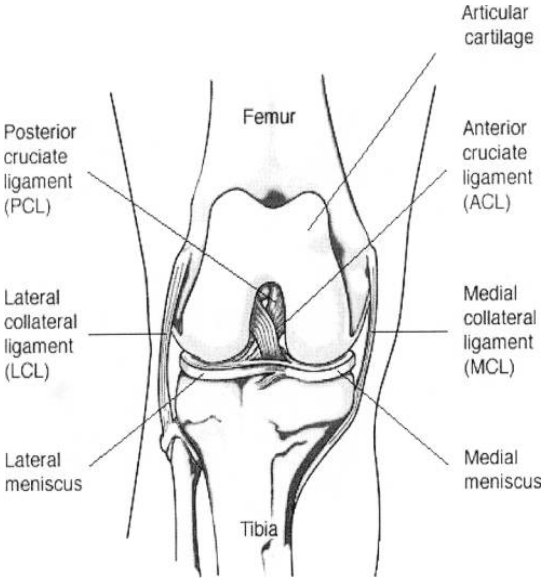
Royal Berkshire
NHS Foundation Trust

Anterior cruciate ligament (ACL) injury: non-operative management

This leaflet explains how an injury to the anterior cruciate ligament in the knee can be managed by non-operative (conservative) means. If you have any queries after reading it, please discuss with your physiotherapist or contact the physiotherapy department on 0118 322 7812 Monday to Friday 8am to 4pm.

What is the ACL?

The anterior cruciate ligament (ACL) is one of the main stabilising ligaments in the knee. It runs diagonally through the centre of the knee joint and attaches to the back of the femur (thigh bone) and to the front of the tibia (shin bone). It passes in front of the posterior cruciate ligament (PCL), a similar structure that runs in the opposite direction. These two ligaments cross near the centre of the knee; it is this crossing of the ligaments that gives them their name (cruciate).




torn ACL

What does the ACL do?

The main function of the ACL is to stabilise the knee, especially during rotation, sidestepping, and pivoting movements. It also provides significant feedback information to the muscles surrounding the knee to help control balance (proprioception), thereby allowing co-ordinated activities. Your ACL is unlikely to repair itself, so this means that when the ACL is injured (ruptured or torn), the tibia can move abnormally on the femur and the knee can often buckle. The main feeling is often a sense of the knee giving way during twisting or pivoting movements (instability) and a sense of not trusting the knee when turning. Sometimes patients may experience pain or an ongoing lack of confidence (known as ‘proprioception’) in their knee.

How is the ACL injured?

The ACL is commonly injured during sporting activities that involve pivoting or twisting movements. For example, football, netball, basketball or skiing, where there is sudden twisting of the knee while the foot is fixed. In contact sports, the ACL can be injured when a direct blow is applied to the outside of the knee. Sometimes, the ligament is damaged in isolation and sometimes in combination with other structures inside the knee e.g. other ligaments, menisci (shock absorbing cartilages), or joint surface articular cartilage.

How is an ACL injury diagnosed?

Typically, patients experience knee pain and early swelling after a twisting injury to the knee. Sometimes they feel (or even hear) a 'pop' or a click inside the knee. Often, they are unable to continue with the game and have to stop the activity. This typical history would alert your doctor to an ACL injury. Examining an acutely injured knee is sometimes difficult due to pain and swelling, and it is often easier to examine the patient a few weeks after the initial injury. If appropriate, your consultant will investigate the knee injury with an MRI scan, which shows the structures inside the knee that are damaged and that can aid treatment decisions.

If scans are unclear, sometimes an examination under anaesthetic and a diagnostic arthroscopy (keyhole operation) is used to get more information about the injury before making a definitive treatment plan.

How is an ACL injury treated?

All patients need to recover from the acute knee injury with common sense measures to reduce swelling and pain. These would include:

- Rest
- Possible use of crutches
- Elevation
- Regular ice packs
- Anti-inflammatory medication
- Simple painkillers

This phase of treatment is usually guided by a physiotherapist with a specialist interest in knee injuries.

