

ACL SURGERY PATIENT INFORMATION BROCHURE

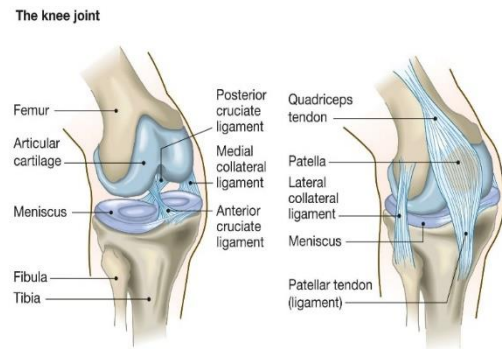
Contents

1. Knee Anatomy: What is the knee?/What is the ACL?
2. Contacts
3. Non-Operative ACL Rehabilitation
4. What is ACL Surgery? Other Procedures.
5. Types of Grafts
6. Complications & Possible Problems
7. Preparing for Surgery
8. On the Day of your Operation
9. Immediate Post-op Rehabilitation
10. Early Rehabilitation
11. Late Rehabilitation
12. Return to Sport

Knee Anatomy

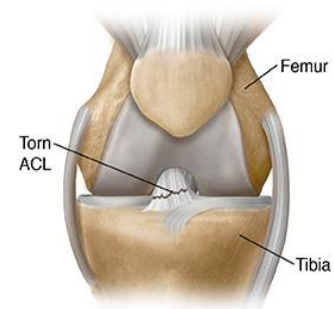
What is inside the knee?

The knee is a sophisticated hinge joint between the femur (thigh bone) and tibia (shin bone). A very smooth form of cartilage covers the end of each bone. Inside the knee, there are two structures known as a meniscus, one on the inside (medial) and one on the outside (lateral) aspect of the joint. The meniscus can be injured and this is commonly known as a 'torn cartilage'. Stability of the knee is mainly dependent upon four ligaments. The medial collateral ligament (MCL) is located on the inside of the knee and the lateral collateral ligament (LCL) is on the outside. The MCL and LCL help control side-to-side stability. There are two 'cruciate ligaments' in the centre of the knee. The anterior cruciate ligament (ACL) sits at the front and the posterior cruciate ligament (PCL) is at the back of the knee. The ACL and PCL help to stabilise the knee from front to back and help with rotational stability.



What is an ACL?

The anterior cruciate ligament (ACL) is located deep inside the knee and runs from the femur to the tibia, helping to stop the tibia (shin bone) from sliding in front of the femur (thigh bone). It also helps to control rotation of the knee. Rupture of the ACL may result in the knee feeling weak, unstable and the joint can 'give-way', particularly when trying to change direction quickly.



How do you injure the ACL?

The ACL is often injured during athletic activity, especially sports such as football, rugby, basketball and skiing. The injury usually results from a twisting or pivot movement at the knee and is often non-contact. ACL injuries as a result of contact with other players can happen and may result in injury to other structures in the knee joint. There are many factors that can contribute to a person's risk of ACL rupture.

How is it diagnosed?

A possible ACL rupture can often be predicted from a description of what happened. Clinical examination by an experienced nurse, physiotherapist or doctor will usually give a good indication, however, examining the knee when it remains sore and swollen can be unreliable. X-rays may be requested at the time of injury and MRI scan will usually confirm the diagnosis, along with any additional injury to the knee, such as a torn cartilage (meniscus) or additional injured ligament.

How is the injury managed initially?

Immediately following injury, most people are unable to continue the activity and may struggle to walk. Bleeding will occur within the knee joint and it will swell up, often rapidly. It is important to rest, apply a cold compress, elevate and take simple pain killers. Advice should be sought from an appropriately qualified person such as a physiotherapist, doctor or in some cases, attend the Emergency Department.

Initial management involves managing the pain and swelling to help regain normal knee movement. If you have difficulty moving the knee, it is important to flag this to your doctor/therapist.

What are the treatment options?

ACL rupture can be managed with or without an operation. Without an operation, management will consist of physiotherapy and exercises. The aim is to regain a full range of motion and strengthen the muscles around the knee. This can be a very effective option for many people, depending on their activities. Surgery usually involves reconstructing the ACL and dealing with any additional injuries, such as a meniscal tear or ligament damage.

Reconstruction is the current standard surgical treatment. This involves creating an entirely new ACL and should not be considered the same as a 'repair'. Primary repair of a torn ACL has recently been a topic of research and discussion amongst orthopaedic surgeons. It might be possible in specific circumstances, usually whenever the diagnosis has been confirmed very quickly, and only in specific types of tear. It remains an area of active research and some patients will be considered for these trials. If this is of interest, you should ask your clinician. Whilst primary repair may be a more widespread option in the future once sufficient evidence is available, until then ACL reconstruction is the gold standard treatment.

Treatment without an operation usually involves the same basic care post injury, followed by a comprehensive physio and rehabilitation programme.

Decision making should be reached after a discussion between you and your clinician. The treatment choice is based on many factors including age, gender, activity profile, occupation and clinical examination findings.

Who could benefit from an operation?

ACL reconstruction is normally considered for patients who fall into the following categories:

Instability – those with a knee that 'gives-way' or feels as though it may do so regularly during normal activities of life, despite physiotherapy and rehabilitation. Regular 'giving way' episodes can lead to damage to other structures within the knee.

Sport – patients who have a desire to return to sport. Classically, these sports involve running and rapid change of direction, such as football and rugby, where the ACL has a significant role in knee stability. The chances of returning to these sports at competitive level without surgery are reported to be as low as 10%. These are not the only relevant sports and others to consider may include skiing, basketball, netball, hockey and martial arts.

Age – young patients (particularly those under the age of 25 years) are more likely to require surgical treatment for their ACL injury, partly influenced by the higher activity level in this age group

Additional injuries – alongside the ACL, it is possible to injure many other structures in and around the knee and in particular, the menisci. Repair of these structures is possible (see below) and the

chance of a successful repair may be greatly increased if combined with an ACL reconstruction. This may have implications for the future health of the injured knee.

