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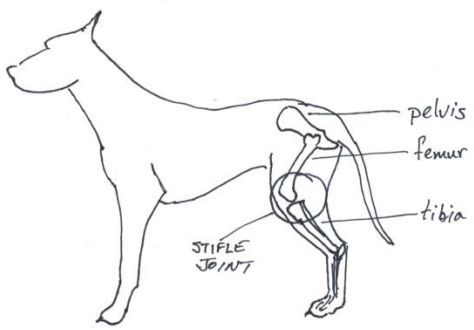
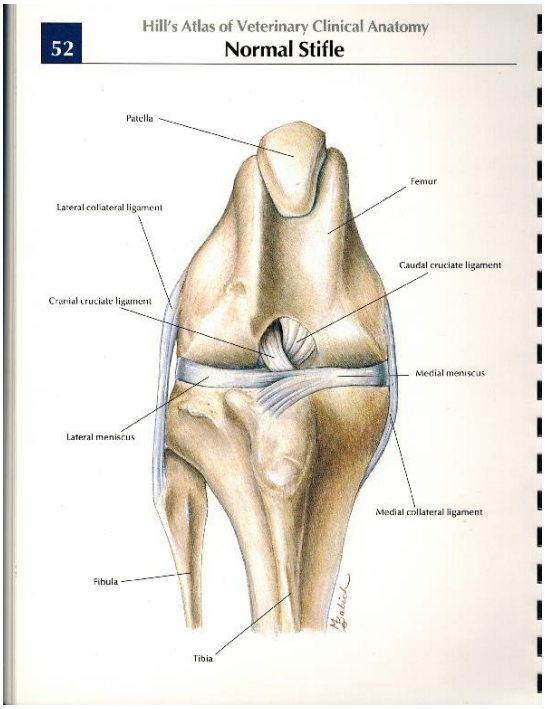
Cruciate Ligament Disease

The Cranial Cruciate Ligament

The cranial cruciate ligament (CrCL, aka in humans anterior cruciate ligament or ACL) is one of several structures in the stifle (equivalent to our knee) that provide joint stability and allow normal function. The stifle is the joint formed by the femur, tibia and patella ("knee-cap") and is a basic pulley system that allows the lower leg to swing in a backward and forward direction like a pendulum. Four ligaments prevent motion in other planes; two collateral ligaments that prevent side-to-side motion and two cruciate ligaments (because they cross each other) that prevent the tibia moving backward and forward independently of the femur. The cruciate ligaments also help limit internal and external rotation of the joint. Two other structures that help form the contact surface of the joint which are also very important are called the lateral and medial meniscus (plural: menisci).

The cruciate ligaments together provide rotational stability to the joint; ie they limit the internal and external rotation that is possible. They do this by locking against each other when excessive rotational force is applied to the joint. If the cranial cruciate ligament is damaged, this motion is not checked and internal rotation may occur. This finding is variable between dogs; some dogs have significant problems with rotational instability while others seem to have far less issues. This is generally determined during the gait exam.





The purpose of the CrCL is to prevent cranial tibial thrust – motion of the tibia in a forward and upward direction**. Rupture of the CrCL allows this motion to occur, which precipitates most of the problems that happen with cruciate disease.** This is a very important concept as it underpins the repair techniques used to correct this problem.

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How Do I Know If My Dog Has Cruciate Ligament Disease?

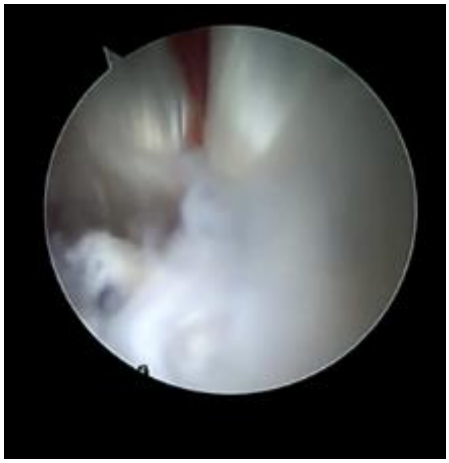
Only a veterinarian can diagnose cruciate disease by performing a proper orthopedic examination and obtaining x-rays. A number of signs can occur that suggest cruciate disease and any hind limb lameness that occurs in your dog should be evaluated. **The vast majority of dogs presented for hind limb lameness will have cruciate ligament disease as the cause**.

