Study of the Protective Effect of Tibial Plateau Leveling Osteotomy on Ligament Degeneration in Canine Cranial Cruciate Ligament Disease

Abstract of Doctoral Thesis

Masakazu Shimada

Graduate School of Veterinary Medicine and Life Science

Nippon Veterinary and Life Science University

Canine cranial cruciate ligament rupture (CrCLR) is a common cause of hind limb lameness in small animal orthopedics. Tibial plateau leveling osteotomy (TPLO) is a useful treatment for CrCLR. Recently, particular attention has been paid to early intervention of TPLO to inhibit the progression of postoperative osteoarthritis (OA) and reduce mechanical stress in the cranial cruciate ligament (CrCL). However, it is unclear whether CrCL degeneration has been histologically suppressed. This study aimed to evaluate the usefulness of the early intervention of TPLO for CrCLR by analyzing whether TPLO has a protective effect on CrCL degeneration.

The present study showed that TPLO could improve weight-bearing function from as early as 3 months postoperatively and maintain it for as long as 36 months postoperatively. Although OA progressed over time after TPLO, its progression was more gradual in stifles with partial tears than in those with complete rupture. This result suggests that the adaptation of TPLO has a favorable outcome. Using a robotic system, TPLO promoted instability under the craniocaudal and internal–external rotation tests without compressive force conditions following CrCL transection. This may be one of the factors for the significant progression of OA in cases of complete CrCLR.

Based on previous studies, we created a model of CrCL degeneration by increasing the tibial plateau angle (TPA) and subsequently adopted TPLO to evaluate its effect on CrCL degeneration histologically. The results showed the maintenance of collagen 1 and inhibition of the production of proteoglycans and elastic fibers, which suggested that TPLO inhibited the progression of CrCL degeneration. This suggests that, by reducing the mechanical load on the CrCL with TPLO in the presence of CrCL, the CrCL degeneration process induced by excessive TPA can be suppressed.

Therefore, the present study suggests that early intervention with TPLO may decrease the biomechanical stress of CrCL, inhibit CrCL degeneration, and preserve CrCL function. The preservation of CrCL function is expected to minimize the instability associated with TPLO and inhibit the progression of postoperative OA.