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Araştırma Makalesi ***Research Article***

The Clinical and Radiological Evaluation of Canine Cranial Cruciate Ligament Rupture Treatment with Tibial Plateau Leveling Osteotomy[#]

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Abstract

Tibial plateau leveling osteotomy (TPLO) is one of the tibial osteotomy techniques for canine cranial cruciate ligament rupture. The purpose of this study is to evaluate the clinically and radiologically findings of the patients with cranial cruciate ligament rupture treated by tibial plateau leveling osteotomy. In our clinical study, treatment of cranial cruciate ligament rupture in 18 dogs with a total of 20 stifles was performed. Cases were diagnosed with cranial cruciate ligament rupture, technical measurements for the operations are determined and the cases were prepared for the operation during the preoperative period of the clinical and radiological examinations. Following the operation, postoperative clinical and radiological evaluations were performed on the 10^{th}, 30^{th}, 60^{th}, 90^{th} and 120^{th} days. At the end of the study, it was observed that the dogs retained stifle joint motion ability, early healing of the osteotomy side in the postoperative period, all stifle joint functions were retained after a period. It was determined that this method of operation can securely (in regards to joint stabilization) be performed on especially in large breed dogs.

Özet

Köpeklerin Ön Çapraz Bağ Kopuklarının Sağaltımında Tibial Plato Düzeltme Osteotomisi-TPLO ile Sağaltımı, Sonuçlarının Klinik ve Radyografik Olarak Değerlendirilmesi

Tibial plato düzeltme osteotomisi (TPDO), köpeklerin ön çapraz bağ kopuklarının sağaltımında kullanılan osteotomi tekniklerinden birisidir. Bu çalışmanın amacı, sağaltımı tibial plato düzeltme osteotomisi ile yapılan ön çapraz bağ kopuğu bulunan hastaların bulgularını klinik ve radyografik olarak değerlendirmektir. Çalışmanın materyalini; arka ekstremitesinde topallık şikayeti ile kliniğe getirilen 18 köpeğe ait 20 adet ekstremite oluşturdu. Olguların preoperatif dönemde klinik ve radyolojik muayeneleri sonucunda, ön çapraz bağ kopuğu tanısı konuldu, ameliyat tekniğinin gerektirdiği ölçümler yapıldı ve ameliyata hazır hale getirildi. Operasyonlarını takiben postoperatif 10., 30., 60., 90. ve 120. günlerde olguların klinik ve radyolojik değerlendirilmeleri yapıldı. Çalışmanın sonucunda diz ekleminin normal hareket yeteneğinin koruduğu, osteotomi hattının postoperatif erken dönemde kaynadığı, ekstremite fonksiyonlarını bir süre sonra tamamen kazandığı gözlemlendi ve özellikle iri ırk köpeklerde diz ekleminin stabilizasyonu açısından bu tekniğin güvenli bir şekilde uygulanabileceği sonucuna varıldı.

Introduction

Rupture of the cranial cruciate ligament is the most common cause of stifle lameness in the dog (Harasen, 2003; Jerram et al., 2003; Johnson and Johnson, 1993; Morris and Lipowitz, 2001). An understanding of the pathogenesis of cranial cruciate ligament rupture and the resulting degenerative joint disease is crucial in establishing an accurate diagnosis and implementing appropriate treatment (Slocum and Slocum, 1998; Vasseur, 2003). Early diagnosis of the cruciate-deficient stifle with appropriate therapeutic intervention may minimize degenerative joint disease (Harasen, 2002) but does not prevent it all cases. Rehabilitation of the surgically corrected cruciate-deficient stifle may

[#] This study was arranged from the first author's PhD thesis.

influence the success of the surgical outcome (Johnson and Johnson, 1993).

If either the forces acting on the stifle joint or degenerative weakness exceed the straining force of the ligament, cranial cruciate ligament rupture occurs (Dejardin, 2003). The resultant of surface reaction forces and extensor muscle forces (quadriceps and gastrocnemius) during weight-bearing forms the compression forces along the tibia. Since the tibial plateau slope is in the caudo-distal direction, tibial compression (during weight-bearing or the tibial compression test) produces a scissor-like force cranially on the tibia, which leads to cranial dislocation due to the absence of the cranial cruciate ligament in the stifle joint. This intersecting component of the compression force in the stifle is called the cranial tibial thrust (Dejardin, 2003; Piermattei, 2006; Reif et al., 2002; Warzee et al., 2001).

