



Anterior Cruciate Ligament (ACL) Reconstruction

Postoperative
Rehabilitation
Protocol

CRUTCHES AND WEIGHT BEARING:

- Crutches should be used for balance and for assistance while learning to walk in the normal “heel-toe” pattern.
- Once you can walk normally you may discontinue crutches, usually by 2 weeks following surgery.
- You are allowed to fully weight bear unless instructed otherwise.
- **Certain meniscus and cartilage repairs require non-weight bearing – your surgeon will tell you if you are to restrict your weight bearing.**

BRACING:

- Wear your hinged knee brace **locked in full extension at ALL times** during the first 2 weeks after surgery, except while showering or performing range of motion exercises.
- After the first 2 weeks following surgery you are encouraged to continue to use the knee brace while ambulating with NO restriction to your knee range of motion. (ie. keep brace unlocked). You may remove brace while sleeping or resting.
- **If you had a meniscus repair, your surgeon will advise you on permissible knee motion and brace parameters.**

CONTROLLING PAIN AND SWELLING:

Pain medication:

- For the first few days after surgery, take your pain medication and/or anti-inflammatories regularly as instructed, then wean as tolerated. Avoid taking pain medications on an empty stomach.

Cold Therapy:

- If you have a cold therapy machine, use it as much as possible.
- If you don't have a cold therapy machine, you can remove outer bandage to ice for 20-30 minutes, at least four times daily for several days. You may use it more frequently as needed. It will help in reducing pain. Avoid placing ice directly on bare skin to prevent frostbite and give a break of 30 minutes in between sessions. Place ice over knee, thigh, and hamstrings.

Elevation:

- Keep leg elevated **above the level of your heart** as often as possible with a pillow under your calf, NOT under the knee.

PREVENTING BLOOD CLOTS:

- Make sure you get up and walk around as much as possible and take the blood thinner or aspirin as prescribed by your surgeon.
- Ankle pump exercises every hour to promote venous blood flow.

SIGN AND SYMPTOMS OF BLOOD CLOT:

- Severe and worsening pain and swelling in the calf muscle.
- Chest pain and/or shortness of breath.
- If any of the above symptoms occur call Health Link at 8-1-1 or go to the emergency department right away.
- **Blood clots, if left untreated, have the potential to become LIFE THREATENING.**

WOUND CARE:

Bandages:

- If you find that the dressing is too tight, unwrap the tensor bandage and rewrap it looser.
- On post-op day 5 you can remove your dressing. Leave steristrips (white strips) in place, if you have them.

Shower:

- You may shower at post-op day 5 once your bandages are off. Do not cover incision.
- Keep out of direct spray of the water, and pat dry afterwards.
- Keep steristrips on your incision, they may fall off in the shower.
- **NO soaking in bathtub/hot tub or pool for first 2-3 weeks and until all scabs are gone from the incision.**

SIGNS AND SYMPTOMS OF INFECTION:

- Excessive or worsening pain, increased redness around the incision sites, drainage from incisions that looks like pus and/or is foul smelling, or if fever above 38.5°C
- If any of the above symptoms occur call Central Alberta Orthopedics at 403-309-2001 or go the emergency department right away.

PHYSIOTHERAPY:

Rehabilitation following anterior cruciate ligament reconstruction surgery is an essential part of a full recovery. The physiotherapist must use their best judgement to incorporate this protocol into an appropriate treatment plan. Physiotherapy should be started before or shortly after 2 week follow-up appointment. Home exercises to be performed in first 2 weeks following surgery are outlined in the following section.

