Extra-articular stabilization of the cranial cruciate deficient stifle with anchor systems*

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Summary
Complete or partial rupture of the cranial cruciate ligament (CCL) is a common injury of the canine stifle. Most practicing veterinarians would agree that optimal outcome is best achieved with surgical intervention. A popular method of stabilization is an extra-articular suture stabilization. The objective of this manuscript is to describe suture placement in a more isometric position as compared to traditional suture placement. A second objective is to introduce the veterinary surgeon to novel anchor products used for stabilization.

Introduction
Complete or partial rupture of the cranial cruciate ligament (CCL) is a common injury of the canine stifle (1, 2, 20). CCL injury causes cranial translation of the tibia relative to the femur resulting in hind limb lameness and often leads to osteoarthritis (21). It has been demonstrated that dogs with CCL deficient stifles cannot prevent cranial translation of the tibia either by altering hind limb gait or muscle forces across the stifle (14). As such, conservative treatment of CCL injury particularly in medium and large breeds of dogs is generally unsuccessful.

The majority of surgeons would agree that surgical stabilization is the preferred method of treatment (6). Numerous surgical techniques have been developed including placement of intra-articular grafts, insertion of suture material and/or advancement of peri-articular structures outside the joint (extracapsular), and tibial osteotomies that alter joint mechanics (8, 11, 19). Although hind limb function and lameness can be improved with surgical intervention, to date, no one technique has been proven to be superior in the clinical setting (6, 18). Conversely, in vitro testing has demonstrated that techniques in which the stabilizing suture is secured to the bone rather than circumfabellar provide superior load to failure, stiffness and load to yield (4). Procedures that require placement of an extracapsular suture are technically less demanding and remain popular with veterinary surgeons and veterinary practitioners alike.

The purpose of this brief communication is to describe the application of novel stabilization products that are anchored to the bone and placed at near isometric sites for reconstruction of the cranial cruciate deficient stifle in the dog and cat.

Methods
Patient preparation and surgical approach
Clip and prepare the limb for aseptic surgery using standard technique. Position the patient in lateral recumbency with the limb to be operated prepared in a hanging position. Sterile draping, including application of a sterile stockinette, is performed to allow maximal manipulation of the limb during surgery.

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* Dedicated to Prof. Dr. Ulrike Matis with best wishes.
Make a skin incision beginning 4 cm proximal to the patella and extending distally 4 cm below the tibial crest. Incise the subcutaneous tissue along the same line and suture the skin margins to the stockinette. Incise and reflect the fascia lata to expose the underlying joint capsule. Perform a lateral arthrotomy, inspect and treat intra-articular pathology if present. Suture the arthrotomy and reflect the fascia lata to expose the region of the fabella and sulcus of the long digital extensor tendon. This will facilitate exposure of the femoral and tibial sites for application of the stabilizing suture. The size of suture used for stabilization is dependent upon the weight and activity level of the patient.

**Application of Corkscrew/FasTak anchor** (Fig. 1)

The femoral site is located at the level of the distal pole of the lateral fabella. Make a vertical incision through the capsular tissue to expose the joint line between the lateral fabella and caudal margin of the lateral femoral condyle. The proper position for the anchor is 3–4 mm distal to the lateral fabella-femoral joint line as far caudal as possible in the lateral femoral condyle without engaging articular cartilage. To insert a Corkscrew/FasTak anchor, prepare the femoral site by pre-drilling a hole with a 2 mm drill bit (or 1/16 Steinmann pin) to a depth of approximately 5 mm. The drill hole is directed toward the center of the trochlea.

Next, prepare the tibial site by locating the protuberances cranial and caudal. Make a vertical incision through the tissue overlying the extensor groove. Palpate and locate the protuberance caudal to the extensor groove; this is the site for placement of the tibial tunnel. At the caudal protuberance, beginning as proximal as is possible on the tibial plateau without entering the joint, insert a 0.045 K-wire from lateral to medial. The K-wire is directed to glide caudal to the extensor groove to exit at the medial cortex of the proximal tibia. With the K-wire in position, place a 2 mm cannulated drill bit over the wire and drill a tunnel to exit at the medial cortex. Leave the drill bit in place and remove the K-wire. Through the cannulated hole...
in the drill bit, place a nytinol Arthrex suture passer such that the loop is lateral. Remove the drill bit and leave the suture passer in the drill hole.

A Corkscrew or FasTak anchor preloaded with FiberWire suture is inserted into the drill hole in the femoral condyle. The application handle is removed and a free end of the suture is placed into the loop of the nytinol suture passer and pulled from lateral to exit medially. The suture is passed through a suture button and then loaded into the suture passer to be pulled through the tibial tunnel from medial to lateral. Once the free ends of the FiberTape exit laterally, they are loaded into the eye of the SwiveLock anchor.

Application of knotless SwiveLock Anchor^a(Fig. 2)

This system is recommended for use in dogs greater than 20 kgs. The location of the femoral site is identical to that described above. The 4.1 mm spade tip drill bit is used to drill the femoral tunnel to the appropriate depth in the femoral condyle. The femoral tunnel is tapped with the hand tap to cut threads in the bone which will accommodate the anchor and suture (2 mm FiberTape).

The tibial site is prepared as described above. The nytinol suture aid is placed in the tibial tunnel such that the loop is positioned medially. The FiberTape is passed through the 2 mm button and then loaded into the suture passer to be pulled through the tibial tunnel from medial to lateral. Once the free ends of the FiberTape exit laterally, they are loaded into the eye of the SwiveLock anchor.

