

# ACL

## ACL Rehabilitation Protocol v1.0



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# ACL REHABILITATION PROTOCOL



60+ mins read

Total 38 pages

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## About

- An evidence-based criteria driven ACL guideline for both clinicians and people who have undergone surgical Anterior Cruciate Ligament Reconstruction (ACLR)

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# About the Author



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Winnie is an experienced Physiotherapist who consults at Breathe Physio & Pilates.

She works closely with lower limb amputees and ACL injuries to help them return to sports.

She is also involved with several football teams including working with the Indigenous Australian football players from the SEQ Serpents Football Team.

Winnie is also an avid cyclist, runner and regularly engages in strength training.

She has also personally gone through ACL reconstruction in February 2022. She has since completed her course of rehabilitation and has successfully returned to sports and continued with weightlifting.

After hours of research, writing, editing and hard work, Winnie has produced the ultimate guide for clinicians and athletes with ACL injury and reconstruction.

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## INTRODUCTION

# ACL REHAB GUIDELINE

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The ACL rehabilitation guideline featured in this eBook is designed for clinicians and people who have undergone surgical ACLR.

We have designed this guide to be interactive and to be read stage by stage adjacent to your rehab journey. So don't be too stressed out about reading the whole book in one go!

The ACL injury is perhaps the most common injury in the sporting population. It is estimated that there are approximately 85 ACL injuries per 100,000 people (Renstrom, 2013) and almost 80% of the injuries to this ligament are caused by non-contact events involving a sudden deceleration or change in direction (Rentrom *et al*, 2008).

The main objective of ACLR is to address the anterior-posterior and rotational instability of the knee joint and prevent further degradation in the long-term.

The graft used for ACLR can vary among individuals depending on several factors such as the extent of the injury, whether the hamstring tendon is viable for harvest, or based on personal choice.

Options can range from hamstrings graft, patellar tendon graft and even allograft from donors.



## Tips!

Here are a few tips to help you through the ACL rehabilitation guideline with minimal problems:

- Move through the protocol at your own pace. Try not to compare yourself with others and be disheartened if you fall behind as ACLR is complex and different for each person.
- It is possible to accelerate rehab time-frame under the right conditions, specific criteria should be used to progress onto the next phase but be mindful of the minimum time





requirement for graft protection and healing.

- Let the pain and swelling be your guide, if you do experience flare ups, it means your joint is not tolerating what you are putting it through in terms of movement, load or volume.
- It takes time! The structures in your knee take time to build up load capacity against impact. Therefore, focus on gradual progression and increase resistance and volume accordingly.
- Technique is everything. Compensation strategy or patterning is common post-injury. Without correction, the recurrence rate of ACL is high, and you may experience injuries elsewhere in your body.
- Upon completing your ACL rehabilitation, it is common to forget and abandon the exercise program you just went through, we highly recommend you to keep up an appropriate exercise regime for injury prevention.

Here at Breathe, we have developed this ACL guideline based on our Roadmap. This Roadmap encompasses our core values and can differ amongst each individual based on the injury / condition, the tests performed and the proposed goals.

This Roadmap was created based on our 20+ year experience, knowledge-base and current evidence based practice. This guideline considers factors involved in the acute stage of the injury all the way to the end stage of return to play and sports performance.

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The Roadmap is uniquely designed for each individual based on these four main concepts.

