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Long-Term Outcome and Complications of 32 Distal Femoral Osteotomies Performed for Correction of MPL in Dogs Without Cranial Cruciate Disease

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LONG-TERM OUTCOME AND COMPLICATIONS OF 32 DISTAL FEMORAL OSTEOTOMIES PERFORMED FOR CORRECTION OF MPL IN DOGS WITHOUT CRANIAL CRUCIATE DISEASE

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Abstract

Many canines suffer severe, grade I-IV, medial patella luxation causing a persistent lameness, severely reducing the quality of life for the dog (Linney et al 2011). For these patients surgical intervention is recommended to alleviate these symptoms. The procedure used to do so is a distal femoral osteotomy (DFO). This procedure allows for correction of torsion in the femur and quadriceps mechanism, and frontal plane abnormalities at the same time. The present study aims to describe the long-term outcome and related complications of 32 DFOs, without concomitant Cranial Cruciate Ligament rupture (CCLR), in a large private practice referral hospital based on data provided by one board certified orthopedic surgeon. We hypothesize that patients having DFOs at Metropolitan Veterinary Hospital (MVH) to alleviate medial patella luxation (MPL) will have a good to excellent long-term outcome with very minimal complications. Canines with any concurrent CCLR, DFOs performed for any other disease process other than MPL, any severe or uncontrolled systemic disease, or a concurrent history of previous ipsilateral stifle surgery were excluded from the study and data sets. Any complications resulting will be described as major: indicating additional surgery required, or as minor: indicating non-surgical intervention. All patients in the present study were described as not having major complications. Results gathered confirmed what was presented in previous data. Modern MPL surgical techniques provide great stability and overall a fantastic long-term outcome as confirmed by this study. This research also addressed an information gap that was forming due to the lack of recent research into this topic providing invaluable new information.

Introduction

Medial patella luxation (MPL) is a common cause of lameness in dogs (Linney et al) and although the etipathogenesis is not easily elucidated, MPL ultimately results from disruption of the quadriceps mechanism. Malalignment of the quadriceps mechanism can be multifactorial and may include shallow trochlear groove that cannot keep the patella tracking in place (the patella normally acts as a fulcrum for the quadriceps mechanism), medialization of the tibial tuberosity (insertion of the patellar ligament), torsion of the femur, or deviation of the femur in the frontal plane (varus deformity), among other features (Hans et al). Many dogs with low grade MPLs can live normal lives without surgical intervention, however for those dogs that become consistently lame, their lameness affects their quality of life, or those that have angular limb deformities that necessitate intervention, surgery is recommended. There are multiple published descriptions (Tobias, K. M., & Johnston, S. A. 2012) of surgical procedures to change femoral and tibial anatomy in order to alleviate MPL, and as affected dogs may have multifactorial changes causing MPL, many patients require multiple procedure types to be performed in order to realign the quadriceps mechanism. Some of these procedures include trochlear sulcoplasty, tibial tuberosity/crest transposition (TTT), soft tissue imbrication or tension releasing procedures, anti-rotational sutures, and corrective osteotomies/ostectomies. Patients commonly have two or more of these procedures performed concurrently.

Malalignment of the quadriceps mechanism places additional stress on the cranial cruciate ligament (CCL) which can lead to CCL rupture (CCLR). Concurrent CCLR is seen in 21.0% - 48.6% of dogs that present with MPLs, with dogs that have grade IV MPL having the highest chance of CCLR (Brower et al). Often, correction of the MPL and stabilization of the CCLR are performed simultaneously. It is beyond the scope of this paper to discuss the many ways to stabilize CCLR and all of the dogs in the current study were free of cranial cruciate disease at the time of initial surgery. Please see Tobias, K. M., & Johnston, S. A. 2012 for additional inquiry. Bone cutting procedures may be perfromed to correct for torsion and frontal plane malformations in dog femora with MPLs and many times include a lateral closing wedge osteotomy on the distal femur [aka distal femoral osteotomy (DFO)].

