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CORA Based Leveling Osteotomy with Tibial Tuberosity Transposition for Cranial Cruciate Ligament Rupture with Concurrent Medial Patellar Luxation in Two Small Breed Dogs

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Abstract : A 5-year-old 6 kg male mongrel (case 1) and a 7-year-old 4.3 kg male yorkshire terrier (case 2) were presented to Chonbuk animal medical center (CAMC). Both animals had non-weight bearing hind limb lameness. Case 1 had complete rupture of cranial cruciate ligament with grade 3 medial patellar luxation. Case 2 had complete cranial cruciate ligament rupture with grade 4 medial patellar luxation. During surgery, in both cases, trochlear block recession was performed followed by CORA based leveling osteotomy (CBLO) and tibial tuberosity transposition (TTT). General soft tissue reconstructions for medial patellar luxation including medial releasing and lateral imbrication were also performed. Postoperatively, both animals demonstrated excellent recovery and regained normal weight bearing of the affected hind limb without any recognizable complication. CBLO followed by TTT can be a curative surgical option without complications in cases of cranial cruciate ligament rupture with high-grade medial patellar luxation in small breed dogs.

Key words **:** CORA based leveling osteotomy, tibial tuberosity transposition, cranial cruciate ligament rupture, medial patellar luxation, small breed dog.

Introduction

Cranial cruciate ligament rupture (CCLR) is a common musculoskeletal disease that causes pain and lameness in dogs (13). Untreated CCLR leads to secondary meniscal injury (33.2%) due to instability of the stifle (7).

Medial patellar luxation (MPL) is another common orthopedic disease in dogs and is caused by skeletal anomalies such as coxa vara, diminished anteversion angle, femoral varus, and medial displacement of the tibial tuberosity (8,14). MPL may cause chronic stress to the cranial cruciate ligament, which leads to its rupture. Concurrent cranial cruciate ligament rupture with chronic MPL is observed in 15 to 20% of middle to old-age dogs (4).

Surgical techniques to treat CCLR are divided into two groups namely, passive constraint and dynamic stabilization. Passive constraint methods include lateral suture techniques, while dynamic stabilization methods use osteotomy techniques such as tibial wedge osteotomy (TWO), tibial tuberosity advancement (TTA), tibial plateau leveling osteotomy and CORA based leveling osteotomy (CBLO) (1-3,12).

Hulse et al. introduced the CBLO technique in 2010. The technique is used to reduce cranial tibial thrust associated with the CCL-deficient stifle. The normal canine tibia has a proximal curvature (procurvatum); therefore, a CORA. As such, the proximal anatomic longitudinal axis is not aligned with the distal axis (5).

Surgical techniques to treat MPL include trochleoplasty, tibial tuberosity transposition (TTT), and soft tissue reconstruction. TTT is necessary to realign the quadriceps mechanism in many cases of MPL (4).

In cases of concurrent MPL and CCLR, a combination of the procedures listed above may be required. Lateral suture techniques followed by trochleoplasty and TTT; TTT and TPLO followed by trochleoplasty or TTT and CBLO followed by trochleoplasty could be effective therapeutic options such case (14). However, lateral suture technique might cause thinner TTT fragment due to the isometric point of the CCL and TPLO is known to have difficulties to maintain TTT fragment security due to its innate shape of the osteotomy line (10,11).

The purpose of this case report was to describe the relatively new combination surgical technique (CBLO + TTT) and its clinical outcome in two small breed dogs with concurrent CCLR and MPL.

Case

A 5-year-old 6 kg male mongrel (case 1) and a 7-year-old 4.3 kg male Yorkshire terrier (case 2) were presented to CAMC. Both animals had non-weight bearing hind limb lameness. Case 1 had complete cranial cruciate ligament rupture with grade 3 medial patellar luxation. Case 2 had complete cranial cruciate ligament rupture with grade 4 medial

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patellar luxation. On physical examination, both animals had non-weight bearing at stance or walk, joint effusion, pain during extension and flexion on stifle joint, positive cranial drawer sign and tibial compression test, and grade 3 and 4 medial patellar luxation, respectively. Plain radiographs of the two animals revealed medial dislocation of the patella with loss of definition of the fat pad and osteophyte formation along the trochlear ridge. Subchondral bone sclerosis of the tibial plateau was also observed in both cases (Fig 2A, 2B).