You will then be reviewed in the orthopaedic clinic by a consultant or a member of their team. During this appointment, further options regarding management of your knee will then be discussed. Treatment options are very much tailored to the individual patient and are dependent on lots of factors, including severity and frequency of ongoing symptoms, response to physiotherapy, age, sporting aspirations and damage to other structures.

It is important that you are fully informed of all the options available and the advantages and disadvantages of the different treatments so that together with your consultant and physiotherapist you can select the best treatment path for you.

Not everyone who has an ACL rupture ends up with a problem. The older and less sporty you are, the less likely it is to go on causing trouble. Nevertheless, the majority of people with a rupture of their ligament will notice looseness but for a proportion of people this can be

overcome with conservative, non-operative management via physiotherapy including strengthening and proprioceptive (balance) exercises.

Non-operative (conservative) treatment options

Physiotherapy

Initially, conservative treatment by physiotherapy is aimed at reducing swelling, restoring the range of movement at the knee and restoring full muscle power. It can also help to improve confidence in walking and regaining trust in your knee. Once your knee is more settled, a large part of physiotherapy management is aimed at addressing any muscle weakness present around the knee, hip, spine and pelvis and any deficits in proprioception. Proprioception can be re-trained using exercises designed to test your balance and co-ordination. Stability of the knee can be improved with intensive physiotherapy exercises – not just for strengthening the muscles at the front (quadriceps) and the back (hamstrings) of the knee, but more importantly for improving balance (proprioception) and the ability to “hold on to your knee”. Good muscle performance and enhanced proprioception are both key factors in a successful conservative management approach to ACL injury. Adjustments may be required to daily activities and sports whilst having physiotherapy. A gradual return to daily activities and carefully graded progression back to competitive sport will be planned, if this is your goal.

Some people seem to gain benefit from and respond well to physiotherapy and can manage very well without their ACL. Additionally, some patients choose to give up certain sports that require more pivoting movements (e.g. football) and prefer to continue with sports that involve moving in straight lines, e.g. running and cycling.

Bracing

Sometimes, knee braces are used to help with physiotherapy. Bracing is another way of stabilising the knee without surgery and there are purpose made ACL braces that protect the joint and can be very valuable during certain sports. The braces are rather too cumbersome to wear day to day and in some contact sports the braces are banned for obvious reasons. But in sports such as tennis and squash and for skiing and snowboarding, they can be particularly useful if these are the occasions that the knee tends to give out. Wearing a brace does not appear to weaken the knee.

The use of slim Neoprene sleeves appears to improve patients balancing skills very slightly and some people use them, but their benefit is very difficult to actually measure.

Operative treatment option (surgery)

Operative treatments are based around a procedure called an ACL reconstruction. This operation involves replacing the damaged ligament with a new ‘graft’. Usually the hamstring tendons (from the same leg) are used to make a new graft and via a special technique the graft is placed across the knee and secured in the femur and tibia by screws and buttons. This stabilises the knee. Post-operatively, there is a big commitment to rehabilitation and further physiotherapy for up to 9-12 months to see the maximum benefit from the surgery.

If it is decided that you need surgery, there is a separate information sheet available to explain the operation in more detail.

Summary

ACL injury is fairly common and needs to be managed carefully by a consultant orthopaedic surgeon with an interest in knee surgery and a specialist knee physiotherapist. Treatment options vary depending on the individual patient. Patients need to be fully informed of these options before deciding how they are managed.

Acute management following an ACL injury

Rehabilitation goals:

- Reduce swelling and pain.
  - Use ice, anti-inflammatory medication and elevation.
  - You can also use a double tubigrip during the day (do not wear at night).
  - Ankle pumps.
- Restore full range of movement at the knee.
  - This is essential even if you are not considering surgery.
- Regain the strength in the key muscles around your knee, hip and ankle.
- Improve proprioception (awareness of where knee is in space) and balance.
- Walk without a limp.

