

Knee ACL Reconstruction

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About to undergo ACL Rehabilitation or Anterior Cruciate Ligament (ACL) reconstruction and then Rehabilitation?

About 50% of all athletes that rupture their ACL do not require surgery but rehabilitation in the patient not requiring surgery is as important if not more so than the athlete who does want surgery to stabilise their knee.

Anterior Cruciate ligament surgery and rehabilitation have undergone dramatic changes recently. This is due to scientific research, improved surgical technique, extensive clinical experience and better understanding of the consequences of rehabilitation.

Pre and post-operative rehabilitation is a major factor in the success of ACL reconstruction. Recognition that early restoration of extension, full joint movement and weight-bearing are of paramount importance for successful rehabilitation.

At SOC Bristol we aim to ensure a complete understanding of the basic principles of the ACL reconstruction with patients and physiotherapists. This helps to mentally prepare the patient for the operation and the rehabilitation following it. Our aims with surgery are to: restore normal joint anatomy; restore stability; maintain a full range of motion; allow a return to work and sport as soon as possible and hence to prevent injury to cartilage leading to arthritis.

The major goals of rehabilitation are to: rapidly recover near normal strength; recover range of movement and restore protective reflexes. Patients must take an active part in their rehabilitation, both before and after the operation. The accelerated rehabilitation program has critically removed unnecessary restrictions on function and acts as a guide to provide a healing environment during the 18 months it takes to remodel the ACL tissues.

Anatomy of the ACL

The knee is a more complex joint than is usually expected. It not only has the ability to function as a hinge but it has the ability to rotate and lock and unlock during rotation. The stability of a joint depends on the shape of the joint, the ligaments around the joint and the muscles that control movement about the joint. Knee ligaments control the limits of this motion by bracing the joint against abnormal types of motion. The ACL is just one of many ligaments that link the femur (thighbone) to the tibia (shinbone). It acts to stabilise the knee, mainly in the forwards, backwards and in a rotational direction. In



Figure 1. Exploded view of the ACL. It is common to also suffer meniscal tear and collateral ligament injury with rupture of the ACL

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addition to this mechanical function the ACL has a number of sensory nerves that provide involuntary feedback information that provide proprioception (feeling) of joint position. This gives us all a muscular reflex that helps to stabilise the knee joint. Voluntary and involuntary proprioceptive reflexes are essential for daily activities. Proprioceptive reflexes are lost following ACL rupture, but can be significantly recovered following reconstruction of the ACL and then rehabilitation.

How would I know if I had ACL problem?

If you had a tear of one of the ligaments in your knee you would notice pain in the knee, giving way, locking or swelling. The typical mechanism of an ACL injury is a direct contact twisting movement, usually due to a blow to the outside of the knee. The ligament can also rupture indirectly during sudden stopping and/or changing direction in sport. Examples of events that may cause an ACL tear include side-stepping (cutting), pivoting and landing from a jump. You may have noticed a “crack” at the time of injury. You may also have been unable to weight bear and found that knee was unstable. Associated damage to other important joint structures, such as menisci, collateral ligaments and articular cartilage may also occur and should be excluded as part of your assessment.

Can I treat it myself?

The trouble with any knee injury is that it may be a minor sprain which recovers quickly or a more serious injury like an ACL tear. A skilled surgeon should be able to distinguish between the two. In either event if your pain is going to go on for more than 6 weeks it is best to see a surgeon and establish an accurate diagnosis. The prognosis will depend on whether the injury has caused damage to the surface of the joint by the time you seek advice.

If you think you have a minor sprain follow these steps to speed healing:

- Stop doing the activity that caused the condition. Do 20-minute ice massage every 4-8 hours for 48 to 72 hours (a small bag of frozen peas or corn is ideal). After 72 hours begin moist heat treatments.
- Start a recovery program seven to ten days after you notice the first symptoms. Cycling is a good exercise.
- Cross-train, performing aerobic activities that do not stress the knee, avoid twisting sports or swimming.
- Seek the advice of an Orthopaedic Surgeon if the problem does not clear up within six weeks.

