Physical therapy or physical rehabilitation has a long history in human medicine and became very popular after World War I and with the polio epidemic in the United States. It is now commonplace for every human undergoing an orthopedic surgery, suffering from musculoskeletal disorders, neurological issues, or other common conditions receive physical rehabilitation. The multimodal approach of reducing pain, inflammation, and improving strength and function is now the standard of care. Dr. Steven Fox, director of pain management at Novartis Animal Health has stated ‘Multimodal management of canine osteoarthritis is rapidly becoming the standard of care. This approach integrates nonmedical modalities – weight control and exercise, EPA rich diets, and physical rehabilitation – with medical modalities (NSAIDs, chondroprotectants, and adjunct drugs).’ In human medicine, the American Pain society issued a statement indicating that the multimodal approach should be practiced in all cases of osteoarthritis.

Physical rehabilitation is appropriate for many cases commonly seen in the small animal clinic. Common cases are inclusive of osteoarthritis, cruciate disease, hip and elbow dysplasia, intervertebral disc disease, soft tissue injuries, degenerative myelopathy, post surgical orthopedic and neurological issues, wound care, and limb deformities. Any condition causing pain and dysfunction may be treated with physical rehabilitation to a degree.

Postoperative conditions, such as cranial cruciate repairs, may begin to receive physical rehabilitation immediately after surgery with applications of cryotherapy, laser therapy, passive range of motion and controlled walking. Canine hip dysplasia may be treated with laser therapy, range of motion exercises, balance and proprioceptive activities, and strengthening through walking in water. Conservative management for intervertebral disc disease may consist of laser therapy, rhythmic stabilization for the spinal and abdominal musculature, active range of motion, and controlled leash walks.

The primary veterinarian refers in appropriate cases to physical rehabilitation, and veterinarians and physical therapists and veterinary technicians depending upon the individual state practice act may perform treatments. Certificate programs exist to assist practitioners in beginning their knowledge on canine physical rehabilitation. It is important to perform a comprehensive evaluation on every rehabilitation patient that will be inclusive of functional deficits, range of motion, goniometry, gait evaluation, pain evaluation, and strength deficits. Often the dog may be presenting for a primary problem, but needs to have secondary and tertiary problems addressed. For example, a dog with canine hip dysplasia often has secondary pain at the iliopsoas and perhaps tertiary pain at the thoracolumbar site. Goals should also be established and reviewed every two weeks with the owners. One dog post cranial cruciate surgery may need to ambulate around their house independently, go up stairs and play the role of companion to
their owner. While another dog with a post cranial cruciate injury may need to return to herding geese off a golf course. Each animal will have a different rehab plan and goals.

Physical rehabilitation may exist in the form of offering services to an existing population of patients within a clinic. For example, offering cryotherapy and laser therapy immediately post operatively will assist with the multimodal approach. Senior dogs will benefit greatly from balance and proprioceptive exercises as part of a home program. More advanced rehabilitation programs may consist of clinics with underwater treadmills, land treadmills, and other fitness equipment. Patients may benefit from home exercise programs, independent home programs, or regular weekly visits to assist with their recovery.

Postoperative patients are probably the easiest cases to begin implementing rehabilitation in your clinic tomorrow. Beginning with cryotherapy, range of motion, controlled standing and leash walking, and balance exercises can be implemented immediately. Laser therapy is appropriate immediately. This patient may then be followed until they reach their goals.

Rehabilitation will be essential for any clinic looking to practice the standard of care in their field. It may be implemented on a basic level or a more in depth level, depending upon the individual goals of the clinic. It will bring more of a comprehensive approach to the field and your facility.
Rehabilitation of Common Rehabilitation Injuries
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Introduction - Forelimb
Injuries to the forelimb complex of the dog are quite common and are often more difficult to diagnose and assess due to the complexity of the area. Soft tissue injuries as well as congenital issues are often the cause of lameness in the forelimb complex. Acute injuries such as sprains are also common, especially with the athletic dog. Elbow dysplasia and the ramifications associated with it are a common problem in the dog.

Biceps Tenosynovitis
*Bicipital tenosynovitis* is a commonly seen problem, especially in the active dog. Conservative treatments are initially attempted, and at times, surgical interventions are required. Owners often describe lameness problems with the forelimb as intermittent, often worsening with activity and improving with rest. A vigorous session of training or competition may have initiated the lameness and a few months history of lameness is common. Traditional methods of nonsteroidal anti-inflammatory and strict or modified crate rest temporarily solve the problem, but as soon as the dog returns to activities, the lameness returns. The specific diagnosis of bicipital tenosynovitis is challenging, especially since it is inclusive of a possible primary tendon disruption or degeneration of the tendon. Both scenarios provide concurrent synovitis of the surrounding synovial membrane.

Radiographs should be performed to rule out an obvious lesion but may prove of little assistance in acute cases. In chronic cases, osteophytes may be viewed along the intertubercular groove. A thorough evaluation of the shoulder should be performed inclusive of range of motion, palpation and manipulation of the shoulder complex. Pain over the bicipital tendon is common, especially at the intertubercular groove with bicipital tenosynovitis. Shoulder flexion combined with elbow extension may illicit pain and a spasm of the biceps muscle. A gait analysis should be performed to determine the severity of the lameness and if any compensations are present. If the dog is intermittently lame, ask the owner to replicate the activity that produces the lameness before the dog comes in for the evaluation.

Acute cases are often treated conservatively with a multimodal approach of nonsteroidal anti-inflammatories (NSAIDS), pain management, and physical rehabilitation. Controlled activity must be instituted to decrease the cause of the inflammation. This often means a cessation of any jumping activity including dog sports, jumping in and out of the car, and jumping on and off furniture. Physical rehabilitation is a strong component in the approach and is utilized to reduce pain and inflammation, restore muscle function, retrain the shoulder complex to perform the desired activities, and return the dog to normal activity. Cryotherapy or ice is a common method of reducing the inflammation of the bicipital region. Ice packs may be applied or an ice massage may be applied to the area. LASER therapy is utilized to reduce the inflammation and pain, promote healing and reduce adhesions. This is applied directly to the bicipital tendon as well as the circumference of the glenohumeral joint. Transverse friction massage is also applied directly to the bicipital tendon. The transverse friction
Massage is applied in sweeping motions perpendicular to the tendon to realign the fibers of the bicipital tendon and prevent adhesions.

In acute cases, avoiding vigorous stretching should prevent micro tears in the biceps tendon. Pain-free and passive range of motion should be performed at the shoulder and elbow. Attention should also be made to the scapulothoracic joint and mobilizations may be applied to this area. There should also be a focus on the restoration of weight bearing on the effected limb with weight shifting exercises. There will undoubtedly be weakness in the postural musculature of the shoulder complex and the atrophy may be controlled with weight shifting and balance activities. Balance activities may be performed on a large theraball, on a rocker board, or on the ground. Leash walking is mandatory and it must be reinforced to the owners about the limitation of jumping activities. Once the lameness has subsided for at least seven days, an increase in activities may be performed and are inclusive of stepping over cavaletti rails, walking in the underwater treadmill, and a progression to jumping.

In more chronic cases, transverse friction massage may be performed for longer periods of time in the attempt to recreate an acute inflammation. Typically ten minutes is adequate and should be followed by stretching of the biceps. Nonsteroidal anti-inflammatories or corticosteroids are not recommended since the desire is to continue the inflammatory process. Stretching involves flexion of the shoulder combined with elbow extension. Stretching should be held for fifteen to twenty seconds and be repeated at least three times. Exercises performed in the acute stages should be performed in the chronic cases with an addition of an increase in activity and a return to function. For example, if the dog is involved in agility, a focus on a return to jumping should be a component of their rehabilitation program. Eccentric activity is required to properly strengthen the bicipital and shoulder complex. Low-level plyometrics should be initiated first. Jumping can be performed on a soft surface, such as soft matting, or sand. Additional controlled activities such as ball playing and running should also be introduced slowly. At no time during the rehabilitation process should the lameness return. This is an indication the shoulder complex is not strong enough to handle the activity and the inflammation and irritation has returned. This will inhibit the healing process. In addition, if the lameness and irritation has not been controlled, surgical intervention and further exploration of the shoulder complex may be necessary.

**Medial Shoulder Instability**

Medial shoulder instability (MSI) has become one of the more common diagnoses seen in performance dogs and may be compared with rotator cuff injuries in overhead athletes in people. The performance dogs’ shoulder complex goes through a variety of extreme angles and forces. Figure 1 depicts the angles the dogs’ shoulder goes through during a turn on the agility course. One can see the force placed on the shoulder complex and the potential for a shoulder injury. Signs of a medial shoulder instability issue can demonstrate as problems with performance (not taking tight turns or avoiding turns), intermittent to chronic lameness, pain with shoulder extension, muscle guarding of the medial shoulder musculature, and excessive shoulder abduction. Depending upon the severity of the instability, treatment
may be conservative with appropriate physical rehabilitation or surgery with appropriate physical rehabilitation after the surgical procedure.

Conservative treatment should be aimed at reducing the inflammation of the shoulder and improving the stability of the shoulder through controlled exercises. Laser therapy, joint mobilization and compressions, soft tissue massage, and range of motion exercises may be performed initially. Balance exercises are imperative to the stabilization of the shoulder and consist of similar exercises described above with the biceps tenosynovitis cases. Stabilization through conservative treatment may take anywhere from eight to twenty weeks depending upon the severity. Some cases may require surgery to stabilize the region. Postoperative management of MSI surgeries is specific and the surgeons’ protocol should be adhered to.

Elbow Dysplasia

*Elbow dysplasia* is a fact of life in many breeds and is the most common cause of elbow lameness and pain in the dog. Elbow dysplasia may be caused by asynchronous growth of the radius and ulna, Osteochondritis dissecans, a fragmented medial coronoid process, or an ununited anconeal process, or a combination. Diagnosis is typically made between four and eighteen months of age.

Treatment of the elbow dysplasia – regardless of surgical or non-surgical treatment – stabilization of the elbow and forelimb complex should be the key concept in treatment. Pain and inflammation should be treated appropriately – a multimodal approach is the best approach and involves a course of pain medications, nonsteroidal anti-inflammatories, and appropriate physical rehabilitation modalities. Modalities very beneficial to these cases include laser therapy, ultrasound, and possibly electrical stimulation for pain control. Moist heat and cyrotherapy are also appropriate for both chronic and acute pain, respectively. If the pain and inflammation are not appropriately addressed, strength and stability will not be regained. The goal with this approach will be to slowly decrease the pharmaceutical interventions and possibly the modalities as well. In some cases, this may not be possible.

Range of motion will need to be addressed through active and passive range of motion exercises, as well as possibly joint mobilization or specific movements to increase the range of the area. Range of motion exercises should be performed to the shoulder, elbow and carpal joints.

Stabilization exercises include balance and proprioceptive exercises on balance discs, boards and foam, walking in the underwater treadmill, walking on a land treadmill, cavaletti exercises, swimming, theraball work, and walking on uneven surfaces. Balance and proprioceptive work is very beneficial to build up the large core muscles of the shoulder and elbow complex. Walking in the underwater treadmill allows the practitioner to exercise the dog while reducing the stress on the elbow. The water height should be filled up at least to the level of the elbow, and in some cases higher, to reduce the stress on the joint. This allows the muscles to function and strengthen while reducing the stress on the joint itself. Core work should be added for the shoulder and elbow stabilizers but also the rest of the body.

Weight loss and weight control play a significant role in rehabilitation of the dysplastic elbow. Once the area begins to function more appropriately through the alleviation of pain and restoration of function, exercise for weight loss is better managed.
Carpal and Digit Injuries

Injuries to the carpal joint and digits are common, but sometimes overlooked due to the focus on the elbow and shoulder. The digits, nails, and pads should be inspected first when looking for a cause of forelimb lameness. Small injuries to the digits or bouts of Sesamoiditis are common, especially in the athletic dog. Carpal injuries may be acute or the result of chronic stresses. Some carpal injuries result in carpal arthrodesis and are a popular rehabilitation patient.

The inflammation and pain need to be addressed initially with the carpal joint and digits. Again, a multimodal approach should be adhered to – with a combination of a pharmaceutical intervention and modalities. Laser therapy works very well on the small joints of the wrist and toes. Ice massage is a wonderful pain reliever and anti-inflammatory for the area. Moist heat is also appropriate in more chronic cases, but may be difficult to apply to the nature of the area.

The restoration of function and movement will need to be addressed both passively and actively. The entire forelimb complex should be attended to since compensations commonly occur throughout the complex. For example, it is very important to stretch the shoulder in to extension in dogs that have undergone arthrodesis to the carpal joint secondary to the compensations.

Strengthening activities include balance activities, walking on uneven surfaces, core strengthening, balance and proprioceptive work and functional restoration. Carpal supports are available in varying supports.

Introduction - Hindlimb injuries and problems are very common in the rehabilitation clinic and will consist of both chronic and acute problems. The cranial cruciate caseload will undoubtedly be a popular patient, as will dogs with canine hip dysplasia. But other diagnoses will also be present. The hindlimb is responsible for generating power and movement of the dog, and this will be an important fact to consider in the rehabilitation of the dog with a hindlimb injury.

Cranial Cruciate Injuries

Injuries to the cranial cruciate ligament are a fact of life in the dog. There are many different surgical approaches to the repair of the cranial cruciate ligament, and approaches to non-surgical treatments as well. It is important to understand the type of repair performed in consideration of the rehabilitation program and any other problems possibly present with the dog, such as canine hip dysplasia or other orthopedic problems. Different surgeons have different approaches to the same technique and this also must be considered in the rehabilitation process.

Immediately postoperative care includes cyrotherapy, laser therapy, range of motion exercises, controlled weight bearing and balance exercises, controlled leash walking, and possibly electrical stimulation for both pain control and neuromuscular education with the hamstring and quadriceps complex. Adequate pain control is another key component. Objective data, such as range of motion, girth measurements, and force plate analysis is performed for a baseline and then monitored throughout the treatment.
One day postoperatively, the dog should be comfortable enough to place the limb down to assist with weight bearing. Cryotherapy may be performed throughout the day for the first three to five days. If the dog is more active, cryotherapy may be continued with. Moist heat is also appropriate at the three to five daytime period, but may not be tolerated well by the dog. Laser therapy should focus on the reduction of pain and swelling and also the healing wound. Laser therapy should be performed daily for an acute setting. Range of motion exercises should be performed to the stifle, hip, hock and toes. Flexion and extension of the stifle should be performed slowly and purposely throughout the day, with approximately two to three sets of ten each time. The hamstrings and quadriceps are the muscles of focus for neuromuscular electrical stimulation. The biceps femoris is one of the easier muscles to stimulate since it is fairly superficial and the motor point is readily accessible.

As the dog progresses, controlled weight bearing is key. Quality over quantity should be adhered with walks. Leash walking is an important component of the home exercise program and owners should understand these needs to be controlled and not performed with a flexi lead or long lead.

Walking in the underwater treadmill may be initiated at suture removal or in some cases earlier, depending upon the integrity of the incision and the surgeons’ and practitioners’ comfort level. Sessions typically start out with the water above the level of the stifle to reduce the stress, and again, quality over quantity is emphasized. The level of the water will reduce the stress on the stifle and the repair. Balance and proprioceptive work is maintained throughout the treatment sessions. As the individual repairs heal and stabilize, additional activity is added. The restoration of function is the goal with rehabilitation and progressive exercises will include balance board, cavaletti walking, theraball exercises, stair work, figure eight walking, controlled ball playing, controlled jogging and running, and then a progression of functional activities. Each cranial cruciate repair rehabilitates different but the same principle should be in place – reduction of pain, restoration of range of motion, and restoration of function. Weight loss if necessary and a home exercise program will be important components of the rehabilitation program.

For a variety of reasons, some dogs with either partial or completely torn cranial cruciate ligaments are not surgical candidates. Physical rehabilitation will not repair the tear but it may improve the dog’s quality of life. If the objective measurements taken at the time of the initial evaluation are maintaining and the dogs’ quality of life is function, a conservative course of rehabilitation may be appropriate.