In the tibial plateau leveling osteotomy (TPLO) technique, the aim is to decrease the tibial plateau slope angle in standing position in order to establish a dynamic cranio-caudal stability in the stifle joint (Dejardin, 2003; Kim et al., 2008). The tibial plateau is leveled and the active forces of the flexor muscles in the stifle joint are increased and cranial tibial thrust eliminated (Lazar et al., 2005). Developed by Slocum, this technique includes bi-radial osteotomy to the proximal tibia and rotation of the proximal tibia making its post-operative TPA angle 5 degrees (Ballagas et al., 2004; Dejardin, 2003; Kim et al., 2008; Reif et al., 2002; Slocum and Slocum, 1993; Warzee et al., 2001).

The purpose of this study is to evaluate the clinical and radiological findings of the patients with cranial cruciate ligament rupture treated with tibial plateau leveling osteotomy procedure.

Materials and Methods

The material of this study comprised a total of 20 extremities belonging to 18 dogs of different breed, age, gender and body weight brought to the Istanbul University Veterinary Faculty Surgery Department and diagnosed with cranial cruciate ligament rupture.

Following history taking from the patient owners and observation of the patient's stance, sitting position and gait, the patients were clinically examined. In order to determine cruciate ligament rupture during clinical examination, the cranial drawer motion and tibial compression tests were performed (Harasen, 2002; Slocum and Slocum, 1998; Vasseur, 2003). Radiographical investigation of the cases was carried out in medio-lateral position, with the stifle joint in a 90-degree flexed position (Figure 1) and by applying tibial compression, while at the same time producing a 90-degree angle to the tarsal joint. Craniocaudal radiographs of the stifle joint were also taken. In the pre-operative planning stage, the tibial plateau slope angle of the cases were determined on radiographs and depending on the saw blade (Aesculap®, 18, 20, 24, 27, 30 mm, Germany) diameter used, osteotomy of the tibial plateau was performed with the Aesculap Rotation Guide and the extent of rotation was calculated. Following pre-operative preparations, anaesthesia induction was carried out by administering Propofol (Propofol, 1%, 200 mg/20 ml, Fresenius, Sweden) at a dose of 6-8 mg/kg intravenous injection and maintained with 2% Isoflurane (Forane, 100 ml, Abbott, United Kingdom) closed circuit inhalation anaesthesia. Pre-operative antibiotherapy of the cases was achieved with IV injection of 20-40 mg/kg Ceftriaxon (Rocephine, 1000 mg/ml, Roche, Switzerland).

Figure 1. Pre-operative mediolateral radiographic view of the stifle joint on case 8.

Şekil 1. 8 numaralı olguya ait preoperatif diz eklemi mediyolateral radyografik görüntüsü.

The surgical site was prepared and approached via a craniomedial parapatellar skin incision to the medial of the proximal tibia. The crural fascia, and the insertions of the semitendinosus and gracilis muscles were incised, elevated sub-periostally and the medial aspect of the proximal tibia was exposed. The cranial tibial muscle was lifted off on the craniolateral surface of the proximal tibia. During osteotomy, bi-radial saw blades of different diameters were used depending on the proximal metaphysis of the tibia. To aid in the rotation in the proximal tibia, temporary Kirschner wires were placed in the proximal segment of the tibia. The proximal tibia was moved to the recommended caudal distance according to pre-operative measurements. Another temporary

Kirschner pin was positioned proximally through the tibial diaphysis for ease of fixation of the proximal and distal segments. The proximal portion of the TPLO plate (Biomedtrix®, USA) was placed onto the osteotomised tibia's proximal fragment and a screw was placed into the middle hole. Another screw was then placed into the middle hole of the distal portion of the plate. Next, screws were placed into the holes in the proximal portion followed by the two holes in the distal portion, respectively, and fixation was completed (Figure 2).

