Focus on Canine Sports Medicine

Cranial Cruciate Ligament Injury in Agility Dogs

Part 2

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This part of the article will continue our discussion of the CCL injury. Here we'll look at the structure and content of rehabilitation therapy, at-home care and therapy, and the dog's progression through various stages from week to week.

Rehabilitation Therapy

Rehabilitation therapy has been shown to improve muscle mass and attenuate muscle atrophy that occurs in the post-operative period, increase stifle joint ROM, especially extension, improve weight-bearing as measured by force plate analysis, and reduce the progression of osteoarthritis.

Rehabilitation guidelines following stifle surgery are structured to direct the clinician in returning canine athletes to preinjury activity levels as quickly and safely as possible. Criterion-based protocols eliminate subjective progression through rehabilitation by dictating the milestones that must be reached in order to progress to the next phase. The rate of progression can differ between canine athletes and is dependent on the individual rate of healing and the demands of the canine athlete's activity level. Also, clinicians should prescribe therapeutic interventions within each phase that are tailored to the patient's needs. Prescribing therapeutic interventions in a cookbook fashion for each particular diagnosis is committing a disservice to the patient.

Three phases of rehabilitation are included for recovery in the canine athlete: the acute phase, advanced phase, and return-to-sport phase.

Three Phases of Rehabilitation

	Acute Phase	Advanced Phase	Return-to-sport Phase
Criteria to enter		Full range of motion and effusion controlled	Quadriceps strength ≥80% of the uninjured side
Goals	• Decrease pain • Increase range of motion • Retard muscle atrophy • Unassisted ambulation	Increase muscle strength and endurance	Prepare canine athlete for a return to competition
Common interventions	• Cryotherapy • Laser therapy • NMES • TENS • Joint mobilization • Soft tissue mobilization at incision site • Isometric exercise (quadriceps sets) • Range of motion exercises	• Isotonic (both open and closed chain) and isokinetic exercises • NMES • Proprioception exercise • Flexibility exercise • Cardiovascular exercise (walking, hill work, underwater treadmill therapy)	• Isotonic (both open and closed chain) and isokinetic exercise • Agility training • Sport-specific exercise

Transcutaneous electrical nerve stimulation (TENS) of the stifle following the TPLO procedure (1-month post-op)

Acute Phase

In the acute phase of rehabilitation, strategies are focused on controlling the effects of inflammation (pain, effusion, loss of motion, and muscle atrophy). The goal of the acute phase is to revise full range of motion, reduce effusion, retard muscle atrophy, and ambulate on the operated limb. Ice, compression, laser therapy, and elevation of the surgical limb can assist in counteracting the effects of inflammation. Relative rest is usually indicated to allow for healing to occur without the detrimental effects of strict immobilization, such as arthrofibrosis and deconditioning.

Cryotherapy/ice therapy, one-day post-op

In the acute stage, ambulation with an assistive device (sling support) is indicated for stairs and slippery surfaces. Use of an assistive device is maintained until the dog can walk without a limp, joint effusion has been controlled, and when the quadriceps have recovered sufficiently to provide protection of healing tissues (typically 60% of the uninvolved side).

Range of motion deficits should also be resolved in this phase of rehabilitation. Most often, regaining knee extension is more difficult, so priority should be placed on achieving extension. The clinician should evaluate any possible sources contributing to a restricted range of motion including: decreased patellar mobility, poor quadriceps strength, decreased accessory motion of the tibiofemoral joint, and muscle guarding and tightness. Interventions should be chosen that address the specific cause of restricted range. A combination of low-load sustained stretching, joint mobilizations of the patella and tibiofemoral joints, and modalities to control pain and resultant muscle spasm are commonly performed.

Rapid and significant quadriceps femoris weakness is a common concern following CCL surgery. Efforts to retard atrophy and facilitate volitional quadriceps activation form the basis of early progressive strengthening programs. Successful early quadriceps strengthening will facilitate efforts to gain full knee extension, restore normal patellar mobility, and correct antalgic gait patterns. Reciprocally, early emphasis on obtaining full knee extension during weight bearing will assist in efforts to regain knee extensor strength.