0-2 WEEKS

GOALS

- Decrease pain and swelling
- Increase range of motion & restore full extension*
- Maintain flexibility of hamstrings, calves
- Quadriceps activation
- Normalizing gait with/without crutches

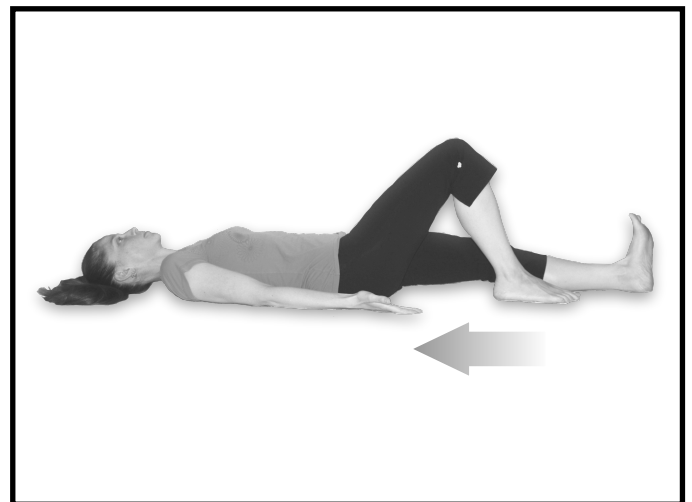
EXERCISE SUGGESTIONS

ROM & Flexibility

Remember - It is important to restore and maintain range of motion early, especially full extension. This is not detrimental to the graft or its stability. If patient has had a **meniscal repair they are to **avoid knee flexion > 90° while weight bearing** (ie. no deep squats)*

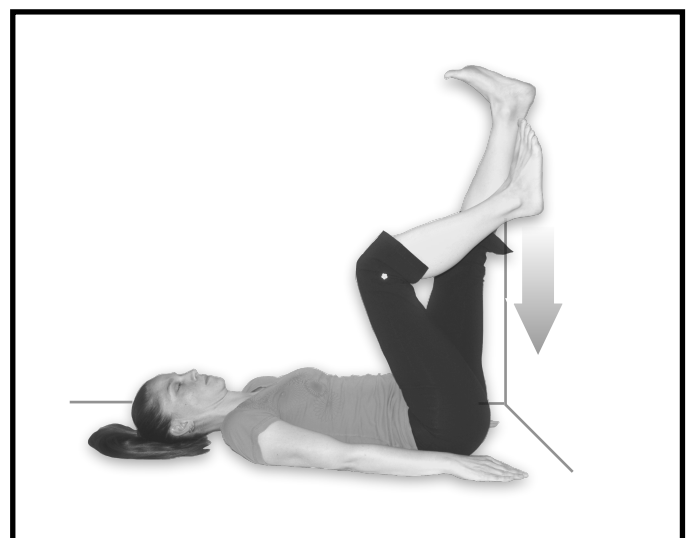
1. Heel slides:

- Slide heel along bed toward buttock while lying on back.
- Hold end position (maximal knee flexion) for 5 seconds.
- 20 repetitions; 3 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.



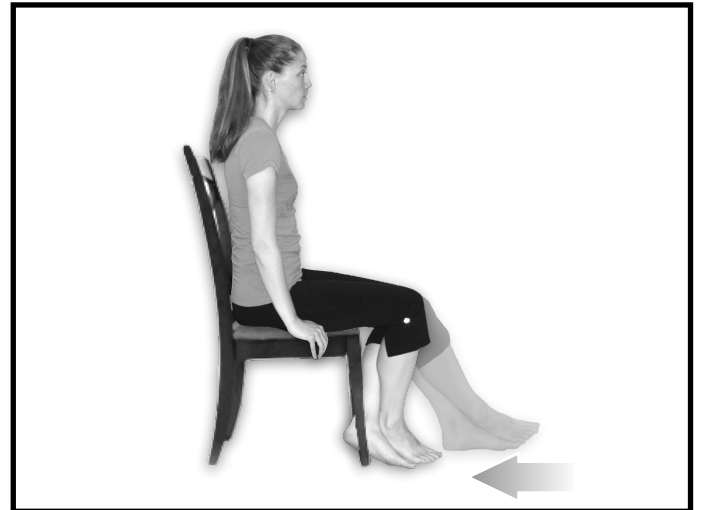
2. Heel slides on wall:

- Slide heel down wall assisted by gravity toward buttock while lying on back
- Hold end position (maximal knee flexion) for 5 seconds.
- 20 repetitions; 3 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.