Ibuprofen or aspirin will relieve pain and inflammation. These medications should not be taken without approval from your General Practitioner if you have an ulcer, kidney problems, an allergy to aspirin, or are on a blood-thinning medication. If you treat it early, a simple sprain can clear up within a week or two.

You may need to reduce your mileage or the frequency of your sports for a while. When you do run or play, warm up longer and do plenty of stretches. A change to a softer running surface and well padded running shoes may help.

Obviously, there is no self-help solution to a tear of the ACL! Please seek the assistance of an Orthopaedic Surgeon within 24 hours of a traumatic injury.

Will I need an operation?

About half of all patients with an ACL rupture achieve stability and function without surgery. In most cases this is not because the ACL heals but because the other determinants of stability compensate. This compensation depends on rehabilitation. Occasionally adjustments to activities of daily living and sports are necessary. Some patients expect early surgery. Experience has demonstrated that ACL reconstruction is best left until after the acute stages of injury have resolved anyway. Your surgeon will advise that surgery should be delayed until a full range of motion is obtained. This reduces post-operative problems such as stiffness. It is also valuable to undergo adequate physiotherapy prior to surgery in order to give yourself the best chance of recovery should you need reconstruction.

If your symptoms persist for longer than 6 weeks this suggests a serious pathology. On most occasions your surgeon will be able to diagnose the problem without resort to surgery. If you have a condition amenable to cure or improvement by simple keyhole surgery then you may be offered this.

A complete tear of the ACL has no ability to heal. Chronic instability due to ACL rupture results in gradual damage to the fibrocartilage (meniscal cartilages) and articular hyaline cartilage (surface of the joint). This leads to early joint wear (osteoarthritis). In these circumstances of instability in order to prevent progression of early joint wear the ACL will need reconstruction.

Your surgeon will inform you of all the non surgical and surgical options available to the type of condition you have. He or she will then take time to describe the risks and benefits of each option. Ultimately it is your decision whether to undergo surgery.

What should I do before my ACL is reconstructed?

You should not attend for surgery with skin problems around your knee (wounds and cuts in any stage of healing) as these vastly increase the risks of postoperative infection. Surgery is best delayed until these have healed. Please do not shave your legs before surgery as this is known to increase the risk of post operative wound infection.

If you are taking the contraceptive pill please stop taking the pill 6 weeks prior to your operation as your risks of thrombosis are increased if you are taking oestrogen type hormones prior to surgery. Please ask your GP about further details. Do not take Aspirin or anti-inflammatories for two weeks before surgery as this increases the risks of post operative bleeding.

Do not forget to tell us if you have any allergies or any new relevant medical problems on the day of surgery.

Bring your regular medication, relevant medical records and any x-ray films in your possession for your admission to hospital. You are not allowed to eat solid food up to 6 hours and drink clear fluids up to 4 hours before the operation.

How will my ACL be reconstructed?

Your surgeon will recommend arthroscopic (keyhole) surgery to reconstruct the ligament in most cases. Arthroscopy is the technique of looking inside a joint by using an instrument called an arthroscope.



The arthroscope is backed by a video camera and is connected to a monitor. Using the arthroscope, your surgeon can see what is wrong inside the joint and also repair the knee ligament injury. The advantage over open surgery is that recovery is more rapid after arthroscopic surgery since smaller incisions are made. Look at the accompanying SOC-Bristol file on arthroscopy for details of this technique.

Can it be done as a day case operation?

Most ACL operations are followed by one overnight stay in hospital, a review by the physiotherapist the following day before discharge and subsequently six months of intensive rehabilitation at home or work monitored by your physiotherapist.

However, if you have other medical problems such as diabetes, obesity, asthma or high blood pressure, you may have to be admitted the day before for tests and stay overnight before and after surgery.

Will I have to go to sleep (general anaesthetic)?

The operation will usually be done under general anaesthetic but occasionally can be done under spinal anaesthetic. Your anaesthetist will advise you about the best choice of anaesthetic for you. In addition at SOC-Bristol the surgeon will prescribe a local anaesthetic injected into your knee while you are asleep to reduce the pain after the operation even if you go to sleep for the surgery. You will also be given pain-killing tablets as required to take home.