- Pain Reduction



- Activation



- Movement

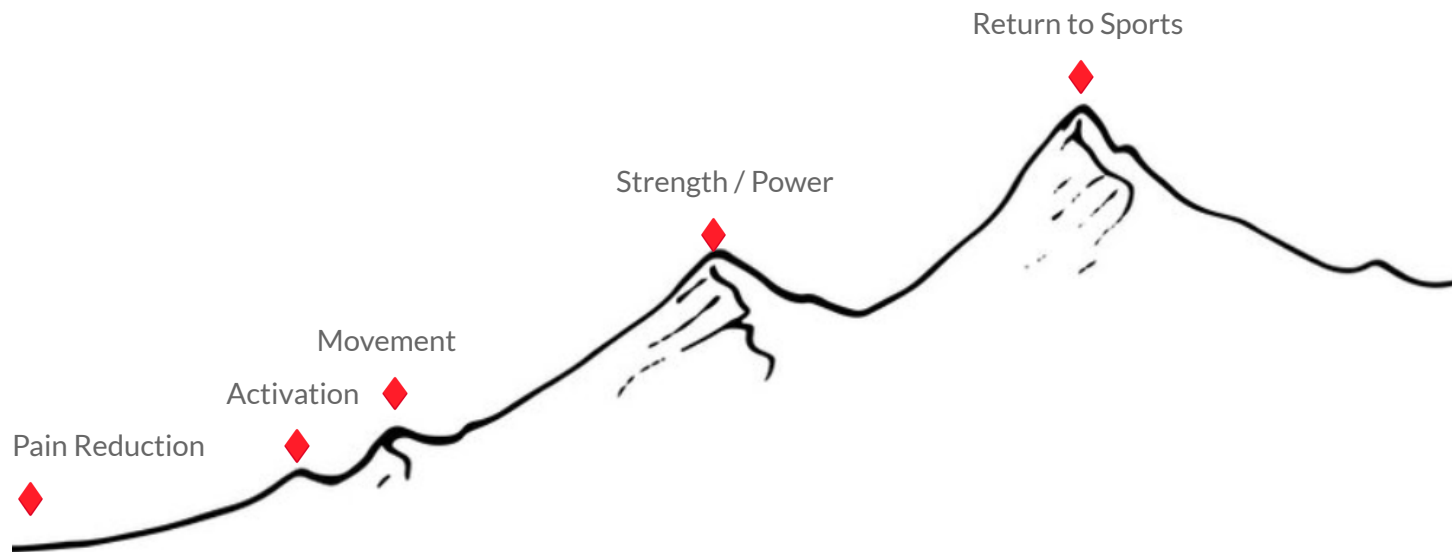


- Strength / Sports Performance



## Your Journey

There are **five major milestones** you will come across post-ACLR.



This eBook is divided into chapters based on these milestones.

There will be goals and a checklist for you to fulfill at each milestone.

You must fulfill every criteria before progressing to the next milestone.

These criteria are marked as  throughout this eBook.

Now, let's get started!





# Injury Recovery & Readiness for surgery

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## The Big Decision

Certain criteria can be used to screen whether you are a potential candidate or *cooper* for conservative management (i.e. without surgery). These following questions can be used to help you decide whether to opt for conservative or surgical. Be mindful to still consider health professionals' opinions if you are uncertain.



### Questions to Ask Yourself

- Do you have an isolated ACL injury with normal range of motion?
- Do you have >80% limb symmetry on all hopping tests?
- Did you score more than 80% on the Knee Outcome Survey?
- Do you rate yourself >60 on the Global Knee Function Scale?
- No episode of self-reported knee giving way?

- Have you dedicated at least 3 months of rehab with a physio?

If you have answered, "Yes" to all the above questions, you are a potential candidate for conservative management (Thoma *et al*, 2019 and Musahl *et al* 2020).

You will also need to consider risk factors associated with ACL recurrence, such as:

- Type of sports pre-injury i.e. physical, contact, non-contact but with pivoting, start-stop motion
- Midsubstance ruptures
- Integrity of ACL bundle

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## Pre-operation Readiness

Immediately after the ACL injury and once it is confirmed by your physio, it is important to start exercises and activities which include:

- Regular icing for swelling management
- Knee ranging / mobility work
- Low impact aerobic exercise such as cycling or swimming
- Progressive strengthening program

As you progress in the pre-op phase, you would expect knee swelling and joint stiffness to reduce while strength and stability of the knee improve. As you continue to strengthen your knee, you will



reach a stage where you begin to incorporate weighted exercises, and jumping and landing activities i.e. hopping.



Back-peddaling



Knee flexion stretch



Prone knee hang



Cryotherapy

The pre-op phase is important for ACL injury as it provides an opportunity for you to check the status of your knee. If you do not fulfill the criteria for conservative approach, it is highly recommended to work towards the following goals before surgery:

#### Pre-op Goals

- Strength quadriceps\*
- Knee with near full range of motion\*
- Eliminate swelling

\*<10-20% deficit vs. unaffected (Kotsifaki R., 2023)

People who have attained these pre-op goals have better outcomes than those who don't up to 2 years post surgery.


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#### Benefits of rehab prior to surgery ('prehab')

- Allows opportunity for instruction and education on the do's and don'ts during acute phase for better future outcome.
- Allows education for post-op rehabilitation journey and what it entails.
- Provide insight into and manage patient's expectations.





 My Pre-Op Checklist:

✓	Outcome Measure & Test Description	Goal
<input type="checkbox"/>	<b>Passive Knee Extension</b> <hr/> Use of goniometer	0°
<input type="checkbox"/>	<b>Passive Knee Flexion</b> <hr/> Use of goniometer	>125°
<input type="checkbox"/>	<b>Swelling</b> <hr/> <b>Stroke Test</b> Zero: nil wave with downstroke Trace: small fluid wave +1: large amount +2: fluid returns with upstroke +3: unable to move fluid	Zero to +1
<input type="checkbox"/>	<b>Strength</b> <hr/> Use of dynamometer (kg)	Quadriceps & Hamstrings 80-90% of unaffected side
<input type="checkbox"/>	<b>Single Hop Test</b> <hr/> Hop for distance (cm)	90% of unaffected side

(Reid *et al* 2007, Norkin *et al* 1995, Mentiplay *et al* 2015)



PHASE 1

# Pain Reduction & Recovery from Surgery

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## Straight outta Surgery, Now What?