Walking

- If it is too painful to walk without a limp, using crutches is recommended.
- Gradually increase the amount of weight you put on your leg as pain allows.
- When you stop using your crutches, limit the amount of walking with an emphasis on “walking well” (quality), over walking too much (quantity).

Stairs

- When you are climbing stairs, make sure you are leading with your non – injured side when going upstairs.
- Coming downstairs you should lead with your injured leg.
- If using crutches, you should keep the crutches with your injured leg.
- Remember “unaffected leg up to heaven, affected leg down to hell”.

Exercises to help with swelling

	• Lie on your back or sit with your legs straight. • Briskly bend and straighten your ankles. • Repeat10 times. • Repeat little and often during the day.

Exercises to help regain full range of movement

Try to complete these exercises 2-3 times a day. Reps 10-20; sets 1-3.

Heel slides

Sitting with your back supported and your legs out in front of you.

- Bend your knee as far as possible. Gently bend your knee a little more.
- Hold for 10 seconds and return to the starting position.
- To help bend your knee, you may put a towel around your foot, or help to bend your knee with your hands around your thigh.

Active assisted knee flexion in sitting

- Sit up straight on a sturdy chair.
- Cross your ankles, with the assisting (non injured) leg on top of the other.
- Move the injured foot backwards by bending your knee, assisting the movement with the other non injured leg.
- Hold for 10 seconds and then return to the starting position.

Heel hangs

- Lying on your back or sitting with your back supported and your legs out in front of you.
- Place a rolled up towel or pillow under your ankle.
- Pull your feet up towards you. Push your knee down firmly so that your thigh muscles tighten.
- Try to touch the bed / floor with the back of your knee.

Prone knee hangs

- Lying face down on a table/bed with your knees and feet over the edge.
- Let the weight of your feet straighten your knees.
- Hold for minimum of 30 secs and gradually increase amount of time able to hold up to 5 minutes. Repeat 6 times.
- A small weight can be placed at the ankle to increase the stretch.

a)

Patella mobilisations

a) Side to side movements

- Sit with your leg straight.
- Push your knee cap towards your opposite leg.
- Slowly release. Repeat 20 times.
- Repeat little and often during the day.

b)

Patella mobilisations

b) Up and down movements

- Sit with a rolled towel under your knee.
- Push your knee cap down towards your foot.
- Slowly release. Repeat 20 times.
- Repeat little and often during the day.

Stretches

Quadriceps stretch

- Stand on one leg and support yourself if needed.
- Grasp your ankle.
- Straighten your hip and pull the heel close to your buttocks, so that you feel a stretch in the front of your thigh.
- Increase the stretch by tilting your pelvis backwards.

NB: The thigh you stretch should be in line with the thigh of the leg you stand on.

Don't let the hip bend or the leg go out to the side.

- Hold for count of 30. Repeat 6 times.

Hamstring stretch

- Stand with the leg to be stretched on a footstool.
- Flex your ankle and push the heel towards the footstool keeping your knee straight.
- Bend your upper body forwards from your hips keeping your back straight. You should feel the stretching behind your knee and thigh.
- Hold for count of 30.
- Repeat 6 times.

Alternative position:

- Lie on the back with both legs straight. Bend one hip to 90 degrees and hold the thigh in this position. The knee should be relaxed.
- Holding the thigh in position, slowly straighten the knee until you feel a stretch at the back of the thigh. Sustain this stretch.
- Hold for count of 30.
- Repeat 6 times.

 ©PhysioTools Ltd	**Gastrocnemius stretch** • Stand in a walking position with the leg to be stretched straight behind you and the other leg bent in front of you. Take support from a wall or chair. • Lean your body forwards and down until you feel the stretching in the calf of the straight leg. • Hold for count of 30. • Repeat 6 times.
 ©PhysioTools Ltd	**Soleus stretch** • Stand tall with your feet hip-width apart. • Take a step back with one leg and move most of your weight onto your back leg. Keep the heel on the ground and squat down to bend the ankle of the rear leg. Keep your knee aligned with the toes and try not to let the ankle collapse inwards. Hold the stretch while breathing smoothly. Then relax. • Hold for a count of 30. • Repeat 6 times.