**Canine Hip Dysplasia**

*Canine hip dysplasia* is another common problem frequently seen in the rehabilitation clinic, both surgically and non surgically. Surgical cases are either seen after a femoral head and neck ostectomy (FHO), a total hip replacement, or other procedures. The key with post operative FHOs is to get the dog moving their hip and weight bearing as soon as possible. Pain control is paramount along with aggressive physical rehabilitation. Range of motion exercises, massage, laser therapy, cryotherapy, weight bearing exercises, and possibly electrical stimulation for pain control is key treatments in the first few days postoperatively. The quicker the dog starts to use their limb, the easier the recovery. The underwater treadmill may be started at suture removal
or earlier, depending again on the integrity of the incision and the comfort level. The level of the water may be brought up to above the stifle to decrease the stress on the limb. Progressions of therapy will include balance and proprioceptive exercises, range of motion, theraball work, cavaletti rails, walking on a land treadmill, figure eights, controlled jogging and ball playing and a restoration of activities. Total hip replacements will follow a similar protocol but a strong respect for the prosthetic implant needs to be adhered to and this will depend upon the type of procedure.

Many of the dogs that come in for rehabilitation have not had surgery – and are being treated conservatively. Pain management is again key and should be adhered to with a multimodal approach. Modalities such as laser therapy, moist heat, and electrical stimulation will assist with the pain control. The lumbar spine, stifles and thoracolumbar area should be examined for compensations due to the decreased movement in the hips. And the forelimbs should also be examined for compensations. Once the pain is under control, balance and proprioceptive exercises are very important. Simple weight shifting may be performed initially to assist with the weight bearing motions. It may then be progressed to balance equipment. Range of motion and stretching exercises should be performed, and maintained in the pain free range. Joint mobilization is very helpful in restoring range of motion and assisting with pain free range of motion and function. Walking in the underwater treadmill, swimming, and possibly land treadmill are beneficial in assisting with the maintenance and increase in strength.

**Iliopsoas Strains**

Acute, stretching-induced muscle injuries are estimated to account for over 30% of injuries seen in a typical human sports medicine practice and have been reported to be the most common injury seen in human general practices. Unfortunately, we do not have specific percentages in canine sports medicine practices and iliopsoas strains may be commonly overlooked or misdiagnosed. They are typically experienced with high power performance events, such as agility, herding, and Schutzhund, and are the result of excessive force acting on the muscle. Presentation of an acute case is a partial or nonweightbearing hindlimb, pain at the musculotendinous unit, possible spasm, and decreased passive and active hip extension.

Initial treatment is aimed at reducing the pain, inflammation and muscle spasm. Pharmaceutical interventions are often necessary in the form of NSAIDs, pain medication and possibly muscle relaxants. Laser therapy, cryotherapy, range of motion in the available range, leash walking, and rest are appropriate treatments in the acute stages. Weight bearing and balance exercises may be utilized to encourage weight bearing in the acute phase. As improvements occur, strengthening may be initiated in the forms of leash walks, underwater treadmill, ball work, cavaletti work, hill work to strengthen the caudal musculature in a concentric fashion and cranial musculature in an eccentric fashion, and balance work. Laser, stretching, and massage are appropriate treatments. Since the origin of the psoas arises from aspects of L2 through L7, attention should be made to the lumbar spine and treated appropriately.

The last aspect of treatment will include a return to activity level. This will be specific to the performance dogs’ activity level. Dogs returning to their performance level should have a sport specific program
Muscular Strains

Muscular injuries are fairly common in dogs, especially the canine athlete. Acute traumatic injuries to muscles and tendons can account for fifty percent of injuries seen in human sports medicine. And while it is not known the exact percentage in canine medicine, muscular injuries may go undetected. The American Academy of Orthopedic Surgeons concluded at their symposium in 1987 that sprains and strains of the musculoskeletal (muscular) tissues cause considerable impairment and pain, and the injuries are often poorly diagnosed and inadequately managed. We can deduce that this is similar in veterinary medicine.

Besides iliopsoas strains, strains to the gracilis, quadriceps, and hamstrings are common in the performance dog. Acute muscular problems are characterized by an acute onset of pain, inflammation, and an inability to fully use the limb. For example, if the gracilis has suffered an acute strain, the dog will be painful and inflamed at the gracilis. Hip abduction will be limited secondary to the fact the gracilis is a hip adductor and will limit hip abduction.

Treatments for acute muscle strains include rest, ice, laser therapy, gentle range of motion, and encouraged weight bearing. Stretching should not be performed in the acute stages in order to protect the muscle and prevent tears of the fibers. Ten to fourteen days post injury, stretching may be initiated. Active motion should also be started and activities such as underwater treadmill, land treadmill, cavaletti rails, balance board, ball work, and increased leash walking may be also be started. Massage, passive range of motion, laser and stretching may also be done at this point. Cross friction massage is also advisable. As the dog continues to progress, a gradual return to performance events should be implemented.

Ligamentous Sprains

Ligamentous sprains may be seen in all joints in performance events, in particular the cranial cruciate ligament, the medial collateral ligament of the stifle, ligaments of the digits and the carpal ligaments. Appropriate modalities, such as cyrotherapy and laser, should be initially applied as well as appropriate support for the ligamentous tear especially on a distal joint. Cranial cruciate ligament sprains should be treated appropriately and many of the performance dogs require surgical intervention.

