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PHYSIOTHERAPY ACL PROTOCOL

Rehabilitation following Anterior Cruciate Ligament Reconstruction (ACLR) is an essential part of a full recovery. This protocol is intended to provide the user with instruction, direction, rehabilitative guidelines and functional goals. The physiotherapist must exercise their best professional judgment to determine how to integrate this protocol into an appropriate treatment plan. Some exercises may be adapted depending on the equipment availability at each facility. As an individual's progress is variable and each will possess various pre-operative deficiencies, this protocol must be individualized for optimal return to activity. There may be slight variations in this protocol if there are limitations imposed from additional associated injuries such as meniscal tears, articular cartilage trauma, bone bruising or other ligamentous injuries.

The focus in early rehabilitation is on regaining ROM, normalizing gait and activation of the quadriceps muscle. To ensure the best possible outcome for a safe return to the same level of activity prior to the injury, the client should be followed for the entire 6 months. The emphasis of rehabilitation should be focused at the 4–6-month mark. In these later stages, crucial skills such as plyometric training, agility drills, instructions on take-off and landing mechanics, patterning drills, and functional testing suggestions are given to determine the client's readiness for return to sport/activity.

Post-operative considerations

If you develop a fever, intense calf pain, excessive drainage from the incision, uncontrolled pain or any other symptoms you have concerns about you should call your doctor.

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RANGE OF MOTION & FLEXIBILITY

After ACLR it is important to restore and maintain full range of motion (ROM) in the knee. Quadriceps re-training has been found to improve ROM in the early stages. Attaining full knee extension as early as possible is not deleterious to the graft or to joint stability and may prevent patellofemoral pain and compensatory gait pathologies. A stretching program is incorporated to maintain lower extremity flexibility. Research recommends that a 30 second stretch is sufficient to increase ROM in most healthy people. It is likely that longer periods of time, or more repetitions, are required for those individuals with injuries or with larger muscles. Body mass has been shown to be positively correlated with muscle stiffness (i.e., the bigger the muscle, the more stiffness/tension there exists). Therefore, for larger muscle groups in the lower extremity, it is suggested to increase in the number of repetitions (ie. 3-5 times) for optimal flexibility.

GAIT RETRAINING

Altered gait kinematics from quadriceps dysfunction is typical during the first stages post ACL reconstruction. Typical adaptations include reduced cadence, stride length, altered swing and stance phase knee ROM, and decreased knee extensor torque with hip and/or ankle extensor adaptations. Early weight bearing is advocated post ACLR in an attempt to restore gait kinematics in a timely fashion, facilitate vastus medialis function and decrease the incidence of anterior knee pain.

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PHASE 1: Early Post-operative Phase

This is the initial recovery phase and it normally lasts 1 - 3 weeks. In the first week you should rest and elevate your leg for a significant amount of the time.

Goals

1. Reduce inflammation and swelling
2. Range of Motion: 0° to ≥ 110° by end of 3rd week post-operative
3. Quadriceps muscle activation

WEIGHT BEARING

Use your crutches to weight bear by putting about 50% of your weight through your operative leg. Increase as tolerated to full weight bearing. With your crutches, try to walk using a normal "heel-toe" pattern. Your progression to full weight bearing will depend on swelling, pain, and quadriceps control.

IMPORTANT: You will be informed if you had a Meniscal Repair or Microfracture procedure. Microfracture patients **may not** progress to full weight-bearing without crutches before 6 weeks post operatively. Meniscal repair patients will progress more slowly with knee flexion for up to 12 weeks to allow for healing. Specific instructions will be provided by your surgeon.

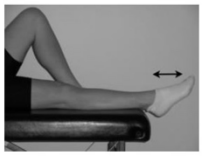
COLD THERAPY & ELEVATION

A Cold Therapy Unit or an ice pack should be applied immediately after surgery and used for at least 20 minutes every other hour while you are awake. Your operative leg should be elevated with the knee straight when applying cold therapy and/or when resting.

Exercises:

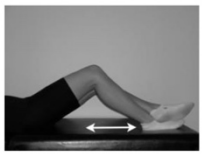
1. **Ankle pumps**

- The foot and ankle should be actively "pumped" up and down 10-20 times every hour.