There is limited literature on the long-term outcome of distal femoral osteotomies (DFOs), specifically without concurrent CCLR. The literature review includes one case series of four cases (Roch et al), one case series including 12 cases (Swiderski et al), and a study on long-term outcome of DFO patients, however almost half of the dogs in latter study had concomitant CCLR (Brower et al). As a result of the CCLR disease process itself, and the potential for additional bone cutting surgery (e.g., tibial plateau leveling osteotomy [TPLO]), one would not expect the long-term outcomes to be similar between DFO surgeries performed for MPL only, compared to DFO procedures combined with additional bone cutting surgeries to alleviate CCLR.

The present study aims to describe the long-term outcome and related complications of 32 DFOs, without concomitant CCLR, in a private practice referral hospital. We hypothesize that patients having DFOs at our hospital to alleviate medially luxated patellae will have a good to excellent long-term outcome with minimal major complications.

Materials and Methods

Medical records between January 1, 2007 and April 1, 2017 were reviewed at a private practice referral hospital for any canine patient with a history of a corrective distal femoral osteotomy and a diagnosis of MPL. Inclusion criteria consisted of admission for a single session

DFO to correct MPL, available surgery report, preoperative radiographs, preoperative exam notes, postoperative exams notes, and postoperative radiographs. Any patient with a history of previous ipsilateral stifle surgery, concurrent CCLR, DFO for other disease process, or severe or uncontrolled systemic disease were excluded from the study.

Demographic data collected included age, sex, breed, body weight (in kg), DFO side (right or left), whether any of the following were concurrently performed: TTT, imbrication, releasing incisions, TPLO, anti-rotational suture, trochlear block recession. Additional information included degrees of torsion removed during DFO, mm or degrees of lateral closing wedge removed, mm of transposition of tibial tuberosity, preoperative (preop) lameness score (0-4 scale), and preop MPL grade.

Each patient was examined at 2 weeks and 8 weeks postoperatively and from the exam notes each of the following data were collected: MPL grade, lameness score, thigh muscle atrophy, and whether there was smooth passive range of motion of affected stifle. Complications were noted and divided into major and minor categories. Major complications were defined as requiring additional surgical intervention, whereas minor complications did not require additional surgery.

The follow-up protocol consisted of a phone call to each owner requesting the patient be brought in for follow-up with radiographs at no charge to the client. During the long-term follow-up exam, the owner completed a previously published and validated Canine Orthopedic Index (COI) questionnaire regarding the outcome of the corrective MPL surgery. If the owners were unable to bring the patient in for a recheck exam, the questionnaire was completed over the phone. The physical exam included a lameness score and current MPL grade, with radiographs also being performed during the visit.

Immediately postoperative, 8 weeks re-check, and long-term follow-up radiographs were scored for stifle arthritis using a previously published scoring system by Brühschwein et al. (2017). Descriptive (quantitative) statistical analysis was not performed on the given data due to the small quantity. Performing statistical analysis on this data would have given results with too high percent error to properly confirm or deny results. Given this data was analyzed with qualatative assesment.

Results

Medical record review found 32 dogs to have undergone a DFO procedure in our hospital between 2007-2017. Six DFO procedures were excluded because they were performed concurrently with a TPLO procedure for ruptured CCL. Two dogs were excluded because the DFO was performed for a previous injury and not for MPL. Three dogs had DFO procedures performed on both hind limbs (all bilateral surgeries were staged with at least eight weeks between procedures), which left 23 DFO procedures on 20 dogs. Right and left limbs on the same patient were treated as separate events. Nine of twenty dogs (45%) were Labrador Retrievers, 6/20 (30%) mixed breed dogs, 3/20 (15%) Golden Retrievers, 1/20 (5%) Rottweiler, 1/20 (5%) American Bulldog. All dogs were medium to large breeds, with body weights (BW) between 17.7 kg - 77.2 kg and a mean BW of 36.6 kg. Average age at the time of diagnosis was 1.9 years (range 0.7 years - 5 years). There were 14 left DFOs performed and 9 right DFOs performed. All of the patients had Tibial Tuberosity Transposition (TTT) and soft tissue imbrication performed. 10/23 stifles had a trochlear recession performed. All plates used for surgery possessed locking screw technology. The lateral closing wedge osteotomy had a range of 4-16 degrees of torsion removed, with the average being 10 degrees. Five dogs were lost to follow-up. One dog was lost due to an early mortality, due to systemic disease. Fourteen of the dogs' owners were able to be contacted for long-term follow-up and completed the questionnaire. Eight dogs returned for long-term follow-up radiographs and re-check. Six of the canines developed minor complications that did not require surgical intervention. One was a more sophisticated complication requiring multiple post-operative rechecks well beyond the normal scope of the surgery and post-operative care maintained at the veterinary facility. All patients had their immediate two week and eight weeks recheck X-rays, along with their long term follow up X-rays (if performed) scored using OA assessment.

