Introduction: Traditional techniques for treating cruciate ligament insufficiency have focused on replacing the static stabilisers of the stifle, whereas recent advances in surgery have centred on stabilising the stifle joint through dynamic means. In other words, altering the biomechanics of the joint so that the cranial cruciate ligament (CrCL) is no longer required and the joint is stabilised by the actions of actively contracting muscles. The most popular techniques that have emerged are the tibial plateau adjustment techniques e.g. Tibial Wedge Osteotomy (TWO) and Tibial Plateau Levelling Osteotomy (TPLO) and the Tibial Tuberosity Advancement technique (TTA). All of these techniques involve cutting, and re-orientating, the proximal tibia so that normal shear forces, which would otherwise be apposed by an intact cruciate ligament, are redirected perpendicular to the articular surfaces. The resultant compressive forces are much better tolerated by the joint surfaces and the stifle becomes dynamically stable when loaded. Excellent results have been claimed with these techniques when compared to the traditional techniques, with more rapid recovery times, less progression in OA, and return to athletic function, even in large breed dogs. However these techniques require specialised training, instrumentation and implants, and because of their complexity have the potential for higher complication rates when compared to the traditional techniques. In addition, the management of more complex types of CrCL rupture such as dogs with conformation deformities (e.g. pathological tibial plateau slope angles, patellar luxations, bowed limbs, and torsional deformities) becomes technically very challenging.

The Triple Tibial Osteotomy (TTO)

The Triple Tibial Osteotomy is a new technique designed to provide dynamic stability to the cruciate deficient stifle. It combines some of the features of the above techniques to achieve the same outcome, but with less radical angular changes. The measurements and calculating the correction angle is made from the radiographs and applying this to a formula.

There are two phases to the surgery; initially a medial arthrotomy is performed to inspect the joint and to deal with any meniscal issues. The second phase involves the tibial osteotomies with the objective to reduce the tibial plateau slope to an angle perpendicular to the straight patellar ligament. Three cuts are made in the proximal tibia. The first cut is a partial tibial crest osteotomy and the second and third cuts create a full thickness wedge ostectomy caudal to first cut but it does not extend as far as the caudal tibial cortex (Figures 1&2). The tibial plateau is made perpendicular to the patellar ligament by rotating the proximal tibial fragment to close the wedge ostectomy and this simultaneously advances the tibial tuberosity. The wedge reduction is held in place with bone clamps while a T-plate is used to stabilize the osteotomy (Figure 3). It is possible to perform this technique without any additional specialised instrumentation, however inexpensive TTO instruments have been developed to make the procedure more precise. About 2/3rds of the correction is achieved via the partial wedge and 1/3rd from the partial tibial crest osteotomy. The result is a very stable repair with minimal alteration to the relationship between the femur and tibial plateau.

The surgical results:

A prospective study of the first 64 consecutive cases of CrCL injury in 52 dogs, treated by TTO was completed in 2004 and the results have recently been published (1). In summary, 43 dogs (55 stifles) returned for long-term evaluation from 11 to 26 months post-operatively (mean, 14.5 ± 3.2 months). Lameness scores ranged from 0 to 1/10, cranial draw signs were present in all cases and the tibial compression test was positive in 50 stifles (91%). There was a significant increase in thigh circumference (P < 0.05) and a significant increase in stifle ROM (P < 0.05). There was no statistically significant increase in osteoarthritis scores from pre-operative to long-term post-operative values (P < 0.001).

Seven post-operative complications were encountered (11%). There were two fractures through the tibial tuberosity, one joint infection, one plate infection, one case of suspect bone neoplasia, and two late meniscal injuries.
Owners completed questionnaires for 48 dogs (92%) at long-term follow-up. Dogs were assessed as being normal or near normal for all of the physical activities surveyed except sitting and standing, where 2% and 4% of owners respectively judged their dogs as being mildly abnormal. All owners reported the procedure had resulted in a marked improvement in their dog’s quality of life and all indicated they would have the procedure performed again if they had another dog with the same condition.

Since the completion of this study, the authors have performed more than 700 TTO procedures and consistently achieved good results. With experience, the post-operative complication rate has reduced to very low levels (<2%) and the technique has been easily adapted to treat dogs with conformation deformities. The TTO is relatively easy to learn and several TTO workshops have now been held in Australia and the UK to teach the technique. As a result, many surgeons from around the world (e.g. Australia, UK, Germany, Holland, Italy and the USA) have enthusiastically embraced the TTO as their technique of choice for the cruciate deficient stifle.

Why do I prefer this method?
A recent review of all known published tibial osteotomy techniques concluded that satisfactory results were achieved with all the techniques. However TWO significantly shifts the tibial axis but despite this there was no clear preferred technique (2). Personally I have never been that good at doing TWO; I am philosophically against a patented procedure (TPLO) where you are not free to discuss and share outcomes with colleagues; although I was involved in the early stages of the TTA procedure I was put off by the fact that the protocol seemed to change all the time. So in my hands the TTO has become my chosen technique as recovery rate is quicker when compared with lateral suture stabilization and the progression of the arthritis is much less. The technique is versatile and causes less alteration to the normal anatomy and function of the limb. The operation can be easily performed single handed. There is a very low rate of implant failure and less chance of creating a limb deformity. Although not a scientific conclusion I have experienced a very high acceptance of the procedure by referring vets.

References: