# Posterior Cruciate Ligament (PCL) Reconstruction and Rehabilitation

## Patient information

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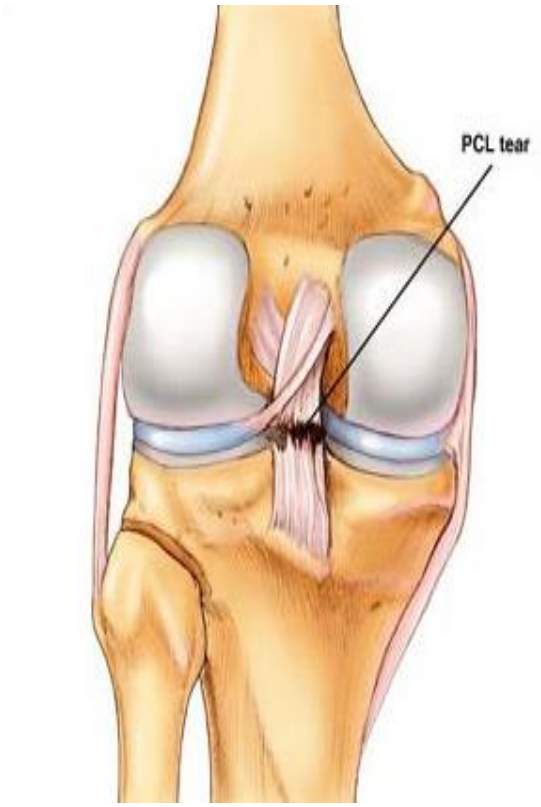
## Introduction

The Posterior Cruciate Ligament (PCL) is the largest ligament in the knee. It is most frequently injured during athletic activity or as part of more significant episode of knee trauma such as a dislocation. With sports becoming an increasingly important part of day to day life and MRI scanning more commonly used in assessing knee injuries the number of PCL injuries being diagnosed has steadily increased. A PCL tear ('rupture') is far less common (20x) than an ACL injury and typically occurs as a result of a different type of knee trauma. The PCL has the ability to heal / tighten over the first few weeks following injury and therefore an initial period of 'non-operative' therapy is always recommended. Seeking a specialist opinion and making an early (first couple of weeks) diagnosis is very important to allow the appropriate splint/brace to be applied.
If surgery is decided upon pre-operative and post-operative rehabilitation is a major factor in the success of PCL reconstruction. It is essential that the patient takes an active part in the rehabilitation both before and after the operation. The aim of this booklet is to inform you about your PCL injury / potential surgical reconstruction and guide you through your rehabilitation with as few problems as possible.

Following surgery, the patient will be involved in a progressive rehabilitation programme for approximately 9-12 months. This booklet contains guidelines for this rehabilitation although the programme will be tailored to each individual.

***What & where is the P<u>CL</u>?***




Posterior view of knee

The knee is a ‘complex’ hinge joint supported by four main ligaments - structures that hold bones together and helps to control joint movement. There are ligaments on either side of the knee (*collateral*) and two ligaments deep in the centre of the knee (*cruciate*). The cruciate ligaments are the *anterior cruciate ligament* (ACL) and the *posterior cruciate ligament* (PCL). Both ligaments attach the end of the thigh bone (*femur*) to the top of the shin bone (*tibia*).

During activity the PCL controls how far the tibia can "slide" backwards relative to the femur. While some degree of motion or sliding is normal - and is essential for normal knee function - too much motion may damage other structures in the knee, which can lead to long term problems. If the tibia is forcefully moved backwards or rotates/extends too far (‘hyperextends’) the PCL can rupture or be torn off its bony attachments. Tearing of the ligament can result in a feeling of instability in the knee. The PCL may not be the only ligament injured when the knee is twisted violently.