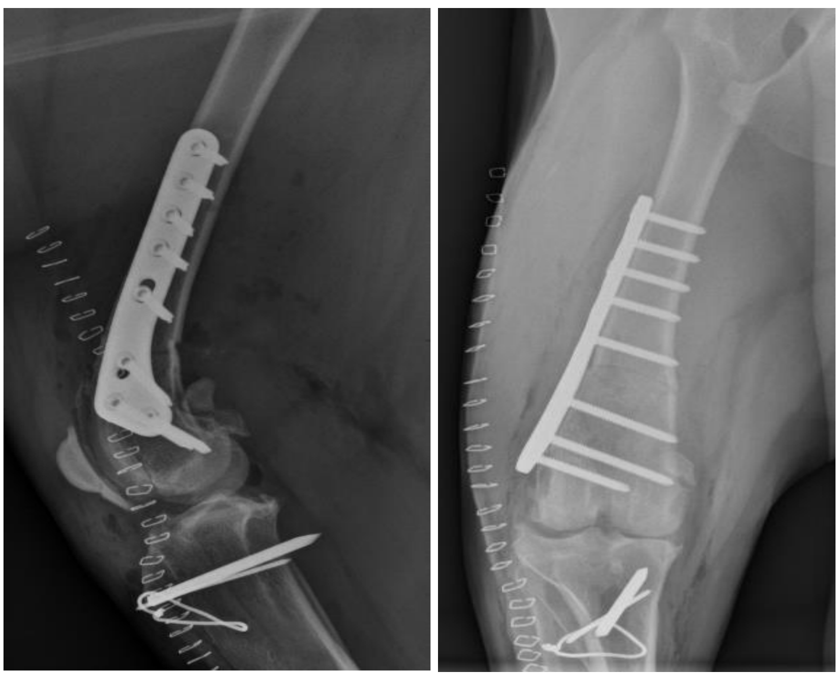

Figure 1: Example Post-operative radiographs used for OA scoring.

The average time from surgery to long-term follow up radiographs was 1193 days, with a range of 192 - 2343 days. Eight patients were able to receive long term radiographs. The average OA assessment score on preoperative radiographs was 4, with a range of 1-17. The average OA score on eight weeks recheck radiographs was 8.25, with a range of 3-19. The average OA score on the long-term radiographs was 14.75, with a range of 4-25. The 22 factors that contribute to determining an OA radiographic score will be listed at the end of this document to provide more context as to what is measured, for the reader. Each factor was rated 0-3 with zero indicating no degenerative changes, one being mild changes, two being moderate, and three being severe changes. These scores are added up to a possible total of 66 points. The higher the score the more defects in the joint. Any surgery will increase the OA score but surgical intervention is to prevent an astronomical increase and loss of joint function.