Weight bearing pressure mapping exam (Kitronix Sensor Mat, Kitronix, Korea) revealed non-weight bearing of the symptomatic leg in both cases. Based on results of the evaluation, the dogs were diagnosed as a case of CCLR and MPL of the right (case 1) and left hind limb (case 2), respectively. Based on the diagnosis, the following surgical procedures were planned: trochlear block recession to correct MPL, CBLO to correct the CCLR, TTT to realign the quadriceps mechanism and soft tissue reconstruction.

Prior to surgery, tramadol (3 mg/kg) and cefazolin (25 mg/kg) were injected as premedications in both patients. Anesthesia was induced in both patients with propofol (6 mg/kg) and maintained by inhalation anesthesia with sevoflurane.

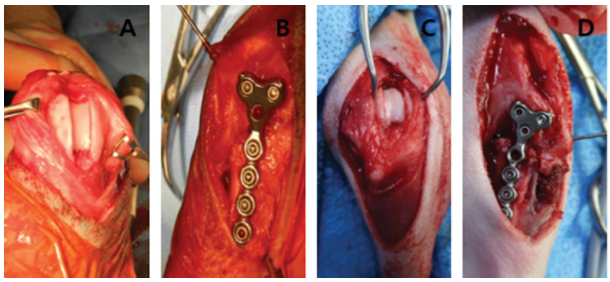

Fig 1. Surgical procedure; Case 1 trochlear block recession (A), Case 1 CBLO and TTT (B). Case 2 trochlear block recession (C), Case 2 CBLO and TTT (D).

During surgery, both patients were positioned in dorsal recumbency and arthrotomy was performed to approach the stifle joint. Meniscus was visually examined and was found to be intact in both patients. Complete rupture of the CCL was spotted in both cases during visual inspection. Remnants of the CCL were removed using No. 11 blade. Following this, trochlear block recession was performed in both patients in a routine manner. Subsequently, CBLO was performed using 10 mm TPLO blade for radial osteotomy, and

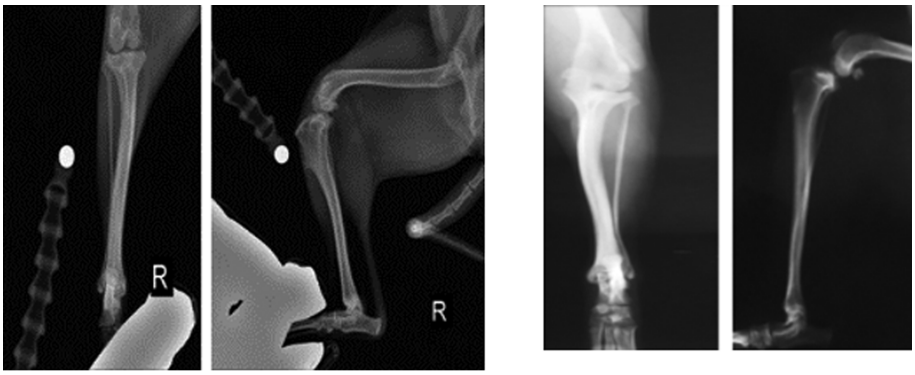

Fig 2. (A) Preoperative radiographs of case 1. (B) Preoperative radiographs of case 2.

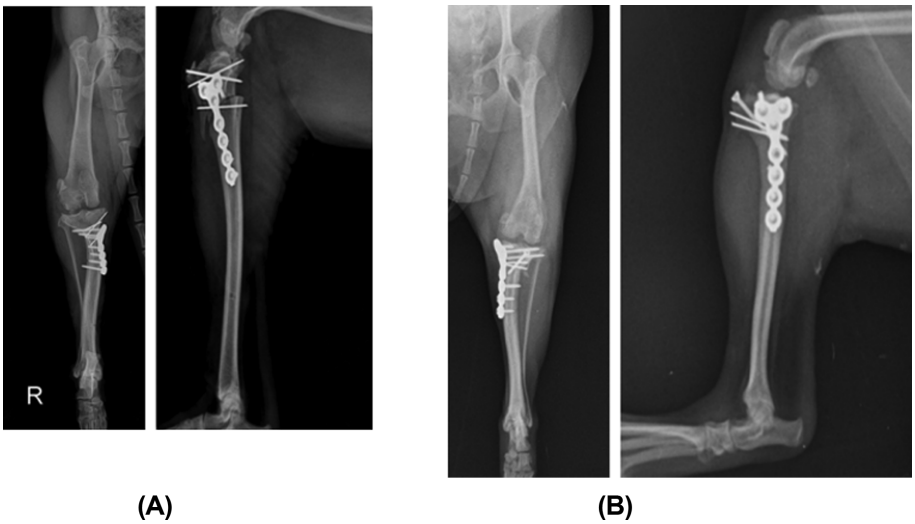

Fig 3. (A) Postoperative radiographs of case 1. (B) Postoperative radiographs of case 2.