One of the problems of tearing the larger knee ligaments is that small ***proprioceptive*** nerve endings in the ligament are damaged. These nerves give the brain information about joint

position in 3D space. The joints rely on these nerves to fine tune the muscles' actions that allow the joint to function properly. Following a PCL rupture *proprioception* is diminished but can be compensated for by specific exercises.

***How is the PCL injured?***

The PCL can be injured or torn in a number of different ways. The most common mechanism is that of a significant blow to the anterior aspect of the knee/shin for example when falling directly onto the front of the knee during sport or hitting the dash board of the car in an accident. Other causes include:

- significant twists or dislocations of the knee
- stretching the knee joint too far to right or left

At the time of the injury a "pop" can sometimes be felt or heard. The amount of pain experienced at the time of the injury is somewhat variable, but can be quite severe especially at the back of the knee joint. Typically, the person is unable to continue play on and has the impression that a significant injury has occurred. The knee may feel “loose”. The knee sometimes swells significantly within the first few hours, but the extent of swelling can be limited if the knee is immediately iced or splinted. In major giving way incidents it is possible to damage other structures in the knee such as the joint cartilage (articular cartilage), mobile cartilages (menisci) and/or collateral ligaments.

***How is a tear of the PCL diagnosed?***

A tear of the PCL can be diagnosed by a physician – usually a knee surgeon - through a history and physical examination. On physical examination the physician can specifically assess the amount of knee motion present and determine if the PCL is torn and assess for any other associated injuries.

X-rays are taken to look for the presence of any bony injury. In most patients a *magnetic resonance imaging* scan (MRI) of the knee will be ordered. The MRI can usually clarify the question of a PCL tear if the history and examination are inconclusive. The MRI is also useful for evaluating the integrity of both articular and mobile cartilages in the knee as this information is often necessary to make a decision regarding the best treatment (and timing) for a specific patient. In some cases an examination under anaesthetic may be required to make the definitive diagnosis if there is a question about what is causing your knee problem. The vast majority of PCL tears are diagnosed <u>without</u> resorting to surgery.

***What are the options if I have a PCL tear?***

***Timing of diagnosis ….***

The treatment options following a PCL tear are individualized for each patient depending on age/activity level and the presence or absence of injury to other structures within the knee. The decisions regarding the 'management' of the knee are also heavily dependent on the amount of time following initial injury. Virtually all acute (less than 3 weeks) injuries are managed in a splint or brace for several weeks. In general, surgery is recommended for younger patients who are active and for those in whom the PCL tear is associated with injury to other structures in the knee.

The main reason to have surgery is to restore stability to the knee so that it no longer gives out or slides too far, which may be uncomfortable or painful. The other – and perhaps most important reason - is to protect the cartilage in the knee from being further damaged, which may lead to degenerative changes (arthritis).

In the chronic (longer term) injury there may sometimes be a role for altering the shape and alignment of the knee (osteotomy) rather than simply replacing the ligament. This is more likely to be recommended if there is some coexisting wear and tear in the joint.

**Conservative *(non-operative) treatment and pre-operative rehabilitation***

PCL reconstruction is not an emergency operation and surgery is usually not required. Proprioception ('confidence') in the knee can improve significantly in the 3 months following injury especially if attention is paid to core and quadriceps strengthening. All patients therefore undergo a rehabilitation programme following injury to improve range of motion, strength and proprioception to determine the level of stability and function they can regain.

Most patients do not require surgery and are able to achieve satisfactory stability with strengthening exercises, activity modification and in some, use of a brace. Sports which do not involve cutting (such as jogging, cycling, or swimming) can often be done without difficulty. In addition to therapy and activity modification, the use of a hinged sports brace may allow the more dynamic sports.

**Surgical Treatment**

Following a PCL rupture, surgical ‘repair’ has not been shown to be effective in the long term. If required far better results are obtained if the PCL is surgically replaced (or reconstructed) with another tendon from around the knee or a donor tendon. There are a number of potential grafts (‘tendons to use’) and methods of fixation for reconstructing the PCL. The exact procedure done may vary from patient to patient depending on the surgeon's preference as well as factors unique to the individual patient.