Cruciate ligament disease can occur in a dog of any breed and any age. Unfortunately, this is often a bilateral disease; approximately 40% of dogs that have cruciate disease eventually have it in both legs. Some breeds of dogs are predisposed to bilateral disease: Labrador retrievers, Mastiffs, Newfoundlands and Bernese Mountain dogs are some examples. Concurrent orthopedic disease such as hip dysplasia and patellar luxation (dislocation of the "knee cap") can occur and may contribute to cruciate disease. It is important that these problems also be recognized and addressed.

When you present your dog to your veterinarian for a lameness problem, a complete orthopedic examination is appropriate to obtain a proper diagnosis. The lameness exam should include a gait evaluation, a complete physical examination including a detailed examination of all 4 legs with the dog awake, and a proper orthopedic examination. The orthopedic examination itself is a very detailed examination of all 4 limbs and all of the joints of those limbs. This examination must be performed under sedation and includes a number of manipulations and physical tests to determine the full extent of any existing orthopedic problems. Good quality, properly positioned radiographs of any affected limbs and joints are then obtained to assist diagnosis and plan appropriate treatment.

Cruciate Disease, Progression and Arthritis

Rupture of the CrCL can either occur acutely in association with an event or chronically by tearing slowly over time until complete mechanical failure occurs. We sometimes refer to these chronic cases as a "partial tear". In dogs, cruciate disease is a chronic, degenerative disease; traumatic injury is uncommon even though to the owner it often appears as an acute event. **It is not an injury**, as happens in humans. It follows a typical, predictable and inevitable progression, from partial tear to complete tear to torn meniscus. When chronic disease is present or a torn ligament goes unrepaired, arthritis begins to develop and other structures in the stifle can become damaged. All patients with cruciate ligament disease will follow this progression if this disease goes untreated.



This dog has a partially torn CrCL. The tear is the disorganized tissue to the lower left. The caudal cruciate is visible in the background.

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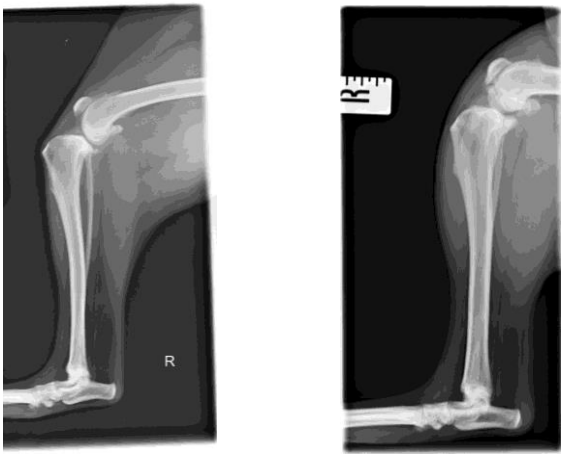
The meniscus can be torn resulting in significant pain and worsening of the lameness with an escalation in the rate at which the joint degenerates and arthritis develops. Approximately 50-60% of dogs with complete cruciate rupture have a damaged or torn meniscus at the time of surgery. Meniscal injuries are dealt with at the time of surgery; the damaged tissue is removed and any functional tissue is preserved whenever possible. In dogs that have an intact meniscus at the time of surgery, approximately 2 to 5% will tear it at some later point.

The severity of disease and the rate at which it progresses is directly related to the weight of the dog – the heavier the dog the more severe and rapid the development of disease. **Regardless of size, this is a surgical disease.** All dogs, including those under 10 Kg, will have a better outcome with surgical treatment. There is no way around this reality and failure to address this disease surgically will usually result in severe and rapid progression of disease. Dogs treated early, such as those with a partial tear, have a much better long-term outcome than those that present with more damage.

A dog that has cruciate disease usually presents with a non- or partial weight bearing lameness that fails to resolve with time. If the injury goes undiagnosed or unattended, the dog may initially appear to get better and the lameness may appear to nearly resolve. If the dog is receiving medical treatment during this time the lameness may appear to have been "cured".

Cruciate ligament tears do not heal and will always get worse if left untreated. We now understand that it is the exposure of the torn internal structure of the ligament to the immune system that brings about its ultimate destruction. It is at the point that a partial tear develops that the patient has a surgical disease; failing to act at this point will simply allow further damage to occur to the joint and puts the cruciate ligament in the opposite leg at risk due to over-loading. **Dogs that do not have timely treatment are at very high risk of tearing the cruciate ligament in the other leg.**

The goal of surgery is to restore normal function and mitigate the development of further damage and arthritis. With timely management the dog can be expected to have a normal life expectancy with good function and normal quality of life afterwards, especially with some of the newer surgical techniques in current use.



1. The radiograph on the left shows a dog that has a recently ruptured cruciate. The joint shows no evidence of arthritis. 2. The radiograph on the left shows a dog that had a ruptured cruciate that went untreated for 12 months. The joint is severely arthritic. This dog was non-weight-bearing on this leg at presentation.

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Medical Management

As mentioned previously, patients with cruciate disease require surgical repair. However, medical management is necessary to protect the joint and keep it healthy pending surgery, in the perioperative period, and for the rest of the patient's life thereafter. It is important to understand that surgery is a very important event, but management of cruciate disease is life-long. No matter how good a job the surgeon does, some arthritis will develop over time. The goal of all therapy, including surgery, is to minimize the development of arthritis so that the dog can live a normal, healthy and pain-free life. Simply investing in surgery and failing or refusing to follow instructions regarding long-term management will result in poor results and poor long-term outcome, often within months following surgery.

It is also important to understand that arthritis is not a disease. Hip dysplasia, cruciate ligament disease, elbow dysplasia, etc, are diseases. These diseases cause inflammation; arthritis is simply the chronic, bony, permanent, degenerative change resulting from unaddressed chronic inflammation. As such, the goal of **all** of our therapies is to prevent or suppress inflammation, thereby preventing the development of arthritis. Attempting to treat arthritis is generally unproductive – at that point it is too late, permanent irreversible damage has occurred.

Medical management may consist of one or more of the following: NSAIDS, laser therapy, joint diet/dietary management, chondro-protectants and biological treatments such as platelet-rich plasma. Which therapies are chosen depends on the particulars of the case, the degree of arthritis present, the size of the dog and the client's preferences**. Ideally, our long-term goal for all of our patients after surgical repair is to manage them with chondroprotectants and joint diet alone.** Understand that these long-term treatments are not optional – failure to comply with the specific diet and chondroprotectant regimen prescribed is likely to result in long term problems after surgery. Some patients may also require other treatments such as occasional laser therapy or medication to keep them functioning normally. A brief description of these therapies is listed below.

Weight, Diet and Cruciate Disease

In any patient with any orthopedic disease, the most important factor impacting the development of disease, prognosis and treatment is the weight of the patient. This is true with respect to the relative weight of the dog (St. Bernard v. Chihuahua) but especially with respect to obesity. **Regardless of the orthopedic condition, failure to recognize and address issues of diet and obesity will result in treatment failure, no matter how much is invested in treatment and surgery.** Some surgeons have a policy of declining to perform surgery until obesity issues are resolved due to the higher complication rates, increased

difficulty in performing procedures and sometimes demonstrated failure of compliance on behalf of the client. Your veterinarian should provide specific dietary recommendations including a specific diet(s), strict feeding guidelines that include specific measuring instructions and complete diet counselling. Any complicating medical conditions such as hypothyroidism need to be diagnosed and treated.

Please also note, among many other hazards, raw food diets have been definitely demonstrated to be associated with increased rates of post-operative infection. Feeding of these diets will be considered an exclusion for surgery. Any patients being fed raw food diets must be off them completely at least 8 weeks preoperatively. Failing to disclose that your pet has been on one of these diets may put them at significant risk and may cause serious harm to the patient.

Joint Diets – A prescription veterinary diet formulated specifically for addressing joint disease and arthritis in our patients. Therapeutic diets are very commonly employed in the treatment of many diseases in veterinary medicine. By therapeutic we mean something very specific: just like any treatment that we prescribe, these diets produce an effect on the patient that is measurable by some means, that is not present in patients not on that treatment, and that the measured change is large enough to be statistically significant. In the case of the diet we prescribe for joint disease, multiple outcome measures have been described in the veterinary literature.