Non-Operative ACL Rehabilitation

What is neuromuscular control and why is it important?

Neuromuscular control is the result of the nervous system working together with the muscular system to control, direct and allow movement of our bodies. It is a complex system of muscle activities including contraction, co-ordination, stabilisation, postural control and balance, all of which are disrupted following injury. Retraining neuromuscular control can be achieved by carrying out balance exercises, dynamic joint stability exercises, jump landing exercises, agility drills, and sports-specific skills and drills.

Exercises to improve neuromuscular control have been shown to reduce the risk of ACL rupture.

Non-surgical Management

As people heal, recovery and rehabilitate at different rates it is important to be aware that progression is not time based but criteria based. This means that you only progress to the next phase when you have achieved the goals in the previous section.

'Prehabilitation', also known as 'prehab' is a physiotherapy programme designed to be undertaken before an operation. The aim would be to optimise recovery and maximise the potential outcomes of surgery.

Non-surgical management and 'prehab' for patients who have decided to undergo an operation should aim to progress through the following phases:

- Pre-op Phase: Injury recovery & readiness for surgery
- Phase 1: Recovery from surgery
- Phase 2: Strength & neuromuscular control
- Phase 3: Running, agility, and landings
- Phase 4: Return to sport
- Phase 5: Prevention of re-injury

Injury recovery phase should achieve:

- Equal left and right passive knee extension ROM
- 125 degrees passive knee flexion
- Zero effusion/swelling
- Good control of Single leg squat.

Strength & Neuromuscular Control phase should achieve:

- >85% of opposite side on aiming for > 20 reps on Single Leg Bridge to failure.
- >85% of opposite side on aiming for > 20 reps on Single leg heel raise.
- >85% of opposite side on aiming for > 30 seconds on Side bridge Endurance test.
- >85% of opposite side on aiming for > 10 reps on a Single leg squat.
- >43 seconds eyes open on single leg standing
- >9 seconds eyes closed on single leg standing
- 1.5 x Body weight Single leg Press 1RM as able
- 1.5 x Body weight Squat 1RM as able

What is ACL Reconstruction Surgery?

What does surgery involve?

Surgery is predominately arthroscopic (key-hole) and involves replacing the torn ACL. A new ACL 'graft' is created, usually using a piece of tissue from your own body, such as a tendon. The graft is passed through the knee, into tunnels drilled in both the tibia (shin bone) and femur (thigh bone) and secured under appropriate tension. Surgery may also be combined with either repair or removal of a meniscal tear. Your surgeon may also add additional procedure, either to add additional stability to the knee such as a lateral extra-articular procedure or another ligament reconstruction and/or repair.

Following the operation, there will be a comprehensive rehabilitation which will be guided with the physiotherapy team. It will take approximately 9 months from surgery until full participation in sport is advised.

An ACL reconstruction goes 'hand in hand' with physiotherapy and rehabilitation. The operation should not be considered unless the patient is fully committed to the rehabilitation following the procedure.

Detailed explanation of surgery:

Aim of surgery

The aim of ACL reconstruction is to provide a stable knee. It will not necessarily improve any pain felt in/around the knee joint, nor will it necessarily prevent arthritis in the future. It is important to discuss any concerns with your surgeon.

Outcome of surgery

ACL reconstruction is an operation performed regularly, across the world. There have been thousands of scientific papers published on the topic area. Despite this, there is a 5-10% failure rate, which equates to between 1 in 10 and 1 in 20 people who undergo the operation. There are many reasons why this is the case. However, the risk of failure can be influenced by the choice of sport, hypermobility (extremely flexible joints), graft choice, additional injuries, bony morphology (shape of individual bones) and how the surgery was performed. However, if an ACL rupture is sustained in one knee, the person is at increased risk of a future injury in the opposite knee.

Not all patients who undergo surgery return to their sport at the same level. Research suggests that approximately 70 – 80% of patients are successful in their desire to return to sport.

Other Procedures:

Lateral Extra-articular Procedure:

Lateral Extra-articular Procedure (LEAP) refers to an additional procedure performed on some patients who undergo ACL reconstruction, to reconstruct or augment a structure called the Anterolateral Ligament (ALL). It may be discussed by your surgeon before the operation. LEAP involves a scar on the outside of the thigh, just above the knee joint. The exact nature of the procedure can vary, depending on a range of patient attributes such as age, sport, physical exam, and surgeon preference. The aim of the procedure is to protect the ACL reconstruction by improving rotational stability. The addition of a LEAP has been shown to reduce the failure rate of ACL

reconstruction by three fold. In addition to an additional, sometimes larger, scar, it may take you a little longer to recover in the early phase following ACL reconstruction.

Meniscal Repair:

The menisci are very important structure inside the knee and there are two in each knee. It is not uncommon to injure one or both of the menisci at the time of injury to your ACL. Injury to the meniscus is commonly known as a “torn cartilage”. The menisci help to act as shock-absorbers and transfer force across the knee joint and also contribute to stability. Historically, a torn meniscus was partially or in some cases totally removed. This may lead to a higher chance of developing arthritis in the future.

Today, we try to preserve, repair and retain as much of the meniscus where possible. The aim is to preserve the shock-absorber function, but can also contribute to stability of the knee. However, time from injury is important. Meniscal tissue will only be removed if it is torn and irreparable or poor quality.

Repair of the meniscus can be performed through a variety of methods, which will be determined by your surgeon, according to the individual scenario. It may involve additional scars around the knee. Repairs can fail and may warrant an additional procedure to either repeat the repair or remove the damaged tissue.

Apart from the risk of failure, there is a slightly higher risk of injuring nerves and blood vessels at the back of the knee. Whilst very uncommon (<1%), nerve or vessel injury may result in numbness or weakness in the leg, bleeding and the potential for emergency surgery.