ACL reconstruction is still considered invasive despite the surgery method being “key-hole” or arthroscopy. The reconstruction involves grafting from either your hamstring tendon (semitendinosis) or patellar tendon. After the surgery, you would expect:

- Pain and swelling around surgical site.
- Stitches and bandages over the surgical site for the first couple of weeks.
- Muscle weakness and atrophy in the quadriceps and hamstring muscles.
- You may be on knee brace or splint paired with crutches as required, or as instructed by your surgeon.
- You may be on analgesics or pain killers as instructed by your surgeon.

The first step for post-op care is to let the knee settle for the first 1-2 weeks. For isolated-ACL, we recommend you to start doing basic ranging exercises, quadriceps activation, early weight-bearing, ice and compression.

Early active knee motion should begin immediately after surgery while adhering to any surgical instructions.

Contrary to traditional belief, immobilisation does not reduce pain and can lead to muscle atrophy and further slow down the recovery process.

Early weight-bearing can be introduced during the first week in a progressive, controlled manner as tolerated.

Isometric quadriceps exercises including static quadriceps contraction and straight leg raise have some degree of effect on faster knee recovery.

Generally, your surgeon would like to review you within 1 month to ensure the wound is healing without any complications.





#### 4 Important Goals in Phase 1

- Restore your knee extension (achieve straight leg).
- Settle the swelling down to “mild”.
- Get the quadricep muscles activated.
- Early weight-bearing as tolerated.



#### My Post-op Checklist:

✓	Outcome Measure & Test Description	Goal
<input type="checkbox"/>	Passive Knee Extension	0°
<input type="checkbox"/>	Passive Knee Flexion	>125°
<input type="checkbox"/>	<p>Swelling</p> <hr/> <p>Stroke Test</p> <p>Zero: nil wave with downstroke            Trace: small fluid wave            +1: large amount            +2: fluid returns with upstroke            +3: unable to move fluid</p>	Zero to +1
<input type="checkbox"/>	<p>Strength</p> <p>In a seated position, use your unaffected leg to assist the other leg into full extension / straight position. As you let go of your supporting leg, does the leg remain straight or does it “lag” to a certain degree?</p>	0 to 5° lag

(Stillman 2004)

## FAQ

**Q. I still get constant swelling and stiffness in the knee 2-3 months down the track, is this normal?**

A. Yes, swollen knees can be common even 2-3 months following surgery. Remember, your surgeon has injected a large amount of saline fluid into your joint cavity to see where they were going with their arthroscopic arms in order to reconstruct your ACL. However, you may want to visit your doctor if you experience unusual, high levels of pain and swelling accompanied by clicking or locking of the knee.

**Q. Should I do a supervised or unsupervised home exercise program for my rehabilitation?**

A. We highly recommend you see a physiotherapist to provide a tailored home exercise program (HEP). Supervision and regular physio visits allow you to perform exercises correctly, modify and progress without the risk of re-injury.



**Q. If I have achieved all the goals listed in the phase 1 checklist, can I move onto phase 2 early?**

A. The duration of each phase is specific to the individual. It is possible to progress early as this guideline is criteria driven rather than based on a timeline. However, we highly recommend you see a physiotherapist for review to see if you are ready to progress.

Be mindful that your graft during the first 1-3 month period is at its weakest. You want to give it a maximum period of recovery for the graft to consolidate without any adverse events.

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#### Evidence behind Pain Reduction Modalities

- ✓ Cryotherapy
- ? Local vibration
- ? Kinesio-taping
- ✗ Whole body vibration
- ✗ Dry needling
- ✗ Continuous passive movement





## PHASE 2

# Activation

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### 3, 2, 1, Activate!

Pain inhibition, muscle weakness, scar tissue formation and residual swelling are common features seen in early rehabilitation where they are likely to impact on your early development of normal knee function.

Phase 2's main goals are to regain muscle activation and early strength so your knee can perform activities such as being able to walk, go up and down stairs and stand up from a seated position.

Muscle inhibition occurs from pain and is affected by joint swelling as part of the ACLR healing process. This in turn can affect the dynamic stability of the knee during normal function such as walking.

Muscle activation is crucial to the overall stability of the knee especially when the passive structures, in particular your ACL graft, is still healing. Muscle inhibition can be addressed by commencing activation exercises to improve the **active stiffness** of your knee.

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### Active Stiffness

Stiffness refers to the mechanical resistance to elongation or shortening of the muscle, tendon, joint and connective tissue. This stiffness can be measured with the muscle in a passive or *active state*. This active stiffness encompasses the contractile elements (sarcomeres) contributing to the stiffness of the muscles. Depending on the level of muscle activation, different components of the muscle will contribute greater resistance to stretch. By acquiring a decent level of active stiffness during motion, it provides the stability your knee needs in order to function without stressing the grafts.



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## Tools of Activation

This stage usually involves a mix of exercises ranging from basic body-weight up to a degree of resistance training and even the use of neuromuscular electrical stimulation (NMES) and blood-flow restriction (BFR) device.