Next, the eye of the SwiveLock anchor and associated FiberTape suture is placed into the femoral tunnel (3–4 mm deep). Eliminate excessive cranio-caudal laxity leaving 2–3 mm normal laxity by tensioning each limb of the FiberTape separately. 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 on the FiberTape where the limbs of the FiberTape intersect the distal end of the anchor. 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 to the depth of the femoral tunnel such that the bottom of the SwiveLock anchor is flush with the bone. The square flange on the shaft is held and the teardrop knob turned clockwise to engage the anchor. The anchor is advanced into the femoral tunnel until the top of the anchor is flush with the bone surface. The strand of FiberWire used to hold the eye in place is unwrapped from the teardrop knob and the SwiveLock insertion handle is removed. One arm of the FiberWire (used to hold the eye) is pulled to remove the FiberWire and the FiberWire suture is discarded. The FiberTape is now cut flush to the bone as it exits the anchor. Tissues are lavaged prior to routine closure.

Clinical outcome

Clinical outcome for cases treated with a FasTak/SwiveLock anchor or a SwiveLock were evaluated using a validated owner questionnaire (10). Fifty-nine stifle joints (58 dogs; 1 DSH cat) were oper-
A number of materials have been proposed for use as extra-articular suture prostheses (3). Polyester, coated caprolactam, and braided polyesters are suture materials that were initially advocated due to the availability of these materials in large diameter sizes (up to No. 7 metric for the polyesters) and increased strength. The use of braided polyesters and caprolactam were replaced by the use of monofilament materials in circumfabellar techniques (15). The most popular materials used for extracapsular reconstruction in the recent past are monofilament nylon fishing line and monofilament nylon leader line. In a study comparing No. 5 metric polypropylene, No. 7 metric multifilament polyester, and monofilament nylon leader material, the monofilament nylon leader material was able to maintain a significantly greater percentage of static tensile load compared to the other materials tested (16). More recently, polyester woven polyethylene sutures, and tape, have gained popularity as materials advocated for extracapsular stabilization. These materials exhibit less cyclic displacement, have greater yield loads and load to failure than other suture materials (5). However, the relatively stiff properties of polyester coated polyethylene material places the suture at higher risk to failure if the isometry of the fixation points is poor.

Isometric positioning of the stabilizing suture is defined as placement such that there is no change in distance between the femoral/tibial anchorage points through flexion and extension of the stifle. The stifle is a complex joint undergoing rotation and gliding through its range of motion. As such, there is no single intra-articular or extra-articular position that is truly isometric. Nevertheless, points of attachments that are quasi or near isometric result in less suture tension and may improve post-operative clinical function. A recent study by Hulse et al. (13) showed that a femoral attachment site located at the caudal border of the lateral femoral condyle at the level of the distal pole of the fabella paired with the tibial attachment site located at the bony protuberance caudal to the sulcus of the long digital extensor tendon resulted in the least change in suture tension through flexion and extension. A study conducted by Fischer et al. (7) disagreed with these results (13), suggesting that the suture placement did not mimic the suture being placed around the femoral-fabella ligament and therefore might not result in a significant improvement in suture tension pattern, when applied to dogs with a torn CCL. We do not recommend circumfabellar suture placement as this relies on soft tissue anchorage of the stabilizing suture. Soft tissue anchorage through the femoral-fabellar ligament showed unsatisfactory creep and elongation in a recent study (4). Fischer (7) concluded that there is a significant increase in suture tension at full flexion with the suture anchored in the lateral condyle and through a tunnel drilled at Gerdy’s tubercle. Hulse et al. (13) agree with this finding and also demonstrated a significant increase in suture tension at full flexion with the suture anchored in the lateral condyle and through a tunnel drilled at Gerdy’s tubercle. The tibial site recommended by Hulse et al. (13) which gives the least increase in suture tension is located at the bony protuberance caudal to the sulcus of the long digital tendon, not at Gerdy’s tubercle. This site was not tested by Fischer (7).
Conclusion

Procedures that require placement of an extracapsular suture are technically less demanding and remain popular with veterinary surgeons and veterinary practitioners alike. Neuer stabilization products which allow secure fixation to bone at near isometric sites with novel suture material have been shown in multiple laboratory studies to be superior to traditional circumfabellar techniques using monofilament nylon. Ongoing clinical studies demonstrate low complication rates and good clinical function based on a force plate validated owner questionnaire. The authors recommend this technique and materials for stabilization of the CCL deficient stifle.

Failure of the prosthesis may occur if the prosthesis is not anchored properly. Techniques utilizing bone fixation are stiffer and elongate less than techniques that rely on soft tissue fixation. Loo-sening of extracapsular prostheses caused by creep and stress relaxation occurs after a limited number of loading cycles with the prosthesis anchored by passage through the femoral-fabellar liga-ment (4). Extracapsular stabilization techniques relying on circumfabellar fixation may be less effective at mitigating cranial drawer motion and cranial tibial thrust due to the propensity for elongation (9). Anchoring the suture to bone with a bone anchor such as the SwiveLock provides the least elongation at failure, conditioning elongation, and peak to peak elongation (4).

Conflict of interest
Arthrex supported courses with supplies. The first author has taught stifle courses in which the faculty were paid by Arthrex.

References


7. Fischer C, Cherres M, Grevel V, et al. Effects of attachment sites and joint angle at the time of lateral suture fixation on tension in the stifle for stabiliza-

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