Internal Brace:

Some surgeons may choose to use a new technique known as ‘internal bracing’ along with ACL reconstruction. This uses a high strength synthetic suture material which runs alongside the reconstructed ligament. It is tensioned such that it only takes the strain when the ACL graft is stressed to a point where it could be re-injured, at which point the internal brace theoretically acts like a ‘seat-belt’. This ‘back-up’ provides an overall biomechanically stronger graft construct, which may permit more accelerated recovery and protect against reinjury after return to sport.

Types of Grafts

What are the graft options?

In most circumstances, your surgeon will use what is known as an autograft. This is a piece of tissue from your own body. However, there is no perfect graft and there is a *trade-off* to some degree.

The most commonly used ACL grafts are:

Hamstring Tendon:

- One or two of the hamstring tendons from the inside of the thigh are removed, folded according to surgeon preference and a graft is constructed.
- Very widely used graft.
- Small incision just below the knee used to obtain the tendon.
- Small chance of injuring the saphenous nerve, which can lead to potentially permanent numbness in the inside aspect of the thigh, knee and calf.
- Commonly associated with thigh pain following the operation, which usually settles.

- May result in reduced knee flexion power, can affect some sports such as athletics, as a small reduction in hamstring power can affect acceleration in the initial stage of a sprint.

BTB (Bone-Patellar Tendon-Bone):

- Central portion of the patellar tendon, which is used to straighten the knee.
- Commonly used graft with a proven track record.
- An open incision is made over the front of the knee and a small portion of the patella tendon along with 2 small blocks of bone are removed. The bone blocks come from the tibia and patella (knee cap) and a strong ribbon of patella tendon lies in between.
- Lowest graft rupture rate and may have better functional results compared to hamstring.
- Higher risk of future arthritis, compared to hamstring.
- 1 in 5 risk of pain at the front of the knee, which can make it difficult to kneel.
- Risk of fracture to the patella or rupture of the patella tendon, both of which could necessitate another operation and delayed rehabilitation.
- Generally allows an earlier return to sport

Quadriceps Tendon:

- Increasingly common graft choice, with less long-term evidence available.
- An incision is place at the front of the knee, above the patella. A small cylinder-like portion of the quadriceps tendon is removed, which is turned into a graft.
- May involve taking small block of bone from the patella, which carries a small risk of fracture, similar to BTB.
- Very strong tendon with low graft rupture rates.
- May take longer to regain quadriceps strength compared to hamstring and BTB grafts, which appears to be a problem that affects women more than men.

Allograft:

The use of donor tissue from a deceased person is used very occasionally and in specific scenarios.

Carries a small risk of transmissible infection.

Synthetic Ligament:

Rare, only used in specific scenarios, which your surgeon would discuss with you.

For non-professional sportspeople, we may need to balance the decision of what may optimise sporting outcomes Vs ability to work. For example, a plumber may want to avoid a graft that risks pain on kneeling.

Graft choice is a decision between surgeon and patient. Despite a huge amount of worldwide research, there is no clear answer on which is the best option.

Complications and Potential Problems

Infection:

- Antibiotics are given at the start of the procedure and may be used during the procedure. It reduces the risk but does not remove it.
- The majority of wound infections can be treated by a course of antibiotics and often settle down following treatment.
- If serious infection was to get into the knee joint, it can cause damage to the articular damage, which can lead to premature onset of arthritis. Although very uncommon, further surgery would normally be indicated and it may lead to failure of the ACL reconstruction.

Instability:

- The operation is intended to provide a stable knee. However, there is a risk that it can feel unsteady. There are various technical and surgical reasons that can affect stability. However, instability can also be a sign that there is a problem with the graft. Graft stretch is a known problem. Depending on the severity of your symptoms, another operation may be considered

Graft rupture:

- The graft may fail following the operation, one of the factors that can contribute to the 1 in 10 failure rate. Once removed from the body, your graft needs to re-incorporate and grow back into the body. If this does not happen, it is likely to fail.
- Other factors, such as hypermobility can affect the risk of graft failure.
- Re-injury is potential, due to the very nature of sport and activity.

Deep Vein Thrombosis / Pulmonary Embolism:

- The risks of blood clots forming in a vein following this type of surgery is low. Pulmonary embolism is a condition where a blood clot travels to the lungs and gets stuck, which can be a very serious problem, although normally very rare following this procedure.
- If you are thought to be at higher risk, your surgeon may advise you to take blood thinning medication for a few weeks following the operation.
- If you have had a blood clot previously or have a family history of blood clots, please tell your surgeon
- Similarly, if you are taking the combined oral contraceptive pill, it will need to be stopped before the operation to reduce the risk of blood clots.

Fracture of patella or rupture of patella tendon:

- If this was to occur during the operation, the surgeon may need to make longer scar and would normally fix the problem. This may lead to a delay in the normal recovery. If this were to occur at a later date, it may require another operation.

Failure of fixation:

- Your surgeon will ensure that the graft is securely fixed in place during the operation. Very rarely, there could be a problem with the fixation method. An x-ray is normally taken following the procedure. If a significant problem was noted, it may require another operation.

Nerve & vascular injuries:

- It is common to have some numbness or altered sensation around the scars, following surgery. This may resolve but it may be permanent. It rarely causes a problem
- Injury to major nerves and blood vessels at the back of the knee would be very rare. If it occurred, it could lead to weakness, numbness or bleeding and may require another operation and very rarely, pain and/or a permanent loss of function.

Pain:

- ACL reconstruction is generally performed to provide a stable knee. It will not necessarily provide a pain free knee.
- Very rarely, it is possible to develop a condition such as Chronic Regional Pain Syndrome (CRPS), which can involve long term pain, swelling, stiffness and problems with affected limb.

Stiffness & arthrofibrosis:

- The physiotherapy following the operation is intended to get the knee moving again. However, it requires effort and determination on the part of the patient. Pain killers are usually required in the first few weeks.
- Occasionally, it is possible to develop a condition called arthrofibrosis, where scar tissue forms inside the knee and this can restrict movement.
- This can often be treated with intensive physiotherapy but can require another operation followed by physiotherapy

Scarring:

- Almost all operations involve a scar and the exact configuration and/or size will be determined by what needs done. If you have any concerns, please discuss this with your surgeon.