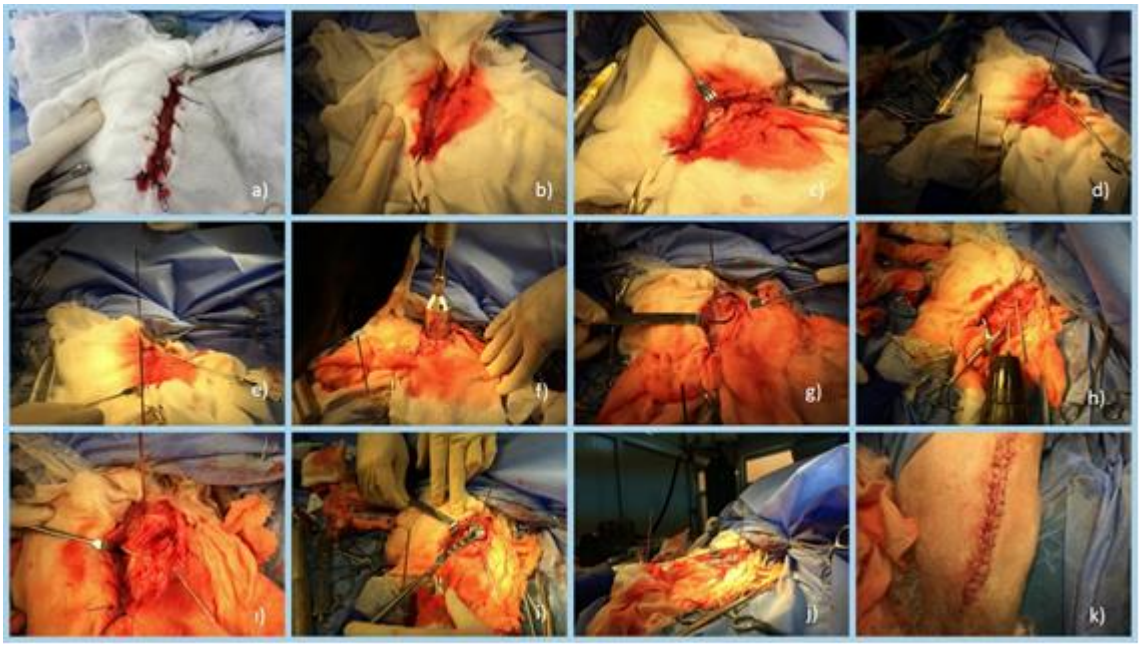

Figure 2. Stages of the TPLO operation method were shown, in order of a-k.
Şekil 2. TPDO'nin sırasıyla (a-k) operasyon aşamaları.

All cases were given post-operative 20-40 mg/kg Ceftriaxon (Rocephine, 1000 mg/ml, Roche, Switzerland) for 1 week. The non-steroid anti-inflammatory drug of choice, Meloxicam (Melox 7.5 mg oral, Nobel, Turkey) was administered orally at a dose of 0.2 mg/kg/day on first day and 0.1 mg/kg/day on subsequent days for 7 days.

All cases were advised to take glycosaminoglycan and chondroitin sulphate (Canvit Chondro, Biofaktory, Check Republic) at a dose of 1 tab/10 kg/day orally for 90 days. This period varied between 90-180 days in cases with degenerative disorders in the stifle joint and meniscus damage.

Following the TPLO procedure, the incision line was protected and cases received unsupported bandages with copious amounts of cotton for 21 days. Patient owners were advised to avoid sudden and extreme movements during this time.

Clinical follow-up examinations were carried out on post-operative days 10, 30, 60, 90 and 120. The cases were evaluated according to the University of Illinois Grading Scale (pain, lameness, stifle joint instability, weight-bearing on affected extremity) (Harasen, 2002; Slocum and Slocum, 1998; Vasseur, 2003). Sutures were removed on day 10 depending on the condition of the wound edges at the incision site and the condition of the wound. Patient owners were advised on limited exercise for 4 weeks and avoiding sudden movements.

Radiological examinations of the cases were carried out on post-operative days 30th, 60th, 90th and 120th using ideal Cr-Cd and ML views. The position and condition of the TPLO implant, healing status of the osteotomy, degenerative changes (OA) in the joint and the post-operative tibial plateau slope angle was assessed. Radiological findings for OA were scored according to the scale of Chauvet et al. (1996).