2. **Range of Motion**

- **Flexion –** In lying, bend your knee by sliding your heel towards your buttocks. Use your other leg to help you if needed. Perform up to 20 times; repeat 2- 3 times daily.
  IMPORTANT: if you had a Meniscal Repair you **should not** force flexion (bending) in the first 12 weeks.



- **Extension -** In lying, place a roll beneath your ankle to passively (allow gravity), stretch your knee into extension. Start with 2 minutes at a time and increase as tolerated up to 5 minutes. Perform 2 or 3 times daily. It is very important in this phase to work on straightening your knee.

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3. Strengthening

- **Quadriceps Contraction –** In sitting with your knee straight and leg supported, tighten your thigh muscle by pushing your leg downwards. Focus on tightening the muscle and avoid lifting your leg from the hip. Perform exercise 5 - 10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 10 secs, resting for 5 secs in between reps. The use of EMS (Electric Muscle Stimulation) is recommended for this exercise.

- **Straight Leg Raises –** In the position shown, tighten your thigh muscle while keeping your knee straight and lift your leg up 2 inches. Perform exercise 5 - 10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 5-10 secs. The use of EMS is recommended for this exercise.
  IMPORTANT: If you do not have full knee extension or have a significant quadriceps lag you should not perform this exercise

- **Hip Adduction –** In lying with your knees bent as shown, squeeze a soft ball or a pillow between your knees. Perform exercise 5 -10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 10-15 secs, resting for 5 secs between reps.

4. Stretching

- **Calf -** Sitting with your knee straight, wrap a towel around your foot and gently pull your toes and foot towards you. Hold each stretch for at least 30 secs and repeat 4 times.

**** Perform all exercises 2-3 times per day to improve your strength and range of motion. You should perform all of the exercises on both legs****

Also consider:

- Other ROM exercises as tolerated (heel slides on wall; passive flexion in sitting using other leg to push, gentle contract-relax knee flexion and extension)
- Hip and ankle strengthening as tolerated
- Stationary bike
- Normalizing gait with/without crutches

Requirements for progression to Phase 2:

- Full knee extension
- Ability to activate quadriceps (specifically VMO)
- Knee flexion ≥ 110°
- Pain levels managed to enable exercise progression

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PHASE 2: Muscle Strength and Core Stability

This is the initial muscle strengthening phase and it normally lasts from 3-12 weeks. This phase emphasizes progressive strengthening of the quadriceps muscles along with core strengthening.

Goals

1. Manage pain and swelling
2. Range of Motion: 0°-135° (or near full range) by week 12 post-operatively
3. Able to perform a straight leg raise
4. Full weight bearing with normalized gait
5. Using stationary bike in daily exercise program
6. Increase bilateral leg strength and core control

WEIGHT BEARING

Before you stop using your crutches you need to be able to take full weight on the operative leg and walk with only a slight limp. If you still need support to walk normally, you may use one crutch or a cane, depending on the recommendation of your surgeon.

IMPORTANT: If you have had a Microfracture procedure you **may not** progress to full weight bearing without crutches before 6 weeks post operatively.

COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

Exercises:

1. **Range of motion** - Progress flexion using active, active-assisted and passive exercises. Add prone hangs, active-assisted and passive range of motion if full extension has not been achieved.
   IMPORTANT: if you had a Meniscal Repair you **should not** force flexion (bending) in the first 12 weeks.

2. **Strengthening**

   - **Quadriceps –** Slowly squat with equal weight on each leg. Bend your knees from 0° to a maximum of 90° of flexion, making sure your knees do not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 30 reps x 15 secs hold. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.

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- **Step-ups –** Do graduated heights, starting at 4" and increasing to 8".
  Stand in front of a stair or stepping stool and place one foot on the step in front of you. Rise up onto the step by shifting all of your weight onto this leg and tighten your quadriceps muscles. Put all of your weight through this leg and do not step up onto the step with your other leg. Start with one set of 10 reps, holding at the top of the step-up for 5 secs. Increase the number of reps as your strength increases, up to 20 reps with 15 secs holds on each leg. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.

- **Step-downs –** Do graduated heights, starting at 4" and increasing to 8".
  Start with one leg standing on the step and slowly bend your knee to lower your other leg to lightly touch floor. Keep all of your weight through the leg that is on the step. Start with one set of 10 reps, holding at the bottom of the step-down for 5 secs. Increase the number of reps as your strength increases, up to 20 reps with 15 secs holds on each leg. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.