Swelling and inflammation:

- It is normal for the knee to be swollen following surgery. This will gradually decrease with time and it is normal for the knee to swell again after activity during rehabilitation.

Graft harvest:

- Rarely, your surgeon will encounter a problem with graft harvest or a complication may occur which could compromise the graft. Therefore, your surgeon would normally use one of the alternative graft options to ensure the operation could be completed. If these were potentially compromised, the opposite leg could be used.

Preparing for Surgery:

You will usually be given an appointment to attend a pre-operative assessment clinic. This helps your anaesthetist consider any medical problems which may affect your risks and complications during the anaesthetic and/or surgery. You will be given time to ask questions you have.

During this appointment you will be asked about the following:

- General health and wellbeing including what level of exercise you are able to do.
- Previous medical history including any anaesthetics you may have had. This includes any family history of anaesthetic complications.
- Height and weight.
- Allergies, smoking status and alcohol intake if appropriate.
- Physical examination.
- Medication history – please bring all your medication with you to this appointment. You will be advised of any medication you need to stop prior to your operation.

On the Day of Your Operation:

Location:

On the day of the operation, you will be admitted to the hospital via the ward. It may be performed as a day-case procedure, meaning you could get home the same day. However, in many cases people stay over for one night and it is advisable to bring an overnight bag.

Fasting:

Instructions will be provided in advance. Usually you should eat nothing other than clear fluids in the 6 hours preceding the time of your surgery,

Clothing:

It is advisable to wear comfortable, loose fitting clothing and it is worthwhile bringing a pair of shorts.

Anaesthetic:

A specialist doctor, an Anaesthetist will discuss and manage your anaesthetic. Most commonly, a general anaesthetic (GA) will be used, which might be considered similar to sleeping, for the operation. There may be times when a spinal anaesthetic will be offered, where you will be numb from the waist down and may be offered sedation during the operation.

It is common for local anaesthetic to be used around the knee at the end of the operation to help control pain afterwards. It may be used to target specific nerves, which is called a *nerve block*.

Antibiotics:

You will be given a dose of antibiotics alongside your anaesthetic. This is to reduce the risk of infection and any drug allergies you may have will be taken into consideration. Antibiotics may also be used during the procedure.

Skin preparation:

A special solution will be used to clean your skin at the start of the operation. This usually has a pigment, which will temporarily stain the skin, usually from the toes up to the thigh. Dark coloured or old underwear is generally advised as the cleaning solution can occasionally stain garments.

Tourniquet:

A device known as a tourniquet will usually be used during the operation to limit the amount of blood loss.

X-Ray:

You will usually have a baseline x-ray following the operation.

Pain Killers:

You will be given medications to help with pain to take home. This may or may not be accompanied by anti-sickness medications or anti-inflammatories.

Immediate Post-op Rehabilitation**Wound:**

A bulky dressing is likely to be applied at the end of the operation. This bandage can often be removed the following day. In some circumstances, your surgeon may suggest wearing it for longer. The wound dressing should be left in place.

An appointment will be provided to check the wound at approximately 2 weeks post-op. Staff will advise you with any instructions at the point of discharge

If you have any concerns regarding the wound you should contact your community nurse or GP.

If you, your community nurse or GP think you have an infection you should use the contact your surgeon's team or the hospital directly. Your surgeon will want to know about any concerns regarding your wound.

Mobility:

It is essential you achieve a normal walking pattern as soon as possible after your operation.

The technique is to place your walking aid forward, step with your operated leg, control your knee by tightening your thigh muscles, lean through your hands onto your walking aid, then step through with your other leg. You will be discharged from the ward when you are able to walk safely and well with 2 elbow crutches or sticks. Over the next few weeks you will improve in comfort and confidence. Once you feel ready to progress to one crutch you should hold this in the hand on the opposite side of your body from your operated leg. Walk placing the crutch on the ground at the same time as the operated leg. If walking with one crutch causes you to limp you should return to using 2 crutches for a little longer. Your MSK physiotherapist will guide you regarding when they think you are ready.

Stairs:

We will show you how to go up and down stairs safely and how to protect your knee when doing so. Stairs practice is necessary for everyone – even though you may not have stairs at home, you will have to negotiate kerbs or stairs out-with your own home.

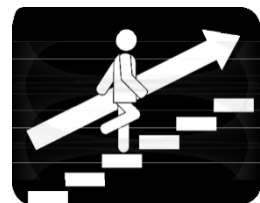
Going up:

Use handrail if available

Step up with un-operated leg (think "good" leg goes up to heaven)

Follow with operated leg onto same step

Bring up the crutch or stick onto same step

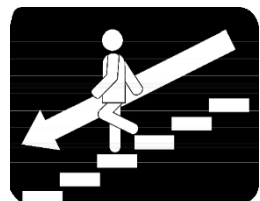
**Going down:**

Use handrail if available

Place crutch or stick down onto step

Step down with operated leg onto same step (think "bad" leg goes below)

Follow with un-operated leg onto same step



Swelling Management:

- Cryotherapy
- Elevation

Continue with ice/compression/elevation until effusion reduces.

Exercises:

Please note progression of the exercise will be influenced by the patient's level of pain and swelling and their physiotherapist's objective assessment.

Please note the exercises below are a selection of exercises that you may be asked to complete by your physiotherapist. There may be adaptations to these exercises and/or other exercises added made by your physiotherapist.

Knee Cap – Patellar Mobilisations (3-4 times/day):

Sit with your knee straight and relaxed.
Take hold of your knee cap
Move it side-to-side for 2-3 minutes
Move it up and down for 2-3 minutes



Ankle Pumps (10 times, 3-4 times/day):
[Ankle Dorsiflexion and Plantarflexion - YouTube](#)



Sit in bed or on a chair.
Move both ankles up and down vigorously.