You may experience some soreness when doing these exercises but if you experience increased pain or swelling the next day, do not push the exercises and stretches as far into discomfort.

Strengthening exercises

It is important to strengthen both your injured and non-injured leg, as even your non-injured leg will lose condition over a period of time. While all these exercises are aimed at your injured leg, all can be completed for your non-injured leg as well.

The following exercises have been listed corresponding to how difficult the exercise is.

Level 1= easy **Level 2= intermediate level** **Level 3 = advanced**

Start with the easiest exercises and gradually increase to the higher levels as your strength, control and confidence improves.

Aim for 3 sets of 8-12 repetitions or until the muscle is slightly fatigued.

Complete 2-3 times a week with a rest day between each session.

Quadriceps

Level 1

 ©PhysioTools Ltd	**Static quads** Lying on your back or sitting with your back supported and your legs out straight in front of you. • Place a rolled towel under your ankle. • Pull your feet up towards you. Push your knee down firmly so that your thigh muscles tighten. • Try to touch the floor with the back of your knee. • Hold for 10 seconds.
 ©PhysioTools Ltd	**Inner range quads** Lying on your back or sitting with your back supported and your legs out straight in front of you. • Place a rolled up towel or cushion under your knee. • Push your knee down hard and straighten your leg. • Hold for 10 seconds.
 ©PhysioTools Ltd	**Heel digs** Lying on your back or sitting with your back supported and your legs out straight in front of you. • Bend your knee to 45 degrees. • Pull your toes up towards you, and dig your heel into the bed. • You should feel the muscles of the front and back of your thigh tighten. • Hold for 10 seconds. • Repeat in different degrees of knee bend.

Level 2

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<td> 
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<td>Lunge +/- weight
Stand in a lunge position with the injured leg forwards and both feet facing forwards. Try to keep your back knee straight and heel on the floor.
• Transfer your weight over your front foot, in line with your mid foot.
• Tighten bottom and stomach muscles.
• Hold for 10 seconds.
• Keep the front knee over the middle of the foot.
This exercise may be made harder by holding small weights in each hand.</td>
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©PhysioTools Ltd</td>
<td>Progression:
Bulgarian split squat +/- weight
• Stand facing away from a step or chair.
• Place the back leg (non-injured leg) on a step or chair. Pelvis faces forward and lower back is in neutral position.
• Place your non-injured leg in front of you.
• Squat down keeping your weight on your front leg and heel on the floor.
• Push back to the starting position pushing through your heel.
• Keep your knee over the middle of your foot while performing this exercise.

To make this more difficult use a weighted bar or hold weighted dumb bells.</td>
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Sit to stand

From a sitting position, try to stand up from the chair without using your hands.

- Slowly lean forwards and stand up, then slowly sit down again.
- You may need to use your arms to help at first. Try not to drop into the chair but try to control the movement.
- This can be made easier and more difficult by changing the height of the chair.
- Try to avoid letting your knees roll in to touch each other. It may help to place a resistance band around your legs to encourage you to keep your knees apart.
- Keep the knees over the middle of the foot.

Level 3

Squat +/- weight

- Stand with feet hips width apart.
- Slowly squat down, keeping your heels on the floor and your back straight. Keep your weight equal on both legs.
- Return to the starting position.
- Keep the knees over the middle of the foot.

To make this exercise harder, hold either two weights, one in each hand, or a heavier weight in front of you in both hands.

 ©PhysioTools Ltd	**Progression:** **Single leg sit to stand +/- weight** Place a chair against a wall or something firm so that it will not move during the exercise. • Start by sitting on the chair. Lift the non-injured leg up off the floor. • Using the injured leg, stand up and straighten your knee and hip. • Slowly lower yourself onto the chair. Remember to maintain your hip. • Keep knee you are standing on over the middle of the foot when bending.