These devices are adjunct to exercise therapy and may help people who are experiencing difficulties with muscle activation, increased level of pain or cannot tolerate high knee joint loads.

### Neuromuscular Electrical Stimulation (NMES)

A modality that sends electrical impulses to the nerve. This external stimulation helps the inhibited motor units within the targeted muscle group to activate. NMES is typically applied to the proximal and distal end of that muscle group. Common muscle groups applied are quadriceps and hamstrings.

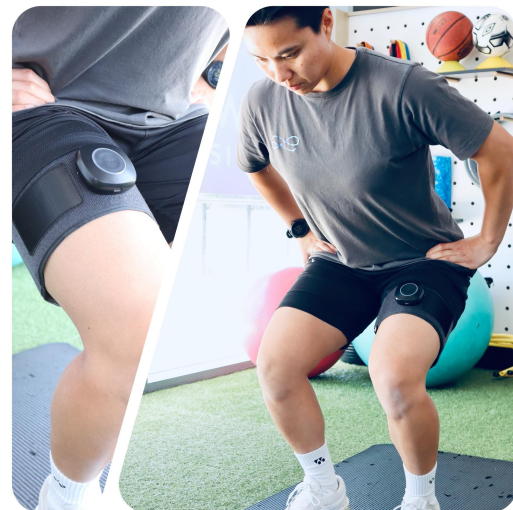
### Blood Flow Restriction (BFR)

A modality that utilises tourniquet to reduce arterial inflow and occlude venous outflow in the setting of resistance training or exercise.

Low-load BFR training has shown growing evidence supporting accelerated recovery, preventing muscular atrophy and promoting muscular growth and endurance.

BFR stimulates muscle hypertrophy via a synergistic response to metabolic stress and mechanical tension. Metabolites are amplified by the ischemic and hypoxic conditions. Type II fast-twitch muscle fibres, which normally require higher intensity exercises, are activated at a lower load under BFR conditions. This becomes ideal for early stage post-operative strengthening without compromising the integrity of the ACL graft.

*(Cognetti et al 2022, Kilgas et al 2019, Watson et al 2022)*



BFR Squat

PHASE 2



Typical activation exercises consider our whole core and the kinetic chain in relation to your lower limbs. These exercises should include:

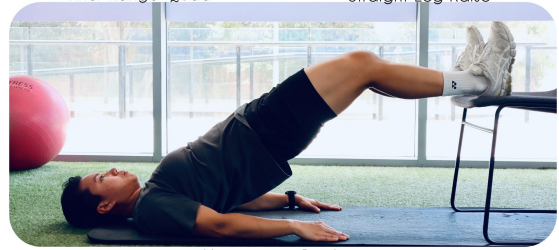
### Proximal Joint

- McGill's Ab curl
- Sidelying clams
- Side plank
- Glute bridge



### Distal Joint

- Inner range quad
- Hamstring bridge
- Straight leg raise



### Evidence behind Early Muscle Activation Modalities

- ✓ Neuromuscular Electrical Stimulation (ES)
- ✓ Low load Blood Flow Restriction (BFR)
- ? Electromyographic biofeedback





## FAQ

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**Q. Do open kinetic chain exercises put stress on the graft and affect recovery?**

A. There is no evidence of difference in terms of knee laxity between commencing open kinetic chain exercises at 4-week to 12-week post-op. However, you should always monitor for knee pain and adjust the load and progression accordingly.



