A Novel Pin Distraction Device for Arthroscopic Assessment of the Medial Meniscus in Dogs

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Objective—To describe an extra-articular joint distractor for meniscal examination and treatment during canine stifle arthroscopy.

Study Design—Case series.

Animals—Dogs ≥ 20 kg with suspected cranial cruciate ligament (CrCL) deficiency.

Methods—A custom designed linear side bar was constructed to allow invasive pin distraction of the stifle joint. Its design efficacy for distraction of the medial joint compartment, observation and probing of the medial meniscus, and value during meniscal surgery was evaluated by clinical use.

Results—Application of the stifle distractor medial to the stifle joint using 2 negative threaded pins was easily performed percutaneously without the need of power equipment; however, unintended intra-articular placement of 1 threaded pin occurred in 2 stifles, without appreciable consequence to joint function. Observation as well as thorough probing of the caudal horn of the medial meniscus, even in the presence of a prominent remnant of the CrCL or severe periarticular fibrosis, was possible. Partial meniscectomy was effectively performed as needed without apparent damage to the associated articular surfaces.

Conclusions—Distraction and translation of the medial compartment of the stifle joint using invasive pin distraction allowed observation and palpation of the caudal horn of the medial meniscus so that assessment and treatment were readily accomplished without apparent morbidity.

Clinical Relevance—With careful attention to accurate pin placement, invasive pin distraction of the medial compartment of the canine stifle joint may improve arthroscopic evaluation and treatment of meniscal pathology.

INTRODUCTION

The incidence of medial meniscal tears in association with cranial cruciate ligament (CrCL) insufficiency in dogs is reportedly as high as 77.3%, 1–6 most commonly affecting the caudal horn of the medial meniscus as a longitudinal vertical tear. 5,7–9 Because visual inspection of the menisci alone is considered suboptimal in diagnosing hidden tears, thorough palpation of both the tibial and femoral side of the caudal horn of the medial meniscus during arthrotomy or arthroscopy has been strongly advised. 10 Nevertheless, persistent or recurrent lameness potentially attributed to missed meniscal injury occurs in 6.3–17.4% of stifles treated for CrCL rupture. 3,6,7,11 These tears are referred to as latent (hidden) meniscal tears in contrast to postliminary (subsequent)
meniscal tears, which are thought to develop after initial CrCL stabilization.12

Arthroscopic diagnosis of meniscal lesions can be challenging because the view may be obstructed by the femoral condyles, synovial villi, and remnants of a ruptured CrCL.8 Distraction of the joint by applying varus or valgus stress in combination with extension and flexion as well as internal and external rotation of the stifle joint improves arthroscopic viewing of both caudal joint compartments.13,14 This technique has been extrapolated from human stifle arthroscopy,15 but may be insufficient even in the relatively large human knee joint.16 To improve observation and probing of the medial meniscus, insertion of a small Hohmann retractor, mimicking the technique when performing arthrotomy, has been suggested.14 Gemmill and Farrell17 reported an improved view of the medial meniscus by using an intra-articular stifle distractor (Veterinary Instrumentation, Sheffield, UK) introduced through the medial working portal; however, this technique has only been evaluated in cadaveric stifles. Regardless of the technique used to improve arthroscopic diagnosis of medial meniscal tears, inspection and particularly probing are even more challenging in joints where the CrCL is not completely debrided.10,14

Despite the cited limitations of arthroscopic evaluation of medial meniscal integrity arthroscopy is considered superior to arthrotomy.6,10 Nevertheless, with a reported in vitro sensitivity of 0.80 and specificity of 0.96 arthroscopy does not fully eliminate the risk of latent medial meniscal tears.10 Therefore, we sought to develop and assess a technique for distraction and translation of the medial joint compartment so that comprehensive arthroscopic observation, probing, and treatment of the caudal horn of the medial meniscus could be consistently performed in dogs. Development and clinical application of an invasive stifle joint distractor for canine stifle arthroscopy was patterned after ankle arthroscopy and meniscal transplantation in humans, procedures commonly performed using invasive distraction aids.18–20

**Design and Use**

The distractor is a modification of an unilateral linear side bar (Fig 1). With the distal clamp fixed to the side bar, the proximal clamp can be moved along the long axis of the side bar using a central threaded rod. The distractor is applied to the joint using 2 negative threaded, 3-mm-diameter pins, connected to the clamps perpendicular to the long axis of the side bar. Insertion of both transfixation pins is performed manually using a Jacob’s chuck, with the stifle at 90° flexion.

The exact point of pin placement on the tibia is defined as the most caudal point on a line perpendicular to the long axis of the tibia at the level of the tibial tuberosity (Fig 2). Pin placement on the distal femur uses the patella apex and medial fabella as reference points (Fig 2). Choosing a point midway between both landmarks assures pin placement at the center of the medial femoral condyle. After percutaneous insertion of the transfixation pins into the distal medial aspect of the femur and prox-
imal medial aspect of the tibia, aiming for parallelism of both pins, the distractor is slipped onto both pins and extended, providing distraction to the medial joint compartment (Fig 3A and B). Distraction is stopped when the opening of the medial joint space is judged to be adequate or if the tension applied to the distractor is felt to be maximal. Pushing caudally onto the proximal end of the central threaded rod provokes cranial tibial thrust, further improving the view of the caudal horn of the medial meniscus, while at the same time distraction of the joint space eliminates crushing of the caudal horn of the medial meniscus between the tibia plateau and medial femoral condyle (Fig 3C). By slipping a metallic tube onto the central threaded rod, an unscrubbed assistant can exert cranial tibial thrust while the surgeon controls flexion and extension of the stifle. This simple lengthening of the lever allows for “unassisted” stifle arthroscopy.