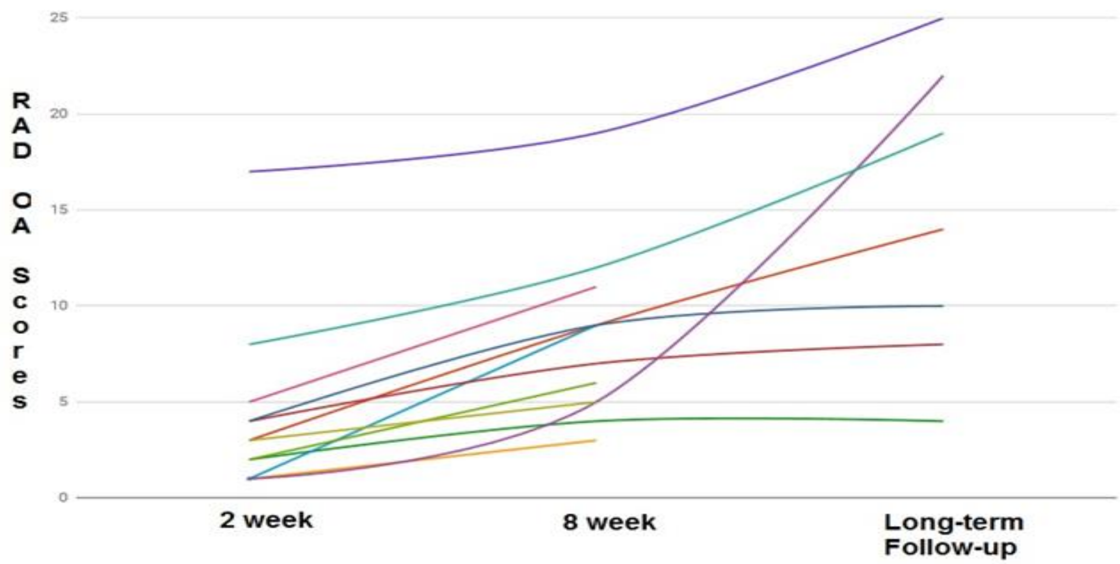

Figure 2: Radiographic OA Scores over time.

The Results of the Canine Orthopedic questionnaire are shown in the graphs below.

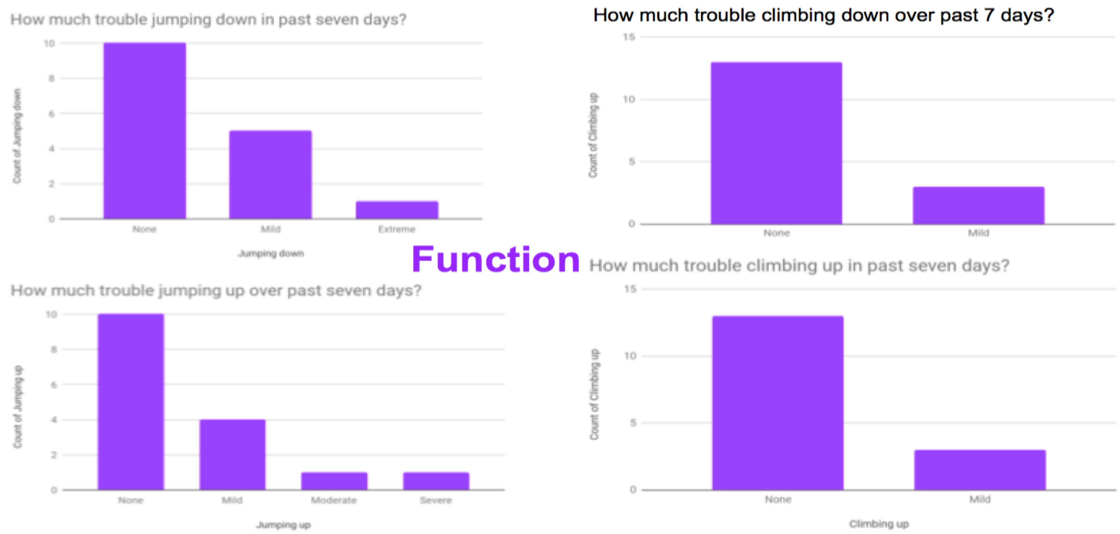

Figure 3: Everyday function related questions.

