Animal Emergency & Referral Associates

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Cranial Cruciate Ligament Repair

Surgical repair for partial or complete tearing of the cranial cruciate ligament (CCL) is commonly performed at AERA. Tearing of the cranial cruciate ligament leads to instability and abnormal motion in the knee or stifle joint which lead to arthritis, cartilage loss, and further degeneration of the joint.

There are several methods of addressing this injury including **intracapsular techniques** in which the course of the natural ligament is mimicked inside the joint, **extracapsular repair**, in which an implant is used to allow the body to produce scar tissue in a controlled fashion to stabilize the joint, and **osteotomy** (bone cutting) or geometry altering procedures. Intracapsular repairs are designed to recreate the cruciate ligament and mimic the current repair strategies used in humans. These repairs in dogs have had, and continue to have, unreliable outcomes and prove that canine cruciate ligament disease is not the same as human disease.

Another paradigm of canine cruciate ligament disease is to try to recreate the function of the ligament by using an extracapsular approach. These methods include the lateral fabellar suture technique, fibular head transposition, and the “tight rope” procedure. These procedures rely on periarticular joint fibrosis and scar tissue to stabilize the cruciate deficient joint and don’t truly address the underlying problem. The fibular head transposition uses the lateral collateral ligament to mimic the course of the cranial cruciate ligament from an extracapsular location.

The osteotomy techniques; **TPLO** (tibial plateau leveling osteotomy) and **TTA** (tibial tuberosity advancement) use precise cuts in the tibia (shin bone) to change the natural forces of the knee and eliminate joint instability during natural weight bearing there by significantly decreasing the progression of joint damage.

Meniscus

One of the most important parts of cranial cruciate ligament repair surgery is assessing and managing the menisci. Although most of the attention is placed

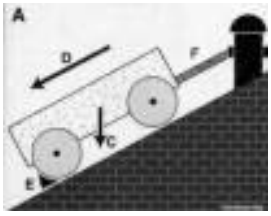
on the medial meniscus since it is more often grossly damaged, reports have indicated that there is trauma and disturbances to the lateral meniscus as well. Most major meniscal damage (bucket handle tears, maceration) occurs with a complete tear of the cranial cruciate ligament however we frequently see abnormal menisci in stifles with partial tears.

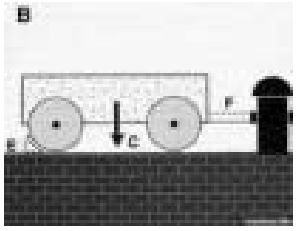
There is continuing debate as to how to correctly manage the meniscus. Obviously if there is gross damage or tearing, a meniscectomy, or removal of the damaged meniscus, needs to be performed. Some surgeons choose to perform a total medial meniscectomy, whereas some prefer to only remove that portion that is torn or damaged. Work is ongoing, but there are currently no good methods for repairing or replacing the canine meniscus.

Medial meniscal release was first introduced by Dr. Barclay Slocum, a pioneer in veterinary orthopedics and the inventor of the tibial plateau leveling osteotomy (TPLO). The medial meniscal release is a procedure by which the medial meniscus is cut from its attachments which allows the caudal pole of the meniscus to slide out of the way of the medial femoral condyle during cranial tibial thrust.

Tibial Plateau Leveling Osteotomy

The tibial plateau leveling osteotomy (TPLO) was the first major paradigm shift in the treatment of cranial cruciate ligament disease. Instead of relying on replacing the function of the ligament with a prosthesis or scar tissue, the TPLO relies on changing the biomechanics of the knee joint during ambulation. The TPLO stabilizes the knee by changing the forces that are acting upon the stifle. The main force that the TPLO reduces is that of cranial tibial thrust (CTT). Tibial thrust is the force that leads to cranial or forward translation of the tibia in the CCL deficient stifle. This translation is theorized to be due to an excessively steep tibial plateau angle. By leveling the tibial plateau, the effectiveness of the pull of the surrounding muscles is increased.





