

## **ACL REHABILITATION PROTOCOL**

### **for physiotherapists**

Successful recovery following ACL surgical reconstruction demands a comprehensive physiotherapy-led rehabilitation programme to guarantee optimal function is achieved and to ensure no further injury.

Many factors need to be considered. The ACL graft is, in essence, a scaffold that takes in excess of 12 months to biologically remodel into a ligament structure. During this process, the graft is susceptible to injury as it has reduced strength relative to a normal ligament. The rehabilitation process should commence immediately after injury and continue for 9-12 months after surgery.

In addition to addressing neuromuscular deficiencies such as impaired muscle strength, function and compromised proprioception, the time taken for biological healing must be respected during the rehabilitation process.

This protocol is a guide only. It is primarily functional goal based with some additional time-based guidelines. Rehabilitation should obviously be individualised and may need to be modified if there are concomitant injuries or other procedures performed such as meniscal repair or chondral surgery.

### **STAGES OF REHABILITATION**

1. Prehabilitation
2. Acute recovery
3. Muscular control and co-ordination
4. Proprioception and agility
5. Sports specific training
6. Return to play

### **PREHABILITATION**

There is evidence that pre-operative physiotherapy is effective for improving the outcomes of treatment following ACL injury. ACL reconstruction should wait until the knee has recovered from the acute injury.

The knee should be pain-free and demonstrate a full range of movement. This may take a few weeks or sometimes even a few months. Furthermore, a deficit in quadriceps strength of 20% or more predicts a significant deficit until 2 years after ACL reconstruction.

Therefore, it is recommended to measure the pre-operative ROM and quadriceps strength as part of the pre-operative rehabilitation protocol and ensure that the strength deficit is not more than 20% of the healthy limb. Hamstring strength should also be recorded.

Pre-operative information about walking with crutches, the early post-operative exercises and the rehabilitation process may improve a patient's self-efficacy.

### Treatment Guidelines

- Regular icing to reduce swelling and pain.
- Recover pain-free full range of movement.
- Optimise muscular strength and function.
- Patients should be informed about post-operative exercise programme.
- Aim to prevent further episodes of instability and therefore further knee damage.
- Once range of movement improved, encourage stationary exercise bike.
- Progressively restore muscle strength (increase resistance, repetitions, complexity, introduce balance board).
- Avoid running and jumping sports because of knee instability risk.

Restoring knee function pre-surgery will result in a faster recovery post-surgery.

### **PHASE 1 - ACUTE RECOVERY**

The knee requires time to recover from the surgical procedure. The ACL graft sees minimal force with the normal activities of daily life. Most patients will leave hospital with crutches but can immediately weight-bear and crutches may be discontinued once walking comfortably. The patient will normally have instructions to remove the outer bandage the morning after surgery and will keep other dressings intact until they return for the first clinic review at approximately 12-14 days post-surgery.

#### Goals

1. Reduce swelling
2. Achieve wound healing
3. Regain full range of movement
4. Establish muscular control
5. Wean off crutches

## Treatment Guidelines

- Reduce swelling and pain with ice, cryotherapy cuff, elevation and co-contractions.
- No routine use of bracing or CPM.
- No use of Tubigrip around knee.
- Weight-bear fully as pain permits.
- Commence active range of movement exercises.
- Patella mobilisations.
- Gently aim for full extension by day 7.
- Gait retraining with full extension at heel strike.
- Active quadriceps strengthening begins as static co-contractions with hamstrings emphasising VMO control at different knee flexion angles, progressing to weight-bearing positions.
- Gentle hamstring stretches to minimise adhesions.
- Begin active hamstring strengthening initially with static weight bearing co-contractions and progress to active free hamstring contractions by day 14.
- Avoid resisted hamstring strengthening for 6-8 weeks.

## PHASE 2 - STRENGTH & CO-ORDINATION

During this phase, advance to body weight exercises and then onto a gym based programme. Avoid resisted open chain quadriceps exercises such as the leg extension machine, as they can apply an adverse strain on the ACL graft.

The ACL tendon graft progressively remodels into a ligament and, during this process, its strength and load to failure can decrease to approximately 30% of a normal ACL at 3 months. It gradually increases in strength over the subsequent 9 months.

The graft remains viable during this 'ligamentisation' process but caution should be employed during this phase. In particular, the patient should not participate in activities that involve speed or height. Swimming with a kick may begin after 6 weeks.

If intermittent swelling occurs during this phase, exercises should be modified as appropriate.

Continue with ice/cryotherapy cuff as needed.

## Goals

1. Acquire good muscle control
2. Regain balance and proprioceptive skills
3. Reduce any intermittent knee swelling

#### 4. Improve strength and endurance

##### Treatment Guidelines

- Use a stationary exercise bike as soon as able.
- Use active and passive methods to achieve full range of movement.
- Develop muscle control by increasing length of contractions, number of repetitions and more dynamic positions through squats, lunges, stepping and resistance bands.
- Progress strength exercises – e.g. half squats with resistance, leg press, wall squats, step-machine.
- Hamstring strengthening is progressed with increasing complexity and repetitions of co-contractions. Eccentric hamstring exercises can be progressed and hamstring curls may be introduced from week 6.
- Commence balance exercises, progressing from single leg exercises to wobble board.
- Address core strength, gluteal strength, tight hamstrings, iliotibial band, gastrocnemii etc.

