



UNIVERSITY OF CALGARY FACULTY OF VETERINARY MEDICINE

This review accompanies the relevant episode of the Cutting Edge veterinary podcast. In each episode of this podcast, 3rd year students in the University of Calgary's veterinary medicine program fill you in on the most up-to-date literature and evidence-based practices on topics that matter to you, the practising veterinarian.

Physical Rehabilitation in Dogs Following Cranial Cruciate Ligament Injury: A Practical Exploration of The Literature

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A. Human and canine evidence for knee/stifle physical therapy post-surgery

Traditional post-operative rehabilitation in humans with anterior cruciate ligament (ACL) deficiency involved weeks of immobilization through casting, followed by a slow progressive return to weight bearing over 12-14 weeks with range of motion (ROM) exercises beginning at 4 months, and full unrestricted activity around the 12 month post-op mark¹. These patients suffered greater knee dysfunction than those who, in the 1980s, experimentally began weight bearing and ROM exercises only days after surgery¹. Those "accelerated" rehabilitation patients gained quicker and better ROM, ligament stability, and strength gains¹. These early studies laid the groundwork for the now-established physical therapy guidelines within human medicine. It is widely accepted now that restricted knee motion post-ACL reconstruction leads to degenerative changes to soft tissue, joint pain, muscle atrophy, decreased joint mobility, and functional impairment². A systematic review published in 2012 showcased the benefits of the current guidelines of rigorous and early rehabilitation for ACL reconstruction patients³. Progressive eccentric exercises, along with immediate postoperative weight bearing, ROM, and closed-chain kinetic strengthening were deemed safe, more likely to improve muscle strength, and less likely to result in osteoarthritis in the post-operative patients^{3, 4}. Beyond its usefulness post-surgery, human literature also supports the use of physical therapy pre-operatively (known as prehab) and as an alternative to surgery in acute cases of ACL tears^{5, 6}. A 2013 randomized control trial (RCT) comparing functional outcomes 5 years after young active adults received either rehabilitation and early ACL reconstruction or only rehabilitation found no significant advantage to rehabilitation with early ACL reconstruction compared to those treated with rehabilitation alone⁵. When preoperative physical rehabilitation was performed by individuals requiring ACL reconstruction, a 2022 study found that prehab patients scored better on functional assessments after ACL surgery than those who did not undergo preoperative rehabilitation⁶.

The existing literature within veterinary medicine regarding the usefulness of physical rehabilitation in patients with cranial cruciate ligament (CCL) deficiency is newer and less

extensive than that of humans. This is due to multiple factors including the more recent emergence of canine physical rehabilitation, the lack of long-term and high-quality studies evaluating efficacy of canine physical rehabilitation, and logistical limitations underlying the nature of these studies^{7, 8}. At this time, evidence is insufficient to suggest that naturally occurring, partial CCL tears will heal completely with rehabilitation⁸. While the CCL is different both anatomically and biomechanically than the human ACL, the strongest existing literature supports the use of physical rehabilitation post-CCL surgery when it adheres to the fundamental principles of soft tissue healing and exercise therapy. This will be further explored later in this paper.

B. Gold standard treatment of CCL-deficient canine patients

It is important to understand that current literature demonstrates surgical reconstruction as the gold standard treatment of CCL-deficient patients^{2, 9}. The most common surgeries are osteotomies, namely the tibial plateau leveling osteotomy (TPLO); however, other common surgeries include tibial tuberosity advancement (TTA), and extracapsular methods⁷. A prospective, randomized clinical trial by Wucherer et al. described the gold standard approach to overweight dogs with unilateral CCL ruptures¹⁰. This study found that patients who underwent surgical and non-surgical (weight loss dietary modifications, NSAIDs, and formal rehabilitation protocol) management had greater return to function than those who only underwent non-surgical, conservative management¹⁰. Conservative, non-surgical management, including rehabilitation, may have greatest success in dogs under 15 kg or those with partial CCL tears⁹. However, the risk of progression to a full CCL rupture is still high in these patients⁹.

C. Aspects of canine physical therapy

Canine physical therapy is individualistic to both the practitioner and the patient. Within North America, practitioners may be board certified by the American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR), certified canine rehabilitation practitioners (CCRP), or certified canine rehabilitation therapists (CCRT). The latter two certifications can be completed by veterinarians, physiotherapists, or registered veterinary technicians. Rehabilitation therapies with the greatest scientific support currently include therapeutic exercise, manual therapy, pain management, and guided return to function⁸. Therapeutic exercise, a cornerstone of rehabilitation, involves prescribed movements to correct impairments, restore soft tissue and joint function, and maintain quality of life and overall health¹¹. Manual therapy techniques may include effleurage, joint compressions, joint mobilization, passive ROM, and massage⁸. Pain management includes but is not limited to NSAIDs, cryotherapy, transcutaneous electrical stimulation (TeNS), and laser therapy⁹. TeNS, laser therapy, and underwater treadmill therapy are reflected in the literature as supplementary, in that they should not replace therapeutic exercise, manual therapy, pain management, and guided return to function.^{8, 9}