Figure 2. Radiographs of one type of screw used to fix the new ligament in place while the bone grows into and locks the ACL graft.

How is it done?

The knee is first examined carefully with the leg relaxed. A temporary tourniquet is applied to the top of your thigh as you are going to sleep. In men the area around the knee is shaved by your

surgeon who will then prepare the skin and drape the leg to reduce the risk of infection following surgery.

Two small incisions are made either side of your patella tendon. Each cut is about 1cm long. Through these cuts, the lens and instruments are inserted into the knee. Fluid is used to inflate the knee. The whole of the inside of the knee is examined and any necessary treatment carried out. For ACL reconstruction another 2.5 cm cut is required over the shin bone to both take the hamstring graft and make the tunnel in the shin bone. The operation usually involves replacing the torn ligament with a graft using two of the hamstring tendons. Occasionally the middle third of the patella tendon with bone from the patella and shin at either end is used. Tunnels are drilled through the shin bone and through the thigh bone to where the original ligament was attached. The tendon graft is then threaded through these tunnels, pulled tight and the tendon graft secured inside the tunnels with screws that push the tendons up against the live bone in the walls of the tunnels. Over the following 12 weeks or so the bone grows into the tendons and fixes them even more securely than the screws.

The knee is then washed out and the cuts stitched with a single stitch each. Occasionally the surgeon will make a pictorial record of the state of your knee joint for future reference.

What will my knee be like afterwards?

You will wake up pain free with a bulky dressing round your knee. When you have recovered from your anaesthetic, you can get up, walking freely on your leg unless otherwise instructed. You may remove the bulky dressing 1-2 days after the operation and start exercising your knee. You will be given an instruction leaflet by our physiotherapist who will visit you both before and after surgery. The knee may still be fairly swollen, bruised and stiff early on, so you should keep it up when not walking or exercising. If it gets very swollen you should remove any constricting bandages and try ice placed indirectly in a towel on it for 10-15 minutes.

You will be seen in the SOC-Bristol outpatient clinic 10 -14 days after your operation for suture removal. Your knee will be re-examined. The findings of your arthroscopy will be discussed with you, and any further treatment that is necessary will be arranged. Physiotherapy is often prescribed at this stage, but many people do not need it and can exercise on their own. If no further treatment is required and your knee is healing well, you may be discharged from further follow-up at this appointment, or a further check-up may be arranged. Contact Sports should not be undertaken for at least 6 months from reconstruction.



Figure 3. Contact sport should be avoided until full ligament integration has occurred and strength is regained.

Will I have a plaster on afterwards?

No, plaster or braces are rarely required. We want you to start exercising your knee as soon as possible.

The Accelerated Physiotherapy program

Pre-operative preparation is extremely important for the successful outcome of ACL reconstruction. Patients with an ACL deficiency, suitable for surgery, are educated on the nature of their problem, surgical technique and rehabilitation, by the surgeon, at the time of the first clinic visit.

On the day of surgery you are also visited by a physiotherapist, that may not be the one supervising your postoperative physiotherapy. In this visit you are guided through the accelerated rehabilitation program outlined below:

Day 1 and 2

- Knee is not usually braced or immobilised,
- Pre-emptive and postoperative pain management (Anti-inflammatory and Tylex).
- DVT prophylaxis: early foot and leg exercises and mobilisation.
- Swelling control: Pressure dressing applied in theatre and taken down prior to discharge from hospital.
- Full passive extension immediately post-operatively and throughout the hospital stay (use folded pillow under heel when in bed). Use heel props and do static quadriceps exercises.
- When you return to your room from recovery unit start moving your operated knee gently (bending and straightening). If this hurts, slow down and rest, your movement will be restricted by the dressings.
- Weight-bear as able, aided with elbow crutches. Aim to progress to full weight bearing, by the following day if this is comfortable.
- Start with basic proprioceptive exercises as soon as you start weight-bearing: briefly shift weight on the operated leg and try to balance on one leg (this may be painful and difficult!).
- As you gain confidence try this holding on to a solid object (washbasin) and progress supervised to the same with eyes closed. You should be able to do this by second day post-operatively.
- Dressings will be reduced to skin cover only, 24 hours post-operatively
- Progress to balancing on operated leg when brushing teeth, combing hair, using the phone etc.
- Prone knee hangs: aim for symmetrical hyperextension.
- Active knee bending in side lying, or on sliding board.
- Resisted knee bending in sitting, over edge of bed.
- Static hamstrings at points in range.
- Static quads in full extension (active extension from 40 to 0 degrees is contraindicated).
- Patella mobilisation: teach self-treatment exercises and how to relax quads when doing this.