Ligamentous strength returns to approximately sixty percent of normal strength, so the strength of surrounding area needs to be considered. A heavy emphasis should be placed on balance and proprioception. For example, if the dog damages any of the carpal ligaments, care should be taken to stabilize the region with a brace or support. The inflammation should be reduced and activities should be returned to if possible. Balance and proprioceptive exercises should be a main component of the rehabilitation program.

4 Kirkendall et al.
5 Saunders DG, Get on the ball. Clean Run Productions, Chicopee, MA Clean Run, 2007
6 Saunders DG. Get on the Ball 2. Clean Run Productions, South Hadley, MA Clean Run 2009.
The Management of Cranial Cruciate Ligament Injuries
Debbie Gross, DPT, MSPT, Diplomat ABPTS, CCRP

The cranial cruciate ligament, commonly known as the CCL, ACL or the anterior cruciate ligament, is one of the most popular injuries seen in the dog. There are many reasons why dogs tear their CCL, and some predisposing factors. Some of the predisposing factors include the following: overweight dogs, active dogs, athletic dogs, hormonal components, and certain breeds are at a higher risk. One study published in 2003 in the Canadian Veterinary Journal presented the following data: Labrador retrievers 21.6%, Poodles 9%, German Shepherd dogs 8.5%, Golden Retriever 4.6%, and Rottweiler 4%. The same study indicated female dogs are more likely to rupture their CCL then male dogs – 65% females compared to 35% males. With regard to overweight dogs, it is well documented that weight plays a key role in the development of CCL related injuries. One study indicated body weights of dogs with ruptured CCL were significantly greater than those of control dogs. In addition, dogs weighing greater than 22kg or 48.5 pounds had a higher prevalence of CCL ruptures. This greatly increased the prevalence of bilateral CCL ruptures, or the ruptures of both stifles.

Additional information on CCL ruptures has pointed to a decrease in incidence in either intact males, intact females or in late neutered females. In early neutered dogs, the occurrence reached 5.1% in males and 7.7% in females increases compared to intact and late neutered dogs. There is often a significant debate on the effect of neutering and spaying on CCL injuries.

So, what is the best treatment for CCL injuries? I think this is very dependent upon the owner and the dog, in addition to the lifestyle we are looking at. We have been taught that surgery is really the only option, and it certainly is for many dogs. However, it may not be the right option for all owners and dogs. In one study, it was indicated, “The ideal treatment modality for cranial cruciate ligament injury has yet to be determined...” Consumers do want options on the treatment of CCL injuries. A few other studies have discovered that cutting does not cure cruciate disease and pointed to the fact that about half of the Labrador retrievers rupture the contralateral CCL within six months after a tibial plateau leveling osteotomy. Some studies have also indicated a higher incidence of osteoarthritis after CCL surgery.

With all of this information, we do know that CCL disease is very complicated and there may not be a quick answer to the problem. In complicated chronic cases, the unrelenting course of CCL disease in dogs emphasizes the need to try a conservative approach first. A surgical option may be pursued at any time, but so many owners will appreciate a conservative approach first. Even in humans who usually acutely rupture their ACL, many physicians advocate rehabilitation initially. Strehl et al related at present, there are no evidence-based arguments to recommend a systematic surgical reconstruction to any patient who tore his ACL. So research for non-surgical approaches for humans and dogs are growing. There is no evidence supporting crate rest only. A combination of rest and a multimodal approach is recommended to successfully treat the CCL injury.

However, it is very important to examine the size and the age of the dog. The Rottweiler is obviously a large dog and full of power and stamina. A young, and this
is a loose term, Rottweiler may do better with a surgical approach, especially if they are active. The goal of surgical intervention for patients with a torn cranial cruciate ligament is to improve the dogs’ comfort level and to optimize their level of function. This is not to say that a conservative approach cannot be attempted. Then there is the examination of what type of surgery should be performed.

Two of the more common surgical procedures for CCL injuries are the Extracapsular stabilization and the tibial plateau leveling osteotomy (TPLO) and the tibial tuberosity advancement (TTA). The Extracapsular stabilization involves an artificial stabilizer, similar to a very strong fishing line, to restrain the abnormal movement of the knee or stifle. The goal of the surgery is to stop or neutralize the abnormal movement, and allow scarring and fibrosis to occur. Normally, fibrosis is not a good think in the body, it is considered ‘normal’ here in regard to decreasing the movement. Some of the pros of this surgery is that is often less expensive than the other surgeries, and possibly less invasive. Some of the cons of the surgery are inclusive of early failure if there is too much activity too soon, and it is often not recommended for the active dog due to the high risk of failure before the scarring and fibrosis takes place.

The TPLO is considered the most common procedure performed to address the knee affected with a cranial cruciate injury in large, athletic dogs. The TTA is another similar procedure that is also utilized to stabilize the knee in large athletic dogs. Both of the procedures involve cutting or an osteotomy of the tibia, the lower bone of the leg, to modify the knee to offer stabilization. Implants are used to stabilize the cut and help alter the angle of the knee. Pros of these surgical procedures include less movement of the tibia on the femur (lower leg on the upper leg), and perhaps a quicker return to function. Cons of the surgical procedures include fixation failures, and fractures related to the implants. Of course, as with any surgery, there are risks with all types of surgery that include infection, rejection of a foreign substance in the body, and gait abnormalities.