Towel Stretch (Hold for 30 seconds for 5 repetitions. Repeat 2-3 times daily)
[Towel Stretch - YouTube](#)

Sit on the floor or the bed. Place your operated leg out in front of you, straight.
Wrap a towel around the ball of your foot, just below your toes.

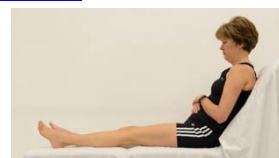


Pull back on the towel until you feel a stretch at the back of your lower leg.



Static Quads (3-4 times/day, hold for 5 seconds):
[Static Quadriceps Contraction - YouTube](#)

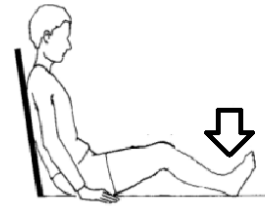
With the knee straight
Tense up the muscles at the front of the thigh as if you are trying to straighten your knee



Hold for a few seconds then relax.

Static Hamstrings (3-4 times/day, hold for 5 seconds):

Bend your knee slightly
Contract your hamstring by digging your heel into the floor
Hold for a few seconds and then relax



Straight Leg Raise (3-4 times/day, hold for 5 seconds):

[Straight Leg Raise - YouTube](#)

Pull your foot towards you
Tighten the muscles at the front of your thigh

Lift your whole leg 5 inches off the bed keeping it straight.
Hold for a few seconds and then relax

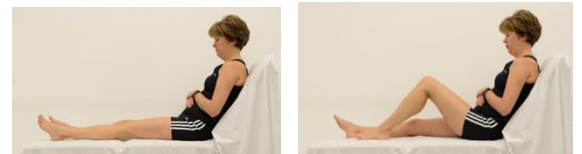


Bending/Flexion (10 times, 3-4 times/day):

[Knee Flexion - YouTube](#)

Bend and straighten your knee by sliding your heel up and down
Try to move your heel further each time

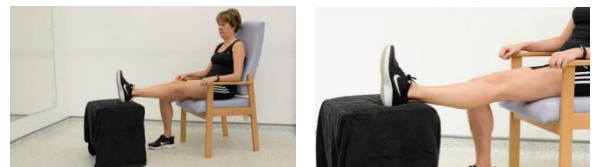
Gently increasing the bend in your knee.
Repeat 10 times (Use a bandage to assist if required)



Straightening/Extension (Hold for 5 minutes, 2 times/day):

[Static Quad Contraction with Stool Support - YouTube](#)

Sit or lie with your leg out in front of you
Put your heel on a rolled up towel so you are stretching the back of your knee.
Hold the stretch for 5 minutes then relax



Standing Hamstring Stretch (Hold for 30 seconds for 5 repetitions. Repeat 2-3 times daily):

[Hamstring Stretch - YouTube](#)

Stand with your heel of the operated leg on a footstool or bottom step.
Pull your toes backwards and keep the knee as straight as possible.

Slowly bend your upper body forwards whilst keeping your back straight.

You should feel a stretch at the back of your knee and thigh.





SCAN ME

Calf/Achilles Stretch (Hold for 30 seconds for 5 repetitions. Repeat 2-3 times daily):
[Standing Calf Stretch - YouTube](#)

Supporting yourself, take a step back with the operated foot.
Keeping the heel and toes of the operated foot on the ground.

Bend the knee of your front foot leg whilst moving your chest towards the wall.

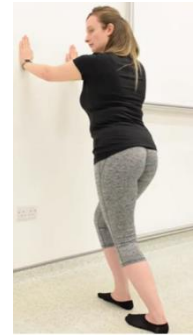
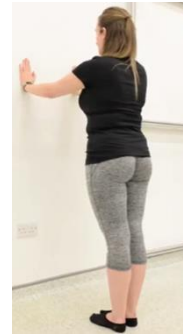
Heel Raises:

[Heel Raises - YouTube](#)

Supporting yourself

Raise up onto your toes

Repeat this sequence 10 times



SCAN ME

Hip Abduction (10 times, 3-4 times/day):
[Side Lying Hip Abduction - YouTube](#)

Lie on your side, with the lower leg bent and the upper leg straight.
Lift the upper leg straight up with ankle flexed. Return to the starting position.



Early Rehabilitation

Returning to Work:

<u>Work</u>	<u>Return</u>
Sedentary/Desk-based	1 to 2 Weeks
Light Activity/General Office and Driving	2 to 6 Weeks
Heavy Activity	3 Months

The timelines above are for guidance only and individual patients may vary

Return to Driving:

Ability to drive is very patient specific and depends upon the nature of their operation and rehabilitation. It depends on the car, type of transmission and which leg was operated upon. The driver needs to be in complete control of the vehicle and able to perform the full range of emergency manoeuvres.

Return to Exercise/Sport:

<u>Sport</u>	<u>Return</u>
Regular Exercise	1 to 2 Months
Light Individual/Non-Competitive Sports (e.g. Golf)	3 to 4 Months
Contact/High Performance (e.g. Football/Rugby/Skiing)	6 to 12 Months

Return to sport is patient and graft choice dependent.

Exercises:

Please note the exercises below are a selection of exercises that you may be asked to complete by your physiotherapist. There may be adaptations to these exercises and/or other exercises added made by your physiotherapist.

For all strengthening exercises aim for 2-3 sets of 8-12 repetitions with a 1 minute rest between sets, unless time, sets and repetitions stated on exercise.

Knee Movement:



Prone Hang for Knee Extension:

[Prone Knee Hang - YouTube](#)

Lying face down on a table/bench with your feet over the edge.

Let the weight of your feet straighten your knees.

Hold for 10 minutes, Repeat twice per day.



Prone Knee Flexion with Towel:

Lying face down with a towel/band around your ankle.

Tighten your stomach muscles to keep your lower back straight. Bend your knee and pull the band with both hands until you feel the stretch on the front of your thigh.

Hold for 20 seconds. Repeat 6 times.



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Active Knee Flexion in Prone:

Start by lying on your stomach with your legs straight. Keep your hips straight and back in neutral position.