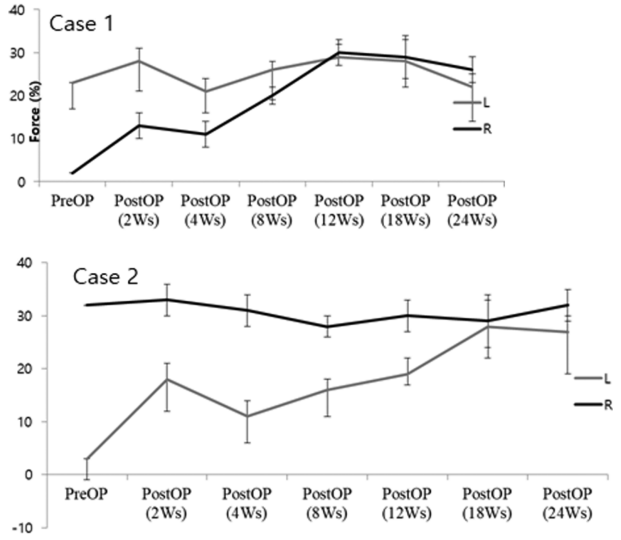

Fig 4. Preoperative and postoperative weight bearing pressure mapping of two cases.

2.0 TPLO and Kirschner wire for fixation (Fig 1).

After CBLO, an oscillating was used to perform TTT in both patients. Osteotomies were performed in a routine manner; however, in case 1, Kirschner wire was used, while a 1.5 cortical screw was for fixation in case 2. Both TTTs were followed by routine retinacular imbrication as a soft tissue reconstruction procedure.

Postoperatively, cefazolin (25 mg/kg) was injected as empirical prophylactic antibiotic in both cases. Tramadol (3 mg/kg) and firocoxib (5 mg/kg) were administered as analgesics. Cage rest, controlled walking, and cool pack were advised for rehabilitation. In postoperative X-ray, the patella was located in the trochlear groove and the implants were in the proper location. The tibial plateau angle (TPA) decreased from 28 degrees to 11 degrees (case 1) and 27 degrees to 10 degrees (case 2) as desired (Fig 3A, 3B). Postoperative weight bearing pressure mapping examination revealed gradual increase of the weight bearing proportion of the affected leg in both cases (Fig 4).

Discussion

Numerous techniques have been reported for management of concurrent MPL and CCLR. Studies have indicated that lateral suture techniques (especially the lateral fabellotibial suture [LFTS]) combined with TTT, and TPLO combined with TTT are the most commonly performed and effective methods compared to other techniques (i.e. Tibial tuberosity Transposition Advancement [TTTA]) (2,14).

The LFTS technique with TTT might pose a challenge with regard to the isometric tibial anchorage site. The most favorable site has been found at the caudal wall of the extensor groove of the tibia. This site can be on the initial point of the path of TTT osteotomy line, which 3 to 4 mm proximal to the attachment of the patellar ligament (9).

TPLO with TTT can be considered a therapeutic option for concurrent CCLR and MPL. Several studies in large breed dogs have reported favorable prognosis with this combination approach (6,8). However, TPLO-TTT is technically challenging because the tibial tuberosity is isolated during the procedure, which can lead to a fracture (10). This technique also requires an additional osteotomy for the tibial tuberosity transposition, which could decrease the stability of the proximal portion of the tibia. Therefore, previous studies did not recommend TPLO-TTT due to concerns that the tibial tuberosity fragment might be difficult to secure (6).

In case of CBLO, as the innate osteotomy method can preserve the whole proximal fragment, the procedure may be considered to provide a safer and easier TTT osteotomy compared to TTT combined with LFTS or TPLO (10,11). The weight bearing pressure mapping in this case contributed to objective evaluation of clinical improvement in the patients.

However, to the best of our knowledge, there are no other case reports or controlled comparative studies that have reported the effectiveness of this new combination approach. Therefore, further studies must be conducted to investigate and evaluate the exact advantages and disadvantages of CBLO with TTT technique.

Conclusion

The combination of CBLO and TTT technique has minimal interference between two procedures compared to other combinations. In this case report, two small breed dogs were found to have excellent therapeutic outcomes following CBLO and TTT. Therefore, this combination approach can be a good surgical option in small breed dogs with concurrent MPL and CCLR.

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