

Conservative Management of Cruciate Deficiency



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Conservative Management of Cruciate Deficiency

Conservative Cruciate Management

- Some dogs are not surgical candidates due to any of the following:
 - age
 - weight
 - breed issues
 - poor health
 - additional factors / issues
 - an inadequate state of fitness
 - financial constraints, or owners' beliefs
- HOWEVER...



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- This group of patients deserves a chance at optimal function as much as those that are prime surgical candidates with owners willing and able to bear the financial burden of surgery.
- This is not a debate about whether surgery is better than conservative management!
- Rather this is a 'HOW TO' do conservative management to get the best results!

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- CANINE Conservative CCL Management in the literature:
- Comerford et al 2013 surveyed British small animal veterinarians and found that conservative management is still widely used for treatment of CCL ruptures in dogs less than 15kg.
 - Conservative management consisted of NSAIDs (91.1%), short leash walks (91.1%), weight loss (89%), hydrotherapy (53.6%), physiotherapy (41.9), and cage rest (24.2%).



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- CANINE Conservative CCL Management in the literature:
- Wucherer et al 2013 compared nonsurgical (PT, wt. loss, & NSAIDs) and surgical (TPLO) management in overweight dogs with CCL ruptures. They found:
 - Body fat % decreased in both groups
 - Owner questionnaires revealed both groups improved.
 - Surgical group had significantly higher peak vertical forces on affected limbs
 - Successful outcomes (GRF >85% & Questionnaire variables >10%):
 - For the surgical group were (67.7%, 92.6%, and 75.0% for 12-, 24-, and 52-week evaluations, respectively)
 - For the conservative group were (47.1%, 33.3%, and 63.6% for 12-, 24-, and 52-week evaluations, respectively).
 - ** 2/3 of the dogs in the conservative group had successful outcomes at the 52-week mark

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking [review paper](#) on the role of muscle activation in cruciate disease:
 - CCL contains mechanoreceptors.
 - Loading of the CCL elicits a corresponding increase in amplitude of quadriceps muscle activation.
 - Therefore CCL injury may have a negative effect on muscle activation.
 - Joint instability stimulates additional local mechanoreceptors and muscles which are not normally active
 - This may contribute to adaptive or maladaptive compensation gait strategies

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking review paper on the role of muscle activation in cruciate disease:
 - CCL rupture = pain, swelling, muscle atrophy & altered muscle control and activation.
 - Dogs with experimentally transected CCL = increased stifle flexion and reduced weight bearing of the injured limb during stance.
 - Altered muscle activation of the muscles responsible for stifle stabilization results in recruitment of other local muscles which can lead to overuse injuries and gait compensations.

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking review paper on the role of muscle activation in cruciate disease:
 - Quadriceps muscle inhibition is expected to contribute to pelvic limb weakness, leading to altered pelvic limb kinematics and weight-bearing within the affected limb
 - Reflex muscle inhibition within the contralateral limb has also been reported in people with ACL deficiency.

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking review paper on the role of muscle activation in cruciate disease:
 - There is decreased limb propulsion within the CCL deficient limb due to increased stifle flexion at the end of the stance phase.
 - So, to restore pelvic limb length, the coxofemoral and tarsal joints within the affected limb increase extension during the stance phase.

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking review paper on the role of muscle activation in cruciate disease:
 - Compensations or alternative gait strategies may lead to overuse and rupture of the contralateral CCL by producing increased shearing forces and increased strain on the CCL.
 - Degeneration of the contralateral CCL is not seen in human ACL injury but occurs in 40 to 50% of dogs 6 to 16 months after the initial CCL disease diagnosis.

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- What happens in dogs' legs after a cruciate tear?
- Adrian et al 2013 presented a groundbreaking review paper on the role of muscle activation in cruciate disease:
 - Cartilage health depends upon normal joint stability, proper articular biomechanics, and normal gait patterns.
 - The thickest regions of hyaline cartilage are located within the highest loadbearing regions of femoral tibial joint.
 - With cruciate injury and rupture, the resultant joint instability, altered joint kinematics, and abnormal muscle activation patterns increase peak forces acting on the hyaline articular surfaces and shift the contact surface areas to regions of thinner cartilage.
 - Increased cartilage loading in regions unaccustomed to resisting compresses or shear forces contribute to cartilage fibrillation and development of OA.

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- Ramirez et al 2015 tested cadaveric canine limbs and concluded:
 - Quadriceps pretension could play a role in the stability of a CrCL deficient stifle and should then be considered in rehabilitation programs and conservative treatment of CrCL rupture in dogs.
- Kanno et al 2012 tested cadaveric limbs and found:
 - The semitendinosus muscle is an agonist of the CrCCL in the stifle joint of dogs.

