Supplementary Material S2: Staged Rehabilitation Home Based Protocol

Rehabilitation is an essential part of a full recovery from ACL reconstruction and requires a minimum commitment of 6 months. This program has been developed in order to assist you with the first half of your rehabilitation for anterior cruciate ligament (ACL) reconstruction.

This booklet is intended to guide you with instruction, direction, and rehabilitative guidelines, with the assistance of a physiotherapist.

This booklet is to be used for the first 12 weeks (3 months) post surgery and is comprised of home exercises for you to complete on a daily basis. It is divided into two parts:

- **Part 1:** Week 2 to Week 6: The first timeframe focuses on regaining range of motion, retraining walking patterns and basic knee and hip strengthening.
- **Part 2:** Week 6 to Week 12: The second timeframe focuses on more advanced knee and hip strengthening.

To ensure you are progressing in a timely fashion, you will have two appointments in the first twelve weeks with a physiotherapist at Fowler Kennedy Sports Medicine Clinic.

- **Appointment 1:** Week 2: The physiotherapist will explain and review exercises for the first part (Week 2 to Week 6) of the booklet.
- **Appointment 2:** Week 6: The physiotherapist will examine knee range of motion and explain and review exercises for the second part (Week 6 to Week 12) of the booklet.

At week 12 (3 months), you will book an appointment with a physiotherapist and will formally commence supervised physiotherapy, in a physiotherapy clinic, for the second half of your rehabilitation until the 6 month mark. The frequency of these appointments will be determined between you and your physiotherapist. Formal physiotherapy sessions will focus on balance retraining, more advanced strengthening for the lower extremity, functional exercise patterning, speed, agility and return to sport exercises. Functional testing (jumping, landing, cutting…) will be evaluated at different timeframes within the 3 to 6 month period to determine your readiness and ability to return to activity.

In order to ensure a safe return to the same level of activity prior to injury, you should complete the FULL duration of the rehabilitation process. Your surgeon, physiotherapist(s) and health care team will use their professional judgment in order to assist you throughout your rehabilitation process; however, it is also your responsibility to take ownership of the rehabilitation. It is important that you meet the criteria set out for each timeframe and attend all recommended physiotherapy sessions in order to achieve a full recovery.
STAGED REHABILITATION PROGRAM FOR ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION (HOME BASED COMPONENT)

Part 1: Week 2 to Week 6

Range of Motion

1. Knee Extension
   Heel Over Roll

2. Knee Extension
   Prone Hangs

3. Knee Flexion
   Heel Slides

4. Knee Flexion
   Heel Slides up the

Knee Strengthening

5. Knee
   Quadriceps Tightening

6. Knee
   Standing Quadriceps Activation

Hip Strengthening

7. Hip
   Flexion in Standing

8. Hip
   Extension in Standing

9. Hip
   Abduction in Standing

10. Hip
    Adduction in Standing

Other

11. Gait
    Protected Weight-Bearing (with crutches)

12. Ice
    Knee in Extension

13. Additional Exercises
    Stationary Bike
RANGE OF MOTION - KNEE FLEXION

HEEL OVER ROLL

Lie on your back on a firm surface with the affected leg straight and place a rolled towel under your ankle. Allow gravity to slowly straighten the knee.

GOAL: Hold for 3-5 minutes, 3 times a day

PRONE HANGS

Lie on your stomach with your knees and lower legs hanging over the end of a table or bed. Allow gravity to slowly straighten the knee.

GOAL: Hold for 3-5 minutes, 3 times a day
1. **HEEL SLIDES SUPINE/SITTING**

   Lie on your back or sit with your back supported. Bend your affected knee and gently slide the heel toward your buttocks. Hold for 5 seconds. Slowly lower your leg back to a straight position.

   *If it is difficult/painful to bend the knee without assistance, you may grasp your thigh with both hands and lift the thigh to help the heel slide.*

   **GOAL:** 30 repetitions, 3 times a day

**HEEL SLIDES UP THE WALL**

   Lie on the floor with your legs up the wall. Bend your affected knee and allow gravity to gently slide the heel down the wall toward your buttocks. Hold for 5 seconds. Straighten your affected knee by sliding your heel back up the wall until your knee is as straight as possible.

   *If you are unable to slide your heel back up, use your unaffected leg and place it underneath the affected heel, and push up for assistance.*

   *When your bending improves over the first few weeks, you can progress this exercise by placing your unaffected foot over the affected leg and pushing down with it to increase the bend.*

   **GOAL:** 30 repetitions, 3 times a day
KNEE STRENGTHENING

QUADRICEPS TIGHTENING

Sit or lie on your back with your legs as straight as possible. Tighten your thigh muscle by pushing your knee down while trying to lift your heel off the surface. Hold for 10 seconds.