These diets are designed not only to deal with inflammation associated with joint disease but are excellent at addressing weight issues that will have the most impact on patient outcomes. The product that we use in our hospital is j/D, produced by Hills. We use this diet for a specific reason that is discussed in detail during our orthopedic consults. Joint diets have had a major impact on how we manage joint disease over the past decade, and for many dogs on monotherapy have allowed us to replace drugs with food.

Therapuetants

Chondroprotectants - All dogs with any type of joint disease should be on chondroprotectants (glucosamine, with or without chondroitin) and this is usually prescribed and supplied in our hospital. Please note, glucosamine incorporated into dry dog food is not present in sufficient quantities to have a therapeutic effect – most of it is destroyed during processing as it breaks down under the high temperatures and pressures used to make dry kibble. It has to be added to the food after processing, usually as a top-dressing added at feeding time by the client. For smaller dogs and cats, we have special treats that help us to administer these products reliably.

NSAID's - All dogs presented for cruciate disease initially start on NSAID's as this is our primary means of immediately addressing pain and inflammation. While our other therapies are just as good at addressing these issues they all take a significant amount of time to start having an effect – drug therapy is immediate. Often we will withdraw the NSAID's if possible when other therapies have had time to take effect. A number of options are available, including some newer products that have a reduced incidence of adverse effects.

Laser Therapy – Therapy lasers have become increasingly popular in small animal practice since they became widely available in the past 5

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years. Laser therapy allows us to treat both acute injuries and chronic disease with often spectacular results. It is also extremely helpful for managing post-operative pain, inflammation and swelling and is included in our post-operative management for all orthopedic cases. This treatment has had a major impact on dramatically lowering our post-op

complication rate for a variety of reasons. A separate hand-out regarding this therapy is available.

Surgical Management of Cruciate Ligament Disease

There are a number of surgical techniques currently available for treatment of cruciate disease. The most common are divided into 2 major groups; extracapuslar repair and geometry modifying techniques

Extracapsular Repair

Extracapsular techniques rely on using very heavy suture materials to construct a restraint on the external surface of the joint to provide stability. These repairs inevitably rely on formation of scar tissue and fibrosis of the joint capsule as the repair is expected to break down over time. The two currently most common are the Lateral Fabellar Suture and Tight-rope®. A number of studies have now demonstrated that extracapsular techniques generally do not perform well in the long term and do not provide adequate stability to the joint. We no longer provide extracapsular repairs as a primary stabilization in our hospital, regardless of patient size.

However, the current primary advantage of extracapsular repairs are their ability to provide rotational stability. In patients with identified significant rotational stability(about 15-20%), we will implant a lateral suture as an anti-rotational device ("Veterinary Internal Brace®") in addition to a TPLO. This will be determined during the gait exam based on internal rotation of the stile during loading. It can also be determined intra-operatively by performing an "internal thrust" test after a TPLO is completed and prior to closure.

There is increasing evidence that the Veterinary Internal Brace ® may offer many advantages over a simple TPLO, including added overall stability and perhaps a better long-term outcome. There are studies currently underway to investigate these outcomes that clients may have the opportunity to participate in.

We have performed a very large number of these procedures and our experience with patient outcomes is excellent. It is important to note that increasing the level of complexity of any surgery may increase the potential for complications. This is discussed in more detail with clients on a case-by-case basis during the orthopaedic consult.

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Geometry Modifying Techniques

A number of geometry modifying techniques have been developed over the years but three are currently in common use – TPLO (tibial plateau levelling osteotomy), CBLO (CORA-based levelling osteotomy and TTA (tibial tuberosity advancement). The manner in which these repairs work is quite complex but all involve cutting and repositioning parts of the tibia and plating the resulting fragment in place until the bone heals in the new configuration. They ultimately provide stability by eliminating tibial thrust. These repairs require much greater expertise to perform, have greater potential for serious complications and are generally more expensive. When properly performed these techniques provide excellent results and client satisfaction is very high.