Results

The study material comprised a total of 18 dogs belonging to 10 breeds among which there was; 1 mixed breed, 1 Anatolian Sheepdog, 1 Beagle, 2 German Shepherds, 2 Cocker Spaniels, 3 Rottweilers, 2 English Bulldogs, 4 Terriers, 1 Golden Retrievers and 1 Cavalier

King Charles. Two cases were bilateral, therefore, TPLO operation was performed in a total of 20 extremities. The ages of the cases ranged between 2-11 years (mean 5.8 years) and their body weight was between 9-65 kg (mean 28 kg). In the etiological evaluation, of the cranial cruciate ligament rupture identified in 20 extremities, 13 had occurred due to unknown reasons and 7 due to trauma. In the light of information supplied by patient owners and clinical examination, it was established that cranial cruciate ligament rupture was acute in 8 cases and chronic in 12. In the pre-operative physical examination of all the cases, the anterior drawer motion test and tibial compression tests were positive.

The first use of affected extremities and walking time was 3-5 days (mean 4 days) in acute cases and 2-15 days (8.5 days) in chronic cases. Within the functional healing process, the first time for running was 10-48 days (mean 26 days) in acute cases and 13-120 days (mean 66.5 days) in chronic cases.

Post-operative radiographs were repeated on days 30 (Figure 3 a, b), 60 (Figure 4 a, b), 90 (Figure 5 a, b), and 120 (Figure 6 a, b). While post-operative re-ossification of the osteotomy line was seen to occur between 30-45 days, in case no 17 a fibula fracture was identified on post-operative day 15. During assessment of this complication, it was also found that the screws had loosened. On post-operative day 20, together with screw loosening, lesions were seen in peri-articular tissues due to osteomyelitis in one case (case 14). Therefore, in addition to post-operative antibiotic administration, a 7-day regimen of 20-40 mg/kg Cefazolin sodium (Sefazol, 1000 mg/ml, Mustafa Nevzat, Turkey) IV and 7 mg/kg Gentamycine sulphate (Genta 80 mg, İbrahim Etem Ulagay, Turkey) IM was given.

Figure 3. a-Mediolateral b-Craniocaudal radiographical views of the stifle joint on case 8 on post-operative 30th day.

Şekil 3. 8 numaralı olguya ait postoperatif 30. gün, diz eklemi a)mediyolateral b)kraniyokaudal radyografik görüntüsü.

Figure 4. a-Mediolateral b-Craniocaudal radiographical views of the stifle joint on case 8 on post-operative 60th day.

Şekil 4. 8 numaralı olguya ait postoperatif 60. gün, diz eklemi a)mediyolateral b)kraniyokaudal radyografik görüntüsü.

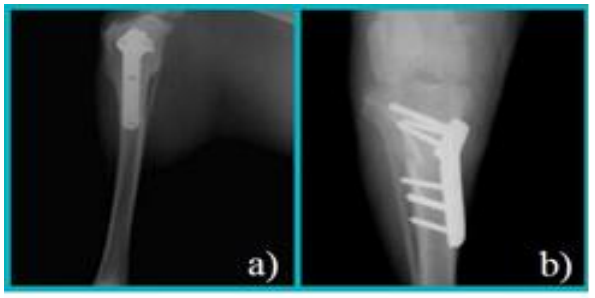

Figure 5. a-Mediolateral b-Craniocaudal radiographical views of the stifle joint on case 8 on post-operative 90th day.

Şekil 5. 8 numaralı olguya ait postoperatif 90. gün, diz eklemi a)mediyolateral b)kraniyokaudal radyografik görüntüsü.

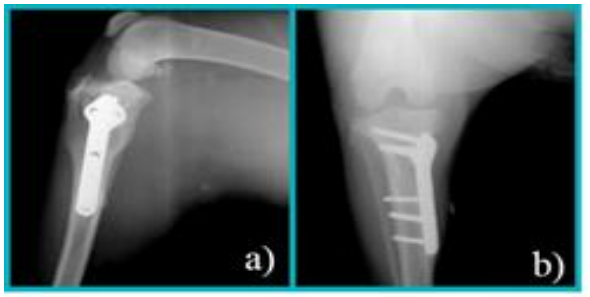

Figure 6. a-Mediolateral b-Craniocaudal radiographical views of the stifle joint on case 8 on post-operative 120th day.