*If you are unable to tighten your thigh muscle in this position (in the first few weeks), place a rolled towel under the knee and try to push your knee down into the towel while trying to lift off your heel.

GOAL: 30 repetitions, 3 times a day

STANDING QUADRICEPS ACTIVATION

Stand with your crutches for support and evenly distribute your weight between your two legs. Try to tighten your thigh as you straighten your knee by pushing your knee back. Hold for 10 seconds.

GOAL: 30 repetitions, 3 times a day
HIP STRENGTHENING

FLEXION IN STANDING

Stand with a crutch or chair for some support and lift your affected leg forward, keeping your knee as straight as possible.
Hold for 2-3 seconds.
Relax and return back to the original position.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day

EXTENSION IN STANDING

Stand with a crutch or chair for some support and lift your affected leg backward, keeping your knee as straight as possible.
Hold for 2-3 seconds.
Relax and return back to the original position.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day
HIP STRENGTHENING

ABDUCTION IN STANDING

Stand with a crutch or chair for some support and raise your hip out to the side, keeping your knee as straight as possible without letting the leg come forward or lifting up your hip/pelvis.
Hold for 2-3 seconds.
Relax and return back to the original position.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day

ADDUCTION IN STANDING

Stand with a crutch or chair for some support and bring your affected leg towards the midline of your body and cross the leg in front of your other leg.
Hold for 2-3 seconds.
Slowly relax and return back to the original position.
*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day
**OTHER – GAIT AND ICE**

**PROTECTED WEIGHT-BEARING**
*(AS TOLERATED WITH CRUTCHES)*

Protected weight bearing means you can fully weight bear on the affected leg as long as you are using crutches for protection.

When walking, place the crutches tips forward about one step’s length.

At the same time, place the affected leg forward level with the crutches (i.e. crutch tips and heel/foot).

Push down on the hand grips and place weight on the affected leg at the same time and follow through with a normal step on the unaffected leg.

* Stay on two crutches until your knee is fully straight and you are not walking with a limp. Then, you can progress to one crutch by placing it on the opposite side of your affected leg (i.e. right side if left surgical knee). Place the affected leg and crutch tip forward, on the ground, at the same time and follow the same directions as above. You can discharge the crutches when you walk normally, without a limp, and with a straight knee.

**GOAL:** Crutches should be discharged by 6 weeks if you have a straight knee and pain free walking without a limp

**ICE WITH KNEE IN EXTENSION**

After completing all your exercises, place an ice pack on top of the affected knee. You may also place an additional ice pack over your shin area if it is sore.

Ensure that the knee is as straight as possible.

*It is important to make sure a towel or pillow is not placed underneath the knee.

**GOAL:** 15 minutes, 3 times a day, after exercises
STATIONARY BIKE

Set the seat height so that your knee is almost straight when the pedal is at the bottom. Begin pedalling in slow bottom half circles, with the affected leg, forward and backwards.

Progress as tolerated to full circles. When you can comfortably go all the way around, progress the exercise by lowering the seat of the bike.

GOAL: 5-10 minutes
Part 2: Week 6 to Week 12

Note: The GOAL for range of motion by 6 weeks is full extension (a straight leg) and approximately 120° of knee bend (about 1 hand span between your buttocks and heel with the knee bent). If you have not yet attained that goal, continue with the Range of Motion exercises that were given at 2-6 weeks in conjunction with the new exercises outlined for week 6 to 12.

**Knee Strengthening**

1. Quadriceps Strengthening Lateral Step Up
2. Quadriceps Strengthening Lateral Step Down
3. Quadriceps Strengthening Wall Slides
4. Calves Calf Raises

**Hip Strengthening**

5. Hip Strengthening Straight Leg Raise
6. Hip Strengthening Extension (lying on)
7. Hip Strengthening Abduction (on side)
8. Hip Strengthening Adduction (on side)
9. Hamstrings/Gluts Bridge

**Other**

10. Balance Single Leg Stance
11. Ice Knee in Extension
12. Additional Exercises Stationary Bike, Elliptical
KNEE STRENGTHENING

LATERAL STEP UP

Place enough books on the floor to total 4-6 inches tall or use a small step/stair.
Use a wall, railing, or chair for some support.
Slowly step up onto the book/stair sideways with the affected foot.
Slowly step off.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day

