Anterior Cruciate Ligament Injury & Surgery

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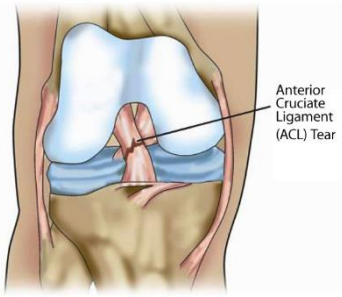
The anterior cruciate ligament (ACL) is a 38mm long band of fibrous tissue that connects the femur (thigh bone) to the tibia (shin bone). Its function is to control knee stability when performing twisting and pivoting actions. The ACL is usually not required for normal daily living activities, however, it is essential in controlling the rotation forces in the knee developed during side stepping, pivoting and landing from a jump. Knees without an ACL may therefore be unable to perform activities involving speed and heights, but usually are fine with normal day-to-day activities and running straight lines.



THE CLASSIC HISTORY OF INJURY

The ACL is commonly injured whilst playing ball sports or skiing in a non-contact fashion. Whilst playing ball sports upon attempting a pivot, side step or land from a jump, the knee gives way after the forces within the knee generate enough force and momentum to rupture or "tear" the ACL. When skiing, the ACL is injured when the binding fails to release as the ski twists the leg. Patients frequently hear or feel a snap, pop, or crack accompanied by pain. Swelling commonly occurs within the hour. Frequently pain is felt on the outer aspect of the knee, but rarely is the lateral collateral ligament injured significantly. The medial collateral ligament of the knee joint may however be injured resulting in severe pain and swelling about the inner side of the knee.

TREATMENT OF ACL INJURIES

The goal of treatment of an injured knee is to return the patient to their desired level of activity without risk of further injury to the joint. The environment within the knee joint, unfortunately, is not conducive to healing of the ACL. Treatment may be without surgery (conservative non-surgical treatment) or with surgery (surgical treatment). Those patients who have a ruptured ACL and are content with activities that require little in the way of side stepping (i.e. running in straight lines, cycling and swimming) may opt for conservative treatment. Surgical treatment is designed to stabilize the joint to allow activities involving side-stepping and landing from jumps at speed.

Conservative Treatment

Conservative treatment is by physical therapy aimed at reducing swelling, restoring the range of motion of the knee joint and rehabilitating the full muscle power of the knee. Proprioceptive (balance and reflex) training to develop the necessary protective reflexes are required to protect the joint for normal daily living activities. This may take months to develop. As the ACL controls the joint during changes of direction, an alteration of expectations and sports to the ones involving straight line activities may be required. Social (non-competitive) sport may still be possible without instability. Skiing is possible with conservative treatment. A brace and adherence to groomed runs may be required. It is known that a small percentage of patients can return to a reasonable level of function with conservative treatment. This number, in most longer-term studies, is usually less than 50%, with some requiring a delayed reconstruction. Experienced clinical assessment is usually required to assist in the decision to manage an ACL injured knee conservatively.