Bend one knee and bring the heel towards your buttocks.

In a controlled manner, return to the starting position.



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Quadriceps Strengthening:

Inner Range Quadriceps:

[Inner Range Quad Contraction \(youtube.com\)](#)

Lie on your back with one leg bent and the other leg straight. Place a ball under the straight knee.

Bend your ankle and straighten the knee using your front thigh muscles. Keep the back of your knee against the ball.

Keep the tension for a moment and then relax.



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Knee Extension in Sitting:

[Seated Knee Extension - YouTube](#)

Sit up straight on a sturdy chair, so that your feet are supported on the floor.

Bend your ankle and straighten your knee using your front thigh muscles.

In a controlled manner, return to the starting position.



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Resisted Knee Extension in Sitting:

[Knee extension with a resistance band - YouTube](#)

Sit up straight on a sturdy chair, so that your feet are supported on the floor.

Exercise band is securely attached behind you, for example on the leg of the chair, and around the ankle of the leg you are training.

Straighten the knee against the resistance by sliding the foot forward on the floor.

Let the foot rise off the floor and straighten your knee.

In a controlled manner, return to the starting position.

Initial colour of exercise band is determined by your physiotherapist.



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Chair Squats:

[Chair Squats - YouTube](#)

Stand tall with your feet approximately hip-width apart and weight distributed evenly on both feet.

Make sure the chair behind you is at a suitable distance from you.

Bend your knees and hips and squat down onto the chair. Knees and toes should be pointing in the same direction.

Sit down lightly and push back up to the starting position using your front thighs and buttock muscles.

To make easier – Use a higher chair or surface.



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Step Ups:

[Steps Ups \(Normal\) - YouTube](#)

Start by standing behind a step and lift one leg onto the step.

Step up and straighten your hip and knee. Maintain hip-knee-toes alignment.

Return to the starting position.



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Reverse Step Ups:

Start by standing in front of a step, with one leg lifted on the step behind you.

Move your weight backwards, step up and straighten your knee. Maintain hip-knee-toes alignment. Return to the starting position.



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Lateral Step Ups:

Start by standing sideways next to a step, with one leg on the step.

Step up and straighten your hip and knee. Maintain hip-knee-toes alignment.

Return to the starting position.



Lateral Step Up

Leg Press with Exercise Band:

[Single Leg press with a resistance band - YouTube](#)

Lay on your back with your knee bent and middle of band looped around the bottom of the foot. Grasp the ends of the band in each hand near your shoulders.

Extend your hip and knee against the band until straight. Hold and slowly return.

Note: Maintain tension on the band by keeping your hands near your shoulders.

Initial colour of exercise band is determined by your physiotherapist.



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Hamstring Strengthening:

Hamstring Curl:

Stand tall and take support if needed.

Bend your knee and take the heel towards your buttocks. Keep both thighs parallel.

Return to the starting position.



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Hamstring Curl with Exercise Band:

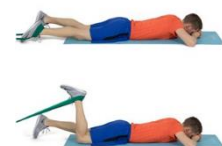
Lie face down, with an exercise band attached around one ankle and secured firmly behind you.

Bend the knee and pull the heel towards your buttocks. Return to the starting position in a controlled manner.

Note: Keep your buttocks and trunk tight to avoid arching your lower back or letting your hip bend.

Exercise can also be done in standing.

Initial colour of exercise band is determined by your physiotherapist.



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Gluteal Strengthening:

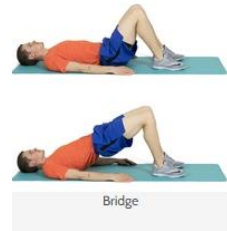
Bridging:

[Hip Bridging - YouTube](#)

Lie on your back, with knees bent and feet hip-width apart.

Draw in your abdominals and tighten your buttocks. Tilt your pelvis backwards and lift your pelvis and back up one vertebrae at a time. Lift only as high as you can while maintaining the pelvis position. Lower your pelvis down in a controlled manner.

Note: Don't let your lower back arch during the lift.



Hip Abduction with Exercise Band:

[Side Lying Hip Abduction Resistance Band - YouTube](#)

Lie on your side, with an exercise band around both ankles. Body is in a straight line and trunk is activated.

Lift the uppermost leg up (away from the midline) using your buttock muscles. Return to the starting position in a controlled manner.

Note: Keep your hips straight and toes pointing forward.



Glute Walk:

Stand tall, with an exercise or loop band around your legs (slightly above or under the knee joint).

Take a hip-width stance so that the band tightens and squat down. In this position, step to the side then return, keeping the band tight at all times.

Do 10-12 steps. Repeat in opposite direction.

Note: Focus on using your buttock muscles.

You can also step forwards and backwards, but remember to keep feet at least hip width apart.

Initial colour of exercise band is determined by your physiotherapist.



Balance:

Single Leg Balance:

[Single Leg Balance - YouTube](#)

Start by standing. Move weight over to one leg and lift the other leg off the floor. Keep your hips level and try to lengthen from the ankle of the supporting leg until the back of your head. The knee of your stance leg should point straight forwards as should your toes and hips.

Aim to complete for 20-30 seconds. Repeat 6 times.



Tip-Toe Walking:

[Toe Walk \(youtube.com\)](#)

Walk up on your toes.

Do 10-12 steps.

Complete walking forward and backwards.



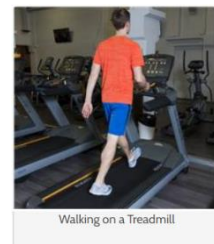
Tandem/Tight-rope Walking:

Walking one foot in front of the other like walking on a tightrope.
Do 10-12 steps.
Complete walking forward and backwards.

Cardiovascular Exercise:

Treadmill with incline:

Step onto the treadmill and attach the safety key to your clothing.
Turn on the treadmill and start walking. Begin at low intensity and gradually add incline. Let your arms swing by your sides as in regular walking, but if necessary take support from the handles. Gradually lower the speed before stopping.
Aim for 15-20 minutes initially. 2-3 times weekly.