Hamstrings
Level 1

 ©PhysioTools Ltd	**Single leg hamstring curls in lying +/- weight** • Lying face down with your hips straight and knees together. • Bend your knee as far as possible, keeping your hip straight and your ankle flexed. • Slowly fully straighten your leg back onto the bed. To make this exercise more difficult, you can put a small weight around your ankle.
 ©PhysioTools Ltd	**Progression:** **Single leg hamstring curl in standing +/- weight** • While standing, hold onto a support and bring one leg slightly backwards. • Bend your injured knee and lift your foot off the floor, taking it towards your buttocks. • Slowly fully straighten your leg back onto the bed.

 ©PhysioTools Ltd	To make this exercise more difficult, you can put a small weight around your ankle.

Level 2

  ©PhysioTools Ltd	**Bridge +/- weight** Lying on your back with your knees bent and feet hips width apart. • Draw in your abdominals and tighten your buttocks. • Tilt your pelvis backwards and lift your pelvis up. Only lift as high as you are able while maintaining your pelvis position. Do not let your back arch or your knees roll in. • Hold for 10 seconds. • Lower your pelvis down in a controlled manner. To make this exercise more difficult, place a weight across your pelvis.

Level 3

	**Romanian double leg dead lift.** Stand with your feet hips with apart and knees slightly bent. • Hold a weight/bar close to your body. Slightly squeeze your shoulder blades together and hold this position. • Lower the weight/bar: Tilt your trunk forward at the hips and push your pelvis backwards. Lower the weight /bar keeping it close to your thighs and shins (weight/bar stays

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<td>over the middle of the foot). Keep your weight equal through your legs.
• When you feel a tightness in your hamstrings, slowly return to the starting position.
• Lift the bar/ weight: Straighten your hips and knees to stand using your buttocks and hamstrings. Keep your knees over the middle of your feet.
• Straighten your trunk to the upright position after the bar has passed your knees.

NB: Maintain neutral spine and neck position throughout the exercise.
○ Shins stay vertical.
○ Weight evenly distributed between the heels and forefeet.</td>
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<td> 
©PhysioTools Ltd</td>
<td>Progression:
Single leg dead lift
• Stand tall on injured leg.
• Hold a weight by your side in the opposite hand to the leg you are standing on.
• Bend forward from the hip of the stance leg, squeeze your buttocks.
• Lift the other leg behind you while tilting your trunk towards horizontal.
• Keep the stance leg knee over the middle of your foot.
• Return to standing.

NB: Try to keep a straight line between the rear leg and trunk.</td>
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Gluteal muscles

Level 1

 ©PhysioTools Ltd	**Hip abduction inside lying** • Lying on your non-injured side with your bottom leg bent and your upper leg straight. • Roll your top hip slightly forward, use your top arm to support yourself in front. • Keeping your top leg straight, lift it up towards the ceiling to hip height. Make sure the leg stays in line with your body and toes point forwards. • Hold for 10 seconds. • Lower your leg slowly.
 ©PhysioTools Ltd	**Hip abduction inside lying +/- weight / resistance band** • Lying on your on-injured side, keep bottom leg straight. • Place a resistance band around your ankles. A weight can be used around the ankle of the upper leg instead. • Roll your top hip slightly forward, use top arm to support yourself in front. • Keeping your top leg straight, lift it up towards the ceiling to hip height. Make sure the leg stays in line with your body and toes point forwards. • Hold for 10 seconds. Lower your leg slowly. To make this exercise more difficult, increase the strength of the resistance band or the weight using.

Level 2

 ©PhysioTools Ltd	**Hip abduction in standing +/- weight / resistance band** • Stand on your non- injured leg with your hand supported on a firm surface. • Keep your body upright and with your hip, knee and foot facing forwards, move your operated leg out to the side. • Do not let your body bend sideways. • Hold for 10 seconds. • Lower your leg slowly. To make this exercise more difficult, tie a resistance band around both ankles, or a stable object that will not move and around the ankle of the injured leg.