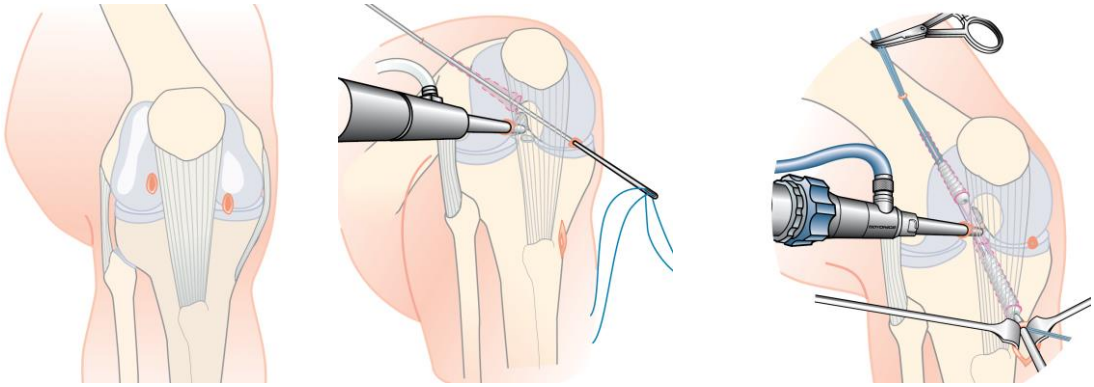
SURGICAL TREATMENT

Those patients who wish to pursue competitive ball sports, or who are involved in an occupation that demands a stable knee are at risk of repeated injury resulting in tears to the menisci, damage to the articular surface, or a lack of trust in the knee. These episodes can then lead to further disability and instability as well as the possibility of degenerative arthritis over the longer term. In these patients, surgical reconstruction is recommended. Studies have shown that this is best carried out on a pain free, healthy joint with a full range of motion. This usually occurs, in most patients without significant injury to other structures in the knee, at about 4-6 weeks after the initial injury with a simple rehabilitation programme.

Long term results suggest that stabilizing the joint protects menisci which reduces the risk of later osteoarthritic degenerative change. Although ACL reconstruction surgery has a high probability of returning the knee joint to near normal stability and function, the end result for the patient depends largely upon a satisfactory rehabilitation and the presence of other damage within the joint. A return to normal stability and function, which includes competitive

sports, can always open the door for the risk of another injury, and this must be accepted and taken into account after a successful rehabilitation period before the decision to return to sport is made.

The **Surgical Procedure** involves a number of steps:



Arthroscopy: Two small keyhole incisions are made, and the inside of the knee inspected with special small camera, called an arthroscope. The torn ACL is removed, as well as any required meniscal surgery.

Graft Preparation: The tissues to be used for the graft can be harvested, if using an autograft, through skin incisions, and then prepared (autograft/allograft) to appropriate dimensions to fit the patient.

Tunnel Drilling: Tunnels are drilled in the bones of the femur and tibia to allow for graft passage and fixation.

Graft Fixation: The graft is inserted into the drilled tunnels and fixed in place with selected fixation devices. This secures the graft in the bony tunnel while healing and remodeling occurs.

GRAFT TYPES USED IN ACL RECONSTRUCTION

All reconstructive procedures for the ACL require a graft which is used to replace the damaged ACL. Regardless of the source, the graft is just a scaffold that the body will remodel into a ligament over time. Grafts can be grouped into 3 types: autograft, allograft, and synthetic. By far the most common graft used, with the greatest number of scientific studies supporting its use, is the autograft. Autograft refers to a structure or tissue taken from the patient's own body. An allograft is tissue taken from another person (living or deceased). Typical autografts used for ACL reconstructions are: hamstring tendon, bone-patellar tendon-bone, and quadriceps tendon. There are specific advantages and disadvantages of the types of autografts, and allografts that may be used in ACL reconstructive surgery.

After ACL reconstruction studies have shown that rates of return to sports and reinjury can vary depending on the specifics of the patient, the sport, as well as the surgical technique. Accordingly, Dr Roe favours an "a la carte" approach over a "one size fits all" approach to graft selection and surgical technique.

Hamstring Tendon Autograft

HT has been the gold standard for many years and revolutionized the ability of ACL reconstruction to be performed as a day surgery procedure. The HT graft is associated with excellent stability and high rates of return to sport. While the vast majority experience no issues with HT harvest site, it may be associated with symptoms (hamstring weakness, pain or fatigue with exercise) in around 7-10% of all patients. HT is the main graft used by Dr Roe, in approximately 70% of all reconstructions that he performs.

Patella Tendon Autograft

PT is the main alternate autograft, and is used in approximately 15% of all reconstructions performed by Dr Roe. It is a stiffer graft than HT, and therefore has a downside of potentially resulting in making the knee a bit "stiffer". It has the more common graft site morbidity of kneeling-pain and pain down the front of the knee when running. In the current "a la carte" approach to graft selection, Dr Roe favours PT in larger male patients involved in contact sports, or "hamstring dominant" type athletes wanting to avoid any chance of impaired hamstring function.

Soft Tissue Allograft

Allograft is tissue taken from a living or deceased (cadaveric) donor. Allografts totally avoid any short or long-term graft-site symptoms, which is a huge potential advantage when undergoing an ACL reconstruction. Additionally

allografts allow the surgeon to precisely construct a graft that is of suitable size to match the recipient, rather than being limited by what can be obtained with an autograft.