## PHASE 3

# Movement & Neuromuscular Control

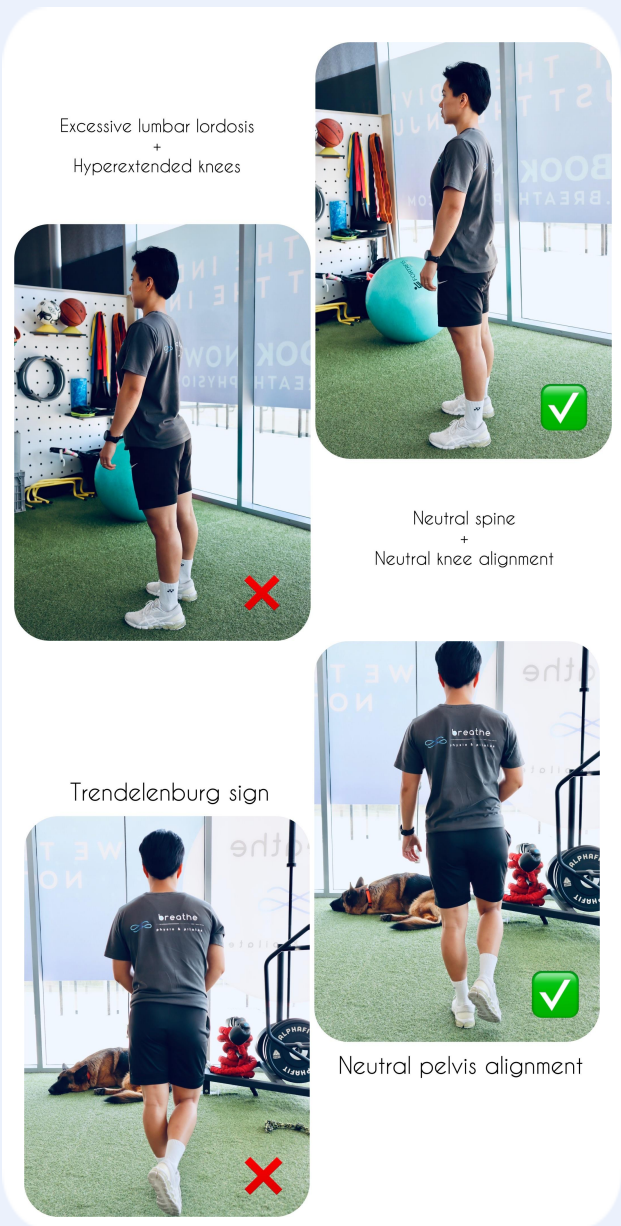
### The Unity of Mind & Body

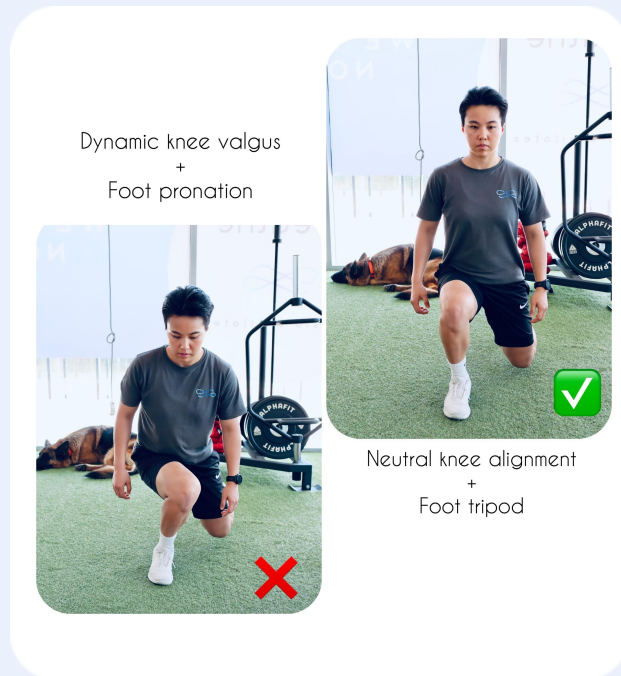
Establishing optimal position for movement is an important step towards enhancing sports performance and reducing risk of reinjury. Without appropriate motor control, proprioception and balance to hold the desired body position and alignment, your body is more susceptible to unnecessary stress and strain on your passive structures such as tendons, ligaments and cartilages. This is why correct movement and technique always come before the Strength Phase as it usually involves heavy lifting.

Some examples of common poor movement strategies and body alignment can include:

- ✗ Low back hyper-extension or lordosis
  - Overuse of lumbar paraspinal muscle
  - Weak calf muscles
- ✗ Trendelenburg sign
  - Weak or poor control in gluteus medius muscle

- ✗ Dynamic knee valgus (caving in)
  - Poor control in gluteus medius muscle
- ✗ Knee hyperextension
  - Poor inner range quadriceps muscle control
- ✗ Foot pronation
  - Congenital causing structural change
  - Weak intrinsic foot muscle






This phase is made easier by the activation exercises where you have already established an adequate level of mind-muscle connection. The next step is to implement good activation and address common faults seen in functional movements.

As the majority of sports involve running, we will cover common neuromuscular exercises to work on:

- ✓ Squat while bracing
  - Breaking at the hips and knees simultaneously
- ✓ Deadlift while bracing
  - Hip hinging with a neutral spine
- ✓ Banded Side Step in squat position
  - Torso remain neutral

- Movement only occurs at the hip during stepping
- ✓ Step Downs
  - Knee aligned with 3rd toe
  - Splay your toes and maintain tripod stability in your foot
- ✓ Banded Step Ups
  - Knee extends into the band without hyper-extending
- ✓ Standing Calf Raise
  - Brace the core to prevent hyper-lordosis
  - Activate your glutes and quads to keep hip and knee in neutral position
  - Keep weight evenly distributed during plantar-flexion (weight through the big toe)



 My Movement Checklist:

✓	Outcome Measure & Test Description	Goal
<input type="checkbox"/>	Address all suboptimal movement patterns	Good body alignment in neutral
<input type="checkbox"/>	<p>Functional Alignment Test (Crossley <i>et al</i>, 2011)</p> <hr/> <p><b>Single Leg Squat</b></p> <p>Set-up: Standing on one leg on 20cm box with arms crossed</p> <p>x5 slow, controlled reps are performed at a rate of 2s per squat to at least 60°</p>	Good
<input type="checkbox"/>	<p>Balance (Springer <i>et al</i>, 2007)</p> <hr/> <p><b>Single Leg Stance:</b> eyes open &amp; closed</p> <p>Set-up: Stand on one leg with other leg raised and arms crossed over the chest</p>	<p>Eyes open 43s</p> <p>Eyes closed 9s</p>





## PHASE 4

# Strength vs. Power

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### Becoming Hercules

By this stage, you would likely notice the degree of muscle atrophy around your quadriceps, hamstrings and calf muscles. This is mainly due to pain inhibition, swelling and disuse.

