



ACL Rehabilitation Guide



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Our Mission

At BSPC, we strive to achieve absolute customer satisfaction and optimal patient outcomes via:

- Listening and understanding patients' values
- Employing therapists with clinical expertise
- Utilising the latest research evidence

Vision

"We believe everyone deserves to be treated like an athlete."

We all know athletes strive for perfection, demand the best and are driven to reach their goals. In doing so, they require cutting edge technology and techniques, access to the latest research and clinicians that understand their needs.

Why shouldn't you have access to the same level of care?

All our goals are different. Some run marathons, some walk around the block. Each are valuable and unique... and we are passionate about helping you achieve yours.

You don't have to be an athlete to receive the highest standard of care.

That is what we believe at BSPC. Come and experience the difference...

Our Values

1. Be Passionate
2. Be Professional
3. Practice What We Preach
4. Constant Improvement
5. Respect

ACL Rehabilitation Guide - Introduction

This is a guide for physiotherapists and patients who have undergone Anterior Cruciate Ligament (ACL) reconstruction surgery. The protocol has five progressive phases using evidence based rehabilitation goals and defined criteria.

The ACL is one of the ligaments within your knee joint. Its role is to provide stability to the knee in both a straight position and in rotational movements. If ruptured, the ligament can be surgically reconstructed, usually using tissue from your hamstrings or patella tendon. The surgery is traumatic to your knee joint and it is important to have a period of rest and recovery following the surgery. The nature of your occupation will determine how long it is until you will be able to return to work. This can be discussed with your physiotherapist and surgeon.

At Balwyn Sports & Physiotherapy Centre we provide a comprehensive rehabilitation pathway which will get you back to sport in the best possible shape, when you are ready to return. Our physios are experts in sports rehabilitation and will guide you through the entire process. We also have access to gym facilities to complete your testing and take you through any gym based exercises that are required.

This ACL rehabilitation protocol is not based on time frames, rather a series of criteria that progressively evaluate your position on the rehabilitation pathway.

Each phase has goals that should all be achieved before moving onto the subsequent phase. Exercises will vary between patients, based on their own individual circumstances and sporting goals, however the criteria remain the same. Your physiotherapist will work with you to develop an individualised treatment and exercise program based on your needs.

Here are some tips to help you achieve the best results during your recovery from your surgery:

- Achieve full extension (knee straight) early after the operation and then keep it straight
- Listen to your knee – if it is becoming increasingly painful or swollen, it is most likely telling you to reduce your activity levels as your knee isn't coping with your current program. This should be discussed with your physiotherapist and/or surgeon
- Consider a gym membership: Although not crucial, we find a well-equipped gym to be very advantageous for your rehabilitation. Ask us for our recommendations
- Strengthen and develop your non-operated leg as well – it needs to be ready to return to sport as much as your operated leg does

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- Don't return to running, sport or other exercise until you're given clearance by your physiotherapist – exercises such as running and jumping will be gradually worked into your program when appropriate. It will take time for your knee to adjust to these activities again
- Full recovery from ACL reconstruction surgery requires a significant commitment from yourself and your physio. It is important you finish the recovery program to make sure your knee is functioning as well as possible for your occupation, sport and long term joint health.

The five phases of the protocol are:

- 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

Where possible, the tests in this protocol are evidence based. The testing is completed at the Balwyn Sports & Physiotherapy Centre building in the clinic and we also have access to the Anytime Fitness gym within the building. We also complete some of the Phase 4 testing at a nearby sporting ground.

This ACL rehabilitation protocol is a guide only and should not override clinical reasoning and judgement from your physiotherapist.

This protocol is a modified version of Randall Cooper's ACL Rehabilitation Guide and we appreciate and acknowledge his contribution.

ACL Rehab: Criteria Driven Protocol Goal Based

	1 Phase 1: Recovery from Surgery
	2 Phase 2: Strength & neuromuscular control
	3 Phase 3: Running, agility & landings
	4 Phase 4: Return to sport
	5 Phase 5: Prevent re-injury

Phase 1: Recovery from Surgery

ACL reconstruction surgery is traumatic to the knee. It is important that you rest and recover for a period of time after the surgery. This period is different for everyone, and the period of time you need to take off work will mainly depend on the nature of your job. However, in the first 1-2 weeks after the operation, it is best that you let the pain and swelling in your knee settle. Basic range of movement and quadriceps strengthening exercises can be completed along with ice and compression. Your physiotherapist will help you progress off crutches when it is appropriate.

