 guide wire inserted from lateral to medial to exit the medial cortex. The 2.5mm cannulated drill bit is placed over the guide wire and drilled to exit medially. The guide wire is removed and nytinol suture passer placed through the cannulated drill bit with the loop exiting medially. **The drill bit is removed leaving the suture passer in place.** The two strands of Fibertape are passed through the two hole button (making 4 limbs). The free ends of the FiberTape are loaded into the suture passer and pulled to exit T3 laterally. The F2 site is located and the spade drill bit used to drill a tunnel to the stop on the shaft of the drill bit. The tunnel is then tapped with the 5.5mm tap. The .045 guide wire is inserted from the depth of the prepared femoral drill hole to exit medially. The 2.5 mm cannulated drill bit is placed over the guide wire and drilled to exit medially. A suture loop passer is placed in the 2.5 cannulated drill bit such that the loop faces laterally. The free ends of the Fibertape are loaded into the loop and the suture passer pulled out from the medial exit such that now all 4 arms of the FiberTape exit through the medial 2.5mm exit hole. Tension is placed on the 4 arms (manual or with tension device) to eliminate cranial translation (note the normal stifle has 2-4 mm of translation). When satisfactory stability is achieved, the eye is now re-inserted into the femoral tunnel at the lateral entrance and a mallet used to drive the eye into the tunnel until the interference screw is flush with the bone. The square handle on the shaft is held and the knob turned clockwise to engage the interference screw. The interference screw is driven to be flush with the bone surface. The strand of Fiberwire used to hold the Eye in place is unwrapped from the knob and the SwiveLock handle removed. One arm of the Fiberwire (used to hold the Eye) is pulled to remove the FiberWire. The FiberTape is now cut at the medial exit site.