Whether you chose the conservative approach, or one of the different types of surgery, you need to decide what will work best for you, your dog, and your lifestyle. If you do chose surgery, I think it is crucial to chose a surgeon that is comfortable with the surgery and the recovery. You will definitely want to chose a surgeon that performs the surgeries throughout the week and has a good outcome. There are certainly what I call ‘deal breakers’ to a conservative approach. These are cases that will most likely not respond to conservative care and should significantly consider a surgical procedure. Some of the deal breakers are inclusive of meniscal damage, non compliant owners that will not be able to follow instructions of rest and avoidance of running and playing, no improvement with four weeks of conservative therapy, and of course if the dog is in pain and discomfort and cannot function. Meniscal damage may be confirmed by the veterinarian and/or board certified orthopedist. Inflammation and dysfunction will continue with the meniscal damage. Some owners will readily admit they will not be able to do modify crate rest and leash walks to comply with a conservative approach. They may be better with a surgical approach, although, compliance will be key to a surgical approach as well. With a conservative approach, objective data (gait analysis, girth measurements, lameness scale, range of motion, a pain scale,
and function) should be obtained and reassessed each week. If there has been no improvement within four weeks, the dog is most likely a candidate for a surgical approach or another form of treatment. And of course, if the dog is in so much pain and discomfort, treatment should be pursued immediately.

Conservative treatment begins with a commitment from the owner regarding a strict restriction in activity. Walks must be kept to a leash walking only, and this must be a slow controlled leash walk. In addition, the leash walks should not be pushed towards an increased lameness and every attempt should be made to reduce the lameness. No jumping, playing with other dogs, playing in the backyard, or running around the house is allowed. Slow walking up and down stairs can be done if necessary, but should be limited significantly. Walking down the stairs places more stress on the knee. It is important owners understand that the conservative method does not always work, and may be just as costly and lengthy as a surgical procedure. In addition, it will not fix the damaged cranial cruciate ligament but rather encourage scar tissue and strengthening of the surrounding musculature to allow a good quality of life. If the conservative approach does not work, the approach should improve the dogs’ body condition to prepare the body for surgery.

A multimodal approach should be taken to address the dog as a whole, the pain, the inflammation, and the dysfunction. It is imperative to reduce the pain and inflammation, and that may be performed in a variety of methods. Non steroidal anti-inflammatories (NSAIDs) will assist in the reduction of pain and inflammation, encourage healing, assist with beginning rehabilitation earlier because the dog is pain free or in less pain. Pain medications are another component that may be combined with the NSAIDs. Homeopathic methods may be utilized to help reduce the pain and inflammation and work very well with some dogs. Cyrotherapy, or ice, is an easy method to reduce the inflammation. And modalities, such as laser therapy, and electrical stimulation for pain are also very options. Acupuncture and massage are other methods that may be combined to assist with the pain and inflammation.

Chondroprotectants, such as glucosamine, MSM, and chondroitin, are an important component in the treatment of cranial cruciate deficiency. Adequan injections are another component that assists with healing damaged cartilage early, interferes with destructive enzymes and also slows the progression of osteoarthritis. Some considerate it an essential component in the care of the osteoarthritis and the care of the cranial cruciate deficient knee.

Weight loss is a huge component and an honest look and analysis of the dog’s weight is so important. Excessive weight puts added stress on the joints, which in turn contributes to the degenerative joint disease. When there is damage to the cranial cruciate ligament, the stress is even more severe. One pound of excess weight equals fours pounds of additional shear force placed on the joints. It is much better to try to maintain a leaner weight with a dog dealing with cranial cruciate injuries.

Rehabilitation is an important component in the treatment of cranial cruciate injuries, whether it is conservative or surgical. The goal of rehabilitation will be to combine treatments with the multimodal approach to reduce the pain and inflammation, improve strength and range of motion, and restore function. The
multimodal approach is accomplished in a variety of methods inclusive of modalities, range of motion and stretching exercises, therapeutic exercises, functional activities and a comprehensive home program. Of course, part of the home exercise program is a conservative approach at home with restricted activity.

Modalities may consist of laser therapy, cryotherapy, electrical stimulation for both pain and muscle reeducation, moist heat, and therapeutic ultrasound. Therapeutic exercise may consist of balance and proprioceptive exercises, low level strengthening activities, underwater treadmill, and functional activities. Manual therapies may include massage, stretching and range of motion, and joint mobilization.

Additional options include bracing to assist with the stabilization of the stifle. The brace will help take the ‘place’ of the cranial cruciate ligament, by stabilizing the movement of the tibia on the femur. It will then allow scar tissue to form and stabilize the stifle as best as a non-surgical option. The brace will stabilize the stifle from the outside, and is worn during the day and taken off at night. Some dogs tolerate the brace very well, while others do not. The braces are custom made and are obtained fairly quickly.

Postoperative rehabilitation should be performed as soon as possible and will be inclusive of ice, range of motion exercises to bend and straighten then knee, and balance exercises. Ligaments help with balance and proprioception so this will be a key component in helping them gain their strength and function. Rehabilitation progressions include more advanced balance work, strengthening, stretching, underwater treadmill, swimming in the later phases of rehabilitation, land treadmill and functional activities. The whole process may take anywhere from three to six months to get full function back.

There are many reasons to not pursue cranial cruciate surgery, but it is important to determine if the reasons are good for your dog. And there are many reasons to pursue surgery, but it is likewise so important to determine if this is the right step for your dog, as well as the type of surgery. Success is highly likely if a great plan is followed.

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Harasen et al.


Jones et al.