Following anaesthesia a tight inflatable band (tourniquet) is wrapped around your thigh which restricts bleeding into and around the knee during the operation. A telescope with a camera (arthroscope) is then introduced into your knee through 2 small anterior incisions (approximately 1cm long) which allows a thorough examination of the joint and probing of all structures. The torn ends of the old PCL must first be removed and any meniscal tears addressed. A torn meniscus can be either repaired or trimmed (*meniscectomy*).

Once this has been done, the graft is ‘harvested’. The most common graft is to combine two of the hamstring muscle tendons that attach to the tibia just below the knee joint - the gracilis tendon and the semitendinosus tendon (the hamstrings**)**. Studies have shown that these two tendons can be removed without affecting the strength of the leg. There are other, much bigger and stronger hamstring muscles that can take over the function of the two tendons that are removed. The surgeon will usually harvest the graft from same leg that is being operated on. However if the quality of the graft is poor he may use your other leg for the graft. Alternatively a donor tendon(s) can be used which does not require any ‘harvest’.

Using one or two small incisions, tunnels are drilled into both the tibia and femur. The graft is threaded across the knee in the position of the original PCL, thus reconstructing the ligament. The graft is then secured in this position, most commonly by "suspending" the graft from a loop secured onto the outer surface of the femur and a screw compressing the graft into the tibial tunnel. These screws and/or staples can be left in place permanently. The skin is closed with stitches.

It is not possible to reproduce the normal anatomy of the knee completely but, the surgery along with intensive physiotherapy rehabilitation is aimed to produce a functionally stable knee for both activities of daily life and sport.

Surgery is frequently performed as a day case (no overnight stay) and then several months of intensive physiotherapy to restore normal movement, strength, flexibility and proprioception.

**What should I expect from the surgery?**

The aim of the surgery is to prevent the knee giving way and allow individuals to return to sports with a stable knee. However often the patients sporting aspirations have changed by the end of the rehabilitation and they return to sport at a lower level.

The new ligament is no weaker than the original and the rate of re-rupture is the same as rupture of the other knee cruciate ligament. However the results of PCL reconstruction are not as good as ACL reconstruction and frequently some laxity may develop in the graft at 6 months although this frequently does not affect the confidence or function.

A good or excellent result can be expected in 60-70% of cases. This is dependent on the rehabilitation following surgery and partly dependent on the time elapsed since the initial injury.

The long term outcome and risk of degenerative arthritis within the joint are unknown as yet.

## Consequences & potential risks / complications of PCL surgery

### Consequences of a surgical procedure

**Pain**
Some slight discomfort is to be expected following every type of surgery. You will be given medication to control the pain both post operatively and on discharge.

**Anterior knee pain**
Patients often complain of some pain / swelling at the front of the knee affecting kneeling, squatting etc. Your physiotherapist will try techniques to reduce this pain.

**(Unsightly) Scarring of the skin**
Most wounds heal to a neat scar but thickened, red and painful scars may occur especially in Afro-Caribbeans.

### More common complications (2-5%)

**Blood clots (Deep Vein Thrombosis)**
These can occur in the lower legs following such surgery and can occasionally enlarge and move through the blood stream to the lungs (pulmonary embolus). Blood thinning medication can be given to reduce this risk but when there has been surgery involving the drilling of bone tunnels the risk of excess bleeding and bruising significantly exceeds the risks of clots and it is usually not given.

**Numbness**
A large proportion of the procedure is carried out at the back of the knee close to the large nerves that travel down the back of the leg. This does put them at risk of significant damage. Sometimes due to the amount of fluid stretching the back of the knee (for visualization) there may be some generalized numbness in the lower leg after the procedure which resolves over the next few days. You may also experience some mild long term numbness on the anterior of your shin close to your scars following surgery.