Once you are able to achieve consistent muscle activation and move optimally, it is time to move onto Phase 4 Strengthening. Progressive loading and resistance training are important to rebuilding muscle bulk and strength for running, jumping and hopping. They are a form of stimulus for the contractile tissues to build and regrow capacity to perform more work or harder tasks.

*“Strength is like the size of your fuel tank, the bigger the capacity, the more distance or work you can perform”*

Common hypertrophy exercises are based on lower load and higher volume ranging from 3 sets of 10-15 repetition maximum (RM).

Starting Hypertrophy Phase is recommended to allow your knee to accustom to low load first as you gradually progress to higher load.

These exercises can include:

- Leg Press (knee flexion 0-45°)  
*\*As early as 3 weeks post-op for hamstring graft*
- Eccentric Cycle (knee flexion 20-60°)
- Open kinetic chain leg extension & curls (knee flexion 90-45°)  
*\*4 week post-op onwards*

As you progress and become accustomed to the load and volume, it is time to move into the Strength Phase territory. Progressive loading is the main goal where you begin to reduce volume and increase load aiming for either 4 sets of 6RM or 5 sets of 5RM on a twice weekly basis.



🏆 Main strength building exercises are:

- Squat
- Deadlift
- Hip Thrust



Deadlift



Squat



Hip thrust

🏆 Secondary and accessory exercises:

- Single Leg Press
- Lunge
- Single Leg Bridge
- Leg Extension
- Leg Curl
- Calf Raise



Single leg bridge



Lunge



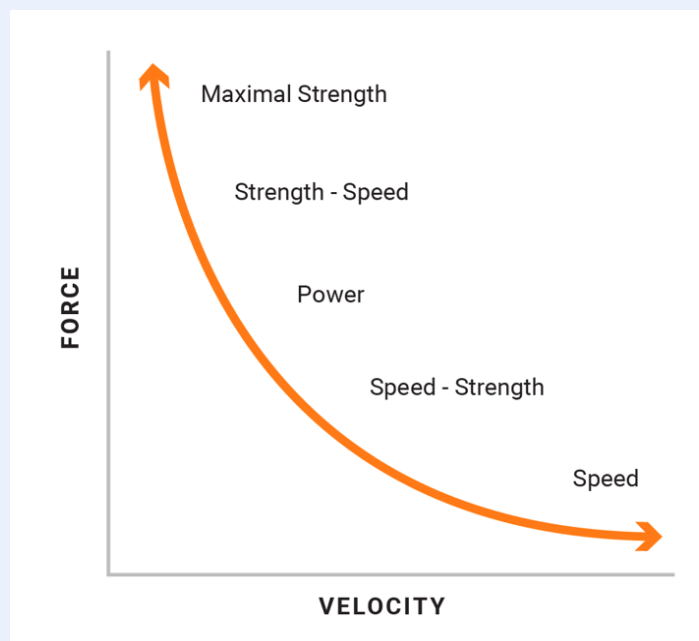
 My Strength Checklist:

✓	Outcome Measure & Test Description	Goal
<input type="checkbox"/>	<b>Lower Leg Strength</b> Use of dynamometer	<10-15% difference
<input type="checkbox"/>	<b>Single Leg Bridge</b>	<15% difference >20 reps
<input type="checkbox"/>	<b>Side Bridge Endurance</b>	<15% difference 30s hold
<input type="checkbox"/>	<b>Calf Raises</b>	<15% difference >20 reps
<input type="checkbox"/>	<b>Single Leg Squat</b> In a seated position with knees at 90° and 10cm from the edge of the chair; arms across the chest, stand and sit as much as you can.	<15% difference >10 reps
<input type="checkbox"/>	<b>1RM Single Leg Press</b> Ensure proper warm up before the 1 rep max. with both hips and knees at 90°	x1.5 body weight
<input type="checkbox"/>	<b>1RM Squat</b> Ensure proper warm up before the 1 rep max. with both hips and knees at 90°	x1.5 body weight

**FAQ** 

**Q. When should I start a power and agility program with speed?**

A. Dynamic Strength Index (DSI) is a way to reflect where you are sitting along the force-velocity continuum. All athletes sit somewhere along this continuum and they can shift along this curve based on their specific training.



DSI is essentially a ratio and comparison between absolute concentric/ eccentric force and isometric force.