There are two common graft donor sites: the hamstrings or patella tendon. Use ice and compression on these sites too. Exercises are aimed to regain full knee extension (straightening), improve quadriceps muscle function and improve knee flexion (bending). Your surgeon or doctor may prescribe pain relief and other medications.

The main goals of Phase 1 are:

1. Control pain and swelling
2. Get the knee straight (full extension)
3. Get the quadriceps firing again



1 PHASE Recovery from Surgery

1. Control pain & swelling
2. Get the knee straight
3. Get quadriceps firing

Phase 1: Outcome Measures & Goals

Outcome Measure	Test Description & Reference	Goal	✓
Passive Knee Extension	Supine with a long arm goniometer [Norkin & White, 1995]. Bony landmarks: greater trochanter, the lateral femoral condyle, and the lateral malleolus.	0°	<input type="checkbox"/>
Passive Knee Flexion	Supine with a long arm goniometer [Norkin & White, 1995]. Bony landmarks: greater trochanter, the lateral femoral condyle, and the lateral malleolus.	100°	<input type="checkbox"/>
Swelling/Effusion	Stroke Test [Sturgill et al, 2009] Zero: No wave produced on downstroke Trace: Small wave on medial side with downstroke 1+: Large bulge on medial side with downstroke 2+: Effusion spontaneously returns to medial side after upstroke 3+: So much fluid that it is not possible to move the effusion out of the medial aspect of the knee	Zero - 1+	<input type="checkbox"/>
Strength	Quadriceps lag test *variation [Stillman, 2004] With the patient sitting on the edge of a treatment bed, the therapist takes the relaxed knee into full passive extension. The patient is then required to maintain full active extension of the knee when the therapist removes support.	0° to 5° lag	<input type="checkbox"/>

Phase 2: Strength & Neuromuscular Control

Phase 2 is about regaining strength, coordination and balance into the affected leg. This phase usually commences with simple, double leg body weight exercises, progresses to single leg body weight exercises and then on to heavier, gym based resistance training. There are also balance and coordination exercises incorporated.

During this phase, it is important to “listen to your body”. As you and your physiotherapist are trying to progress the strength, you may get more swelling or pain. If this is the case, inform your physio as the knee may not be tolerating the work load.

Typically, running commences during Phase 3 and it's important that your legs have the strength, balance and coordination to be ready to begin this. Phase 2 often also includes non-impact aerobic conditioning exercises such as cycling and/or swimming.

The main goals of Phase 2 are:

- Regain most of your single leg balance
- Regain most of your muscle strength
- Be able to single leg squat with good technique and alignment



2 PHASE
Strength & neuromuscular control



1. Regain single leg balance
2. Regain most of your muscle strength
3. Be able to single leg squat with good technique & alignment

Phase 2: Outcome Measures & Goals

Outcome Measure	Test Description & Reference	Goal	✓
Passive Knee Extension	Prone hang test (Sachs et al, 1989) Subjects lie prone on a treatment bed with the lower legs off the end allowing full passive knee extension. The heel height difference is measured (approx 1cm = 1°)	Equal to the other side	<input type="checkbox"/>
Passive Knee Flexion	See description in Phase 1	125°+	<input type="checkbox"/>
Swelling/Effusion	See description in Phase 1	Zero	<input type="checkbox"/>
Functional Alignment Test	Single leg squat test (Crossley et al, 2011) Subjects stand on one leg on a 20cm box with arms crossed. 5 x single leg squats are performed in a slow controlled manner (at a rate of 2 seconds per squat). The task is rated as "good", "fair" or "poor". For a subject to be rated "good"; <ul style="list-style-type: none"> - Maintain balance - Perform the movement smoothly - Squat must be to at least 60 degrees - No trunk movement (lateral deviation, rotation, lateral flexion, forward flexion) - No pelvic movement (shunt or lateral deviation, rotation, or tilt) - No hip adduction or internal rotation - No knee valgus - Centre of knee remains over centre of foot 	"Good"	<input type="checkbox"/>
Single Leg Bridges	Single leg bridge test variation (Freckleton et al, 2013) Subjects lie supine on the floor with one heel on a box or plinth at 60cm high. The knee of the test leg is slightly bent at 20° and opposite leg is bent to 90° hip and knee flexion with their arms crossed over chest. Subjects elevate the hips as high as possible and the assessor places a hand at this height. Repeat this action as many times as possible touching the assessors hand each time. The test concludes when the subject is unable to bridge to the original height (assessors hand).	→85% compared with other side	<input type="checkbox"/>

