Tibial Plateau Leveling Osteotomy

Over the past decade, veterinary orthopaedists have come to respect and recommend corrective osteotomies of the proximal tibia as their preferred approach in the management of canine patients with diseases of the cranial cruciate ligament. These procedures, although surrounded by controversy, are powerful techniques and can deliver dependable outcomes in the vast majority of cases. They are complex and require experience and advanced training to avoid the more common technical pitfalls and minimize patient morbidity.

The principle of improving joint biomechanical function by performing a corrective osteotomy is well established in the orthopaedic community. Joints are composed of articulating cartilage surfaces which transfer physiologic loads. An unstable joint environment, such as is the case in the cruciate-deficient stifle, results in abnormal load distribution within the cartilage and underlying subchondral bone and secondary osteoarthritis ensues. The goal of a corrective osteotomy is to alter the mechanical environment to improve load distribution and joint function and preserve the joint or minimize the progressive degenerative changes which develop. An understanding of the biomechanical function of normal and diseased joints is required. Common examples include proximal tibial varus osteotomies in human patients with unicompartmental knee osteoarthritis to delay total knee replacement and pelvic osteotomy to restore joint stability in human and canine hip dysplasia.

Unlike the situation in the human knee where the bearing surface of the proximal tibia is perpendicular to the long axis of the bone, the canine stifle possesses unique anatomy. The articular surface of the proximal tibia is caudally sloped relative to the functional tibial axis. During weight bearing, the gravitational forces directed through the limb, combined with compressive forces generated by contraction of the gastrocnemius muscles, result in tibial compression. A cranially directed force, called tibial thrust, is generated which results from compression of the cylindrical femoral condyles on a sloped tibial plateau. This force is normally balanced by active muscular contraction of the hamstring muscle group pulling the proximal tibia caudally and opposed by the intact ACL. Following cruciate rupture, muscular forces alone cannot compensate for loss of the ACL and dynamic anterior tibial subluxation occurs during the stance phase of the gait cycle.

The goal is to eliminate or neutralise the cranial tibial thrust force vector and therefore stop cranial tibial subluxation. Caudal tibial thrust is created instead, however the magnitude of this force is smaller than before leveling. Functional stability is created due to the integrity of the caudal cruciate ligament which prevents caudal drawer motion. Plateau leveling procedures do not address passive stifle laxity and drawer motion can still be achieved during orthopaedic examination.

Tibial plateau leveling procedures are accepted, appropriate treatments for both partial and complete cruciate injuries. Muscle bulk consistently improves, joint range of motion is preserved and patients return to preinjury function. These techniques are now available in Melbourne and can be recommended with confidence to pet owners. In my opinion, all practitioners who make recommendations to clients with cruciate injuries should be aware that they exist and offer these procedures in the appropriate setting. The discovery that corrective osteotomies can be successfully applied to the cruciate-deficient stifle has greatly improved our prognosis for the most common cause of pelvic limb lameness and should both intrigue the scientist and reward the clinician.