Jones et al.
Neurological patients are prevalent in the small rehabilitation clinic, and they are wonderful candidates for laser therapy. The application of laser therapy is beneficial in the reduction of pain and inflammation, potential never regeneration, increased blood flow, and increased axonal growth. Clinical applications include postoperative intervertebral disc disease, conservative intervertebral disc disease, degenerative myelopathy, acute neurological trauma, plexus damage, and neuropathies secondary to inflammation.

In the cases of postoperative cases, laser will assist with the reduction of pain, inflammation, and the initiation of healing. Laser will also be very beneficial to the fresh wound and initiate a wound healing response. In conservative management, laser will also assist with the pain and inflammation control and reduction. It will also demonstrate an increase in recovery time and potential increase in the conduction of the nervous system. The laser may be applied directly over the spinal region and the incision if present.

Degenerative myelopathy is a difficult diagnose to give and difficult for the owner to accept. Many treatment options exist in various forms, but unfortunately many of the results are minimal and the prognosis is often grim. In an article by Kathmann et.al., daily controlled physiotherapy was demonstrated to increase survival time in dogs with suspected degenerative myelopathy. Animals receiving physiotherapy had longer survival time with a mean of 255 days compared to animals that did not receive physiotherapy with a mean of 55 days. Rehabilitation is often recommended for dogs diagnosed with degenerative myelopathy and common therapies include active exercises, passive range of motion and exercises, owner education, skin protection and integrity education, massage, aquatic therapy and thermal modalities. Goals of treatment include the maintenance of movement and postural strength for as long as possible. Laser therapy offers a promising adjunct to the approach to cases of suspected degenerative myelopathy.

While it is known at this time, there is no cure or specific therapy for degenerative myelopathy. The goals of treatment are the prolonged and improved quality of life. By principle, the photonic energy of laser stimulates the photoreceptors on the mitochondria to decrease the reaction time for cytochrome c to become cytochrome c oxidase. This facilitates the increase in the cellular respiration rate and increases the blood flow to the region. The photobiomodulation also causes an increase in the circulation of the region receiving treatment. With these facts, it may be deduced that the application of laser therapy will have a positive effect on dogs with degenerative myelopathy to increase the blood flow and circulation to the region. In most of the cases of degenerative myelopathy, the anatomic localization is between T3-L3 and L3-S3. Increased circulation and stimulation of the neural pathways should be beneficial for the dog and their functional and ambulatory status. In addition, many dogs with degenerative myelopathy also have additional issues complicating the
These complications are inclusive of minor disc protrusions, spondylosis, canine hip dysplasia and stifle disease.

In dogs with advanced degenerative myelopathy, degenerative changes are noted in the lumbar dorsal roots. Since photobiomodulation can decrease the inflammation and degenerative changes, can we decrease the rate of changes and therefore the neurological impact?

Based on the study by Kathmann, et al., we started to set up a formalized program for clients referred in to the rehabilitation clinic with degenerative myelopathy or a strong suspicion of degenerative myelopathy. As with every rehabilitation patient, each patient was individually evaluated and his or her problems and goals were determined. Treatment programs consisted of range of motion exercises, balance and proprioceptive exercises, core strengthening, underwater treadmill, joint mobilization, stretching, and laser therapy. Both strengthening exercises and endurance exercises were modified according to the patient's baseline. Laser therapy was consistent with all of the cases. Dosages of 10 to 14 joules/cm² were applied to the anatomic localized region, and epaxials located in the region. In addition, if the dog also had existing orthopedic disease, this was also treated with the appropriate dosages. Many of the German Shepherd dogs had preexisting hip dysplasia.

Standard evaluation procedures including a static force plate evaluation, girth measurements at 70% thigh length, body weight and conditioning score, functional analysis, and owner impression. The functional analysis included ability to walk and transitions. The static force plate was performed at the start and conclusion of each treatment session. The other evaluation techniques were performed every two weeks.

At the time of writing these procedures, we have treated twenty-four dogs with our protocol laser therapy as a staple treatment. Twenty of the dogs tested positive for genetic inflictions with degenerative myelopathy. Board certified neurologists referred fourteen in; six by board certified orthopedists, and four by general practitioners.

All the dogs started therapy completely ambulatory, without the assistance of a sling, cart or harness. Varying levels of hindlimb proprioceptive losses were present, from almost normal to significantly delayed. Ages of dogs varied from eight years of age to fourteen, and all but two dogs were altered.

The recommended course of treatment was twice per week but due to schedule or financial considerations, some dogs were treated once a week or twice per month. The majority was seen twice a week.

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Rehabilitation is an integral part of multimodal approach of the musculoskeletal treatment of many small animal rehabilitation cases. Conditions such as osteoarthritis, postoperative orthopedic and neurological cases, wound management, canine hip and elbow dysplasia and tenosynovitis are commonly treated with rehabilitation services.