Phase 2: Outcome Measures & Goals

Outcome Measure	Test Description & Reference	Goal	✓
Calf Raises	<p>Single leg calf raises</p> <p>Subjects stand on one foot on the edge of the step and perform a calf raise through full range of motion. Calf raises are performed at 1 repetition every 2 seconds. The test concludes when subjects are unable to move through full range or slow below the cadence outlined above.</p>	<p>→85% compared with other side</p> <p>[Hurdle requirement = 15 repetitions]</p>	<input type="checkbox"/>
Side Bridge Endurance Test	<p>Side bridge test (McGill et al, 1999)</p> <p>Subjects lie on an exercise mat on their side with legs extended. The top foot is placed in front on the lower foot, then subjects lift their hips off the mat to maintain a straight line over their full body length for as long as able. The test (time) ends when the hips return to the mat.</p>	<p>→85% compared with other side</p> <p>[Hurdle requirement = 30 seconds]</p>	<input type="checkbox"/>
Single Leg Press	<p>1RM Single Leg Press</p> <p>This test can be performed in most commercial gymnasiums that have an incline leg press. Please ensure an appropriate warm up.</p> <p>Seat position is at 90 degrees to the slide, and the foot should be placed so that the hip is flexed to 90 degrees. A valid repetition is where the weight is lowered to a depth of 90 degrees knee flexion and then extended back to full knee extension.</p>	<p>1.5 x Body Weight (sled + weight)</p>	<input type="checkbox"/>
Balance	<p>Unipedal stance test (Springer et al, 2007)</p> <p>Subjects stand on one leg with other leg raised and arms crossed over the chest. The assessor uses a stopwatch to time how long stance is maintained on one leg with a) eyes open, and b) eyes closed.</p> <p>Time ends when:</p> <ul style="list-style-type: none"> - Arms are used (uncrossed) - Use of the raised foot (touches down or other leg) - Movement of the stance foot - 45 secs has elapsed (maximum time) - Eyes opened on eyes closed trials 	<p>A (eyes open) 43 seconds</p> <p>B (eyes closed) 9 seconds</p> <p>[Normative data for 18-39 year olds]</p>	<input type="checkbox"/>

Phase 3: Running, Agility & Landings

Throughout Phase 3, you will progress to hopping, running, jumping, dynamic balance activities and further progress your strengthening program. It's important to focus on the correct technique. Your physiotherapist will take you through drills to make sure your landing (changing direction at speed) and other activities are performed optimally to minimise the risk of re-injury.

Phase 3 prepares you for the sports specific training in Phase 4. The exercises in Phase 3 will increase the load on your knee, so it's important you take appropriate rest both during and between sessions. Pain and knee swelling should not be present during Phase 3, so if these occur, they should be discussed with your physiotherapist.

The main goals of Phase 3 are:

1. Regain full strength and balance
2. Progress successfully through an agility program
3. Score 'excellent' on a jump rebound task



3 PHASE
Running, agility & landings

1. Regain full strength & balance
2. Progress successfully through an agility program
3. Score 'excellent' on a jump rebound task

Phase 3: Outcome Measures & Goals

Outcome Measure	Test Description & Reference	Goal	✓
Single Hop Test	<p>Single leg hop test (Reid et al, 2007)</p> <p>Subjects stand on one leg and hop as far forward as possible and land on the same leg. The distance is recorded with a tape measure which is fixed to the ground.</p> <p>Two valid hops are performed.</p> <p>A limb symmetry index is calculated by dividing the mean distance (in cms) of the involved limb by the mean distance of the non involved limb then multiplying by 100.</p>	→90% compared with other side	<input type="checkbox"/>
Triple Cross Over Hop Test	<p>Triple Cross Over Hop Test (Reid et al, 2007)</p> <p>This test is performed on a course consisting of a 15cm marking strip on the floor which is 6m long. Subjects are required to hop three consecutive times on one foot, crossing the strip on each hop. The total distance is measured.</p> <p>Two valid hops are performed.</p> <p>A limb symmetry index is calculated by dividing the mean distance (in cms) of the involved limb by the mean distance of the non involved limb then multiplying by 100.</p>	→90% compared with other side	<input type="checkbox"/>
Modified Landing Error Scoring System	<p>Landing Error Scoring System (LESS) (Padua et al, 2009)</p> <p>Subjects jump off a 30cm high box onto the ground (at a distance from the box of 50% of their height) and immediately jump vertically upward as high a possible. The subject performs this task multiple times until the assessor has observed and marked all items/errors on the criteria.</p> <p>A visual or video analysis can be performed using the following criteria:</p> <p>Sagittal (Side) View</p> <ul style="list-style-type: none"> • Hip flexion angle at contact – hips are flexed Yes=0, No=1 • Trunk flexion angle at contact – trunk in front of hips Yes=0, No=1 • Knee flexion angle at contact – greater than 30 degrees Yes=0, No=1 • Ankle plantar flexion angle at contact – toe to heel Yes=0, No=1 • Hip flexion at max knee flexion angle – greater than at contact Yes=0, No=1 • Trunk flexion at max knee flexion – trunk in front of the hips Yes=0, No=1 • Knee flexion displacement – greater than 30 degrees Yes=0, No=1 • Sagittal plane joint displacement Large motion (soft)=0, Average=1, Small motion (loud/stiff)=2 	<p>Excellent</p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Soft <input type="checkbox"/></p> <p>Average <input type="checkbox"/></p> <p>Stiff <input type="checkbox"/></p>	<input type="checkbox"/>