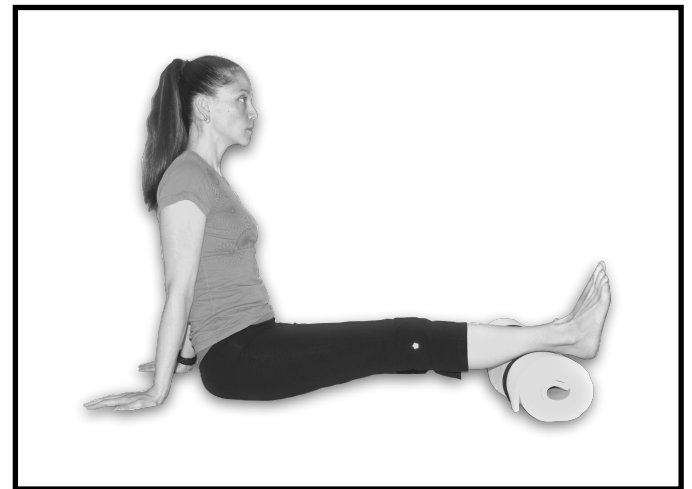
3. Seated assisted knee flexion:

- Use the other leg to gently push back on the lower leg, increasing knee flexion as far as possible.
- 30 second duration; 4 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.



4. Passive knee extension:

- Place a roll beneath ankle to passively stretch your knee into extension.
- 2 minute duration; 3 sets
- May increase duration of stretch as tolerated up to 10 minutes.
- Perform this exercise 2-3 times per day on both legs as tolerated.



5. Calf stretches

- Sitting with knee straight, pull back on toes and foot with a towel or belt
- 30 second duration; 4 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.



Muscle Strength & Endurance

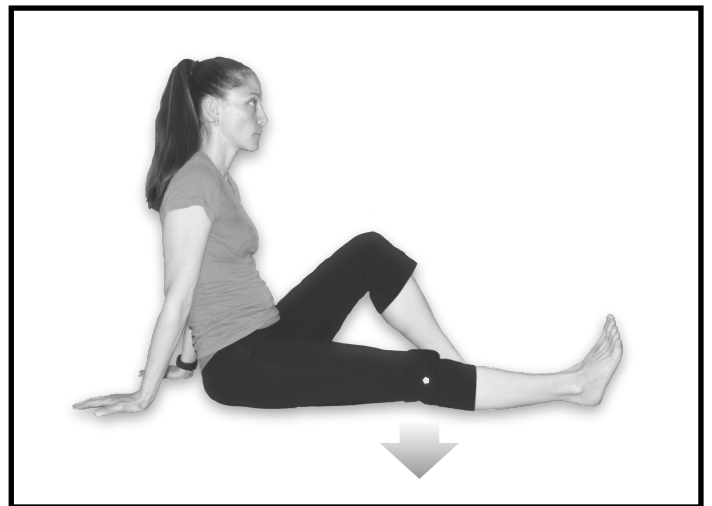
Quadriceps/Hamstrings:

**Precautions with Hamstring Grafts*

The typical donor graft for ACLR at this facility is the hamstring (semitendinosus / gracilis). Careful measures must be taken to avoid over-stressing the donor area while it heals. Although, isolated hamstring strengthening is initiated around the six-week mark in this group, it is important for the therapist to be aware of the natural stages of healing. There may be too much stress too early if the patient reports pain at the donor site during or after specific exercises.

1. Isometric Quadricep Contractions

- With knee straight and leg supported, tighten thigh muscle by pushing your knee downward.
- 5 - 10 second duration;
- 10 - 30 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.