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- Sanchez-Bustinduy et al 2010 studied the kinematics of dogs with CCL ruptures:
 - Between the affected & unaffected limb, there was a difference in paw velocity (reduced) and stifle angular velocity ('just different').
 - Between CCLR and control dogs, the largest differences were shorted stride length and reduced paw velocity.

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- Mostafa et al 2010 studied the morphometric characteristics in Labs with CCL-D:
 - CCL-D was predominantly associated with atrophy of the Quadriceps.
- Ragetly et al 2010 the dynamics of the rear leg in Labs with CCL-D:
 - Reaction forces during braking & extension during push off are predominantly affected

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- **HUMAN LITERATURE**
 - Problems with **symptomatic** human ACL-D Knees have the following:
 - Greater flexion angles during stance phases
 - Quadriceps weakness (persistent in poorly functioning knees)
 - Symptomatic ACL-D knees exhibit more anterior displacement than non-symptomatic ACL-D knees with weight bearing
 - **NOTE:** static translation does not correlate with function
 - Significant proprioceptive deficits in symptomatic ACL-D knees
 - **NOTE:** relation between poor proprioception and chondral or meniscal lesion

Wexler 1998; Tagesson et al 2008; Friden et al 1993, 1999, 2001; Roberts et al 1999, 2000; Zatterstrom et al 1994

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• HUMAN LITERATURE

- **Successful treatment of non-surgical ACL-deficient knees** has been shown to be possible with specifically targeted rehab programs.
- The **rule of thirds** for chronic ACL-D treated with rehab:
 - 1/3 manage w/o reconstruction
 - And resume previous recreation activities
 - 1/3 manage w/o reconstruction
 - By modifying or lowering their activity level
 - 1/3 require reconstruction
 - Due to recurring 'giving-way' episodes
- Thus we have copers, compensators & non-copers

Noyes et al 1983

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• HUMAN LITERATURE - Comparing Conservative Treatment to Normal Knees

• Function

- Single leg hop test was normal:
 - In 77% of subjects at 1-year post-injury
 - In 89% of subjects at 3-years post-injury
 - In 85% of subjects at 15-year post-injury
- Strength (isometric and concentric) was normal:
 - In 42 – 56 % of subjects at 1-year post-injury
 - In 54 – 68% of subjects at 3-years post-injury
 - In 69 – 82% of subjects at 15-years post-injury



Oh those Swedes!

Ageberg et al 2001 & 2007

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• HUMAN LITERATURE - Comparing Conservative Treatment to Normal Knees

• Function

Treatment	Pre-injury	1-Year Follow-up	3-Years Follow-up	15-Years Follow-up
Rehabilitation only	7	6	6	4
Reconstruction & Rehab	7	5	6	5

Oh those Swedes!


Kostogiannis et al 2007

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Oh those Swedests!

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- **HUMAN LITERATURE - Comparing Conservative Treatment to Normal Knees**
- Subjective knee function / Quality of Life scoring
 - Highest scores at 1 & 3 years post-injury in rehab only groups
 - Those injured in contact sports scored the lowest
 - At 15-years post-injury:
 - Reconstruction group scored lower than non-reconstructed

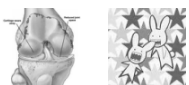


Kostogiannis et al 2007

Oh those Swedests!

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- **HUMAN LITERATURE - Comparing Conservative Treatment to Normal Knees**
- Radiographic evidence of osteoarthritis at 15-year mark
 - 16% of rehab-patients developed OA
 - ALL of these patients had undergone a meniscectomy!
 - NONE of the non-meniscectomized patients developed OA!
- Subjective report of symptoms
 - 68% reported to be asymptomatic at 15-years post-injury
 - 23% had had reconstruction at an average of 4-years after-injury



Neuman et al 2008

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- **HUMAN LITERATURE - Comparing ACL-reconstruction to Non-Surgical Rx**
- Strehl & Egli 2007 found:
 - Despite pre-screening for suitability for conservative management, almost 2/3 of the primarily conservatively treated ACL ruptures needed an operative reconstruction in the long term.
- Muaidi et al 2007 (systematic review of 15 studies) found:
 - Conservatively managed ACL-deficient knees had good short- to mid-term prognosis for self-reported function & functional performance.
 - However, subjects reduced their activity levels on average by 21% following injury.
- Kessler et al 2008 found:
 - Stability was higher as is osteoarthritis in reconstructed cruciates
 - 24% incidence of OA 11 years after conservative management of ACL-D knees not needing a secondary surgery
 - ** Good outcomes from conservative management could hinge on a rehab program designed to keep secondary meniscus tears at a low level.