Phase 3: Outcome Measures & Goals

Outcome Measure	Test Description & Reference	Goal	✓
Modified Landing Error Scoring System	<p>Coronal (Frontal) View</p> <ul style="list-style-type: none"> • Lateral (side) trunk flexion at contact – trunk is flexed Yes=0, No=1 • Knee valgus angle at contact – knees over the midfoot Yes=0, No=1 • Knee valgus displacement – knees inside of large toe Yes=1, No=0 • Foot position at contact – toes pointing out greater than 30 degrees Yes=1, No=0 • Foot position at contact - toes pointing out less than 30 degrees Yes=1, No=0 • Stance width at contact - less than shoulder width Yes=1, No=0 • Stance width at contact - greater than shoulder width Yes=1, No=0 • Initial foot contact - symmetric Yes=0, No=1 • Overall impression – Excellent=0, Average=1, Poor=2 <p>Stratification of an individual's jump performances are represented with the following scale:</p> <ul style="list-style-type: none"> • Excellent (0-3) • Good (4-5) • Moderate (6) • Poor (7 or greater) 	<p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Y <input type="checkbox"/> N <input type="checkbox"/></p> <p>Excellent <input type="checkbox"/> Average <input type="checkbox"/> Poor <input type="checkbox"/></p> <p>TOTAL:</p>	<input type="checkbox"/>
Single Leg Press	<p>1RM Single Leg Press</p> <p>This test can be performed in most commercial gymnasiums that have an incline leg press. Please ensure an appropriate warm up.</p> <p>Seat position is at 90 degrees to the slide, and the foot should be placed so that the hip is flexed to 90 degrees. A valid repetition is where the weight is lowered to a depth of 90 degrees knee flexion and then extended back to full knee extension.</p>	1.8 x Body Weight (sled + weight)	<input type="checkbox"/>
Balance	<p>Star Excursion Balance Test (Gribble et al, 2012)</p> <p>The star excursion balance test (SEBT) is performed in the anterior, posterolateral, and posteromedial directions. If unfamiliar with the SEBT, watch the following video link: http://www.youtube.com/watch?v=OQPUdZYkII8</p> <p>A composite score for all 3 directions is obtained for each leg. A limb symmetry index is then calculated by dividing the mean distance (in cms) of the involved limb by the mean distance of the noninvolved limb then multiplying by 100.</p>	→95% compared with other side	<input type="checkbox"/>

Phase 4: Return to Sport

Phase 4 prepares you for returning to sport and the exercises, drills and focus will be more sports specific. This will include gradually introducing drills that you might normally complete at training, through to partially and then fully returning to your normal training regime.

The focus in this section is not only on your knee, but your whole body. You will need to regain your confidence in your knee and your whole body. Your knee and body need to be strong and well controlled during movement.

The testing to complete Phase 4 is based on our version of the Melbourne Return to Sport Score. We have included an extra test, to judge your changing direction while at high speed. Our deep understanding of the risk factors for an ACL led us to include this as a crucial factor in preventing recurrence. We are comfortable with people returning to competitive sport if they have satisfied the following criteria:

1. Successful completion of the Melbourne Return to Sport Score (Score of > 95)
2. Successful completion of unplanned change of direction at high speed test
3. The athlete is comfortable, confident and eager to return to sport
4. An ACL injury prevention program is discussed, implemented and continued whilst the athlete is participating in sport



4 PHASE
Return to sport

1. Successful completion of the Melbourne Return to Sport Score (Score of > 95)
2. Successful completion of unplanned change of direction at high speed test
3. The athlete is comfortable, confident and eager to return to sport
4. An ACL injury prevention program is discussed, implemented and continued whilst the athlete is participating in sport