Şekil 6. 8 numaralı olguya ait postoperatif 120. gün, diz eklemi a)mediyolateral b)kraniyokaudal radyografik görüntüsü.

In this study, post-operative TPA of the cases varied between 2-7 degrees (mean 4.6°). In 8 of the cases included in this study, TPA was below 5 degrees, however, this did not present any risk or complication in any of the cases.

When pre-operative and post-operative "pain, lameness, weight-bearing on extremity and stifle joint flexibility" were compared, according to the University of Illinois Grading scale "excellent" recovery was seen in 14 cases including bilateral cases, whereas "good" recovery was seen in 1 cases. While "medium" recovery was seen in 2 cases, only "poor" recovery was observed in 1 case due to complications.

Dimensions of the TPLO plates, diameter of TPLO saw blades and extent of rotation used in the cases are shown in Table 1 and pre-operative and post-operative evaluation and findings are shown in Table 2.

Table 1. Preoperative evaluation and findings, according to breed, age, sex, weight, affected limb, saw blade diameter, TPLO plate size (mm), rotation (mm), and preoperative TPA degree of the cases.

Tablo 1. Olguların preoperatif olarak ırk, yaş, cinsiyet, etkilenen bacak, testere çapı, TPDO plaka boyu (mm), rotasyon miktarı (mm) ve preoperatif TPA na göre değerlendirilmesi ve bulguları.

Case	Breed	Age	Sex[a]	Weight	Affected Limb[b]	Saw Blade Diameter	TPLO Plate Size (mm)	Rotation (mm)	Preop TPA
1	**G. Shepherd**	10	M	45	R	30	XL	10	24
2	**Rottweiller**	10	F	38	L	27	XL	9.7	26
3	**S. Cocker**	10	F	20	R	20	M	7.9	28
					L	20	M	7.9	28
4	**Terrier**	3	F	10	R	20	M	7.25	28
					L	20	M	7	29
5	**Terrier**	8	F	9	R	18	S	7.5	30
6	**Beagle**	6	M	21	L	20	M	8.6	30
7	**Terrier**	7	F	11	L	18	S	6	25
8	**G. Retriever**	2	F	25	R	27	L	9.25	25
9	**Rottweiller**	8	M	55	R	20	XL	11	26
10	**E. Bulldog**	2	M	27	R	24	M	8	24
11	**Terrier**	6	F	12	L	18	S	6.25	26
12	**S. Cocker**	6	F	13	R	18	M	7	28
13	**E. Bulldog**	3	F	26	L	20	M	7.9	28
14	**Kangal**	1.5	M	65	R	30	XL	11	26
15	**Mix breed**	4	F	25	L	24	M	9.5	28
16	**Rottweiller**	8	F	40	R	27	L	9.7	26
17	**G. Shepherd**	11	M	40	R	30	XL	10.4	25
18	**K. Charles**	7.5	M	22	L	20	M	7.2	26

[a]: M=male, F=female; [b]: L=left, R=right.

Discussion

Cranial cruciate ligament ruptures may be due to progressive and irreversible degenerative changes occurring during daily activities such as acute traumatic or spontaneous ruptures (Doom et al., 2008). It has a more chronic presentation in dogs with no history of trauma and is seen in more frequently in mature dogs. Clinical lameness, joint effusion, osteoarthritis and progressive destruction of the cruciate ligament has been described as the "cruciate disease" by Benette et al. (1988). Cruciate disease is usually seen bilaterally (Bennett et al., 1988; Doom et al, 2008; Hayashi et al., 2004; Rooster et al., 2006). When the cases in this study were assessed etiologically, 7 of the 20 extremities with cranial cruciate ligament rupture were found to be due to trauma, whereas for the remaining 13 cases the reason was unknown. Although cruciate disease is generally considered to be bilateral, only 1 case in our study was diagnosed with bilateral cranial cruciate ligament rupture in the pre-operative period. The fact that this case with cruciate disease belonged to a predisposed breed was consistent with literary data. The remaining bilateral case suffered cranial cruciate ligament rupture in the contralateral stifle joint within 2 months post-operatively. Besides the fact that the case belonged to a predisposed breed, in the authors' opinion, cranial cruciate ligament strain had increased due to the dog bearing most of its body weight on the contralateral extremity in the post-operative period.