<b>DSI Score</b>	<b>Training Recommendation</b>
< 0.60	Ballistic Strength Training
0.60 - 0.80	Concurrent Strength Training
> 0.80	Maximal Strength Training

VALD ForceDecks are one of the ways to determine this DSI score using tests such as Counter-movement jump (CMJ) for concentric and eccentric scoring and Isometric Mid-Thigh Pull (IMTP) for isometric comparison.

If your strength program has been working well and you achieved a DSI score of 0.6, this is suggesting you start training for power or plyometric style training. If you fall above 0.8 then the recommendation is to keep up with strength training.



# Return to Sports & Performance

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## The Power of Tempo & Speed

This phase you will see the return of running, agility, jumping and hopping with continuation of strength and neuromuscular training.

Power and agility is important in sports as quick, controlled movements are desirable out on the fields.

This stage of training should encompass elements of:

- Acceleration and deceleration in both linear and irregular motion pattern
- Changing directions and pivoting
- Hopping and landing

It is important to continue effort and emphasis on great form and technique particularly in deceleration tasks such as landing from a jump.

The exercises should specifically address the anterior-posterior and rotational instability

that the post-ACLR athletes may experience especially at higher levels of play.

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## Eccentric is Key

All types of sports involve acceleration and deceleration. These two components of movement are created by different types of muscle contractions such as isometric, concentric and eccentric.

Isometric contractions are where muscle length remains constant or the same during its active state. The ability to keep particular body parts still whilst moving another is important for stability and great form for performance. The best example is perhaps your core and trunk stability during a lunge.

Concentric contractions are the main powerhouse for movement, as the rapid shortening of muscle length brings about movement and articulation over joint/s. Concentric type of movement is also known as the positive. Whereas, eccentric contraction or the negative involves elongation of muscle length whilst under active tension.





The reason why eccentric phase of contraction is vital in sports is due to a number of key points such as:

- Ability attenuate load in a controlled manner
- Absorbs and stores the kinetic energy upon impact
- Able to quickly brake speed and momentum to allow fast transition for propulsion during the stretch-shortening cycle

Common eccentric-focus exercises include:

- B-stance Squat
- B-stance RDL
- Single Leg RDL
- Nordic Hamstring Curl



All exercises have positive and negative movements. In order to make it sports specific, start modifying your speed and tempo of the exercise. A great example of this is implementing the 3:1 tempo rule where you perform 3s duration for the negative part of movement and only 1s quick positive movement to follow up with. This rule can be applied to your current strength program where you start to focus on the responsiveness and quickness of all movement rather than focusing on the actual amount of weights.

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### Agility Exercises

Agility is a more refined version of your power program where you introduce sports specific complex tasks which often require coordination and dynamic balance. These tasks can include footworks or even ladder drills, shuttle runs, slalom running.

Agility training is not limited to hopping and landing drills such as box jump and scissor jump, but can also include advanced progression into single leg landing with perturbation to mimic on-field experiences.





Slalom running drill

Ladder drills



Box jump



Single leg landing + perturbation



 My Return to Sports Checklist:

✓	Outcome Measure & Test Description	Goal
<input type="checkbox"/>	<b>Single Hop Test</b> Hop for distance & landing on same leg <i>(Noyes et al, 1991)</i>	<5% difference
<input type="checkbox"/>	<b>Triple Hop Test</b> 3 consecutive hops for distance on same leg	<5% difference
<input type="checkbox"/>	<b>Triple Cross Over Hop</b> 3 consecutive hops for distance on one foot but going in medial, lateral then medial direction.	<5% difference
<input type="checkbox"/>	<b>Side Hop Test</b> Hopping side to side outside the 40cm parallel tape without touching.  Performed as many as possible within 30s duration  <i>(Gustavson et al, 2006)</i>	<5% difference
<input type="checkbox"/>	<b>Star Excursion Balance Test</b>  Performed in 3 directions: anterior, posterolateral, posteromedial  Mean distance (cm) calculated <i>(Gribble et al, 2012)</i>	<5% difference

<input type="checkbox"/>	<b>Vestibular Balance Test</b>  Performed in single leg standing with soft knee and hip. Hands are placed on the waist whilst moving the neck at 60bpm for 15s in direction of 1.) Side-side 2.) Up and down	Pass both sides
<input type="checkbox"/>	<b>Single Leg Squat</b>  In a seated position with knees at 90° and 10cm from the edge of the chair; arms across the chest, stand and sit as much as you can.	>22 reps
<input type="checkbox"/>	<b>1RM Single Leg Press</b>  Ensure proper warm up before the 1 rep max. with both hips and knees at 90°	x1.8 body weight
<input type="checkbox"/>	<b>1RM Squat</b>  Ensure proper warm up before the 1 rep max. with both hips and knees at 90°	x1.8 body weight



## FAQ

**Q. My training has been consistent and I have fulfilled all goals and check-lists as listed from phase 1 to 5.**

**Am I ready and clear to return to sports?**

A. Current research recommends a minimum of a 9-month period, however, please consult and be guided by your surgeon and physiotherapist.