Phase 4: Melbourne Return to Sport Score

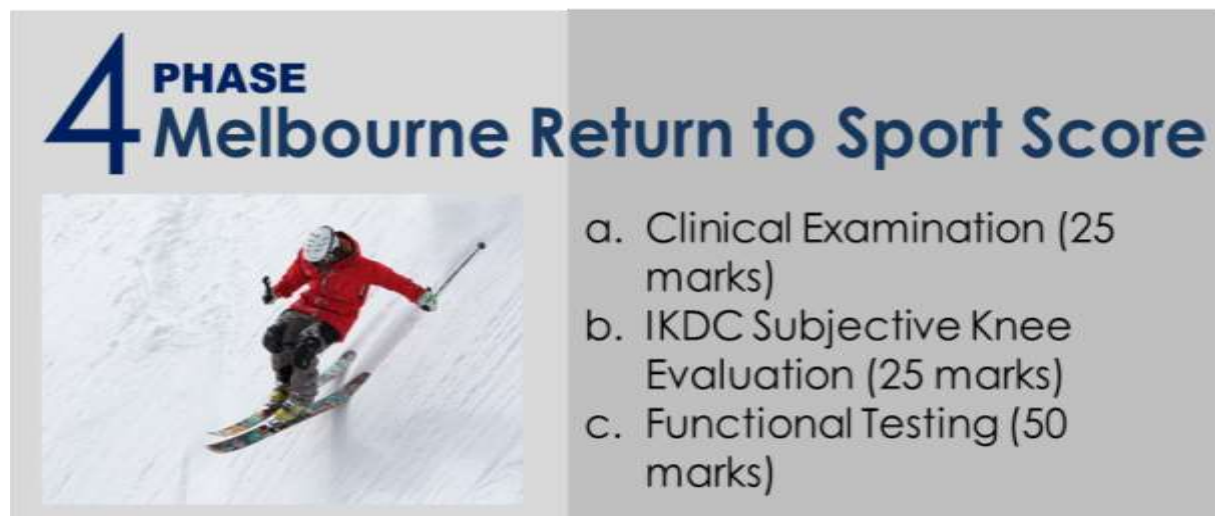
The Melbourne Return to Sport Score (MRSS) is an assessment tool for returning to sport following anterior cruciate ligament reconstruction.

There are three components to the test:

- a) Clinical Examination (25 marks)
- b) IKDC Subjective Knee Evaluation (25 marks)
- c) Functional testing (50 marks)

People receive a score out of 100, and pilot data suggests that a score of greater than 95 indicates a greater chance of returning to pre-injury sports and in the short term, predicts a quicker return to form.

All tests in the MRSS other than the Lachman's test, pivot shift test, IKDC, and the single leg squats to fatigue test have been described in previous chapters on ACL Rehab Phases 1-3. The single leg squats to fatigue test is described in the relevant sections.



4 PHASE
Melbourne Return to Sport Score

a. Clinical Examination (25 marks)
b. IKDC Subjective Knee Evaluation (25 marks)
c. Functional Testing (50 marks)

Phase 4: Melbourne Return to Sport Score

Part A: Stability, Swelling, & Range (see pg. 17)

Item	Result	Score	
Effusion		/5	
Stability		/10	
Flexion		/5	
Extension		/5	Converted
		/25	/25

Part B: IKDC Subjective Knee Evaluation Form (see pg. 18)

Item	Raw Score	Converted
IKDC	/100	/25

Part C: Functional Testing (see pg. 21)

Item	Result	Score	
Balance		/10	
Single Hop		/5	
Triple Hop		/5	
Jump/land		/25	
SL Squats		/5	Converted
		/50	/50

Final Score

Final Score	/100
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Phase 4: Functional Testing Sheet

Star Excursion Balance Test

	Right	Left	LSI	Points
Anterior			%	/5
Posteromedial				
Posterolateral			LSI	Points
Total			%	/5

Single Hop Test

	Right	Left		
Trial 1	cm	cm		
Trial 2	cm	cm	LSI	Points
Mean	cm	cm	%	/5

Triple Cross Over Hop Test

	Right	Left		
Trial 1	cm	cm		
Trial 2	cm	cm	LSI	Points
Mean	cm	cm	%	/5

Abridged LESS: Jump-Land-Rebound Score

Item	Score	
Knee valgus at contact	/5	
Knee flexion → 30 degrees	/5	
Trunk stability at contact	/5	
Foot contact – symmetrical/30°	/5	
Overall impression	/5	Points
Total	/25	/25

Single Leg Squats to Fatigue (90° knee flexion)

	Right	Left	LSI	Points
Trial 1			%	/5

Phase 4: Melbourne Return to Sport Score Criteria

The following section explains the criteria for each of the Melbourne Return to Sport Score (MRSS) outcome measures.