Table 2. Postoperative evaluation and findings, according to concurrent lesion, postoperative radiological ossification, postop TPA degree (30th day), first day using extremity, functional recovery walking, running, major complication, result of the cases.

Tablo 2. Olguların postoperatif olarak eşlik eden lezyon, postoperatif radyolojik ossifikasyon, postoperatif 30. gün TPA, ekstremiteyi ilk kullandığı gün, yürüme ve koşmasına göre fonksiyonel iyileşme günleri, major komplikasyona göre değerlendirilmesi ve bulguları.

Case		Concurrent Lesion	Post-op Radiological Ossification	Post-op TPA (30th day)	First Using Extremity	Functional Recovery		Major Complication	Result
						Walking	Running		
1		Spondylosis Deformans OA	30	5	4	4	17		****
2			30	6	4	4	15		****
3	R	Meniscal damage Patellar luxation	30	5	4	7	4		****
	L		30	5	4	7	4		****
4	R		30	4	3	5	10		****
	L		30	3	3	5	12		****
5			30	2	3	7	13		****
6		Meniscal damage	30	2	7	21	65		***
7			30	3	2	4	13		****
8			30	7	5	8	21		****
9			40	7	5	7	25		****
10			30	2	5	6	18		**
11			30	5	3	5	12		****
12		Patellar luxation	33	5	5	4	21		****
13		OA	34	7	6	7	24		****
14		Effusion	45	5	15	20	60	Osteomyelitis Implant failure	**
15			30	7	5	5	14		****
16				5	5	7	48		****
17		OA	40	4	6	10	-	Implant failure	*
18			34	3	4	9	20		****

**** : very good, ***: good, **: moderately, *:poor

Of the 20 extremities belonging to 18 cases in the study, acute cranial cruciate ligament rupture was diagnosed in 8 and chronic cranial cruciate ligament rupture was diagnosed in 12 cases. Complete rupture was present in all cases diagnosed with cranial cruciate ligament rupture. Arthrotomy was not performed in any of the cases. Contrary to Slocum's recommendation (developer of the TPLO procedure), the meniscal release procedure was not carried out in 3 cases with meniscus damage. Although meniscal release or hemi-menisectomy of the caudal pole are routinely performed prophylactic procedures in veterinary orthopaedics, studies have shown that these procedures have detrimental effects on the joint function during weight shifting (Kennedy et al., 2005; Pozzi et al., 2005) and a different study has demonstrated that these procedures change the weight distribution on the meniscus and may cause osteoarthritis (Luther et al., 2009; Pozzi et al., 2008). In another study investigating the effects of medial meniscal release following the TPLO procedure, meniscal release after TPLO was shown to be much less significant. The wedge effect of the meniscus in this instance loses its

importance when it neutralizes the cranial tibial thrust. Also in this study, it has been demonstrated that meniscal release and caudal pole hemi-menisectomy eliminates the stabilizing function of the meniscus on the joint. It is also thought that, TPLO may protect the caudal pole from damage and meniscal release would be unnecessary (Pozzi et al., 2006). In the light of this literary data, neither prophylactic nor therapeutic meniscal release was performed in any of the cases included in the present study.

Although studies have shown that the TPLO procedure may be carried out for bilateral cranial cruciate ligament rupture in a single session (Barnhart, 2003), the authors have found it to be more convenient to perform the operation of the bilateral case 2 months later. Two months later no osteoarthritis findings were observed in either of the joints in this case.

Henderson and Milton (1978) have discussed the force created by the extensor (quadriceps) and flexor (gastrocnemius) muscles in relation to the tibial plateau slope in the stifle joint and consequently causing the tibia to be pushed cranially, expressing that only a strong cranial cruciate ligament may prevent this cranial push of the tibia. Slocum and Devine developed the TPLO technique, which eliminates this force by changing the slope of the plateau. In this technique, a radial osteotomy is performed in the proximal tibia and the segment is moved caudally in order to level the plateau (Corr and Brown, 2007). To eliminate the cranial tibial thrust, it has been recommended that the tibial plateau slope has to be approximately 5 degrees (Duerr et al., 2008; Reif et al., 2002; Slocum and Slocum, 1993). In this study, in the 20 extremities belonging to 18 cases, the tibial plateau slope angle on post-operative day 30 was found to be 4.65 degrees. This data was consistent with the angle value recommended in the initial TPLO procedure. Although post-operative TPA was found to be 4.65 in this study, there are studies stating that an angle of 6.5 degrees is sufficient for stabilization (Moeller et al., 2006). It is known that TPA may change after the osteotomy area has healed, however, its clinical significance is thought to be minimal. In this study, the authors measured the TPA on post-operative day 30 only. It has also been expressed that, in giant breed dogs with an extreme TPA (over 34 degrees), it may be difficult to achieve the target 5 degrees, therefore, angles smaller than 14 degrees may be sufficient for stabilization (Duerr et al., 2008).