Dr Roe has pioneered the use of a live-donor allograft taken from a parent for the ACL reconstruction in a skeletally immature patient or child. Results of these surgeries, performed since 2007, have shown equal or better outcomes as well as the elimination of any graft-site symptoms for the recipient.

Cadaveric allograft has been criticized in past studies due to a higher failure rate than traditional autografts. The failure of these allografts has been thought to be due to older forms of sterilization techniques involving irradiation of the tissue which weaken the material properties of the allograft. Newer sterilization techniques have been shown not to alter the material properties of the allograft and are thus showing some promise in more recent studies for ACL reconstruction.

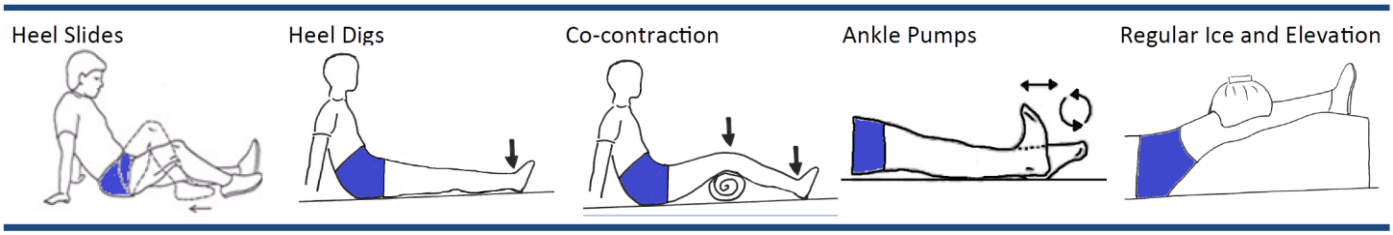
SUPPLEMENTARTY TECHNIQUES - Lateral Extra-articular Tenodesis (LEAT)

The lateral or outside of the knee has for many years been a focus in the treatment of unstable knees due to ACL insufficiency. Along with focusing on graft-types and techniques to fix the ACL, there has been a renewed interest in augmenting or reinforcing the reconstruction with an extra-articular procedure (LEAT). A recent study form Canada has evaluated one technique of supplementary LEAT in addition to ACL reconstruction and compared it to ACL reconstruction alone. Its early results have shown that it may have benefit in reducing reinjury rates. The downside in the short-term was an increased amount of pain from this surgical technique. The advantages in the medium to long term have not yet been shown and there are various different surgical techniques when performing this procedure which are hard to compare accurately. Dr Roe uses this procedure in younger patients with hypermobile joints and certain anatomical factors, as well as those with a positive family history of ACL injury. It acts as “an extra seat-belt” in stabilizing and protecting those knees that are known to be at an increased risk of reinjury when returning to competitive sport.

POST-OPERATIVE CARE AND REHABILITATION

In the vast majority of cases you will be discharged to home on the same day as your surgery, with adequate pain medication and a cooling device. Before discharge you will be seen by a physiotherapist who will help you to mobilise with crutches and give you some simple exercises. Rehabilitation will commence according to a specific and individualized protocol, dependent on the individual patient’s pathology and surgery performed.

Unless directed otherwise, after surgery you may commence the simple exercises below, and arrange to see a physiotherapist who will progress these exercises and guide you through the rehabilitation. Dr Roe’s rehabilitation protocol can be found on his website here



The use of crutches with or without a brace is usually required for a period of time after the surgery and the involvement of a Physiotherapist to assist with the acute recovery and longer rehabilitation phases is expected. In the first week after surgery simple strengthening and range of motion exercises are commenced, along with anti-inflammatory modalities to reduce the side-effects of knee joint swelling. This phase is very similar to the process of recovery from the initial injury that took place prior to the surgery. In the first few weeks, gait retraining and muscular co-ordination exercises will assist in rebuilding confidence to return to simple day-to-day activities.

The process of making a return to each patient’s desired level involves a standardized rehabilitation programme with individualized modifications and progressions based on the achievement of goals and evaluation by the rehabilitation provider and Surgeon. It is well recognized and accepted that the timing of a successful return to sport and unrestricted activity is multifactorial and not solely time-dependent. Most rehabilitation programmes will take place over a period of 12 months with a graduated increase in the intensity and complexity of exercises to achieve a successful return to play. More details can be viewed in Stage 4 and 5 of Dr Roe’s rehabilitation protocol, here.

