Cruciate disease can be a confusing and difficult to explain to clients especially if they are financially constrained. However it is the number one cause of hind limb lameness in dogs and costs Americans $1.32 billion dollars per year. It effects almost all breeds of dogs and is surrounded by controversy regarding which surgical procedure is most beneficial.\(^1\) There have been several iterations of surgical procedures that have come and gone over the years, and new procedures continue to be tested in research settings. Over the last 20 years, as the incidence of cruciate disease increased so have the specialty and referral options for owners. There are now multiple opinions with little scientific evidence increasing the confusion for primary veterinarians and owners. In fact, the controversy started to erode the confidence that the public has placed in veterinarians. Many articles in the lay press have noted that there was a disconnect between the evidence and the recommendations for a more invasive and more expensive technique thus fueling the suspicion that veterinarians were making recommendations to promote monetary gain over animal welfare.\(^2,3,4\) There have been recent strides in veterinary medicine to fill some of the knowledge gap.

Cruciates can be addressed either surgically or conservatively. The magic cutoff for dogs treated conservatively versus surgically is 30 pounds based on a 1972 paper where most small breed dogs recovered satisfactorily with rest whereas working dogs and large breed dogs required surgical intervention for a satisfactory outcome.\(^5\) Since then, very little has been published on conservative therapy. Dogs with experimentally created cruciate ruptures improve over time but do not return to normal weight bearing, and they are used as an induced osteoarthritis model.\(^6\) More recently, the University of Minnesota compared dogs receiving institutional rehabilitation, weight loss program, and an NSAID to those receiving a TPLO. The surgery group did better, but 2/3 of the conservatively treated dogs had successful outcomes.\(^7\) More aids in conservative management have become available including braces. These range in types and expense and have little to know evidence for their use.

Surgical management falls under the following categories: reconstruction/replacement, extracapsular stabilization, and biomechanical alteration. All the methods have the same goal: to stabilize the knee or eliminate cranial tibial thrust. We have used humans as a model for the reconstruction/replacement techniques using tissue autografts or allografts as replacements for the cruciate ligament. These techniques do not alter the range of motion of the stifle or the femorotibial contact, but results have been disappointing thus far.\(^8\)

Extracapsular stabilization techniques are those that require a direct cranial tibial thrust opposing force outside the joint. This would include fibular head transposition (the lateral collateral ligament is moved into a position to counteract thrust), lateral fabellar suture (or its multiple variations), or tightrope. The lateral fabellar suture and tightrope more widely used than the fibular head transposition in general. The technique for the lateral fabellar suture has improved with crimp clamps decreasing knot size and irritation; however, the nylon suture is not expected to last the lifetime of the dog and has been shown to stretch, loosen or break; however, rehabilitation of the muscles which can assist in stifle stabilization with the help of scar tissue can still end in a good result. The tightrope is stronger material when compared in mechanical testing, and it is placed using bone anchors or tunnels rather than around the fabella. However, the suture still cycles and therefore is unlikely to last a lifetime. The bone can also remodel and allow loosening of the tightrope. The fibular head transposition depends on the fixation of the fibular head cranial to its original position and fixation failure is not uncommon allowing fibular head movement caudally. These techniques in general also decrease flexion of the stifle by decreasing the ability of the tibia to internally rotate. The tightrope procedure uses landmarks that help ameliorate this as much as possible.

The remaining category is biomechanical alteration of the joint to eliminate the cranial tibial thrust. This includes the tibial plateau leveling osteotomy (TPLO), tibial tuberosity advancement (TTA), and Closing Wedge Osteotomy (CWO). These techniques have been developed based on biomechanical investigation of the canine knee and aim at altering the stifle to allow a mechanical advantage for the muscles, and other tendons and ligaments to counteract cranial tibial thrust.

**Which is the best technique?**
The best technique would be minimally invasive, re-establish the biomechanics and kinematics of the knee prior to injury, low complication rate, and be inexpensive. Unfortunately, this is not the case with current techniques. To date, the TPLO has the best evidence for the best outcome.\(^9,10\) This includes a recent meta-analysis that came to this conclusion.\(^9\) The highest level of evidence is a randomized controlled clinical trial. Recent trials comparing TPLO to lateral fabellar sutures and TPLO to TTA have been performed. In the TPLO to lateral fabellar suture trial, the TPLO group had a better outcome based on owner satisfaction (93% of dogs in the TPLO were rated a 9 or 10 compared to 75% in the LFS group) and gait analysis (11% better in the TPLO group at a trot).\(^10\) In the
trial comparing TTA to TPLO, presented but not published in a peer-reviewed journal, dogs receiving a TPLO did slightly better than dogs receiving a TTA. There may be several reasons for this including a steep learning curve for TTA’s. Complications can also be used to compare the procedures, but similar rates have been reported ranging from 19-28%. The majority of major complications such as implant failure are much lower and superficial skin infections are higher. This is also likely associated with experience with the procedure which is typically not addressed in the largely retrospective studies.

If TPLO is the best why offer other procedures?
1. Small size. There is still very little evidence in dogs under 30lbs that a TPLO would be better than any other procedures in dogs that fail conservative therapy.
2. Aftercare issues. Occasionally, owner will openly refuse to do the aftercare needed for a TPLO. In those cases, implant failure in a TPLO is much more catastrophic than a tightrope or lateral fabellar suture. Also, since controlled exercise is permitted after suture techniques, some will choose based on the personality of the dog.
3. Financial considerations. Some owners want the least expensive option regardless of “best”.
4. Age. Some owners do not want the invasiveness, or the long term differences in the procedures don’t matter as much to them.

What should the owners expect for aftercare?
Tightrope and LFS require controlled exercise for 6-8 weeks at least. Rehabilitation makes a big difference in the outcome. TPLO and TTA require rest to prevent implant failure. No running jumping playing and limited walking to prevent implant complications associated with fatigue until the bone is healed (6-8 weeks). Then slowly increasing exercise over time to rebuild muscle.

Managing long-term expectations
Dogs with cruciate ruptures have osteoarthritis. Unfortunately, there is no cure for osteoarthritis. Surgical intervention is designed to slow it down, but it is not uncommon for dogs to have occasional flare ups of the osteoarthritis.

References
12. TTA LEARNING CURVE