Level 3

 ©PhysioTools Ltd	**Step ups with high knees** • Start with one leg on a box. • Stand on one leg while lifting the other leg up in a bent position. • Step up using the injured leg and drive the knee of the other leg forwards. Ensure full hip and knee extension on the stance leg. Keep your knees over the middle of your feet. Return to starting position. • Reach up above your head as you step up or practice arm movements as if running as you step onto the step. This exercise can be made harder by putting weights in your hands.

Adductor muscles

Level 1

Hip adduction in side lying

- Lie on your injured side, with the uppermost leg bent and foot on the floor in front of you.
- Slightly lift your injured leg off the floor, keeping the leg straight.
- Maintain the position for 10 seconds. Slowly lower leg to floor.

To make this exercise harder, place a weight around the leg you are lifting.

Level 2

Hip adduction in standing against theraband.

- Attach a theraband to something sturdy which will not move.
- Start in a standing position holding on to something sturdy with one hand.
- Put your injured leg foot into a theraband or use a weight around this ankle, move it from outside in, in front of your supporting leg. Keep your hips straight.
- Hold for 10 seconds.
- Slowly let the leg return back to the starting position.

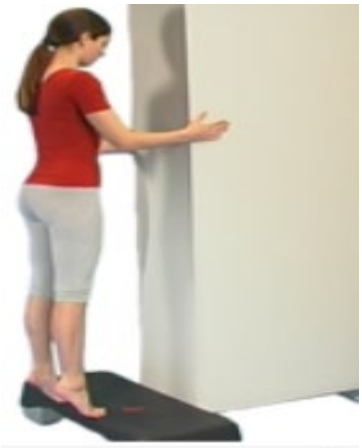
To make this exercise more difficult, increase the strength of the resistance band or the weight.

Level 3

 ©PhysioTools Ltd	**Adductor bridge** **Copenhagen adductor exercise** • Start by lying on your injured side with your upper body supported on your forearm. • Lift the ankle of your upper leg onto a bench or a chair. • Lift your pelvis off the floor so that your body is in a straight line and hold the position. Lift your injured leg up and pull your legs together. • Hold for 10 seconds and then lower the leg back down.

Calf muscles (gastrocnemius)

Level 1

 ©PhysioTools Ltd	**Double footed heel raise** • Stand with your feet slightly apart. • Raise up onto your toes. • Hold for 3 seconds and lower slowly. This exercise can be made harder by holding a weight.
 ©PhysioTools Ltd	**Double footed heel raises over edge of step** • Stand on the edge of a step with your feet slightly apart and heels off the edge of the step. • Push up onto tip toes. • Hold for 3 seconds and lower slowly. • Make sure you are near a wall or banister to support you if you overbalance. This exercise can be made harder by holding a weight.

Level 2

 ©PhysioTools Ltd	**Single leg heel raise** • Stand on your injured leg. • Hold onto something for support to maintain balance if you need to. • Raise up onto the toes of your injured leg. Do not let your legs roll in. • Hold for 3 seconds and lower slowly. This exercise can be made harder by holding a weight in your free hand.

Level 3

 ©PhysioTools Ltd	**Single leg heel raises over edge of step** • Stand on your injured leg with your heel off the edge of the step. • Hold onto something for support to maintain balance if you need to. • Raise up onto the toes of your injured leg. • Hold for 3 seconds and lower slowly. This exercise can be made harder by holding a weight in your free hand.

Calf muscle (Soleus)

Level 1

 ©PhysioTools Ltd	**Double footed heel lift with knees bent.** • Stand with your feet slightly apart and knees bent. • Raise up onto your toes, keeping your knees bent. • Hold for 3 seconds and lower slowly. This exercise can be made harder by holding a weight.

 ©PhysioTools Ltd	**Double footed heel raises over edge of step with knees bent** • Stand on the edge of a step with your feet slightly apart, knees bent and heels off the edge of the step. • Push up onto tip toes keeping your knees bent and over the middle of your feet. • Hold for 3 seconds and lower slowly. • Make sure you are near a wall or banister to support you if you overbalance. This exercise can be made harder by holding a weight in your free hand.