For the conservation of tibial plateau position and biomechanical stability during TPLO plate fixation, locking screws and traditional screws have been compared. In this comparison, locking screws have been found to be superior in conserving tibial plateau position. Furthermore, as a result of careful and even shaping by experienced surgeons, use of traditional screws has also been shown to be similar to locking screw fixation in the proximal section of the TPLO plate with regards to biomechanical stability (Leitner et al., 2008). In this study, locking screws have been used in the fixation of large and extra-large plates. Despite previous studies stating that locking screws are superior for stabilization, in this study, a locking screw was used in case no. 17 and a complication in the form of screw loosening was encountered. This was a notable finding. As a result of our study, locking or traditional screw applications did not create a significant difference.

TPLO is one of the most frequently performed procedures in the treatment of cranial cruciate ligament rupture in dogs. It involves a cylindrical osteotomy to the proximal tibia and the use of a patented jig. The jig has been designed to protect or limit varus/valgus disorders forming iatrogenically in normal limbs, any faulty positioning or tibial torsions, as well as to correct similar disorders in abnormal extremities (Bell and Ness, 2007; Dejardin, 2003). Prior to osteotomy, the jig is placed into the proximal and distal ends of the tibia with the aid of two pins. It is removed once the proximal fragment of the tibia is moved and fixated. However, use of a jig may not be necessary (Dejardin, 2003). The authors did not use a jig in any of the TPLO operations. Studies have shown that the use of a jig does not improve the sensitivity of the TPLO operation. It also lengthens operation time, may cause complications during placement of the pin into the distal fragment and may cause additional surgical trauma (Bell and Ness, 2007; Schmerbach et al., 2007). All of these factors were taken into consideration and the osteotomies were performed carefully and meticulously and the plates positioned suitably. A jig was not used during any of these procedures and there were no complications.

After the radial osteotomy procedure and before plate fixation once the suitable slope was achieved, the authors carried out a temporary fixation using a Kirschner wire from the distal fragment towards the proximal fragment in order to preserve the deviation and position the plate comfortably. In the authors' opinion, although not reported in the literature, this fixation method provided relatively ease application.

Post-operative TPA values of the cases included in this study varied between 2-7 degrees. It is known that as TPA decreases, cranial tibial thrust converts into caudal tibial thrust. The minimum TPA required to eliminate cranial tibial thrust has been determined as 6.54 ± 0.9 degrees (Reif et al., 2002; Warzee et al., 2001). Slocum and Devine have reported that, if the proximal part of the tibia is

rotated more than necessary, this will increase the tension on the caudal cruciate ligament and pose the risk of caudal cruciate ligament rupture. In this study, 8 cases had a post-operative TPA below 5 degrees. However, this did not cause a risk or complication in any of the cases. It is suggested that dogs will compensate even if TPA is not ideal (Priddy et al., 2003).

An unsupported bandage was applied for 3 weeks to each case in this study. During this time, patient owners were advised to allow the dogs limited exercise. Case no. 17 presented with the complication of a fractured fibula. It was discovered that the patient had removed its bandage at the end of day 10 and that the owner had neither made bandage on dog's leg nor limited the patient's movements.

It was interesting that, in the pre-operative assessment of the cases, both acute and chronic, the drawer motion test and tibial compression test were positive.

Conclusion

In conclusion, when the Pre- and Post-operative clinical symptoms of the cases with acute and chronic cranial cruciate ligament rupture, their post-operative recovery times, post-operative osteoarthritis development, return to full function and radiological healing times of related extremities were examined, it was seen that the tibial plateau leveling osteotomy method delivered successful and radical results in both acute and chronic cases.

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