The tibial plateau is the portion of the tibia that articulates with the femoral condyles (depicted as the brick hill in the above pictures). The meniscus is represented by the wedge labeled (e), and (c) is depicting the force generated during weight bearing. The increased angle of the tibial plateau, or slope, causes a stress on the cranial cruciate ligament (f) each time the stifle is loaded in weight

bearing. In a normal animal the CCL prevents tibial thrust. It is thought that the repetitive stressing of the ligament leads to eventual degeneration in certain stifles that leads to a partial or complete tear of the CCL. Unfortunately, the real story is not that easily explained. If the slope of the tibial plateau was the only factor in leading to a CCL tear then in theory there would be an angle that would serve as a screening tool to determine if an animal will go on to tear the ligament. This has been shown to not be the case. Therefore there are obviously some other factors that lead to the degeneration of the ligament. In the TPLO the top of the tibia or tibial plateau is rotated and stabilized with a plate and screws to hold the newly positioned tibial plateau in the new position to allow for the bone to heal.

Post operative care consists of exercise restrictions and controlled walking during the healing period to allow for a trouble free recovery. Activity must be controlled until there is bony union at the osteotomy. This usually takes 8-12 weeks in most patients. Flexion and extension exercised and ice packs can begin 24-48 after the surgery. Short controlled leash walks of 5-10 minutes are encouraged. A recheck is performed in 10-14 days to assess the incision and soft tissues and to assess limb function. Most patients are using the leg anywhere between 1-14 days post operatively. At 2 weeks physical therapy including more aggressive flexion and extension activities and longer slow controlled leash walks are encouraged. We typically recheck again at 8 weeks post-operatively for radiographs to assess healing of the osteotomy and to make any necessary changes to the physical therapy plan. Usually at this point, unlimited leashwalking is encouraged with short sessions of light jogging at 4 months. A slow return to normal function over the next 8 weeks ensures a gradual loading of the osteotomy and encourages strong bone formation. Obviously uncontrolled activity, jumping, and falling can have devastating consequences that could possibly lead to implant failure or fractures of the tibia.

It has been shown that early physical therapy following the TPLO leads to increased limb usage and more rapid return to normal function as compared to patients who did not receive physical therapy. Therefore we strongly recommend meeting with or Physical Therapist during the recovery. These meetings usually coincide with the 2 week and the 8 week rechecks. Overall client satisfaction has been reported to be as high as 93%.

Tibial Tuberosity Advancement (TTA)

Like the TPLO, the TTA approaches the cranial cruciate deficient stifle from a biomechanical standpoint, and attempts to neutralize the abnormal forces that result. The theory of the TTA is that all normal joints are in equilibrium with equal forces pulling the joint in each direction. In the stifle the only force supporting cranially is the patellar ligament. If the patellar ligament is perpendicular to the tibial plateau then all forces are equal. The goal is to

eliminate the tibial shear force and decrease instability and thus decrease the progression of osteoarthritis. The TPLO accomplishes this by moving the plateau, the TTA works by moving the patellar ligament. By advancing the patellar ligament, it is reported that all reaction forces in the stifle are decreased including patellar femoral force and femoral tibial force. It is thought that these forces lead to excessive stress on the articular cartilage, leading to osteoarthritis and chondromalacia.

A TTA plate is contoured to the proximal medial tibia and an osteotomy is performed to free the tibial tuberosity and patellar ligament insertion form the tibia. A spacer or "cage" is used to advance the tuberosity. The cages come in 3 sizes and the appropriate cage is placed at the osteotomy site. Custom titanium implants are used to secure the cut section of bone. All of the TTA implants are made of Titanium, which is reported to be much less reactive than stainless steel. A bone graft is applied to the defect created by the advancement.

The reported advantages of the TTA are that the operative time is reduced, the procedure is less invasive, and there is less perioperative and post-operative morbidity. The TTA also offers the ability to try to correct a medial patellar luxation by transposing the tibial tuberosity laterally during implant application. Scientific reports on the TTA are limited. Two early studies one with 500 cases and one with 300 cases both report complication rates around 5%.

If your dog has been diagnosed with torn cruciate ligament, please call to schedule a consultation with Dr. Singer or Dr. Hunt. At the appointment, a thorough evaluation will be performed, all procedures will be discussed in depth, and the surgery that is best suited for your pet and you can be scheduled.