The Challenge of Isometry for Extracapsular Devices

Stabilizing the canine stifle after failure of the cranial cruciate ligament (CCL) is a daily challenge for many of us in the veterinary orthopaedic world. No matter which technique we choose, many cases do well clinically – but some haunt us. So we strive to improve – we ponder the problem, and come up with a modification that might address the issue that caused those "failures" to not do well. There have been so many different ideas proposed – and, I suspect, many, many, more tried, and not published – it could be said that you are not really an orthopaedic surgeon until you have developed your own CCL stabilization technique.

In this issue, D’Amico et al. have evaluated an extracapsular suture system that is designed to loosen slightly as the joint flexes (1). This concept developed from the observation that sutures from the fabella to the tibia tend to tighten during flexion. Using a limb press system, they measured relative motion between the femur and tibia with an electromagnetic motion tracking system. The limbs were evaluated at three joint angles with the CCL intact, transected, and finally, with the joint stabilized with the proposed device. The suture system eliminated drawer in the extended position, and limited drawer in the two more flexed joint positions. It effectively prevented internal rotation, and did not cause excessive external rotation.

As with many recent studies, they discussed the importance of isometry of the suture (1). Locating the origin and insertion of a single strand of suture such that it will mimic the complex function of the multi-stranded CCL is a difficult task – hence the use of the term "quasi-isometric". In this paper, they described the ideal location of the femoral anchor and the landmarks used to locate these implants. However, this is not as easy as it seems, particularly if a minimally invasive approach is being used. In the paper, the location of the femoral screw in Figure 2B is more cranial than the one depicted in Figure 5B. While this shift may seem small, the isometric patterns of an extracapsular suture are very sensitive to the position of its origin. I think that it is very important for the femoral anchor or tunnel to be located in the most caudal position possible on the condyle in order to have the origin of the device aligned with the CCL origin. If the anchor or tunnel is more cranial, it will be closer to the origin of the lateral collateral ligament, and the ideal tibial point will likely need to be more caudal to maintain isometry. With the potential for variation in the femoral origin, it would be interesting to assess the isometry of the proposed location of the tibial attachment before committing to drilling a hole.

Another issue that is intertwined with isometry is the choice of suture material. If the suture is perfectly isometric, then, ideally, it should have a similar stiffness to the natural cruciate ligament. The newer synthetic fibres can achieve that, particularly with firm anchor points. However, if your device is not isometric, and it is strong and stiff, it may limit joint motion, increase joint compartment pressures, and/or cut through, or pull out of, the bone, or eventually, break. The stiffer and stronger the material you use, the more important it is to be isometric in its placement.

Given the frequency of CCL injury and the frustration that develops when a particular patient does not have a good outcome, it is likely that there will be continued efforts to refine and improve our approach to the unstable stifle. While in vitro evaluations of new ideas and devices are a necessary first step, true progress is made by critical prospective evaluation of outcomes in our patients. Each case that does not do as well as we would like must be critically evaluated and learnt from. These studies are best structured prospectively so that complete data will be collected in each instance – these are difficult and time consuming studies, but they are sorely needed to guide surgeons in their struggle to decide the optimal approach for a particular patient.

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References