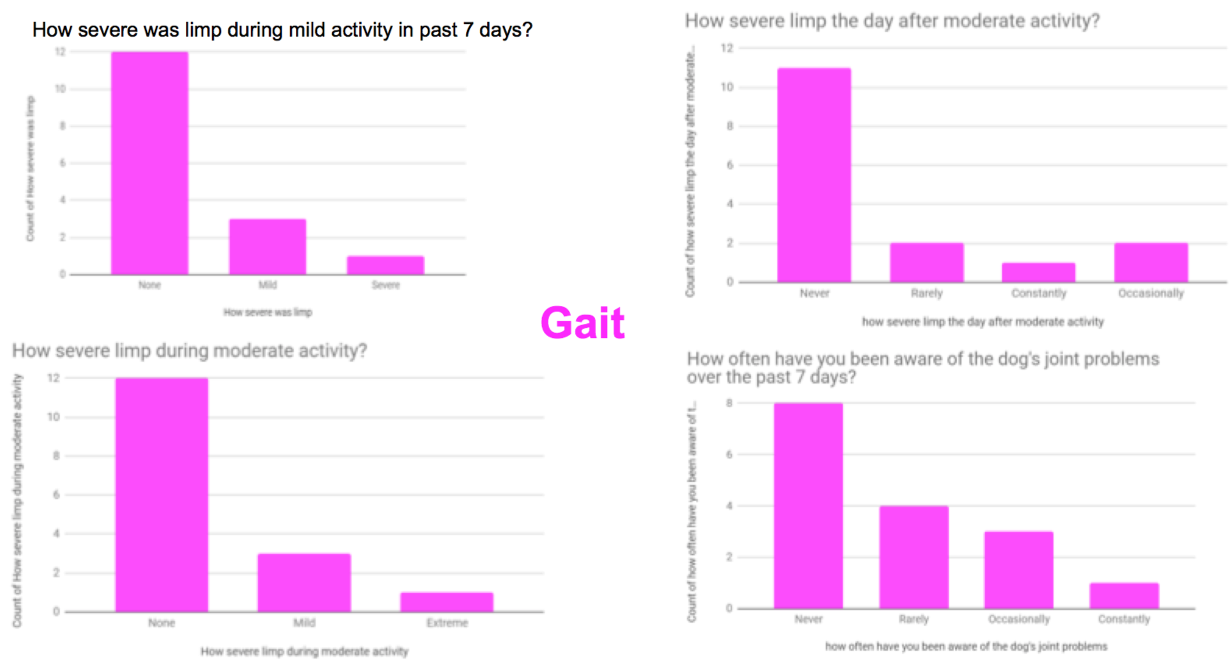

Figure 4: Gait related question results.

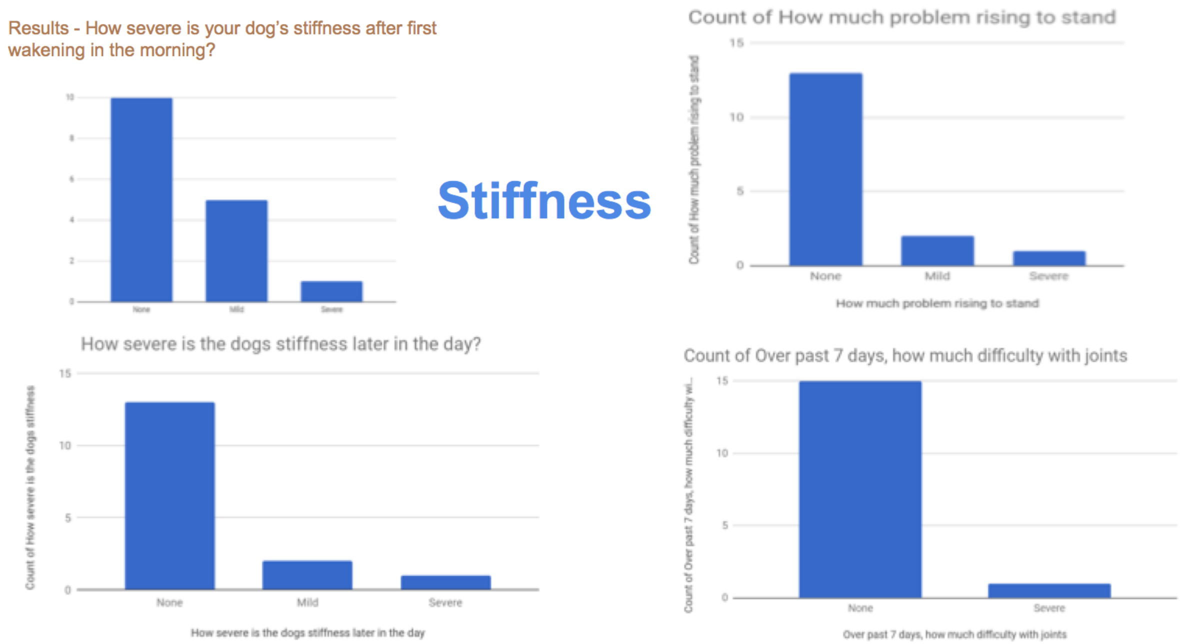

Figure 5: Stiffness related questions.