If the dog is experiencing difficulty producing a strong quadriceps contraction, neuromuscular electrical stimulation (NMES) is indicated. The success of NMES depends upon achieving adequate levels of electrical stimulation to provide stimulus to promote strength gains. It is important to try to get the dog to relax while the electrically elicited isometric contractions are increased in an effort to achieve 50% of the injured leg's maximal volitional isometric contraction. Intensity levels that are below 50% of maximal voluntary isometric contraction (MVIC) have limited capacity to assist in strength gain beyond volitional exercise alone.

Advanced Phase

The advanced phase of rehabilitation is initiated when range of motion is full and effusion controlled. The goal of this phase is to increase muscle strength and endurance. Higher intensity resistance training can be initiated and should include exercises for all muscles of the lower extremity. If the intensity of therapeutic exercises creates an increase in effusion, intensity levels are reduced to the previous level. Progression to higher activity is dictated by the presence of lameness after exercise.

Exercise Progression Guidelines Based on Lameness

If no lameness is present from previous exercise, progress exercise by modifying one variable.

If lameness is present from previous exercise, but recedes with warm-up, stay at same level.

If lameness is present from previous exercise, but does not recede with warm-up, decrease exercise to the level before progression. Consider taking the day off if lameness is still present with the reduced level of exercise. When exercise is resumed, it should be at the reduced level.

Rehabilitation exercises are commonly categorized as open or closed chain exercises. Open chain exercises are those in which the distal end is free to move (for example, Thera-band), and closed chain exercises are those in which the distal end is fixed (for example, moving from a sit to a stand). Optimal strengthening requires a combination of both open and closed chain exercises. When dogs perform closed chain exercises, clinicians should be cognizant of the tendency to compensate for weak muscles in the kinetic chain. Reliance on the ankle plantar flexors and the hip extensors is a common substitution with closed chain exercises following knee injury.

Often, exercises designed to improve dynamic stability are added in this phase. Although there is no literature to support the inclusion of such exercises, there is a theoretical framework for including such exercises based on basic science and applied research. Balance exercises using unstable surfaces (wobble boards) are included.

Progression of aerobic condition often includes hill walking and an underwater treadmill therapy program that is usually initiated in this phase of rehabilitation. To start running, the dog's injured side quadriceps strength must be restored to at least 80% of the uninvolved side, and sufficient healing of the injured structure must have occurred (for a TPLO approximately 8 weeks). Bone healing is usually sufficient at 8 to 12 weeks. Return of muscle mass is usually sufficient at 12 weeks as long as an appropriate post-operative rehabilitation therapy program was followed.

Return-to-sport Phase

The goal of the return-to-sport phase is to prepare the canine athlete to return to the demands of competition. The dog is allowed to enter this phase when instance resistance training and a running program do not increase effusion or lameness. In humans, therapeutic exercise interventions follow the SAID (Specific Adaptations to Imposed Demands) principle. This concept is based in the notion that the body will adapt to accommodate to the stress and strains applied to it. Therefore, exercises should attempt to mimic the demands of activities required for the canine athlete to successfully return to sport.

The return-to-sport phase is characterized by agility training and sport-specific exercise. Less complex agility drills should be used initially, moving to more complex agility drills. The volume of agility activities should be graded by frequency, duration, and intensity. Only one variable should be modified at one time, otherwise it is difficult to determine which factor caused an adverse response (increased pain or effusion) to the treatment. Sport-specific activities are introduced and progressed in the same manner. Practice drills are started, leading to competition-level activities.

Canine athletes are cleared to return to sport when they have progressed through all phases of rehabilitation without symptoms and have met the criteria of return-to-sport testing. Return-to-sport testing involves symmetric thigh circumference, strength testing, and gait analysis.

Day 14-30 Post-op Rehabilitation Home Program

2-3 sessions per day

Apply cold compresses to stifle (knee) 10-15 minutes following rehabilitation exercise session

Continue to restrict exercise; no running or jumping. Continue indoor confinement.

PROM

Take each rear limb through passive range of motion. Visualize and perform a running pattern with the dog's hind limb, holding for 5-10 seconds in the flexion and extension position of the limb, always staying within your dog's comfort level. Never move into positions that cause pain. Watch the dog's expressions during movement (10-15 movements per limb).