TPLO TTA

TPLO is the most commonly performed repair in North America and is the current gold standard against which other treatments are compared. When properly performed it results in elimination of tibial thrust by rotating ("levelling") the tibial plateau. For some dogs that have very high tibial plateau angles, TPLO is the only appropriate repair method. We also know that TPLO can be protective of partial cruciate tears, in some cases preventing further breakdown of the ligament. Newer implant designs in recent years such as locking screws and pre-stressed/precontoured plates have eliminated a lot of potential complications. One disadvantage of TPLO is that it does not account for rotational instability and can actually make it worse (a complication called pivot shift).

A TPLO is performed by making a circular cut through the back of the tibia and rotating the resulting segment by a predetermined amount to result in a tibial plateau angle of about 6 degrees. The bone segment is held in that position by a special plate where it heals permanently. In our hospital the site is treated with PRP to accelerate healing and mitigate post-op pain. The incisions are closed and the leg is bandaged overnight. The vast majority of our patients receive this procedure, with or without an internal brace.

TTA, CBLO and Other Procedures

The vast majority of patients in our hospital are treated with TPLO as it is the most appropriate repair choice for them. However, there are some situations that may involve a particular patient's anatomy, concurrent disease or other factors that either make TPLO impossible or simply not the best choice for that patient. For patients with unique problems, we offer numerous other techniques to ensure the best possible outcome for them. We have a great deal of experience with these procedures and offer them when appropriate. These are discussed with the client on a case-by-case basis.

Canine Total Knee Replacement

Some patients are presented to our hospital for long-standing problems that have resulted in severe damage to the joint. In some cases we see patients for "second opinions" that have a history of post-operative problems, failed surgeries or highly complex knee problems. Occasionally during the course of what was expected to be a routine case, arthroscopic

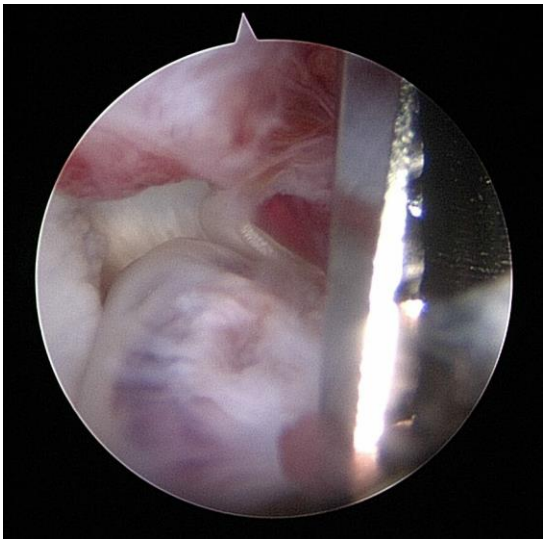
findings may indicate severe, irreversible joint damage. For these patients, conventional therapy may be insufficient to provide them with a good long-term outcome and Total Knee Replacement (TKR) may be the most appropriate treatment.

TKR involves replacement of the entire surfaces of the tibia and femur with titanium and polyethylene implants. In order to accomplish this, the cruciate ligaments, menisci and all articulating surfaces of the joint must be removed. Therefore, TKR is a "one-way street" – there is no way of reversing a knee replacement one this process has been started. When successful, patients are expected to fully recover normal mobility, be pain-free and without any limitations. As with all total joint replacement techniques, TKR is complicated and has the potential for severe complications. A separate handout on TKR is available and an in-depth consult will take place for any patients being considered for this procedure.

Arthroscopy – Addressing the Joint

Stabilization of the joint with TPLO, CBLO or TTA is important but is only half the procedure – the joint itself must be addressed and tissues inspected for damage and removed or debrided if necessary. Addressing the joint is a major part of proper surgical management and should be performed in every single case. The best approach for performing this procedure is arthroscopically.