### **PHASE 3 - PROPRIOCEPTION & AGILITY**

Once sufficient strength is attained, the focus can change to addressing balance, agility and proprioception deficits. Frequently, patients will have established poor techniques in jumping and landing that need correcting and the significance of this phase in dramatically reducing further injury cannot be over emphasised.

##### Goals

1. Resume running and jumping activities
2. Improve balance and agility
3. Continue strength and power training
4. Improve confidence in preparation for sport specific training

##### Treatment Guidelines

- Running can be progressively introduced usually around 3 months, preferably once there is good muscle strength and no knee effusion.
- Proprioceptive activities should include hopping and jumping with a strong emphasis on good technique. These should evolve with increasing complexity and height.
- Once able to perform basic running, agility exercises can commence through shuttle runs, sideways running, skipping etc.
- Emphasis always on maintaining good form through hopping, jumping and change of direction drills.

- Begin basic components of PEP programme (Prevent Injury & Enhance Performance) and advance as able (<https://www.aclstudygroup.com/pdf/pep-program.pdf>).
- Continue to develop strength and power.

#### **PHASE 4 - SPORTS SPECIFIC SKILLS**

Sports specific training can be commenced once the goals of Phase 3 have been successfully completed.

However, sport specific drills and skills that involve significant speed or height should not ideally be commenced before 6 months in consideration of the biology of ACL graft healing.

##### Goals

1. Improve jumping, landing and change of direction skills
2. Increase confidence with sports specific skills

##### Treatment Guidelines

- Progress plyometric and agility drills including perfecting single and double leg hops, jumps and change of direction skills.
- Several sports specific injury prevention programmes have been developed and, where appropriate, these should be incorporated and the drills should be individualised according to the patient's sport:
- Football (soccer) - progress through the skill components using FIFA 11+ (<http://www.f-marc.com/fifa-11/>) or the PEP programme (Prevent Injury & Enhance Performance) - (<https://www.aclstudygroup.com/pdf/pep-program.pdf>)
- Tennis - lateral step lunges, forward and backward running drills
- Skiing - slide board, hill climbers, lateral box stepping and jumping, zigzag hopping
- Rugby – Burpees, commando rolls, drop and roll drills, contact drills and tackles, side-stepping, side hurdles, plant and cut drills, quick feet drills.
- Basketball, netball - vertical jumps, jumps with overhead ball catching.

Sports specific skills should be fully mastered before a return to team training is contemplated – usually not before 10 months.

## **PHASE 5 – RETURN TO SPORTS**

Return to play is the ultimate goal of rehabilitation programmes. Timing is dependent on factors such as the specific sport, age, severity of injury, and progress with rehabilitation.

There is evidence that return to sport, especially competitive team ball sports, within 12 months increases the risk of repeat ACL injury.

### **Goals**

1. Completed sport specific training
2. Confident to return to sports
3. >90% quadriceps strength
4. >90% hop symmetry
5. >90% on Patient Reported Outcome Score (IKDC Subjective Score)
6. Understand importance of ongoing injury prevention programme

### **Treatment Guidelines**

- In general, we recommend delaying a return to competitive team sports until 12 months from surgery.
- This is particularly important for young patients.
- Guidance should be given with regards to playing within an individual's confidence level.
- Ongoing training and participation in injury prevention programmes should be encouraged.

### **CRITERIA FOR RETURN TO SPORT**

- No knee pain on sport specific activities
- Stable knee on clinical examination
- IKDC subjective score more than 90/100 (<http://orthotoolkit.com/ikdc/>)
- ACL-RSI score >60 (see below)
- >90% quadriceps strength in comparison to contralateral side
- >90% hop symmetry relative to contralateral side
- Good performance on drop vertical jump – no valgus, adequate knee flexion, symmetrical landing
- Successful completion of sports specific training programme and return to team training

- Ongoing injury prevention programme

Altered neuromuscular function and biomechanics (greater hip internal rotation, the occurrence of dynamic knee valgus or less knee flexion during landing) after ACL reconstruction could be risk factors for a second ACL injury (graft re-rupture or contra-lateral rupture).

## ACL-RSI SCALE

Instructions: Please answer the following questions referring to your main sport prior to your injury. For each question tick a box between the two descriptions to indicate how you feel right now relative to the two extremes.

1. Are you confident that you can perform at your previous level of sport participation?

Not at all confident	0	10	20	30	40	50	60	70	80	90	100	Fully confident
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

2. Do you think you are likely to reinjure your knee by participating in your sport?

Extremely likely	0	10	20	30	40	50	60	70	80	90	100	Not likely at all
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

3. Are you nervous about playing your sport?

Extremely nervous	0	10	20	30	40	50	60	70	80	90	100	Not nervous at all
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

4. Are you confident that you could play your sport without concern for your knee?

Not at all confident	0	10	20	30	40	50	60	70	80	90	100	Fully confident
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

5. Do you find it frustrating to have to consider your knee with respect to your sport?

Extremely frustrating	0	10	20	30	40	50	60	70	80	90	100	Not at all frustrating
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

6. Are you fearful of reinjuring your knee by playing your sport?

Extremely fearful	0	10	20	30	40	50	60	70	80	90	100	No fear at all
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Sum individual items and divide by 6.

Maximum score is 100. A higher score indicates a more positive psychological response.

Reference – Webster KE, Feller JA. Development and validation of short version of the Anterior Cruciate Ligament Return to Sport After Injury (ACL-RSI) Scale. Orthopaedic Journal of Sports Medicine 2018.