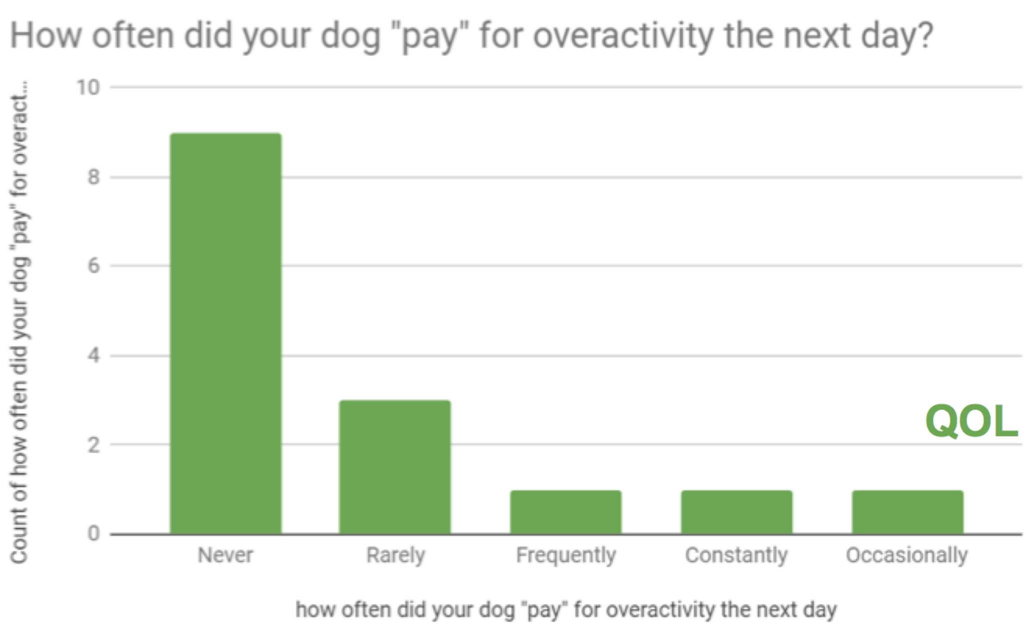

Figure 6: Results of question in regards to heavy use of knee.

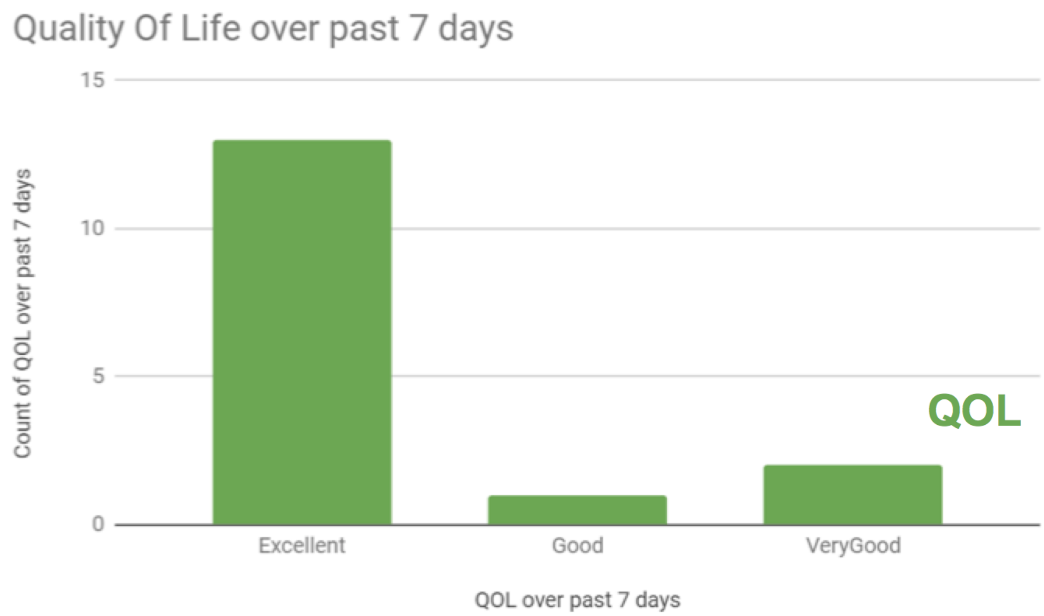

Figure 7: Question in regards to the quality of life following surgery.