An arthroscope is both a camera and a magnifying glass – up to 20X magnification. Arthroscopy is performed through 3 or 4 very small holes through which both the scope and miniaturized surgical instruments are passed into the joint. The entire joint is visually inspected and the damaged cruciate ligament is very carefully debrided or removed. Both menisci are also inspected for tears and other damage and treated if necessary. We are also able to perform these procedures far more accurately and precisely than by open joint exploration. Many lesions not visible to the naked eye are very easily visualized and treated with this minimally invasive approach. This is currently considered the gold standard of care for treatment of the joint. **As part of our commitment to provide the highest possible standard of care to our patients, we have invested the necessary resources so that every patient undergoing cruciate surgery in our facility is scoped.**



Ruptured cruciate being arthrocopically debrided with a 3.0mm motorized shaver.

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Post-Operative Care

Client compliance with post-operative care is extremely important – **failure to meticulously follow instructions can, and usually does result in severe complications and treatment failure.** It is our preference whenever possible to provide complete and comprehensive case management for the entire post-op period. Patients are taken in for surgery at 8:15am the morning of and are discharged the following day at 9am. In our practise, we perform laser therapy during the first two weeks post-op to aid with recovery and pain management. Other pain management such as NSAIDs, opioids (codeine), etc, are provided as is a short course of antibiotics.

Rehabilitation is a crucial component of post-op management and is initiated immediately except in the case of an internal brace. Rehabilitation instructions are given at discharge and include passive range-of-motion exercises and controlled leash walks. As we have a canine rehabilitation facility on-site and a Certified Canine Rehabilitation Therapist, we are happy to offer, and strongly recommend, participating in a structured rehab program post-operatively. For out-of-town clients we are able to either make a recommendation to a canine rehabilitation therapist in your area or offer "tele-rehab" through our own program.

Other than prescribed rehabilitation, absolute exercise restriction is necessary and off-leash activity is strictly forbidden. Unrestricted access to flights of stairs in the house is to be avoided, however going up and down exterior stairs to get in or out of the house is permissible (on-leash only!). Construction of ramps or other devices is generally not necessary.

Sutures are removed after 14 days and post-op x-rays are taken at 8 weeks. If necessary owners are instructed to continue with prescribed rehabilitation and restrictions for whatever time period is necessary, after which normal activity may be resumed. For dogs with bilateral cruciate disease, the second surgery can be booked at 8 weeks post-op if the x-rays show sufficient healing.

Complications

As with any surgical procedure, complications can and do occur. Unfortunately, the majority of complications that we see are induced by the owner wilfully not following the discharge instructions, so it is vitally important to follow the instructions as given. The discharge instructions are not difficult to perform but do require some regimentation and self-discipline to complete over the 10 to 12 week healing period. Occasionally, patient compliance can be challenging but can usually be managed with some extra assistance from our hospital staff. Discharge instructions are provided the morning after surgery, which typically takes approximately 20-30 minutes and are provided in writing and highly detailed.

Some of the more common post-operative complications of these procedures include infection, post-operative meniscal tear, patellar tendonitis, implant loosening or breakage, and fibular fracture. Of these, infection and post-operative meniscal tear are the most common. Implant infections are always treated seriously and usually require removal of the implants after healing is complete at approximately 12 weeks. Post-operative meniscal tears can be neither prevented or caused and may occur at anytime during the dog's life after surgery. They are treated

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arthroscopically by removal of the damaged segment or through a meniscal release.

Clients should be aware that the costs associated with the treatment of complications are the responsibility of the client and are not included in the cost of surgery. These costs may be substantial. While complications will usually produce lameness and certainly have nuisance value, they rarely affect the long-term outcome of the surgery.

Cost

The cost of these procedures is as follows:

Orthopedic exam: $450 + HST
(includes consult, sedation and whatever xrays are necessary)

Cruciate Surgeries:
(includes laser therapy sessions, all routine post-op medications, suture removal, rechecks)

Up to 50kg:
TPLO, CBLO or TTA $3000 + HST
TPLO with Internal Brace $3500 + HST

Over 50kg
TPLO, CBLO or TTA $3500 + HST
TPLO with Internal Brace $4000 + HST

Total Knee Replacement - $4500 + HST

Note that 8-week post-op xrays are **not** included in the cost of surgery: $75 each xray + HST (sedation not included if necessary, usually xrays can be obtained without). If sedation is necessary add $150 + HST

Note that prices are subject to change and should be confirmed at booking.

****A non-refundable deposit of $250.00 is due at the time of booking any orthopedic work-up and/or surgery.****