**Swelling / Bleeding into the knee**
Post operatively blood can collect in the knee joint. In most cases it will be absorbed by the joint itself but occasionally excess fluid/blood may require an operation to drain the joint.

**Less common complications (<1%)**

**Infection**
The wound sites may become infected - this usually settles with antibiotics. Very occasionally a further operation may be needed. Deep infection within the knee joint is rare. Antibiotics are given at the time of the surgery to prevent this. If this occurs a further operation will be required to wash out the joint.

**Graft rupture**
The graft may rupture spontaneously or after further trauma. Further surgery may be necessary.

**Compartment syndrome**
This is a build up of pressure with the lower leg and causes pain, muscle damage, nerve damage and interruption to the blood supply. If this occurs it requires an emergency operation to release the pressure and prevent further damage.

**Loss of balance / proprioception**
Despite it being functionally stable, the knee may feel different for quite sometime. Regular balance exercises and a tubigrip may reduce this feeling.

**Stiff Knee**
Stiffness may occur following surgery - especially if performed whilst the knee is still inflamed following the initial injury. In some patients a manipulation and arthroscopy may be required at 6-8 weeks to break down scar tissue and restore knee movement.

**Severe pain**
Pain, stiffness and loss of use of the knee (complex regional pain syndrome) is rare and the cause is unknown. If this happens you may need further treatment including painkillers and physiotherapy. The knee can take months or years to fully recover.

**If you have any queries regarding surgery please ask your consultant <u>before</u> the surgery.**

## Post-operative rehabilitation

**You are expected to actively participate in your rehabilitation.** The home exercises you are given are to be performed several times a day and will take up a large portion of your time. This is a basic protocol with targets / expectations but will differ according to the individual and the complexity of the injury.

***Day 1* (Day of surgery)**

You will return to the ward with a PCL splint on the knee.

You will be visited by your physiotherapist, taught some exercises and mobilized with crutches. Your aims are to regain your quadriceps control and be able to lift your leg straight. Regular icing will reduce pain and swelling and you should take regular painkillers in order to complete your exercises.

Prior to discharge from hospital you should:

- Have adequate pain control
- Be able to achieve a straight leg raise
- Have a home exercise programme
- Be able to walk competently with 2 crutches (manage stairs if required)
- Have an appointment for outpatient physio and your consultant (6 weeks)

**Outpatient physiotherapy**

**Weeks 0 - 2**

**Goals**

- Protect fixation and mobilise surrounding soft tissues
- Diminish swelling / inflammation
- Maintain PCL splint in full extension (No hyperextension), even for sleep
- All exercises to be completed in the splint
- Regain active quadriceps (especially inside part - vastus medialis oblique)
- Restore knee cap movement
- Touch weight bearing (with splint on)

**Week 2:** Clinic appointment (removal of stitches) and change of splint to dynamic PCL brace (0-60°).

**Week 2 - 6**

**Goals**

- Prevent scar adhesions
- Prevent symptoms of anterior knee pain
- Improve strength, power and endurance.
- Be able to perform straight leg raise with no lag (knee bend). (May require electrical stimulation)
- Pillow to be placed under knee when resting to support lower leg. PCL brace should be left on for 6 weeks and only removed for washing
- Passive knee bending (0-60°) is allowed with the brace on. You should help to bend your knee with either your hands or a towel hooked around your foot and keep your foot in contact with the bed. Do not actively bend your knee without assistance.
- Increase to full weight bearing (as swelling, quads strength and confidence allows).
- Restore balance reactions and control.

**Week 6:** Clinic appointment (x-ray on arrival)

**Week 6 - 12**

**Goals**

- Continue to wear PCL brace (0-100°)
- Wean from / remove brace at 12 weeks post operatively.
- Normal gait pattern. Wean from crutches if no quads lag, full knee straightening and knee bend 90- 100º.
- Eliminate any joint swelling which occurs.
- Prevent any graft site or scar adhesions.