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- **HUMAN LITERATURE - Comparing ACL-reconstruction to Non-Surgical Rx**
- Frobell et al 2010 studied whether early ACL-Sx plus rehab was superior to structured rehab (with an option for later Sx):
 - No differences in functional scoring between the groups.
 - Note: of the later-Sx option group, only 39% opted for surgery later on
- Harris et al 2015 – similar study as above with a 5-year follow up:
 - 51% of knees required meniscal surgery over the 5-years, regardless of treatment group.

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• So, what do we do?



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- **REHABILITATION PLANNING FOR CONSERVATIVE CCL-DEFICIENCY**
- **GOALS in successful management of ACL-D in humans:**
 - Early activity modification
 - Neuromuscular knee rehabilitation
 - Strength training
- **STAGING the goals through rehab:**
 - TIME does not dictate progression
 - Attention should be paid to ROM, strength, fluidity of performance of functional activities, & functional testing

Ageberg et al 2007; Kostogiannis et al 2007; Markey 1991; Neuman et al 2008; Tagesson et al 2008; Brozman & Wilk 2007; Eltzen et al 2010.

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- **Patient selection (for dogs)**
- Consideration should be made regarding the following:
 - Suspected meniscal tear (these dogs don't do well)
 - Concomitant medical conditions that impact the building of muscle (i.e. Cushing's disease, etc.)
 - Desire to do sports or be very active with the dog (just do the surgery already!!)
 - Young dog without medical issues making surgery problematic (just do surgery instead!)
 - Owners that can't stick to the program (They'll let the dog do too much, blow the meniscus, and you'll want to scream!)

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- **PHASE 1** (appx weeks 1 – 3): PROTECTION PHASE
- **Decrease pain and effusion**
 - Icing
 - PROM & AROM within pain tolerance
 - Joint compressions
 - Grades 1 -2 joint mobilizations
 - NMES
 - Modalities
- **Increase proprioception**
 - Joint compressions
 - Grades 1 – 2 joint mobilizations.
 - Weight shifting



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- PHASE 1 (appx weeks 1 – 3): PROTECTION PHASE
- **Increase ROM**
 - PROM flexion and extension
 - Tummy rubs into extension
 - 'Square' sitting practice



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- PHASE 1 (appx weeks 1 – 3): PROTECTION PHASE
- Increase muscle function using movement synergies and utilizing motor learning transfer
 - Active sitting down to a stool or normal sit to stand practice
 - Toe pinches in side lying
 - Leash walking to toilet, progressing to 5 minutes and increasing time by 3 – 5 minutes per week (if no increase in joint inflammation) – multiple times a day



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- PHASE 1 (appx weeks 1 – 3): PROTECTION PHASE
- Increase muscle function using movement synergies and utilizing motor learning transfer
 - Weight shifting exercises
 - Balance board exercises (front legs up)
 - Standing on soft surfaces and balance



Conservative Cruciate Management

- PHASE 1 (appx weeks 1 – 3): PROTECTION PHASE
- Increase muscle function using movement synergies and utilizing motor learning transfer
 - 3-leg standing
 - stepping over
 - Walking in circles or figure-of-8 patterns.



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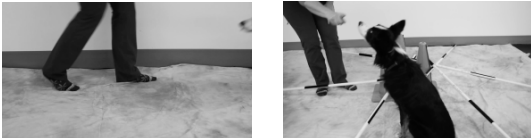
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- **PHASE 2** (appx weeks 3-7): **Early Strength Training**
- Full **ROM**
 - As above
 - May add toe-touch hanging, or extension on the stairs
 - May add sitting practice on a stool or platform



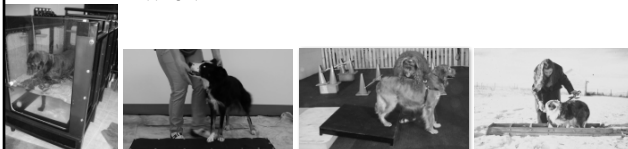
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- **PHASE 2** (appx weeks 3-7): **Early Strength Training**
- **Normal Gait**
 - Walking with a 'disturbance' on the unaffected foot
 - Obstacle walking or trotting
 - Steep up-hill walking or trotting



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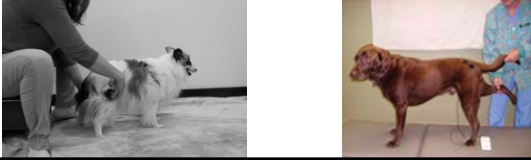
- **PHASE 2** (appx weeks 3-7): **Early Strength Training**
- Increase **motor control** (neuromuscular training) and **strength**
 - Underwater treadmill or swimming exercise
 - Forwards stepping, Side stepping or Backward stepping over a pole
 - Stepping up backwards