Leash Walks

Leash walks may be increased to 5 minutes twice daily (taking the dog out more often for quick "potty" elimination breaks). Gradually increase walk time by adding 5 minutes each week. For example day 14-21 your dog may have 2 walks per day at 5 minutes each, then day 21-28 your dog may have 2 walks per day at 10 minutes each and so on.

Torso Strengthening

Gently place hands on either side of the hips and rock your dog from side to side, while in a standing position, thus engaging the core torso muscles and promoting hind limb weight bearing. Once your dog tenses, stop, rest and then perform exercise again. Repeat 5-10 times.

Cookies at Contra-lateral Hip

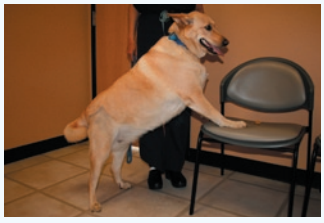
Have your dog take a treat from near the hip on the good side. This creates bending away from the good side and shifts weight onto the problematic side. Hold this stretch for 5-30 seconds, then return to normal stance. Repeat 5-10 times. This exercise can be performed to the other side for a good paralumbar muscle stretch.

Sitting Exercise

Ask your dog to sit and encourage him to tuck the surgical leg under the body by tapping on the foot. Rewarding your dog with praise or a treat when he accomplishes this task will encourage him to sit squarely each time. Repeat 6-10 times per session

Three-leg Standing

While the dog is in a standing position, lift the good hind limb off the ground and extend it backward. Support this leg from the knee as opposed to the shin or foot in order to discourage your dog from weight bearing through your hand and support. Hold this position for 5-30 seconds depending on the stability of your dog, then replace leg to floor. Repeat 5-10 times.



Paws on Counter

Have your dog place his front paws on the second or third step of a staircase or on a chair and offer a cookie from above his head height to cause weightbearing in the rear and the stretching of back muscles and hip flexors. Hold this position for 30 seconds. Repeat 3-5 times

Hair Scrunchy on Good Leg/Paw

Use a hair scrunchy on the good leg. This mildly irritates your dog thus shifting weight to injured limb in order to buildup muscle mass. Have your dog walk around for 5-minute intervals 3-5 times daily.

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Day 30-60 Post-op TPLO Rehabilitation Home Program

2-3 sessions per day

Apply cold compresses to stifle (knee) 10-15 minutes following rehabilitation exercise session

PROM
Take each rear limb through passive range of motion. Visualize and perform a running pattern with the dog's hind limb, holding for 5-10 seconds in the flexion and extension position of the limb, always staying within your dog's comfort level. Never move into positions that cause pain. Watch the dog's expressions during movement and perform 10-15 movements per limb.

Leash Walks
Continue to increase the time of leash walks by 5-minute intervals every 3 days. You can work up to 20-30 minute walks 2-3 times a day. These need to be on leash and controlled.

Walking Uphill
This should be done on a leash in a slow controlled walk to allow for extension of the spine and engagement of the rear. Start off with very mild inclines for 3-5 minutes per session and increase incline and length of time every 2-3 days according to your dog's tolerance. You never want your dog to be in discomfort or become too tired to complete the exercise.

Torso Strengthening
Gently place hands on either side of the hips and rock your dog from side to side, while in a standing position, thus engaging the core torso muscles and promoting hind limb weight bearing. Once your dog tenses, stop, rest, and then perform the exercise again. Repeat 5-10 times.

Cookies at Contra-lateral Hip
Have your dog take a treat from near the hip on the good side. This creates bending away from the good side and shifts weight onto the problematic side. Hold this stretch for 5-30 seconds, then return to normal stance. Repeat 5-10 times. This exercise can be performed to the other side for a good paralumbar muscle stretch.

Sitting Exercise
Ask your dog to sit and encourage him to tuck the surgical leg under the body by tapping on the foot. Rewarding your dog with praise or a treat when he accomplishes this task will encourage them to sit squarely each time. Repeat 6-10 times per session.

Three-leg Standing
While the dog is in a standing position, lift the good hind limb off the ground and extend it backward. Support this leg from the knee as opposed to the shin or foot in order to discourage your dog from weight bearing through your hand and support. Hold this position for 15-60 seconds depending on the stability of your dog, then replace leg to floor. Repeat 5-10 times.