Part A: Stability, Swelling, & Range

Test	Outcome	Points Awarded
Effusion	Absent	5 points
	Present	0 points
Lachman's test	Nil	5 points
	Mild	3 points
	Moderate-severe	0 points
Pivot shift test	Nil	5 points
	Grade I	3 points
	Grade II	1 points
	Grade III-IV	0 points
Flexion	0-5 degrees deficit	5 points
	5-20 degrees deficit	3 points
	20+ degrees deficit	0 points
Extension (Prone Hang Test)	0-2cm deficit	5 points
	2-5cm deficit	3 points
	5cm+ deficit	0 points
		/25 points

Presence of effusion test

- absent
- present

Lachman's test

- Nil: no difference to the uninvolved side
- Mild: 0 to 5 mm laxity (greater than the uninvolved side)
- Moderate: 6 to 10 mm laxity (greater than the uninvolved side)
- Severe: 11 to 15 mm laxity (greater than the uninvolved side)

Pivot shift test

- I: Gentle twisting slide with tibia twisting internally maximally
- II: Clunk with tibia neutral, negative when tibia externally rotated
- III: Painless glide for examiner and patient
- IV: Jamming and plowing, impingement

Phase 4: Melbourne Return to Sport Score Criteria

Part B: IKDC Subjective Knee Evaluation Form

Test	Outcome	Points Awarded
IKDC	Raw score /100 Divide by 4	/25 points

Your Full Name _____

Today's Date: ____/____/____ Date of Injury: ____/____/____
Day Month Year Day Month Year

SYMPTOMS*:

*Grade symptoms at the highest activity level at which you think you could function without significant symptoms, even if you are not actually performing activities at this level.

1. What is the highest level of activity that you can perform without significant knee pain?

- 4 Very strenuous activities like jumping or pivoting as in basketball or soccer
- 3 Strenuous activities like heavy physical work, skiing or tennis
- 2 Moderate activities like moderate physical work, running or jogging
- 1 Light activities like walking, housework or yard work
- 0 Unable to perform any of the above activities due to knee pain

2. During the past 4 weeks, or since your injury, how often have you had pain?

- Never | 0 1 2 3 4 5 6 7 8 9 10 | Constant

3. If you have pain, how severe is it?

- No pain | 0 1 2 3 4 5 6 7 8 9 10 | Worst pain imaginable

4. During the past 4 weeks, or since your injury, how stiff or swollen was your knee?

- 4 Not at all
- 3 Mildly
- 2 Moderately
- 1 Very
- 0 Extremely

5. What is the highest level of activity you can perform without significant swelling in your knee?

- 4 Very strenuous activities like jumping or pivoting as in basketball or soccer
- 3 Strenuous activities like heavy physical work, skiing or tennis
- 2 Moderate activities like moderate physical work, running or jogging
- 1 Light activities like walking, housework, or yard work
- 0 Unable to perform any of the above activities due to knee swelling

6. During the past 4 weeks, or since your injury, did your knee lock or catch?

- 0 Yes
- 1 No

7. What is the highest level of activity you can perform without significant giving way in your knee?

- 4 Very strenuous activities like jumping or pivoting as in basketball or soccer
- 3 Strenuous activities like heavy physical work, skiing or tennis
- 2 Moderate activities like moderate physical work, running or jogging
- 1 Light activities like walking, housework or yard work
- 0 Unable to perform any of the above activities due to giving way of the knee

Phase 4: Melbourne Return to Sport Score Criteria

SPORTS ACTIVITIES:

8. What is the highest level of activity you can participate in on a regular basis?

- 4 Very strenuous activities like jumping or pivoting as in basketball or soccer
- 3 Strenuous activities like heavy physical work, skiing or tennis
- 2 Moderate activities like moderate physical work, running or jogging
- 1 Light activities like walking, housework or yard work
- 0 Unable to perform any of the above activities due to knee

9. How does your knee affect your ability to:

		Not difficult at all	Minimally difficult	Moderately Difficult	Extremely difficult	Unable to do
a.	Go up stairs	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
b.	Go down stairs	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
c.	Kneel on the front of your knee	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
d.	Squat	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
e.	Sit with your knee bent	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
f.	Rise from a chair	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
g.	Run straight ahead	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
h.	Jump and land on your involved leg	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>
i.	Stop and start quickly	4 <input type="checkbox"/>	3 <input type="checkbox"/>	2 <input type="checkbox"/>	1 <input type="checkbox"/>	0 <input type="checkbox"/>

FUNCTION:

10. How would you rate the function of your knee on a scale of 0 to 10 with 10 being normal, excellent function and 0 being the inability to perform any of your usual daily activities which may include sports?