Level 2

 ©PhysioTools Ltd	**Single leg heel raises with knees bent** • Stand on your injured leg with your knee bent. • Hold onto something for support to maintain balance if you need to. • Raise up onto your toes of your affected leg keeping your knee bent. • Hold for 3 seconds and lower slowly. This exercise can be made harder by holding a weight in your free hand.
 ©PhysioTools Ltd	**Single leg heel raises over edge of step with knees bent** • Stand on your affected leg with your heel off the edge of the step and your knee bent. • Hold onto something for support to maintain balance if you need to. • Raise up onto your toes of your affected leg keeping your knee bent. • Hold for 3 seconds and lower slowly. • Keep your knee over the middle of your foot. This exercise can be made harder by holding a weight in your free hand.

Balance and proprioception exercises

Balance: The ability to remain upright due to the state of equilibrium / equal weight distribution.
Proprioception: Awareness of the position of your body and limbs in space.

Level 1

Single leg balance on floor

- Stand on your injured leg and try to keep your balance for as long as possible. Keep your knee over the middle of your foot.
- Aim to balance for 60 seconds for 3 sets.
- You can make this exercise more difficult by throwing a ball against a wall and catching it whilst standing on your injured leg.

Level 2

Single leg balance on uneven surface

- Stand on your injured leg on either a BOSU or wobble cushion.
- If you do not have a wobble cushion or BOSU, you could stand on an ordinary cushion.
- Try to keep your balance for as long as possible.
- Keep your knee over the middle of your foot.

This exercise can be made harder by throwing a ball against a wall and catching it while standing on your injured leg.

Level 3

Star drill

- Stand on your injured leg with a towel under your non-injured leg.
- Squat down with your injured leg and at the same time slide your non-injured leg with the towel alternatingly in five directions: front, 45 degrees, side, 135 degrees and back.
- Between the directions straighten back to the starting position.
- Keep your knee over the middle of your foot.

NB: When squatting with the supportive leg, remember to maintain toes-knee-hip alignment.

This exercise can be made harder by standing on a wobble cushion or BOSU.

Aerobic exercise

It is important to maintain cardiovascular fitness levels while you recover.

Completing low impact exercise is safe and can help with relieving knee pain.

Work at a moderate rate intensity for up to 30 minutes using a static bike or cross trainer. Initially, start with no resistance and gradually increase resistance as your knee settles.

Plyometric exercises

When the strength and control of your knee is returning, you can gradually increase the demand on your knee by introducing hopping and jumping activities.

 ©PhysioTools Ltd	**Two-legged jump** • Jump up vertically. • Land softly, keep your knees over your mid foot and push your bottom out into a squat position on landing. • Aim 20 repetitions.
 ©PhysioTools Ltd	**Single legged hop** • Hop vertically up on your injured leg. • Land soft on your injured leg, keep your knees over your mid foot and push your bottom out into a squat position on landing. • Aim 20 repetitions.
 ©PhysioTools Ltd	**Drop jump with two footed lands.** • Stand on a step or box. Place hands on hips. • When ready, step off the box with your injured leg, making sure you don't jump. • Land softly on both feet, keep your knees over your mid foot and push your bottom out into a squat position on landing. • Immediately jump straight up as fast as you can. • Try to keep your feet on the ground for as short a time as possible. • Aim 20 repetitions.