- Discontinue any exercise that causes unexpected pain and discuss it with your physiotherapist or surgeon.
- Discharge from the hospital, if progressing well, on morning after operation.

Proprioceptive exercises: balance and proprioceptive training are very important components of this rehabilitation program. A quick and easy way of doing daily proprioception and balance exercises is to stand on one leg while brushing your teeth. This gives you regular opportunities to exercise proprioception for several minutes, a couple of times each day. Even if you have poor balance and proprioception initially, you can do your exercises whilst holding on to the sink with the opposite hand. As your skill level improves you can progress to “no hands” exercises. The next skill level involves the same exercise but with closed eyes, which may feel strange and will require some practice. Once these exercises become too easy, try to lean in different directions (while standing on one leg and brushing teeth), and then stabilise yourself without losing balance. This will enable you not only to master the skill of standing in one spot, but also to fine-tune the ability to balance once the centre of gravity has moved. Also, remember, that brushing teeth up and down and sideways are very different proprioceptive exercises.

3 to 14 days

- No more walking than is strictly necessary
- Continue to regain full extension with straight leg and closed kinetic chain exercises (always exercising with full weight through the leg). This is the most important target for now!
- Proprioceptive aptitude: improve on balance with eyes shut, shift weight from one leg to other, walk along lines in all directions, catching ball, move ball around foot, use wobble board. Increase one-legged activities.
- Flexion exercises: wall and heel slides. Aim for 90 degrees by the end of second week post-operatively.
- Normalise gait: walk in front of mirror.
- Discard crutches once walking well and confident in activities of daily living.
- Contact your physiotherapist if you have problems with your knee or exercises. You may have bruising around your knee or ankle.
- At 10 days; stitches removed by GP practice nurse or hospital
- At 2 weeks postoperatively: 1st follow-up with surgeon

2 to 6 weeks

- At 2-4 weeks: usually ready for driving and return to work.
- Continue to progress according to your abilities.
- Progress with closed kinetic chain exercises.
- Exercises may progress to: sitting to standing, dips, exercise bike and step machines.
- Progress with resisted hamstrings exercises.
- Progress with proprioceptive exercises.
- Carefully resume pre-operative gym level.
- Swimming: straight leg kick only, and pool exercises.

- You should have a full range of movement (symmetrical full hyperextension to full flexion) by the end of this period.

There is no universal agreement on when it is safe to travel by plane or long car journeys after an ACL reconstruction. It seems that most Orthopaedic Surgeons advise their patients not to fly for at least 6 weeks following the ACL reconstruction. Long intercontinental flights are a potential problem as there is an increased incidence of spontaneous DVT (deep venous thrombosis), even in the young and healthy passengers. It is possible that sitting for long period of time, in a confined space could predispose to the development of deep venous blood clots, especially in people following recent knee surgery. If you have to travel by plane, between 2 and 4 weeks after your ACL reconstruction, it would be wise to contact your airline's Medical Department and ask them for advice on compression stockings and exercise. Also, please discuss this issue with your GP, as you may have to take prophylactic Aspirin (as anticoagulant) for several weeks.

6 to 12 weeks

- At 6 weeks: 2nd follow-up; graft healing assessed by surgeon.
- Continue progress: increase gym workouts, step ups and step downs, ball dribbling etc.
- Continue to improve your confidence, walking and proprioceptive exercises.
- Prone "leg flicks" to stimulate hamstring reflex contraction.
- Swimming: continue regularly (no breaststroke).
- Cycling on normal cycle.
- Start jogging, on the treadmill.
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3 to 6 months

- Isokinetic testing (the involved quadriceps strength should be 70% of the non-involved, at three months).
- Introduce sport specific exercises.
- Progression of strength work: leg press, leg curls etc.
- Agility work: catching a ball, sideways running, 2 leg jumping, skipping rope etc.
- Single leg hop test (start with the good leg, try with operated one and if you can manage 20 to 30 hops around points of 60 cm square, you can gradually return to your previous non-contact sports).
- Earliest return to heavy manual labour.