FUNCTION PRIOR TO YOUR KNEE INJURY:

Couldn't perform daily activities	0	1	2	3	4	5	6	7	8	9	10	No limitation in daily activities
	<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"/>	

CURRENT FUNCTION OF YOUR KNEE:

Can't perform daily activities	0	1	2	3	4	5	6	7	8	9	10	No limitation in daily activities
	<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"/>	

Phase 4: Melbourne Return to Sport Score Criteria

Several methods of scoring the IKDC Subjective Knee Evaluation Form were investigated. The results indicated that summing the scores for each item performed as well as more sophisticated scoring methods.

The responses to each item are scored using an ordinal method such that a score of 0 is given to responses that represent the lowest level of function or highest level of symptoms. For example, item 1, which is related to the highest level of activity without significant pain, is scored by assigning a score of 0 to the response "Unable to perform any of the above activities due to knee pain" and a score of 4 to the response "Very strenuous activities like jumping or pivoting as in basketball or soccer". For item 2, which is related to the frequency of pain over the past 4 weeks, the responses are reverse-scored such that "Constant" is assigned a score of 0 and "Never" is assigned a score of 10. Similarly, for item 3, the responses are reversed - scored such that "Worst pain imaginable" is assigned a score of 0 and "No pain" is assigned a score of 10. Note: previous versions of the form had a minimum item score of 1 (for example, ranging from 1 to 11). In the most recent version, all items now have a minimum score of 0 (for example, 0 to 10). To score these prior versions, you would need to transform each item to the scaling for the current version.

The IKDC Subjective Knee Evaluation Form is scored by summing the scores for the individual items and then transforming the score to a scale that ranges from 0 to 100. Note: The response to item 10a "Function Prior to Knee Injury" is not included in the overall score. To score the current form of the IKDC, simply add the score for each item (the small number by each item checked) and divide by the maximum possible score which is 87:

$$\text{IKDC Score} = \left[\frac{\text{Sum of Items}}{\text{Maximum Possible Score}} \right] \times 100$$

Thus, for the current version, if the sum of scores for the 18 items is 45 and the patient responded to all the items, the IKDC Score would be calculated as follows:

$$\text{IKDC Score} = \left[\frac{45}{87} \right] \times 100$$

$$\text{IKDC Score} = 51.7$$

The transformed score is interpreted as a measure of function such that higher scores represent higher levels of function and lower levels of symptoms. A score of 100 is interpreted to mean no limitation with activities of daily living or sports activities and the absence of symptoms.

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The IKDC Subjective Knee Form score can be calculated when there are responses to at least 90% of the items (i.e. when responses have been provided for at least 16

items). In the original scoring instructions for the IKDC Subjective Knee Form, missing values are replaced by the average score of the items that have been answered. However, this method could slightly over- or under-estimate the score depending on the maximum value of the missing item(s) (2, 5 or 11 points). Therefore, in the revised scoring procedure for the current version of a form with up to two missing values, the IKDC Subjective Knee Form Score is calculated as: $(\text{sum of the completed items}) / (\text{maximum possible sum of the completed items}) \times 100$. This method of scoring the IKDC Subjective Knee Form is more accurate than the original scoring method.

A scoring spreadsheet is also available at: www.sportsmed.org/research/index.asp

This spreadsheet uses the current form scores and the revised scoring method for calculating scores with missing values.

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Part C: Functional Testing

Test	Outcome	Points Awarded
Balance		/10
Single Hop		/5
Triple Hop		/5
Abr LESS: Jump/land		/25
Single Leg Squats		/5
		/50 points

Functional Assessment Scoring:

The hop tests, single leg squats, and star excursion balance test will be calculated as a limb symmetry index by dividing the mean distance (cms), or repetitions of the involved limb by the mean of the non-involved limb, and multiply by 100. Each criteria of the abridged Landing Error Scoring System (LESS) -jump/land/rebound task will be assessed on a 0/5 point scale:

	Points Awarded
Excellent / NAD	5 points
Mild, Moderate, or Severe Error	0 points

For the tests that use the limb symmetry index, the following criteria will apply:

Limb Symmetry Index (dominant leg)	Points Awarded	Limb Symmetry Index (non dominant leg)	Points Awarded
97-105	10/10 or 5/5	95-103	10/10 or 5/5
90-96 / 105-110	8/10 or 4/5	85-94 / 103-110	8/10 or 4/5
80-89 / 110-120	6/10 or 3/5	75-84 / 110-120	6/10 or 3/5
70-79 / 120-130	4/10 or 2/5	65-74 / 120-130	4/10 or 2/5
60-69 / 130-140	2/10 or 1/5	55-64 / 130-140	2/10 or 1/5
<60 / 140+	0 points	<55 / 140+	0 points