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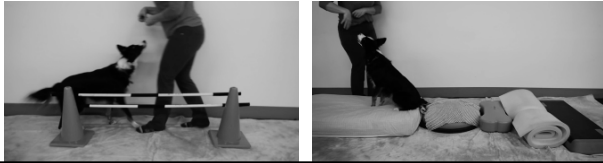
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- PHASE 2 (appx weeks 3-7): **Early Strength Training**
- Increase motor control (neuromuscular training) and strength
 - NMES or manual tapping on quadriceps or gluteals with 3-leg standing
 - NMES or manual facilitation on/of hamstrings with sitting practice



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- PHASE 2 (appx weeks 3-7): **Early Strength Training**
- Increase motor control (neuromuscular training) and strength
 - Walking backwards
 - Any of the above land exercises on a soft surface



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- PHASE 2 (appx weeks 3-7): **Early Strength Training**
- Increase motor control (neuromuscular training) and strength
 - Hill walking
 - Stair walking



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- PHASE 2 (appx weeks 3-7): **Early Strength Training**
- Increase Load: 70 – 80% of uninjured limb (increasing by 10% nearer end of stage)
 - Increase time and duration of exercises above
 - Perform exercises above with a weighted vest.



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- **PHASE 3** (appx weeks 7-11): **Intensive Strengthening**
- Increased strength, and motor control (neuromuscular training)
 - Continue most challenging exercises from above
 - Walking with a weight on the affected leg (open kinetic chain training)
 - Trotting up-/down-hills



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- PHASE 3 (appx weeks 7-11): **Intensive Strengthening**
- Increased strength, and motor control (neuromuscular training)
 - Recall running between two people or Retrieves
 - Tug of war – straight line backwards and forwards



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- PHASE 3 (appx weeks 7-11): **Intensive Strengthening**
- Increased strength, and motor control (neuromuscular training)
 - Step ups or Squat blocks



Conservative Cruciate Management

- PHASE 3 (appx weeks 7-11): **Intensive Strengthening**
- Increase Load: 70 – 80% of uninjured limb (increasing by 10% nearer end of stage)
 - Perform exercises above with a weight pack
 - Increase time and duration of exercises above



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- **PHASE 4** (appx weeks 11-16): **Intensive Strengthening & Return to Sport-TYPE of Training**
- Increased strength
 - Continue most challenging exercises from above
 - Destination jumping exercises from a stand (plyometrics)



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- **PHASE 4** (appx weeks 11-16): **Intensive Strengthening & Return to Sport-TYPE of Training**
- Increased strength
 - Aggressive tug of war (side to side, over objects, etc)



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- **PHASE 4** (appx weeks 11-16): **Intensive Strengthening & Return to Sport-TYPE of Training**
- Increased ability in sport-specific activities
 - Medium-distance ball retrieves
 - 1 or 2 agility-type pieces of equipment
 - Avoid play with other dogs until closer to 6 months or longer and start with only short intervals



Conservative Cruciate Management

- **PHASE 4** (appx weeks 11-16): **Intensive Strengthening & Return to Sport-TYPE of Training**
- Load 80% of uninjured leg (increasing by 10% nearer end of stage)
 - Increase time and duration of exercises above
 - Perform exercises above with a weight pack



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- Realistically
 - 6-month mark = drawer is reduced in extension
 - 9 – 12-month mark = drawer in flexion is reduced
 - Be cautious for 9 + months to a year
 - Don't blow the meniscus!



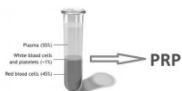
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- Additional Advice
- Joint Health
 - Advisement on supplementation: glucosamine and fatty acids
 - Weight loss or weight maintenance advice



Conservative Cruciate Management

- Additional Therapies
- PRP may also be useful in canine cruciate tear and meniscal deficiency
 - A series of PRP injections may aide in ACL repair (of partial tears), improve ROM, decrease pain, and improve limb function for up to 6 months
 - A single injection of PRP improved lameness, pain and effusion, and enhanced function and comfortable ROM compared to NSAIDS (but so did a saline flush!). However it was not protective against OA progression.



Cook et al 2016; Bozynski et al 2016

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- **Additional Options**

- Stifle bracing may be of assistance as well:

- Stifle joint biomechanics were improved following orthosis implementation compared to CCL-D stifle joints.
- Stiffness of the hinge influences stifle joint mechanics
- Owner satisfaction for stifle bracing is high and comparable to satisfaction with surgical intervention for CCL-D
- Owners contemplating management of CCL-D with an orthoses should be advised of potential complications such as persistent lameness, skin lesions, patient intolerance of the device and the need for a subsequent surgery.



Bertocci et al 2017; Hart et al 2016

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- **It Can Be Done!**



www.FourLeg.com



CONSERVATIVE MANAGEMENT OF CRUCIATE LIGAMENT DEFICIENCY

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