6 to 9 months

- Isokinetic testing (the involved quadriceps strength should be 80% of the non-involved, at six months).
- Participating in skill exercises as well as improving power and endurance.
- Plyometric exercises.
- Earliest return to competitive contact sports (provided: no swelling, no ligament laxity, full mobility, full muscle strength and proprioception, operated leg equal or better than the opposite leg).

How soon can I....

Walk on the knee?

You can walk on the knee immediately you have recovered from your anaesthetic. It may be quite sore for a few days and some people need crutches to take some of the weight off their knee. Almost everyone can walk fully weight-bearing on the knee within a week.

Go back to work?

If you are comfortable and your work is not too demanding, you could go back to work within a week. However, if you have a heavy manual job, or have had extensive surgery within the knee, you may not be able to go back for two weeks to a month.

Drive?

You need to decide when you are safe to drive. A good indication of return of adequate function and safety is the ability to hop on the affected leg again (this is the “Hardy Hop Test”). Very little information exists in current literature about the ability of ACL injured or reconstructed knees to respond to situation-specific stimuli, such as braking quickly while driving a car. It is difficult to determine when it is safe to return to driving following surgery. A recent study from Australia seems to indicate that following a right ACL reconstruction patients should wait at least six weeks before driving again. However, this could take place at two weeks for patients with left ACL reconstruction and an automatic car.

Play sport?



Figure 4. The Cybex is used by athletes that want to return to contact sport to indicate when they have recovered at least 95% of strength.

As you recover from your operation, you can gradually increase your activity, determined by comfort and the amount of swelling and flexibility in the knee. Follow the program above. Start with walking and cycling, then light running. Make sure your foot and knee are fairly flexible before moving to twisting or impact activities, and make sure you can turn and jump comfortably before returning to contact sports following the 6 month program.

The rate of recovery can be accurately monitored in our facility using equipment such as the “reactomat”, Cybex and running mill. Even if you are having physiotherapy closer to home, where this equipment is not available, you can be referred into our facility for these tests.

What can go wrong?

The commonest problem after knee arthroscopy is persistence of your symptoms. This is not surprising as ACL reconstruction may be performed in patients with arthritis and while the surgeon cannot cure arthritis some relief is often achieved by the reconstruction and chondroplasty.

Numbness either side of the small incisions is not uncommon. This is because the cuts are made close to the nerves to these areas, and the nerves have to be pushed aside to get access to the joint. Although this is done very carefully, sometimes this stretches the nerves and they stop working. Usually this numbness recovers within 2 months, but a few people have small areas of permanent numbness. The cuts usually heal up quite quickly, but a few (less than 6%) discharge some fluid and take 2-3 weeks to heal. Usually dressing the wounds carefully is all that is required to get them to heal. You will know if you have an infection if the small cuts become red, hot swollen and tender. If this happens you should attend your General Practitioner, have the sutures removed early and go on antibiotics. If this is done the infection frequently resolves.

Post operative swelling in the knee may cause swelling under the bandage. This could cut off some of your circulation and lead to thrombosis. If it gets very swollen you should remove any constricting bandages and try ice placed indirectly in a towel on it for 10-15 minutes.

All keyhole surgical techniques involve delicate work with fine instruments very close to the surface of the joint. Very rarely an instrument breaks in the joint. Usually it can be retrieved through the "keyhole" incisions, but sometimes the joint has to be fully opened up. The more extensive and involved the procedure, the greater are the chances of pain, swelling, and bleeding. The time required for recovery after this kind of treatment procedure is also longer than with diagnostic arthroscopy alone.

Should you require any more information please make an appointment with any of the surgeons at SOC-Bristol we would be glad to help.