 ©PhysioTools Ltd	**Single leg hops on / off step** • Start by standing behind a step/box. • With your injured leg, start hopping back and forth on and off the step. • When hopping off the step try to hop immediately back up trying to touch the ground as briefly as possible. • During the jump take-off and landing, remember to maintain hip-knee-toes alignment. • Aim 20 repetitions.
 ©PhysioTools Ltd	**Drop jump with one leg land.** • Start by standing on a step or box. Place hands on hips. • When ready, drop off the box onto your injured leg, making sure you jump as little as possible. • Land softly on your injured leg and jump up as fast as you can. Try to touch the ground as briefly as possible. Land gently on the same leg again. • Keep your knee over your mid foot and push your bottom out into a squat position on landing. • Aim 20 repetitions.
 ©PhysioTools Ltd	**Lateral jumps** • With feet together, hop side to side laterally over two strips of tape approximately 40 cms apart without touching them. • Do not pause between jumps. • As skill improves, widen space between strips of tape. • Keep your knee over the middle of your foot. • Aim 20 repetitions.

Practice change of direction by hopping and running around cones in a figure of 8.
Practice running in a straight line and stopping quickly followed by running again as fast as possible.

How do I know when to progress the exercises?

You should feel slightly fatigued (tired) when you have finished the final repetition of the exercise. This will encourage your muscles to adapt and get stronger. Once you find that the muscles are not fatiguing (getting tired) by the last repetition, it suggests you can increase the load (weight) used.

The following can be used to progress your exercises

- Rate of perceived exertion (RPE)
- Pain
- Swelling

Rate of perceived exertion (RPE)

- RPE measures how difficult an exercise is.
- RPE is measured on a scale of 0-10, where 10 is the maximal effort for the exercise, causing complete fatigue of the muscle working. This should mean that you are unable to perform further repetitions.
- RPE of 1 is little or no effort. If you feel you can repeat an exercise more than six times at the end of the set, it is too easy and the muscle is not working hard enough to adapt and strengthen.

To improve muscle strength, it is recommended to do 8-12 repetitions for 2-3 sets with 2-3 minutes rest between sets.

Ideally, your RPE should feel fatigued, but you should not feel exhausted. You should feel like you could manage 2-4 more repetitions once you have completed the set. This is called repetitions in reserve (RIR).

This table will explain this further.

Rate of Perceived Exertion (RPE)

Rate of Perceived Exertion (RPE)	Description of perceived Exertion. Repetition in Reserve (RIR).
10	Maximum effort
9	1 repetition remaining
8	2 repetitions remaining
7	3 repetitions remaining
5-6	4-6 repetitions remaining
3-4	Light effort
1-2	Little or no effort

Reference: Helms et al (2016).

From the table above, if your RPE goes below 6, this means that you should progress your exercises to the next level or increase the load (weight) that you are using for the exercises.

Pain

Progression of your exercises also depends on the amount of pain you are experiencing.
Aim to keep pain between 0-3/10 where 0/10 is no pain, 5/10 is moderate pain and 10/10 is extreme pain. If pain rises above 0-3/10, this usually indicates that you are doing too much and should reduce the number of repetitions and / or load used for your exercises.

Swelling

If your knee starts to swell, this usually means that you have done too much and you need to reduce the number of repetitions and / or load used for your exercises.
You can measure the swelling in your knee by placing a soft tape measure around the middle of your knee joint.
If the swelling around your injured knee is more than 1 centimetre greater than your non-injured, it may mean you are doing too much.

If your pain and / or swelling does increase, it is important to let your knee settle before continuing with your exercises to reduce further injury to your knee. **An increase in pain and swelling can be avoided by building your exercises up slowly using your RPE as a guide.**

What to do if your knee pain and swelling does not settle

If your knee pain and swelling does not improve with the advice and exercises in this leaflet or you have any other concerns, please speak to your physiotherapist or contact a member of your consultant's team.

References

Helms, E.R., Cronin J., Storey A., Zourdos M.C., (2016). Application of the repetitions in reserve-based rating of perceived exertion scale for resistance training. *Strength and Conditioning Journal,* 38 (4), 42-49.

Useful numbers and contacts

Orthopaedic Outpatients Clinical Admin Team (CAT 5)	0118 322 7415
or email: rbb-tr.cat5@nhs.net	
Physiotherapy Outpatients	0118 322 7812

Visit the Trust website at www.royalberkshire.nhs.uk

Please ask if you need this information in another language or format.

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