D. Implementation of physical therapy post-CCL surgery: Individualistic patient management

Management of post-CCL surgery patients should adhere to the fundamental principles of exercise therapy including progressive neuromuscular training and dynamic functional tasks⁷. A 2020 invited review, in which specialists in small animal surgery, rehabilitation, sports

medicine, and human physical and occupational therapy reviewed current evidence for post-CCL surgery rehabilitation, supports this guideline⁸. The review suggests immediate implementation of manual therapy followed by therapeutic exercise multiple times each week beginning 2-3 weeks after surgery⁸. It recommends that rehabilitation be guided by the goals of re-establishing normal joint kinematics, resolving pain, and complete return to function⁸. The review put forward four principles of small animal physical rehabilitation including: 1) Tissues follow a predictable pattern of healing which will be supported by the rehabilitation therapist, 2) Treatment plans developed by the therapist should be individualized to the patient and constantly re-evaluated based on tissue healing, strength, and functional abilities, 3) Goal-oriented therapy involving measurable, attainable, and relevant goals must be established for each patient, and 4) While therapeutic modalities may be beneficial, they should be used supplementary to the foundational therapies of pain management, therapeutic exercise, manual therapy, and guided return to activity⁸. A 2022 systematic review reiterates the third principle, recommending that the goals, and subsequent treatment, of each patient must reflect the patient signalment, temperament, impairments, chronicity, owner compliance, and level of required return to function¹². The effectiveness of rehabilitation on three patients with CCL rupture was assessed in a 2022 case report out of Poland¹³. The study concluded that targeted early rehabilitation (which encompassed passive and active ROM, massage, magnetotherapy, ultrasound, electrotherapy, and laser therapy) that accounts for the 8-week bone healing phase post-TPLO supports patients most effectively¹³. They reiterated the aforementioned principle two - treatments must be individualized and constantly re-evaluated - as the case studies involved different signalments, CCL stabilization techniques, postoperative complications, and thus therapy protocols¹³.

E. CCL surgeon perspectives on physical rehabilitation following surgery

An anonymized electronic survey was sent to veterinarians who perform any form of canine CCL stabilization (members of American College of Veterinary Surgeons (ACVS), European College of Veterinary Surgeons (ECVS), American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR), Veterinary Orthopedic Society (VOS), and the German Veterinary Association)¹⁴. Of the 376 respondents, 55% of practitioners recommended formal (39%) or informal (16%) postoperative rehabilitation for all post-stabilization patients, and 23% recommended it for specific cases only¹⁴. Recommendation was more likely for geriatric, sedentary, and sporting and working dogs, as well as those with muscle atrophy and decreased stifle range of motion¹⁴. 16% recommend at least one consultation with a rehabilitation specialist post-surgery, and only 2% of respondents did not recommend physical rehabilitation postoperatively¹⁴. Although widespread support for post-CCL reconstruction rehabilitation amongst those performing these surgeries, there is an even wider desire for resources and guidelines that practitioners can share with their clients^{8, 14}. Almost all (92%) respondents agreed that guidelines for physical rehabilitation would be helpful to them¹⁴. This near-unanimous agreement speaks not only to the difficulty in creating guidelines from newly emerging research, but the complexity of physical rehabilitation in its application and benefits.

F. Practical implementation of physical rehabilitation as a general practitioner

General practitioners with patients undergoing CCL-surgery have two options for offering physical rehabilitation to their clients.

Referral

One available option is to refer the patient to individuals that are certified in veterinary physical rehabilitation. There are varying levels of qualifications that general practitioners should be familiar with in order to confidently recommend their services to clients. A few of the more common specializations include:

1. American College of Veterinary Sports Medicine and Rehabilitation (ACVSMR).
2. Certified Canine Rehabilitation Practitioner (CCRP) or Certified Canine Rehabilitation Therapist (CCRT). These individuals have completed additional online and practical courses pertaining to canine rehabilitation. An example of this certificate can be found through the University of Tennessee and requires individuals passing an examination.
3. Individuals who have completed rehabilitation continuing education courses. Limited examples include courses offered by: Veterinary Chiropractic Learning Centre, Medical Acupuncture for Veterinarians program etc.

In-clinic Management

An additional option of in-clinic management may be necessary if the client is not able to afford referral or if the referring veterinarian doesn't have an appropriate option within the client's geographical area. As general practitioners may lack specific, professional training, basic physical rehabilitation may be provided to patients after appropriate discussions regarding client expectations occur. Educating clients about all their treatment options and providing them practical resources is crucial.