- Full pain free hyperextension and flexion to 100 degrees
- Improve balance reactions and control.
- Enhance muscular power and endurance.
- Weights above the knee may be used to progress exercises as strength permits (be guided by your physiotherapist).
- Static bike – no resistance. Saddle needs to be set high so knee not fully straight as push down. Place instep on pedal to decrease hamstring action.
- Return to driving when 'safe' to do so.

**Week 12:** Clinic appointment (check appropriate progress)

**Weeks 12-16**

**Goals**

- Wean from / remove brace at 12 weeks post operatively.
- Normal gait pattern with full knee straightening.
- Aim for full knee flexion
- Start walking on the treadmill and progress to light jogging.
- No anterior knee pain.
- Start open chain hamstring strengthening (i.e. without foot being fixed).
- Strengthening exercises can be progressed by placing a weight on the tibial tubercle (bony bump at front of knee) and gradually moving these towards your ankle as strength and control allows (be guided by your physiotherapist).
- Progress muscular strength, power and endurance of hamstrings and quadriceps (quadriceps should be good to normal).
- Start agility and early plyometric work
- May start swimming but no breaststroke.

**Week 24:** Clinic appointment (KOOS questionnaire)

**Weeks 24 - 36**

**Goals**

- Enhance lower limb confidence and function.
- Start harder agility work.
- Maintenance of strength and endurance through home exercises.
- Start sports specific training (no pivoting sport for at least 6 months).
- Preparation for return to full sport / activity. Able to return to pivoting sports, e.g. basketball, football, skiing from 9 months.
- It is advised that 3 months training be completed to regain confidence and skill acquisition prior to first competitive game i.e. return to play at 12 months

**Week 36+**

**Goals**

- Quadriceps strength 90% of uninvolved leg.
- No significant knee cap or soft tissue irritation.
- Patient demonstrates a clear understanding of their possible limitations.
- Unrestricted confident function.

**Week 52:** Clinic appointment (KOOS questionnaire)

NB. It is advised that the strengthening programme you have been taught by your physiotherapist should be completed on a regular basis for 1-2 years following surgery to maximise any benefits.

## Post operative progress

As listed above you will be reviewed at regular intervals in the clinic but the most important component of your recovery is your regular attendance at physiotherapy classes where you will be given strict instructions regarding appropriate exercises and the ‘dos and don’ts’.

## Long term outlook

70% of people get benefit from the operation and are back doing the activities they wish between nine and twelve months from the time of the operation, depending on their commitment and their level of sporting activity. The long-term stability of the knee once achieved, seems to last indefinitely with graft failure being unusual unless another specific injury occurs. Re-rupture of the original graft is relatively unusual. We are not sure whether wear and tear (degenerative arthritis) is inevitable in everyone who has had a ligament injury or whether surgery can delay this somewhat but even with a successful stabilising operation, it is possible wear and tear arthritis will ensue at some point in the future.

## Return to work

As a guide you can expect to return to office work about 4 weeks after surgery when discomfort and travel to and from work allows. If you have a physical job but are able to carry out light duties that involve limited walking, you may return to work at 6-8 weeks. If your job is more physically active than this, it may take anything up to 3 months to return to work, particularly if it involves squatting or heavy lifting.

## Return to Sport

It should be remembered that full return to unrestricted sporting activity is progressive with your rehabilitation, not an isolated event. It is advisable to complete 3 to 4 months of training to rebuild skill acquisition prior to your first competitive game. This training period will allow you to gradually rebuild your confidence in returning to sporting activities. Full return to contact sports is dictated by type of sport, ability, fitness and confidence and may take 12 months or longer.

## Driving

Depending upon which leg is involved, you can begin driving short distances between 2-4 weeks provided your rehabilitation is progressing well. You must be able to perform an emergency stop. Also to check that you are covered by your insurance before starting to drive again.