- **Calf Raises –** Both legs: Start with feet shoulder width apart and toes pointed straight ahead, and raise up onto your toes. Start with one set of 10 reps, holding each raise for 5 secs. Increase the number of reps up to 30 with 5 sec holds. Start by using support at a wall or table and progress to no support as able.

  Single leg: Start on one leg with toes pointed straight ahead, and raise up onto your toes. Start with one set of 10 reps, holding each raise for 5 secs. Increase the number of reps up to 20 with 5 sec holds on each leg. Start by using support at a wall or table and progress to no support as able.

- **Gluteals –** In lying with your knees bent and your arms by your sides, squeeze your buttocks and lift up to create a bridge. Keep equal weight on each leg and straight alignment from your shoulders to your knees. Be careful not to push down on your neck or shoulders – use your buttocks to do the work. Start with one set of 10 reps, holding each lift for 5 secs. Increase the number of reps as your strength increases. Once you can complete 20 reps holding for 10 secs each, change to single leg bridges.

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- **Hip Abduction –** In the position shown, with a resistance band around your outside thigh just above your knee, lift your leg to place slight tension on the band. Move this leg sideways slowly against the resistance of the band using the muscles in your buttock and your hip. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.

- **Hip Extension –** Stand with legs shoulder-width apart with a resistance band around one of your thighs just above your knee as shown. Extend your leg to place slight tension on the resistance band. Slowly move the leg backwards against the resistance of the band using the muscles in your buttock and the back of your thigh. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.
  IMPORTANT: if you had a hamstring graft you **should not** perform this exercise until 6 weeks post op.

- **Hamstrings –** In sitting place a resistance band around your ankle and also have it attached to a chair or table leg in front of you as shown. Slowly bend your knee backwards pulling against the resistance band using the muscles under your thigh. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.
  IMPORTANT: if you had a hamstring graft you **should not** perform this exercise until 6 weeks post op.

3. **Proprioception**

- **Single leg stance** (eyes open → eyes closed)
- **Double leg squats on an unstable surface** (thick carpet → foam block → camping mattress → pillow → BOSU**)**
- **Single leg stance on an unstable surface** (thick carpet → foam block → camping mattress → pillow**)**

4. **Stretching**

- **Calf**– Standing at a wall in the positions shown. Lean forward until you feel a stretch in your calf. Hold each stretch for at least 30 seconds and repeat 4 times. Do exercise with back leg straight and again with back leg slightly bent.

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- **Hamstring stretch –** In lying, place a towel or belt around your foot and bring your leg up until a stretch is felt at the back of the thigh. Hold each stretch for at least 30 seconds and repeat 4 times.
  IMPORTANT: if you had a hamstring graft you **should not** perform this exercise until 6 weeks post op.

**** Perform all exercises each day to improve your strength and range of motion. You should perform all of the exercises on both legs****

Also consider:

- Wall squats (with/without ball squeeze)
- Double leg squats with ball squeeze
- Abdominal and core strengthening (i.e. curl-ups, obliques, isometric holds, transversus abdominis, planks and Pilates)
- If you have good balance and full ROM you can commence outdoor cycling on a smooth, flat surface at 6 weeks post-op

Requirements for progression to Phase 3:

- Full range of motion (you may lack a few degrees of motion compared with your other knee)
- Double leg squat with good motor control on an unstable surface
- Single leg calf raise
- Good control and alignment during hip and core strengthening exercises

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PHASE 3: Muscle Strength and Control

This phase normally lasts from 9 weeks to 4 months post-operatively, but may last up to 6 months. This phase focuses on improving muscle bulk, muscle control, balance and proprioception.

Goals

1. Increase quadriceps, hamstrings, gluteal and core strength using advanced dynamic exercises
2. Improve proprioception and balance
3. Aerobic activity for 20-30 minutes per day, 3-4 times per week

WEIGHT BEARING

You should be full weight bearing with a normal gait pattern without using walking aids.

COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

Exercises:

1. **Range of motion** - Continue active assisted and passive range of motion exercises to ensure full range of motion.
   IMPORTANT: if you had a Meniscal Repair you **should not** force flexion (bending) in the first 12 weeks.