Our recommendation to general practitioners is to prepare a toolkit for managing cruciate injuries post-operatively ahead of time. This may include:

1. Educational take-home documents teaching owners about the disease, treatment options, and management expectations.
2. Examples of home exercises owners can do to promote stifle range-of-motion and optimize return to function. This can be in the form of descriptions, images or links to online videos.
3. Having specific methods for assessing a pet's recovery. This may include requesting clients take videos of their pet performing a particular task at a set interval of time (i.e. walking up stairs every week) or having them keep a daily journal of their pet's progress.
4. Creating specific, individualized goals for each pet and a timeline for their recovery. This can be guided by the time point at which you expect the dog to be able to perform certain tasks. The creation of these goals may both aid in owner compliance and influence the frequency of follow-up appointments this pet will need for progress re-evaluation.

5. Have a Plan B. If this form of management doesn't seem to be working for this specific pet or owner, consider what other resources could be offered.

Pre-surgical Rehabilitation

Physical rehabilitation can also be utilized after a diagnosis has been made but before surgical correction. This is informally known as “prehab” and usually has the goals of decreasing pain and inflammation, restoring range of motion, improving muscle strength and neuromuscular control. The literature to support this on the veterinary side is currently lacking; however, there are numerous studies supporting pre-operative rehab in the human literature. Reddy et. al. compared the results of humans undergoing pre-ACL surgical rehab in conjunction with post-surgical versus post-surgical management alone and found that it helped prepare patients for surgery and had better post-surgical outcomes including greater extensor muscle strength and improved knee function¹⁵.

G. Goals of physical rehabilitation post-CCL surgery

Whether these canine patients post-CCL surgery receive personalized physical rehabilitation management from their general practitioner or from a certified rehabilitation veterinary professional, the goals remain the same. Within the initial recovery period, generally the first 72 hours following orthopedic surgery, physical rehabilitation should focus on reducing the patient's inflammation and pain, maintaining stifle range of motion and promoting vascularization and tissue healing¹². This can be accomplished through massage and manual therapy, cryotherapy, passive range of motion exercises and low-impact isometric therapeutic exercises¹². After the initial inflammatory phase, the goals of physical rehabilitation should shift to restoring weight bearing, balance, proprioception, gait patterning, strength and recovery of function¹². Therapies during this phase of management include therapeutic exercises, aquatic therapies and increasing the animals general activity level over time¹². Therapeutic exercises may include additional equipment such as, but not limited to, a balance disc, physioball, wobble board, resistance bands, land and underwater treadmill, and swimming pools¹². To reinforce the importance of individualistic management, it is recommended to identify the impairments of each patient at multiple points during their recovery and ensure that veterinarians create specific goals that reflect upon patient signalment and temperament, the chronicity and type of injury, client's perspective and compliance, as well as the required and desired level of functional recovery¹². Owner compliance is best encouraged by having specific goals and timelines set for their pet's recovery and having frequent follow-up appointments with their veterinarian to re-evaluate progress and make plan adjustments¹².

Appendix

Canine Cranial Cruciate Injury Management

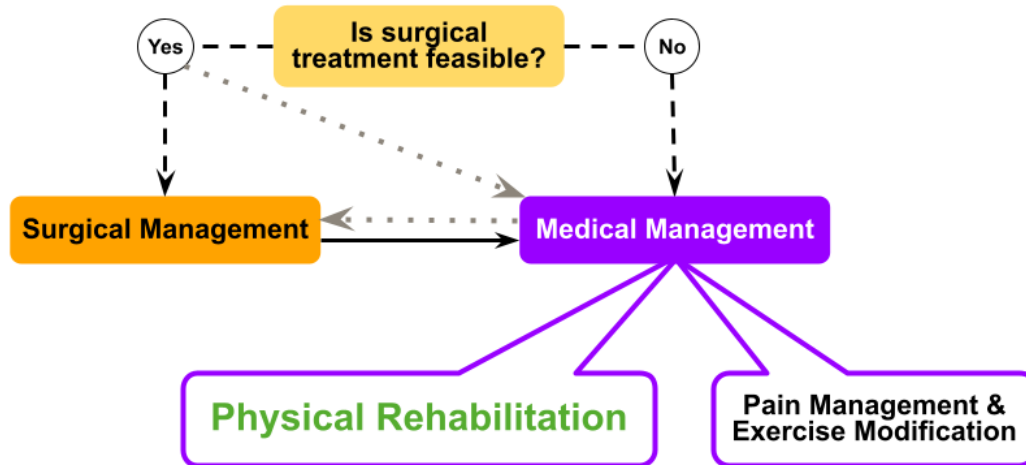


Image A: Flowchart demonstrating clinical reasoning in managing a canine patient diagnosed with a cranial cruciate ligament injury.

Additional Resources

- *Diplomate of the American College of Veterinary Sports Medicine and Rehabilitation*
 - o <https://www.vsmr.org/>
- *Rehabilitation of the cranial cruciate deficient stifle and targeted therapeutic exercise by Dr. Christopher Frye in DVM360*
 - o <https://www.dvm360.com/view/rehabilitation-of-the-cranial-cruciate-deficient-stifle-and-targeted-therapeutic-exercise>

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