POTENTIAL RISK & COMPLICATIONS RELATED TO SURGERY

While ACL reconstruction surgery is generally very safe, all procedures carry some potential risks and complications.

Potential Complications related to surgery

- Deep vein thrombosis and pulmonary embolus: Although this complication is rare, a combination of knee injury, prolonged immobilisation, smoking and the oral contraceptive pill or hormonal replacement therapy (HRT) all multiply to increase the risk.
- Excessive bleeding resulting in a haematoma or haemarthrosis (bleeding into the joint) can occur as a consequence of the surgery. This may result in the need for further surgery, immobilization, or medication.
- Nausea and Vomiting: side-effects related to the administration and consumption of medications are common and usually resolve with time and cessation of the medications.

Potential complications specifically related to your knee reconstruction surgery.

- Postoperative bleeding & marrow exuding from the bony tunnel may track down the shin causing red inflamed painful areas. When standing up the blood rushes to the inflamed area causing throbbing. This should ease with elevation and ice packs. This is a normal postoperative reaction and only delays short term recovery.
- Numbness: Around the skin incision(s) you may notice a numb patch on the outer aspect of your leg. This tends to shrink with time and does not affect the result of the reconstructed ligament.
- Graft Site Issues: Depending on the type of graft used, there may be some side effects resulting in muscle weakness, pain or discomfort around the harvest site, or pain with kneeling. These side effects usually occur in a small percentage of patients and don't tend to overshadow the benefits of the surgery.
- Graft failure due to poorly understood biologic reasons occurs in < 1% of grafts.
- Infection: Surgery is carried out under strict germ-free conditions in an operating theatre, and supplemented by antibiotics. Despite these measures, following ACL surgery there is a < 1 in 400 chance of developing an infection within the joint. If this occurs, further surgery and prolonged antibiotic treatment is usually required, and may adversely effect an optimal outcome.
- Repeat ACL Injury: Even with a complete rehabilitation it is possible to have another ACL rupture when returning to sports or risk activities. After 1 year from surgery the reconstructed knee and the opposite knee have equal risk of ACL rupture.

QUESTIONS COMMONLY ASKED

Q. Anaesthetic?
A. General anaesthetic

Q. Duration of operation?
A. Approximately 60-90 minutes.

Q. Do I need crutches? A. Yes. You should bring these with you to your surgery. Unless otherwise directed by Dr Roe, you may take weight through the knee as comfort allows and progress to walking without crutches as soon when comfortable, usually over about a week.

Q. When do I see a physiotherapist? A. Seeing a physiotherapist before your surgery will help the knee recover from the injury, and familiarize with the exercises to be done in the early stages following surgery. You should arrange to see your physiotherapist in the week after surgery. Your physio will supervise your rehab for about 12 months, progressing from weekly to monthly sessions.

Q. What medications should I cease prior to the surgery? A. Any blood thinning medication should be stopped. Notify the Anaesthetist of any medications or drugs that you take regularly.

Q. Driving a car? A. Driving an automatic car is possible as soon as pain allows after left knee surgery as long as you are not taking narcotic medication. If the right knee is involved driving is permitted when you can walk without crutches and are off medication.

Q. How long does it take for the swelling to go away? A. After 8 weeks most of the swelling should be gone. It may return intermittently depending on what you are doing.

Q. How long do I need off work? A. Sedentary and office workers may return to work 2-7 days following surgery.

Q. When can I travel? A. You can travel domestically after 7 days and internationally after 4 weeks.

Q. When can I play sport? A. Training to play sports starts to be introduced after 6 months. A return to non-competitive sport may be permitted at 6-9 months following surgery depending on the sport and recovery. A return to competitive sport is usually expected from 12 months, provided that there has been a complete rehabilitation including a sport-specific programme. Specific sports and goals should be discussed with Dr Roe to establish a reasonable time frame for them to occur.

Q. When do I need to see Dr Roe after the surgery? A. You will return for removal of the superficial dressings and a wound check at 10-14 days from surgery, then at the 6-8 weeks, 6-8 months and finally, at the 1 year after surgery for a clearance to return to competitive sport if required.