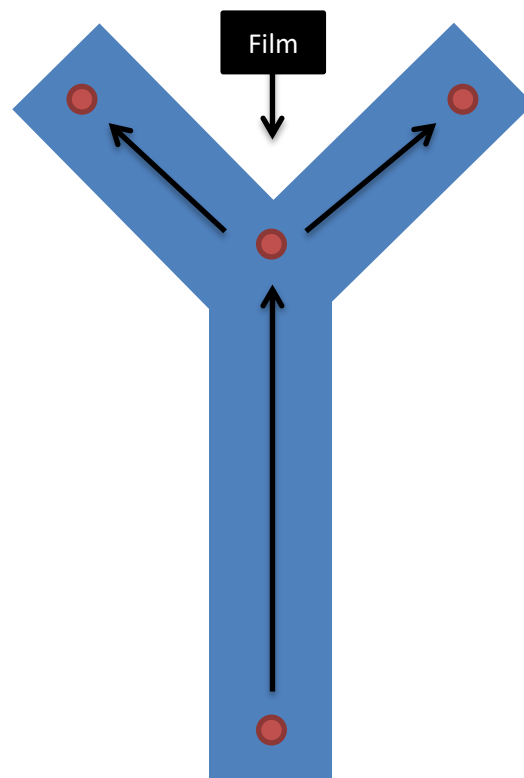
The single leg squats to fatigue test:

Subjects are seated on the edge of a treatment plinth with hips and knees at 90°. Arms are to be crossed over the chest. On one leg, subjects are asked to rise to a fully extended knee as many times as possible at a tempo of 2 seconds up and 2 seconds down. The test is complete when subjects are unable to complete any further squats or the tempo or form is incorrect. The maximum number of squats is recorded for each leg.

Unplanned change of direction at high speed test

The unplanned change of direction at high speed test is designed to assess your biomechanics when changing direction. Many ACL injuries occur while changing direction, and we believe it is important to assess this. The test is conducted with a 10 metre run way, followed by a cone, and then a cone at 45° on both sides, five metres away. The athlete runs at high speed (minimum of 4m/s) along the 10 metre runway. When they are two metres from the end of the runway, the physiotherapist calls either “left” or “right” and the athlete changes direction to that side. The change of direction is filmed from in front of the athlete, and footage is assessed by the physiotherapist. Five tests are completed.

A successful test is where the athlete does not decelerate of the contralateral leg (2nd last leg before changing direction), but instead completes deceleration using the push off leg. They should not plant their push off leg far outside their body.



Phase 5: Prevention of further injury

Once you have returned to sport, it is important you continue an ongoing program to help prevent re-injury as much as possible. ACL injury prevention programs aim to improve the neuromuscular control of individuals during standing, cutting and landing tasks. Most ACL injuries occur during change of direction at high speed, also known as cutting, or when landing on one leg from an out of control situation. It is important that athletes continue strength training and develop neuromuscular connections to help prevent a further injury.

The program should be completed more than once a week while the athlete is continuing to play sport. The program should include strength, balance and plyometric exercises. At a minimum, the program should be completed for at least six weeks after returning to sport.

5 PHASE Prevent re-injury



- a. Plyometric, balance & strengthening exercises
- b. A program performed more than once per week
- c. A program that continues for at least 6 weeks.

Phase 5: Prevention of further injury

Two popular programs are the FIFA 11+ and the PEP program.

1. The FIFA 11+

Link: <http://usclubsoccer.org/wp-content/uploads/2015/08/POSTER-FIFA-11-.pdf>

The FIFA 11+ has been shown to reduce injury rates in soccer players. It is divided into three parts: part 1 is a series of running based exercises, part 2 focuses on strength, balance and stability and part 3 is a further set of running exercises. It takes approximately 20 minutes to complete and can be used as a warm up before training. Parts 1 and 3 can be used as a warm up before a match.

2. The PEP

Link: <http://smsmf.org/smsf-programs/pep-program>

The PEP (Prevent injury, Enhance Performance) Program is a highly specific 15-minute training session that replaces the traditional warm-up. It was developed by a team of physicians, physical therapists, athletic trainers and coaches, and has funding support from the Amateur Athletic Foundation of Los Angeles (AAF). The program's main focus is educating players on strategies to avoid injury and includes specific exercises targeting problems as identified in previous research studies.



5 PHASE
Prevent re-injury

"Women are up to eight times more likely to sustain an ACL injury than men who undertake the same sport or activity."