2. **Strengthening**

   - **Single leg squats** – Standing on one leg, slowly squat bending your knee from 0° to a maximum of 90°, making sure your knee does not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 30 reps x 15 sec holds on each leg.


   - **Lunges** – Standing with feet as pictured, squat down to lunge as shown. Control the descent ensuring your knee that is forward does not move beyond your toes. Start with 1 set of 10, holding each lunge for 5 secs. Increase the number of reps as your strength increases, up to 3 sets of 10 on each leg.


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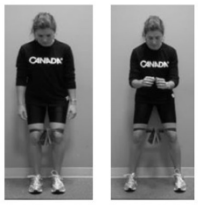
- **Hamstrings –** Lying on your stomach, place a resistance band around your ankle and also have it attached to an anchor point as shown. Slowly bend your knee against the resistance of the band pulling your foot towards your buttock. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.

- **Hip abduction** – In standing with legs hip width apart and feet pointing forwards, tie a resistance band around your thighs as shown. Take a sideways step against the resistance of the band and then step back to the starting position with your other leg. Start with 10 steps to the left and right, and increase to 3 sets of 15 steps to the left and right.



- **Gluteals –** Single leg: In lying with your knees bent and your arms by your sides, squeeze your buttocks and lift up to create a bridge. Straighten one knee and hold that leg in the air. Keep straight alignment from your shoulders to your knees. Be careful not to push down on your neck or shoulders – use your buttocks to do the work. Start with one set of 10, holding each lift for 5 secs. Increase the number of reps as your strength increases, building up to 15 reps with 10 sec holds for each leg.

- **Core –** Increase core strength. Some exercise ideas include bridging with legs on physio ball, bridging with back on physio ball, sit ups on physio ball, side sit ups on physio ball, "dead bug" on a BOSU and Pilates core exercises.

3. Proprioception

• **Single leg squats on trampoline -** Standing on one leg, slowly squat bending your knee from 0° to a maximum of 90°, making sure your knee does not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 20 reps x 15 sec holds for each leg.

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• **Single leg stance with ball toss -** Standing on one leg on a BOSU or other unstable surface (i.e. foam), toss and catch a light ball against a wall. Start with 2 sets of 10 tosses on each leg and increase as strength and balance improve.

4. **Cardio** – Maintain or improve aerobic fitness by doing 3 - 4, 30-minute workouts per week. Some ideas include walking, hiking, cycling and using an elliptical trainer.

**** Perform all exercises each day to improve your strength and range of motion. You should perform all of the exercises on both legs****

Also consider:

- Hamstring curls in supine lying with a physio ball
- Hip adduction: bridging with ball squeeze
- Stretching – stretch after exercising (quadriceps, hamstrings, calves, IT band, hip flexors)
- Pool: easy jogging in waist deep water or running in deep water with an aquabelt can be commenced around 3 months post-operative with approval from your surgeon
- Ice skating and cross-country skiing on even, flat surfaces can be commenced around 4 months post-operative with approval from your surgeon

Requirements for Progression to Phase 4:

- Single leg squat with good motor control on an unstable surface to 70° flexion
- Through-range hamstrings contraction against medium resistance
- Ability to demonstrate good core control and posture in single leg stance activities
- Evidence of improvement in strength (hamstrings, hip abductors, hip extensors, hip rotators)

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PHASE 4: Strength, Agility and Plyometrics

This phase begins as early as 3 months and may last up to 12 months postoperative. This phase focuses on improving agility and power through plyometric exercises.

IMPORTANT: You **should not** begin plyometric exercises any sooner than 3-months post-operative to ensure the graft is healed into the bone. If you had an Allograft surgery you should not begin plyometric exercises until 4 months post-operative.

Goals

1. Increase agility using pivoting and jumping activities
2. Commence jogging and running drills
3. Maximize quadriceps, hamstrings, hip and core strength with functional exercises

COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

Exercises:

1. **Strengthening** - progressive strengthening program ensuring all muscle groups are included using functional exercises
   - Quadriceps (stair descent)
   - Hamstrings (reverse lunge)
   - Hips (side shuttles with resistance band)
   - Calves (heel raises on unstable surface)
   - Core (plank, side planks, sit ups with physio ball, bridging with physio ball, Pilates)

2. **Proprioception**

- **Squats on a BOSU** - Slowly squat with equal weight on each leg. Bend your knees from 0° to a maximum of 90° of flexion, making sure your knees do not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 20 reps x 15 sec holds on each leg. Progress to single-leg squats starting with 10 reps x 5 sec holds, increasing to 20 reps x 15 sec holds on each leg.