Generally, there are three more key criterias that need to be satisfied for return to sports:

- Acquired and implement ACL prevention program for 15 mins prior to each training or game
- Athletes feel confident, comfortable, and eager to return to sports (can be measured by ACL-RSI and IKDC)
- Pass all VALD testing relevant to your sports with less than 10% asymmetry

Read on to the next Chapter on Phase 6 for injury prevention program.

ACL-RSI or Return to Sports after Injury is an outcome measure that evaluates athletes's psychological readiness, risk appraisal, emotion and confidence. The score from these domains allow the user to identify any aspects that may need to be addressed through counseling. Refer to appendix A for more information or fill out the form to see how you score.

The International Knee Documentation Committee (IKDC) - Subjective Knee Evaluation Form includes 3 categories to assess the athlete's functional overall rating: symptoms, athletic activity and knee function. Higher scores indicate higher levels of function and lower levels of symptoms with >95% being the ideal score for a satisfactory return to level 1 sports.

VALD - Forcedeck is a pressure plate system that helps evaluate numerous metrics behind some of the key components during functional tasks such as counter-movement jump, hopping and landing. For athletes to return to a satisfactory level of return to sports, it is ideal for them to score <10% limb asymmetry in all tests. Some important key asymmetry metrics we look closely for sporting athletes are: concentric rate of force development (RFD), eccentric deceleration RFD, peak landing force.



# Prevention of Re-injury

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## Knee Longevity

ACL Injury Prevention Program is a continuation and upkeep of neuromuscular exercises for athletes to implement at least 10 mins before each training or game.

Key components of the prevention program consist of:

- Strength
- Power / plyometric
- Balance

There are numerous well-established injury prevention programs to help reduce the risk of ACL re-injury such as:

- FIFA 11+ Warm up
- The KNEE Program - Netball Australia
- The FootyFirst Program - AFL
- The PEP Program
- The Sports Metrics Program





# ACL-RSI

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

Not at all  
confident

Fully confident

0    1    2    3    4    5    6    7    8    9    10

2. Do you think you are likely to re-injury your knee by participating in your sport?

Extremely  
likely

Not likely at all

0    1    2    3    4    5    6    7    8    9    10

3. Are you nervous about playing your sport?

Extremely  
nervous

Not nervous at  
all

0    1    2    3    4    5    6    7    8    9    10

4. Are you confident that your knee will not give way by playing your sport?

Not at all  
confident

Fully confident

0    1    2    3    4    5    6    7    8    9    10



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

Not at all  
confident

Fully confident

0    1    2    3    4    5    6    7    8    9    10

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

Extremely  
frustrating

Not at all  
frustrating

0    1    2    3    4    5    6    7    8    9    10

7. Are you fearful of re-injuring your knee by playing your sport?

Extremely  
fearful

No fear at all

0    1    2    3    4    5    6    7    8    9    10

8. Are you confident about your knee holding up under pressure?

Not at all  
confident

Fully confident

0    1    2    3    4    5    6    7    8    9    10



9. Are you afraid of accidentally injuring your knee by playing your sport?

Extremely  
afraid

Not at all  
afraid

0    1    2    3    4    5    6    7    8    9    10

10. Do thoughts of having to go through surgery and rehabilitation prevent you from playing your sport?

All of the time

None of the  
time

0    1    2    3    4    5    6    7    8    9    10

11. Are you confident about your ability to perform well at your sport?

Not at all  
confident

Fully confident

0    1    2    3    4    5    6    7    8    9    10

12. Do you feel relaxed about playing your sport?

Not at all  
relaxed

Fully relaxed

0    1    2    3    4    5    6    7    8    9    10

Your Score:  $\frac{\_}{120} \times 100 = \_ \%$

Optimal Test Result: >65%

(Sadeqi et al, 2018)



# IKDC - Subjective Knee Evaluation Form

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

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

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

Never										Constant
<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"/>
0	1	2	3	4	5	6	7	8	9	10

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

No pain										Worst pain imaginable
<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"/>
0	1	2	3	4	5	6	7	8	9	10

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

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



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

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

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

- Yes (0)
- No (1)

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

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

## Sporting Activities

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

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





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	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
b. Go down stairs	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
c. Kneel on the front of your knee	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
d. Squat	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
e. Sit with your knee bent	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
f. Rise from a chair	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
g. Run straight ahead	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
h. Jump and land on your involved leg	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0
i. Stop and start quickly	<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	<input type="checkbox"/> 0



## 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?

a.) 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

b.) 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

Your Score:  $\frac{\_}{87} \times 100 = \_ \%$

Optimal Test Result: >95%

*(Webster & Feller, 2018)*

N.B. Item 10a is not assessed or part of the total score.



# DISCLAIMER

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DISCLAIMER



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