Clinical Experiences

Application of the distractor was tested in >40 stifles of dogs >20 kg affected by naturally occurring CrCL insufficiency. Observation of, and access to, the caudal medial compartment was established in all stifles using the distractor (Fig 4). Exerting cranial tibial thrust was advantageous in almost all joints, being particularly useful in joints with a prominent remnant of the CrCL.

Meniscal integrity was assessed by thorough probing of both sides of the medial meniscus with a hook probe, pressing the hook firmly onto the meniscal tissue for detection of incomplete tears, apparent as softening of the meniscal texture. When the hook was trapped in a tear, the axial portion was further mobilized with the hook and subsequently freed at its cranial attachment to the midsection of the medial meniscus with a hook knife. The attachment at the level of the caudal meniscotibial ligament was cut using a small punch and the meniscal tissue subsequently removed from the joint space. Probing of the remaining meniscus and resection of mobile meniscal tissue was repeated until repeated probing revealed no further tearing. Finally, a 2.5 mm meniscal cutter (Slotted Whisker, Karl Storz, Tuttingen, Germany) was introduced through the distracted joint space into the caudal compartment to trim the border of the remaining meniscus.

The only complication encountered using the distractor has been intra-articular pin placement (Fig 5). Application of the distractor to the limb was straightforward taking ~2–3 minutes without use of power equipment; however, intra-articular placement of the femoral or tibial transfixation pin occurred in 2 stifles. This happened in the first 10 stifles, when the exact point of pin placement was not defined. After using a standardized protocol for defining the anatomic landmarks (Fig 2) for pin insertion, no further complications occurred.

DISCUSSION

The most striking advantage of invasive pin distraction for canine stifle arthroscopy is the ease of access to the caudal horn of the medial meniscus without the need for a scrubbed surgical assistant. Whether the subjectively determined improvement in observation and palpation of the medial meniscus will indeed result in an increased accuracy of arthroscopic assessment of medial meniscal integrity warrants further studies. Comparison of the incidence and types of medial meniscal tears detected with and without the use of a distractor also requires further study. It is our impression that distractor use has resulted in our recognition of multiple longitudinal...
Fig 3. Correct application of the distractor to the medial aspect of the stifle joint. (A) Neutral position, (B) distracted position, (C) distracted position in combination with cranial tibial thrust exerted by pushing on the most proximal aspect of the central threaded rod.

Fig 4. Arthroscopic view of the medial meniscus in a left stifle of a 20 kg Beagle Dog with complete rupture of the cranial cruciate ligament. (A) without distraction, (B) after distraction and exerting cranial tibial thrust with the distractor. Unconstrained probing of both meniscal surfaces was possible despite the relatively small size of the joint (C, D). In this dog a probe of smaller size would have been appropriate.
tears that were likely missed before we began routine use of the distractor.

The 2 occurrences of intra-articular placement of 1 of the transfixation pins identifies a potential source of serious complication when using the distractor. Even though we observed no obvious clinical consequences in these 2 dogs, strict adherence to the proposed anatomic landmarks for correct pin placement is advised.

Despite the fact that invasive pin distraction of the knee or ankle joint is considered safe in humans,

tension exerted on the medial collateral ligament when distracting the medial joint space might be of concern in dogs. We did not observe obvious medial instability after distractor use and assume the technique to be safe in dogs but this requires additional evaluation. Bending of the transfixation pins occurred in some dogs indicating an inability of the surgeon to reliably feel when maximal distraction had occurred. To prevent overstretching of the collateral ligament, use of undersized rather than more rigid pins that might exert undue force on the ligamentous structures, is strongly advised.20

Another potential disadvantage of using the distractor might be interference of the tibial transfixation pin tunnel with subsequent application of the tibia plateau leveling (TPLO) jig and bone plate. Whereas plate application was not problematic in cases treated with a tibial osteotomy we cannot comment on the jig because we perform TPLO without using a jig. Similar to the tibial side, the femoral transfixation pin tunnel might interfere with implant application at the lateral femoral condyle when performing extra-articular joint stabilization techniques; however, when adhering to the landmarks we describe, pin placement should be more proximal and cranial to the site recommended for bone anchor or graft tunnel placement.22,23

In conclusion we suggest use of invasive pin distraction in canine stifle arthroscopy to facilitate diagnosis and treatment of medial meniscal tears. Particularly in stifles with a prominent ligament remnant or severe periarticular fibrosis where external manipulation of the stifle joint may be insufficient to gain enough distraction of the medial joint space, use of this distractor may be helpful. Likewise for surgeons performing unassisted stifle arthroscopy, the device can be extended so that an unscrubbed person can achieve the necessary manipulations. Although invasive in nature, all observed complications so far have been related to poor surgical technique with no further complications after establishing anatomic landmarks for correct pin placement.

REFERENCES


Fig 5. Intra-articular placement of the distal transfixation pin (Dalmatian, right stifle, 5% tear of the CrCL). The arrow is pointing onto the tip of the misplaced transfixation pin. CrCL, cranial cruciate ligament; mFC, medial femoral condyle; crHmM, cranial horn of the medial meniscus.
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