Static Bike:

Sit up straight on a stationary bike that has the seat adjusted to your height.
Start with no resistance.
Aim for 15-20 minutes initially. 2-3 times weekly.
Gradually increase time/resistance as appropriate.



Cross Trainer:

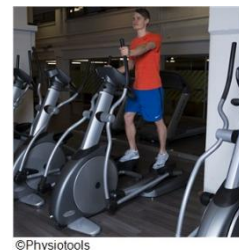
Stand upright on the elliptical machine and hold on to the handles. Look straight forward instead of staring at your feet.

Move your legs in a circle driving the pedals down. At the same time press one arm straight forward and pull the other straight back. Keep the movement controlled.

Note: Make sure that your knees and toes are aligned and point straight forward.

Start with no resistance.

Aim for 15-20 minutes initially. 2-3 times weekly
Gradually increase time/resistance as appropriate.



Swimming/Aqua Jogging:

Use an aqua jogger belt in the deep end of the pool. Your feet should not hit the bottom. Mimic the jogging motion using your arms and legs.

Complete initially for 20-30 minutes, 2-3 times weekly.

Walking in Water:

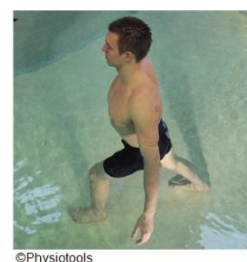
Stand in chest deep water.

Walk forwards keeping your arms 45 degrees out to the side and palms facing forward. Do not allow your arms to move when walking.

Increase speed for more resistance and decrease depth of water for increased weight bearing.

Complete walking forward and backwards.

Aim for 15-20 minutes initially. 2-3 times weekly



Weight Machines at Gym:

Leg Press:

Sit up straight on a leg press machine, with your feet placed hip-width apart on the platform. Release the safety locks and lower down to a squat and lock the position.

Push through your heels and straighten your knees. Actively push your knees out, to avoid them collapsing in. In a controlled manner lower yourself back to the squat.

Note: The weight is evenly distributed between the heels and forefeet. Complete with both legs then operated leg only.

Note: Adjust weight accordingly.



Seated Leg Curl:

Avoid over extending your knees.

Sit up straight on a leg curl machine with your knees straight and the resistance lever behind your ankles.

Bend your knees and bring heels towards your buttocks. In a controlled manner let your knees straighten back to the starting position.

Complete with both legs then operated leg only.

Note: Adjust weight accordingly.



Late Rehabilitation

Exercises:

Please note the exercises below are a selection of exercises that you may be asked to complete by your physiotherapist. There may be adaptations to these exercises and/or other exercises added made by your physiotherapist.

For all strengthening exercises aim for 2-3 sets of 8-12 repetitions with a 1 minute rest between sets, unless time, sets and repetitions stated on exercise.

Single Leg Exercises:

Split squat:

[Split Squats - YouTube](#)

Stand tall. Lift your operated leg forward, keeping the weight mainly on your front leg.

Keep your pelvis facing forwards and lower back in neutral position.

Squat down, keeping your trunk upright. Push back up focusing on pushing through the heel of your front leg.

Progression: Try holding dumbbells/kettlebells in each hand to add more load, increase the depth of your squat.

Single Leg Squat:

Stand on one leg. The other leg straightened in front of you.

Squat down and push back up again. Your hip, knee, ankle and toes should stay aligned.

Progression: Try holding a dumbbell/medicine ball close into your chest to add more load, increase the depth of your squat.



Single Leg Calf Raises:

Stand tall on one leg, the forefoot on the edge of a step and a towel roll placed under the toes. Take support if needed. Push up onto your toes. Lower the heel towards the ground and repeat from the beginning.

Progression: Try holding dumbbells/kettlebells in each hand to add more load.



Side Lunges:

[Side lunge - YouTube](#)

Start by standing with your feet hip-width apart. Take a long step to the side with one leg and squat down. Keep the other leg straight, and trunk upright. Push back up to starting position.

Progression: Try holding dumbbells/kettlebells in each hand to add more load, increase the depth of your lunge.



Step down multidirectional:

Stand on a step/box, with your toes on the edge. Take one leg in front and lower the heel towards the floor by squatting down with your other leg. Push back up.

Note: Keep hip, knee and 2nd toe aligned.
- Keep your pelvis level.

Progression: Try holding dumbbells/kettlebells in each hand to add more load, Try increasing the height of the step



OC Quads Extension

Sit up straight on a knee extension machine with your knee bent and the resistance lever in front of your ankle.

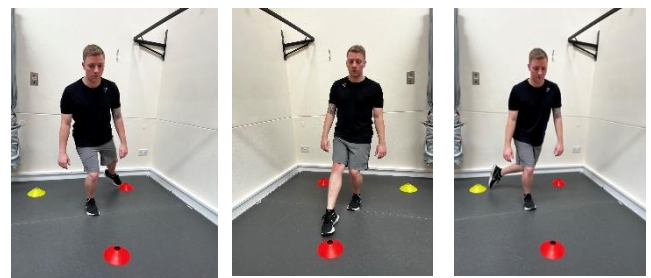
Straighten your knee. In a controlled manner let your knee bend back to the starting position. (Make sure you are fully straightening the knee)

Progression: Try and progressively increase the weight on the machine

Neuromuscular Control Exercises:

Y-balance:

Stand on one leg with a few markers surrounding you on the floor. Try pointing to the different markers with your non-standing foot while maintaining your balance.



Single Leg Stance Variations:

Try maintaining your balance standing tall on one leg. This can be progressed by changing the surface you are standing through and activity.

Surface: pillow, trampet, wobble board, Bosu Ball)

Activity: Medicine ball trunk twists, Eyes closed, Throwing and catching ball against wall, SL deadlifts.