**Wound Management**

‘Meg’ is a 9-year-old female spayed chocolate Labrador retriever that was accidentally run over in her owner’s backyard by a family member. She was removed from the middle of the car, and had spent approximately five minutes under the car before she was removed. She was immediately taken to her primary veterinarian and a full orthopedic and neurological examination was performed. Testing revealed no deficits neurologically and no fractures, although she was unable to ambulate. She was placed on tramadol and Derramax and sent home. After five days of progressing pain and inability to ambulate, the owner returned to the office for a re-evaluation. It then started to become evident a large burn was present across her lumbar region. The burn was initially measured 14 cm long and 7 to 9 cm wide at varying spots. Pain medication was increased and an antibiotic was initiated. Over the course of the next few days, the tissue began to slough off and a surgical correction was attempted. The dog was kept in the hospital following the surgery for three days and then referred for laser therapy for wound management. The wound was treated daily for the first four days, and then three times per week while under the owner’s care. Dosages were approximately 2 to 3 joules/cm² for a total of 700 joules. The surgical repair did release at the second week and the owner and referring veterinarian opted for continued laser therapy rather than surgical interventions. The wound was completely healed after 5 weeks from the incident and she began physical rehabilitation for the scar tissue and hindlimb weakness. Normal epithelial migration is expected to be 0.5 – 1.0 mm/day. This far exceeded the normal migration and we saw improvements of at least 1.6mm/day.

**Neurological**

‘Sadie’ is a 10-year-old female spayed Pit Bull that underwent a left hemilaminectomy on 9-30-13 at L2/L3. She presented for an initial evaluation for physical rehabilitation on 10-8-13. She was non-ambulatory in her hindlimbs, but demonstrated deep pain, and good flexor withdrawal. Conscious proprioception was absent bilaterally. Previous history includes bilateral osteoarthritis in her stifles. She belonged to elderly owners and they expressed a strong concern for her ambulation out to eliminate, especially with the winter months coming. Their goals were to have her ambulate independently, and hopefully go for short walks with them again. Treatment was started with laser therapy at the cranial lumbar region with a contact method at 10 joules/cm². The treatment area included the T13 to L5, the bilateral epaxial region and both stifles for a total of 2100 joules. She received
laser therapy twice a week, along with balance and proprioceptive exercises to work on her standing activity. After the first visit, she returned two days later and was able to stand unassisted for ten seconds. The owners were very pleased. After the third visit, she began taking independent steps on land and walked in the underwater treadmill for 8 minutes at 0.5 mph with the water height below the greater trochanter. Sadie continued with treatment twice a week for a month and progressively improved. She was able to go outside to eliminate independently after three weeks of therapy. After two months of rehabilitation, she was at ninety percent of normal according to the owners at home. Clinically she presented with minor deficits in balance and proprioception.

**Soft Tissue Issues**

Lefty is a 5-year-old intact male Bullmastiff with a 6-month history of intermittent left forelimb lameness. Radiographs were clear at the onset and at the six-month mark. Ultrasound revealed inflammation of the biceps and supraspinatus tendons. Lefty is a popular conformation dog and lameness had been noted when he turned into the left shoulder. Dogs walk around counterclockwise with their handler in the ring and the left shoulder is on the inside. He was referred to physical rehabilitation with a two-week prescription of NSAIDS. The initial evaluation revealed a well-muscled dog with pain upon palpation to the left biceps tendon and supraspinatus tendon. Both shoulder flexion and extension were limited compared to the right side. 1.5 cm of atrophy was noted measured at the mid humerus compared to the left side. Cervical range of motion was within normal limits and the rest of the examination was unremarkable. Laser treatment was initiated to the biceps tendon, supraspinatus tendon, glenohumeral joint, and the cervical origins of the biceps and supraspinatus tendon at 6 to 8 joules/cm². Total joules were approximately 1800 and he was treated three times a week initially. Stretching exercises were also performed.
The Business of Canine Rehabilitation
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Physical rehabilitation is a wonderful tool to add to your facility or establish as a separate program. However, it is a business and should be run as a successful business. Physical rehabilitation may be easily added to most existing practices.

Treatment applications include but are certainly not limited to:
1) Pain management (pain of a known source)
2) Osteoarthritis
3) Wound care
4) Postoperative management of pain and inflammation
5) Lick granulomas
6) Soft tissue injuries
7) Athletic injuries
8) Conservative and surgical management of intervertebral disc disease
9) Conservative and surgical management of cruciate disease
10) Hip and elbow dysplasia
11) Dermatological issues
12) Ear infections
13) Degenerative myelopathy
14) Trauma

The financial aspects of physical rehabilitation need to be considered when adding this opportunity to your practice. There are three major reasons for adding physical rehabilitation to your practice. The first one should be a goal of all practices – providing a higher quality of care to your existing patients. The multimodal approach is the standard of care and consists of reducing pain and inflammation while improving strength and function. Improving strength and function is pursued through rehabilitation. The reduction of pain and inflammation may also be addressed through rehabilitation. The second reason is physical rehabilitation will attract new patients to your practice. More and more consumers are seeking physical rehabilitation for their animals based on their research and current marketing in the media. The third reason is to create a new revenue center for your clinic. Physical rehabilitation may be a very profitable component to your clinic or as an existing clinic.

Factors that need to be considered in the addition of the physical rehabilitation include the following:
Will you add to an existing clinic?
Will you build a new clinic?
Do you want a stand-alone facility?
Do you want the facility to be an adjunct to your existing clients?
Who do you hire?
How much staff do you need?
How much space do you need and what space can you spare?
What is the necessary equipment?
What should you charge per visit?
Who will be your target audience?
How many patients do you need to see a day to break even?

As with any good business plan, the cost of the new service should be entered into the plan and the appropriate charges set. In a general veterinarian practice, identity and notify potential clients that are appropriate for rehabilitation services. A personal letter or card to the clients adds a nice personal touch and your confidence behind the new addition to your practice. Target all geriatric patients, patients currently on NSAIDS, cortisone, and neutraceuticals. Many clients are looking for a method to decrease their pets' NSAIDS and this is a good promotional tool.