LATERAL STEP DOWN

Place enough books on the floor to total 4-6 inches tall or use a small step/stair.
Use a wall, railing, or chair for some support.
Slowly step up onto the book/stair sideways with the affected foot. The unaffected foot should be level but not touching the book/step.
Unlock/bend the affected knee and unaffected foot should dip down below the step. Ensure that your affected knee does NOT pass your toes and that you hip/pelvis remains level.
Slowly straighten your knee back up.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day
KNEE STRENGTHENING

WALL SLIDES

Begin by standing with your back against a wall; feet shoulder width apart and approximately 12-14 inches away from the wall. Slowly slide down the wall until you are in a “chair” position. Try to put equal weight on both legs. Ensure that your knees do NOT pass your toes. Hold for 5 seconds. Slowly return back to the original position by pressing up through heels rather than front of the foot.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day

CALF RAISES

Stand with your legs straight and with even weight bearing. Hold onto a chair for support and stand on one leg. Push up onto your toes using your calf muscles to bring your heel off the ground. Do not curl your toes. Slowly lower your heel back to the original position.

*If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

GOAL: 10 repetitions with progression up to 30 repetitions on the affected leg, 3 times a day
HIP STRENGTHENING

STRAIGHT LEG RAISE

5

GOAL: 10 repetitions with progression up to 30 repetitions on each leg, 3 times a day

Lie on your back. Straighten your affected leg and have the other knee bent with your foot flat. While keeping the leg completely straight, slowly raise your leg. Hold for 5 seconds. Slowly lower your leg back to the original position. Repeat this exercise with the opposite leg. *If you can perform 10 repetitions easily, you can progress up to 30 repetitions.

HIP EXTENSION (LYING ON STOMACH)

6

GOAL: 10 repetitions with progression up to 30 repetitions on each leg, 3 times a day

Lie on your stomach with a pillow positioned under your stomach. Keep the leg straight and slowly raise your thigh up. Do not lift high, just enough to clear the surface. Hold for 5 seconds. Slowly lower your leg back to the original position. Repeat this exercise with the opposite leg. *If you can perform 10 repetitions easily, you can progress up to 30 repetitions.
HIP STRENGTHENING

HIP ABDUCTION (ON SIDE)

**Goal:** 10 repetitions with progression up to 30 repetitions on each leg, 3 times a day

Lie on your side. Straighten your top and have the lower knee slightly bent. Slowly lift your leg up without your pelvis rolling forward or backward. Hold for 5 seconds. Slowly lower your leg back to the original position. Repeat this exercise with the opposite leg. *If you can perform 10 repetitions easily, you can progress up to 30 repetitions.*

HIP ADDUCTION (ON SIDE)

**Goal:** 10 repetitions with progression up to 30 repetitions on each leg, 3 times a day

Lie on your side. Straighten your bottom leg and have the top knee slightly bent in front of your lower leg. Slowly raise your bottom leg up toward the ceiling. Hold for 5 seconds. Slowly lower your leg back to the original position. Repeat this exercise with the opposite leg. *If you can perform 10 repetitions easily, you can progress up to 30 repetitions.*
HIP STRENGTHENING – HAMSTRINGS/GLUTS

BRIDGE

Lie on your back with your arms at your sides. Place your feet shoulder width apart on a chair or bed with your knees and hips bent to 90°. Slowly press heels into the chair or bed, tightening your buttocks and lifting them off the floor while keeping your pelvis level. Try not to press down with your arms into the floor. Hold for 5 seconds. Slowly relax and lower pelvis to the original position.

GOAL: 30 repetitions, 3 times a day
OTHER – BALANCE AND ICE

SINGLE LEG STANCE

Stand on one leg without support and look forward. Try to maintain your balance for 30 seconds on the affected leg.

*If you can perform 5 repetitions easily with your eyes open, you can progress up to having your eyes closed.

GOAL: 5 repetitions with progression to eyes open and closed, 3 times a day

ICE WITH KNEE IN EXTENSION

After completing all your exercises, place an ice pack on top of the affected knee. You may also place an additional ice pack over your shin area if it is sore.

Ensure that the knee is as straight as possible.

*It is important to make sure a towel or pillow is not placed underneath the knee.

GOAL: 15 minutes, 3 times a day, after exercises
OTHER – ADDITIONAL EXERCISES

STATIONARY BIKE, ELLIPTICAL

Set the seat height so that your knee is almost straight when the pedal is at the bottom. You may add some resistance to the bike to your tolerance.

GOAL: 10-20 minutes