- **Lunges on a BOSU** – Step forward or back and lunge as shown. Control the descent ensuring your knee that is forward does not move beyond your toes. Start with 1 set of 10 reps, holding each lunge for 5 secs. Increase the number of reps as your strength increases up to 3 sets of 10 on each leg.

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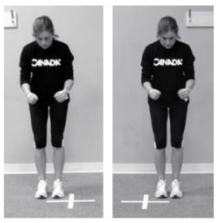
3. **Plyometrics:** Patient must be able to perform a very well controlled single leg squat before commencing plyometric exercises.
IMPORTANT: You should **not** begin plyometric exercises any sooner than 3-months post-operative for hamstring grafts and **not before** 4-months post-operative for allografts.

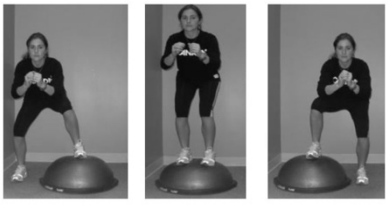
- **Agility jumping** – start with straight-line jumping, backward/forward/side-to-side and progress to diagonals and combined patterns. Once speed and agility are good with jumping, progress through activities using single-leg hopping on each leg.

Agility jumping



Agility hopping

- **Side to side steps on the BOSU** – Perform quick steps in both directions over BOSU. Start with 1 set of 10 steps in both directions and progress to 3 sets of 15 steps in both directions as your strength increases.



- **Straight line jumping activities** (vertical jumps, shuttle jumps, standing long jumps)
- **Straight line hopping activities** (single leg hop for distance, timed single leg hop, single leg vertical hop, cross-over hopping)
- **Straight line running activities** (high knee lifts, glute kickers, shuttle sprints)
- **Jogging:** recommended return to running progression
straight line activity → indoor track → treadmill (walk:run intervals) → outdoor even ground

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- **Running:** shuttle runs, wide angle cutting, running and pivoting.

**** Perform all exercises once per day to improve your strength and range of motion.**
You should perform all of the exercises on both legs*

Also consider:

- Skipping rope – double and single leg
- Cariocas
- Box hop up/down (start at 6 inches)
- Tuck jumps
- Wobble-board balance activities
- Flutter kick at the side of the pool or with flutter board (not before 4 months)
- Ice skating and cross-country skiing on even, flat surfaces may be commenced around 4 months post-operative with approval from your surgeon
- Mountain biking on easy trails may be commenced after your 6-month post-operative assessment with approval from your surgeon

Requirements for Progression to Phase 5:

- Able to perform plyometric exercises with good motor and core control
- Improved aerobic endurance and able to run on even surfaces
- Good strength and endurance of bilateral lower extremities

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PHASE 5: Sport Readiness

This phase begins as early as 5 months and continues until 12+ months post-operatively. This phase involves return to functional activities including sports.

Goals

1. Sport specific proprioception and agility
2. Progressive plyometric exercises
3. Return to sport specific training

COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

Exercises:

1. **Agility:**
   - Running figure 8's around cones
   - Agility ladder
   - Grapevine / Cariocas
   - Quick Lateral shuttles from cone to cone

2. **Plyometrics:**
   - Box jumps
   - Tuck jumps
   - Hopping: 6m timed hop, triple hop for distance, crossover hop for distance

3. **Running Drills:**
   - Shuttle sprints, stop and go drills
   - Zig-zag running, sideways and backwards drills
   - Sprinting with cutting and pivoting drills

4. **Sport-specific drills:**
   a. **Basketball**: Lay-up drills, lateral shuttle runs while throwing/catching ball off wall, run-pivot-vertical jump, dodging drills, defence drills (running/jumping backwards)
   b. **Soccer**: dribble around cones, shooting drills, defence drills, lateral shuttle runs while kicking ball off wall, tackling drills (not until 9-months post op)
   c. **Football/Rugby**: dodging/deking drills, running and throwing drills (all directions), defence tackling drills (not until 9 months post op)
   d. **Hockey**: skating figures, stick handling drills, shooting drills, deking drills, no contact drills until 9 months post-op