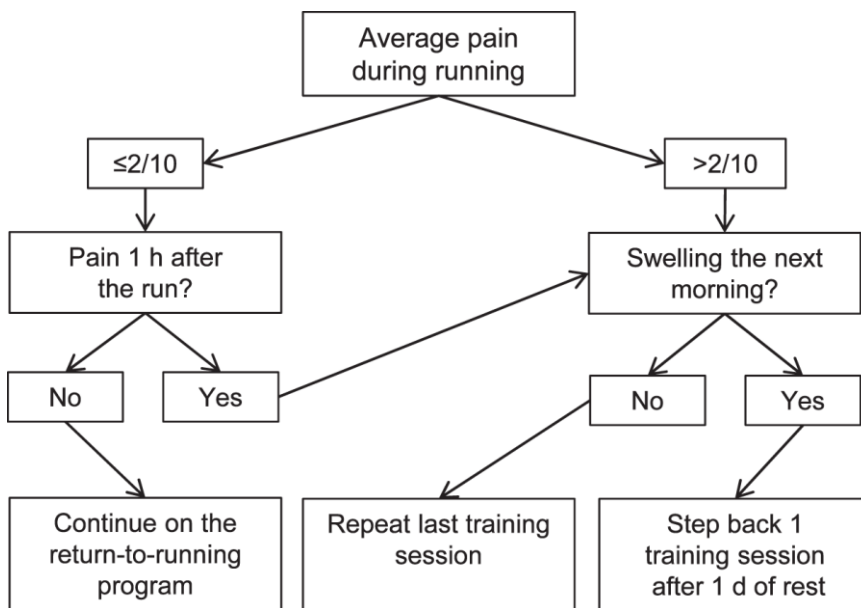
Return to Running:

Criteria:

- Able to walk briskly for 30 minutes
- Balance on one leg for 30 seconds
- Perform 15-20 controlled single knee dips
- Do 20-30 single leg calf raises
- Jump, bound and hop pain-free

If you aren't ready yet, don't worry! Try crosstraining with cycling, swimming/aquarunning or using the cross-trainer

Session	Warm Up	Run	Walk	Repetitions	Cool Down
1	Warm up with brisk walk for 5 minutes	60 secs	90 secs	7	Cool down with brisk walk for 5 minutes
2		90 secs	2 mins	5	
3		2mins	90 secs	5	
4		3mins	90 secs	5	
5		5 mins	3 mins	3	
6		5 mins	90 secs	3	
7		15 mins	0 secs	1	
8		20 mins	0 secs	1	
9		25 mins	0 secs	1	
10		30 mins	0 secs	1	
We recommend no more than 3 running session per week on top of your other rehab					



Return to Plyometrics:

Typical Weeks	10-14	15-18	19-22	23-29
Criteria	- <2/10 pain with day to day activities - Full ROM	- Able to run continuously for 10 mins	- Good SL landing kinematics	

	- >70% knee extensor strength symmetry	- Good DL landing kinematics - Good SL squat kinematics - Able to leg press 1.25 times bodyweight 8 times.	- Able to leg press 1.5 times bodyweight 8 times.	
Training Type	Low intensity bilateral plyometrics with goal of developing eccentric/ motor control and preparation for running	Moderate intensity bilateral and unilateral plyometrics with goal of developing power and unilateral deceleration capability	Higher intensity bilateral and unilateral plyometrics with goal of developing power and multidirectional control and acceleration	
Exercise Examples	<ul style="list-style-type: none"> • Squat jump to box • Step up and jump 	<ul style="list-style-type: none"> • Split jumps • Split jumps alternating legs • Bilateral drop jumps • Step and land • Step and land with push back 	<ul style="list-style-type: none"> • Unilateral squat jumps • Rotational jumps • Multidirectional unilateral jumps/ hopping • Unilateral drop jumps • 	

Return to Sprinting:

Print rehabilitation phase	Pre-requisites	Training aim	Exercise prescription
Phase 1 reintroduction of HSR	LSI>70%, return to undermaximal linear running	55-70% maximal speed, stride, bounce and dynamic placement quality	CMJ one-leg repeated plyometrics on one leg at 20cm skills in gym in frequency, axis, lateral, front-back, push-brake at moderate intensity 50-100m straight line at target speed in a running session with aerobic capacity drop jump one-leg repeated plyometrics on one leg at 20cm in all axes
Phase 2 reintroduction of VHSR	LSI>85%	75-85% MS, efficacy and qualities of strides during acceleration	skills on the pitch , axis, lateral, front-back, push-brake at sustained intensity 50-100m straight line at target speed in a running session with aerobic capacity
Phase 3 reintroduction of sprint in control situation	LSI near 100% RSI-mod CMJ one-leg near 100% to training group value >3N/kg of BW of concentric Q strength in isokineticism >1,8N/kg on concentric H strength >2.2N/kg on eccentric hamstring strength	>90% MS, efficient of postural control	repeated plyometrics on one leg at 30cm in all axes skills on the pitch , all type of movement at high intensity specific sprint and acceleration work
Phase 4 sprint with chaos situation	"	near 100% MS, Maintain quality and intensity despite the environment and complex tasks	skills on the pitch , all type of movement at maximal intensity specific sprint and acceleration work specific football skills with chaos environment

Return to Sport/Activity Criteria

Treatment should be based on individual needs and appropriate clinical decision making regarding the progression of the patient's post-operative course.

The purpose of this returning to sport / activity criteria is to allow the physiotherapist to work through each section as a check list, which highlights the patient's readiness for discharge / return to sport.

Based on up to date recent research, if the patient is successfully passing each section they will be showing their ability to cope with their sporting environment / training. If patients are not passing each section or showing concerns, they should consider a review with their physiotherapist to ensure they are successfully working towards their goals, or consider a review with the consultant.

According to relevant research, it is recommended to use outcome measures such as, KOOS-ACL (Knee Injury and Osteoarthritis Outcome Score), ACL-RSI (Anterior Cruciate Ligament Return to Sport after Injury) following an ACL reconstruction.

Furthermore, in order to successfully prepare individuals to return to their sporting environment, it is crucial to expose patients to linear and agility based drills with multidirectional patterns.