Para Standing
Kneeling or standing bent over the uninjured side of your dog, lift both the front and rear limb on this side (you are holding up the good legs). Hold this position while it is comfortable for your dog, about 5-30 seconds. If weakness starts to occur in weight-bearing legs immediately replace limbs and support dog. Repeat 5-10 times

Paws on Counter
Have your dog place his front paws on a chair or counter (increased angle from last month) and offer a cookie from above his head height causing weight bearing in the rear and stretching of the back muscles and hip flexors. Hold this position for 30 seconds. Repeat 3-5 times.

Wheelbarrowing
Lift your dog's torso off the ground while holding his front legs on your forearm above the wrist. Pull and push your dog gently back and forth and encourage your dog to take a few steps forward and backward. Make sure he is standing at an angle and not straight up. After a few steps replace the front legs to the ground and rest. Repeat exercise 5-10 times. Depending on the size of your dog you may have to bend over to do this. Make sure you are physically capable of doing this exercise and do not strain your own back. Only do this exercise if your dog is stable using both back limbs.

Day 60-90 Post-op TPLO Rehabilitation Home Program

2-3 sessions per day

Continue to restrict exercise. No off leash running, no jumping.

Leash Walks
Continue to increase time of leash walks by 5-minute intervals every 3 days. You can extend walks up to 1 hour, 2-3 times a day if time permits. These need to be on leash and controlled.

Walking Uphill
This should be done on a leash in a slow controlled walk to allow for extension of the spine and engagement of the rear. You can increase the time and incline of the hills by 5 minutes per session every 3 days.

Cookies at Contra-lateral Hip
Have your dog take a treat from near the hip on the good side. This creates bending away from the good side and shifts weight onto the problematic side. Hold this stretch for 5-30 seconds, then return to normal stance. Repeat 5-10 times. This exercise can be performed to the other side for a good paralumbar muscle stretch.

Three-leg Standing
While the dog is in a standing position, lift the good hind limb off the ground and extend it backward. Support this leg from the knee, as opposed to the shin or foot, in order to discourage your dog from weightbearing through your hand and support. Hold this position for 20-60 seconds depending on the stability of your dog, then replace leg to floor. Repeat 5-10 times.

Para Standing
Kneeling or standing bent over the uninjured side of your dog, lift both the front and rear limb on this side (you are holding up the good legs). Hold this position while it is comfortable for your dog, about 15-60 seconds. If weakness starts to occur in the weight-bearing legs immediately replace limbs and support dog. Repeat 5-10 times

Paws on Counter
Increase the incline on which your dog is standing; thus you eventually have him in a comfortable, close-to-vertical position. Have your dog place his front paws on an appropriate height counter and offer a cookie from above his head height causing weightbearing in the rear and stretching of the back muscles and hip flexors. Hold this position for 5-30 seconds. Repeat 3-5 times.

Wheelbarrowing
Lift your dog's torso off the ground while holding his front legs on your forearm above the wrist. Pull and push your dog gently back and forth and encourage your dog to take a few steps forward and backward. Make sure he is standing at an angle, but increase the angle closer to an upright position, but not straight up. After a few steps, replace the front legs to the ground and rest. Repeat exercise 5-10 times. Depending on the size of your dog you may have to bend over to do this. Make sure you are physically capable of doing this exercise and do not strain your own back. Only do this exercise if your dog is stable using both back limbs.

Para Walking
Kneeling or standing bent over the uninjured side of your dog, lift both the front and rear limb on this side (you are holding up the good legs). Now gently push your dog away from you causing him to alternately step with a front and a rear limb, away from the side you are pushing from. Have him take a few steps and then rest. Perform this exercise on stable footing 5-10 times.

Long, Low Obstacle
Walk your dog over a long, low obstacle that requires a larger step length in order to clear the obstacle, but not so wide as to make the dog jump over it. Walk him over this for a period of 5 minutes

Circles
Walk your dog in circles alternating direction after 3-5 times in one direction. Start with a moderately sized circle and then decrease the diameter slowly over 7-10 days time, eventually accomplishing a very tight circle in both directions.

Ladder Walking
Walk your dog slowly and under control through the rungs of a ladder or cavelettis placed a dog's length apart. Start off with walking and then gradually increase to a jog over a period of 7-10 days. Perform this exercise for 5-10 minutes per session.