Discussion

Through the research conducted in this study, it was concluded that surgical intervention through a distal femoral osteotomy and other surgical procedures that correct a medially luxated patella, that the quadriceps mechanism of the rear legs is stabilized and concurrent cranial cruciate ligament tears were prevented. Furthermore, the primary objective of this study, the long-term outcome of surgical intervention, was proven to be conclusive in terms that it is positive and advantageous for the canine to undergo surgical intervention for MPL. This confirmed the hypothesis conceived for this study. The excellent long-term prognosis for these patients is due to the proper realignment of the quadriceps mechanism, allowing the patella to act as the fulcrum for the quadriceps and allow guidance for the extensor mechanism. All patients had distal femoral osteotomy, tibial tuberosity transposition, and soft tissue imbrication. While 43% of patients also had a trochlear recession performed based on need to alleviate mechanism malfunction. The results gathered in this study are comparative to other research on the topic such as the papers presented by Arthurs et al., Hans et al., and Linney et al., which are respectively similar in size based on sample size.

It is important to note that a key limitation in this study was sample size. This is a rare surgery especially in the case of a private practice hospital, and the data being limited to one orthopedic surgeon to eliminate any difference in technique between surgeons. There is limited size to most other published works such as Weh et al. with a sample size of 12 canines and Swiderski et al. with 12 canines as well. While our data is considerably larger than previously mentioned published works, it should be noted that sample size is limited across the spectrum. To adequately gather enough data on this subject it would be best to consult multiple surgeons patients at a public university vet school hospital over a longer period. Even then the paper with the largest data collection Arthurs et al., presented with 109 patients. Future studies could expand on the quality of life questionnaire used in this study and develop new techniques to review radiographic changes more accurately.

Overall, this project aimed to provide more data to address a knowledge gap in the veterinary field. Considering that this project was a resounding success, the data collected will provide ample insight to modern day MPL correction techniques and their success long term. Moving forward, these data will provide veterinary surgeons more confidence in their surgical technique and hopefully spark further studies into the surgical procedure itself.

Conclusion

Medial patella luxation is a persistent problem to pets and their veterinarians today. As more people consider animals a part of their family they have begun to pursue more advanced medicine for their companions, MPL correction has been a top priority to many veterinary orthopedic surgeons. Surgical technique has advanced greatly over the recent decades but this has been followed by a lack of literature in the long-term outcome of the surgery. The present study aimed to alleviate this lack of information by providing data that represents following the several months to years after the surgery. This includes data based on an owner/patient questionnaire and an examination of the long-term radiographic changes over to understand if there are any lasting changes due to having a surgical implant.

We aimed to further isolate the results to only include patients with a non-concurrent cranial cruciate injury. This allowed us to primarily focus on the effects of the distal femoral osteotomy and other surgical techniques used to correct medial patella luxation. It is clear after this study and comparison to the limited others like it that surgical intervention for an MPL is in the best of interest of any patient. It may prevent many problems arising and does so without causing too many orthopedic changes to the knee. With the quadriceps mechanism stabilized after surgery there is also a reduction in chance of CCLR injury.

Figure 8: Demonstrates the drastic mechanism of the knee joint changes with a luxated patella. Correction of the quadriceps mechanism stabilizes the joint and prevents further stain on the main ligaments in the joint.

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OA Assessment factors (Score of 0-3 per category)

1. Periarticular osteophytes, lateral femoral condyle
2. Periarticular osteophytes, medial femoral condyle
3. Osteophytes, femoral intercondylar region
4. Lateral collateral ligament enthesopathy
5. Medial collateral ligament enthesopathy
6. Lateral soft tissue thickening
7. Medial soft tissue thickening
8. Periarticular osteophytes, proximolateral tibia
9. Periarticular osteophytes, proximomedial tibia
10. Osteophytes, central tibial plateau
11. Meniscal mineralization
12. Intra-articular mineralized osseous fragments
13. Intercondylar avulsion fracture fragments
14. Apical patellar osteophytes
15. Basilar patellar osteophytes
16. Stifle joint effusion or capsular thickening
17. Periarticular osteophytes, fabella, lateral and medial gastroc, and popliteal sesamoids
18. Cranial apical patellar enthesopathy
19. Periarticular osteophytes, cranioproximal tibia
20. Periarticular osteophytes, caudoproximal tibia
21. Tibial condylar remodeling
22. Femoral subtrochlear lysis