2. Straight Leg Raises

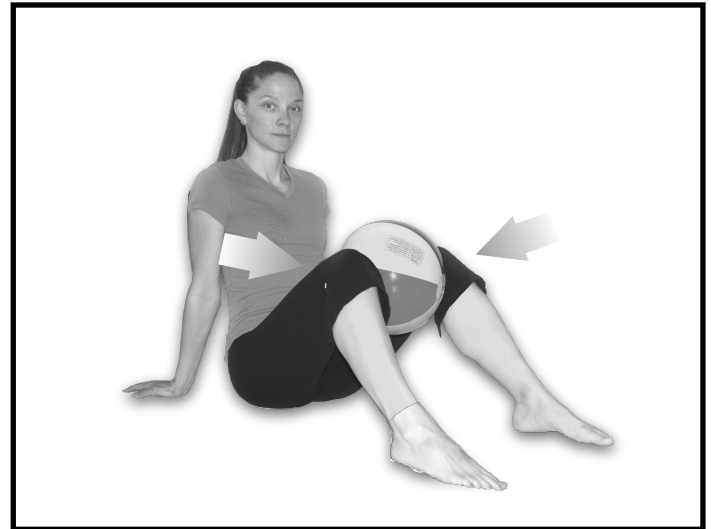
- Lying on a flat surface, tighten thigh muscles and lift leg with a straight knee up about 5 inches.
- 5 - 10 second duration;
- 10 - 30 sets
- Perform this exercise 2-3 times per day on both legs as tolerated.
- **Do NOT perform if significant quads lag present.**



Hip/Gluteals:

1. Hip adduction:

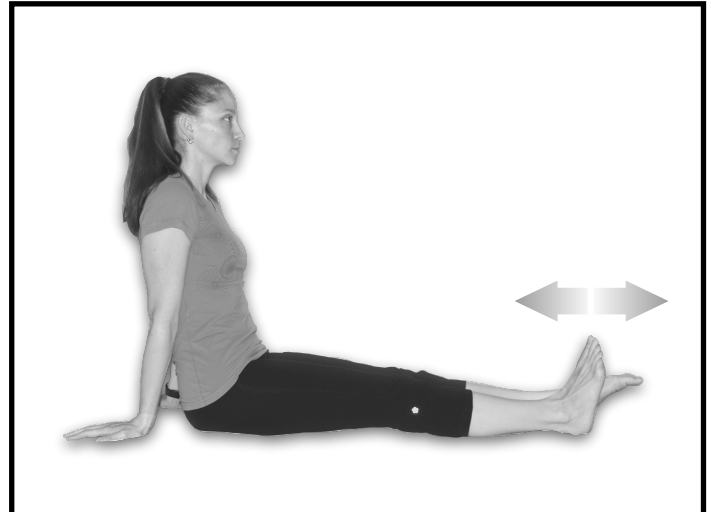
- Sitting or lying with knees bent, squeeze ball or pillow between knees
- 5 - 10 second duration
- 10 - 30 sets
- Perform this exercise 2-3 times per day.



Calves:

1. Ankle Pumps

- Keeping legs flat on bed, pull your foot up and down at the ankle.
- 10 - 20 repetitions every hour for both legs.

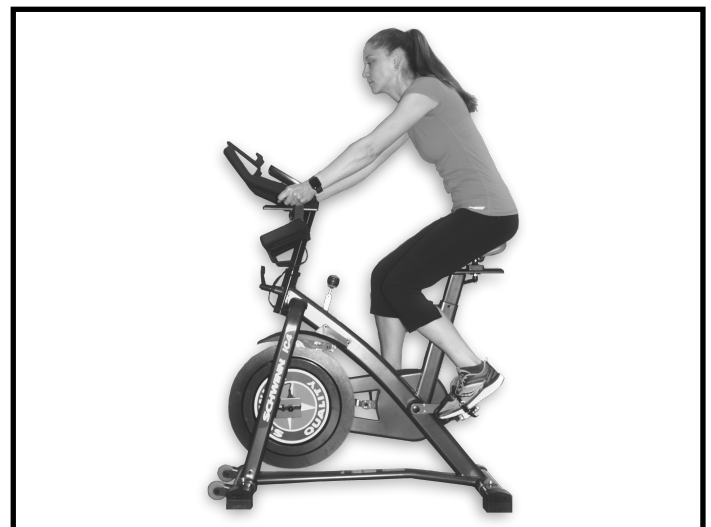


Additional Exercises:

ROM & Flexibility

1. Stationary bike:

- Bike pendulums: high seat 1/2 circles forward/backward > full circles – lower seat
- **If meniscus repaired, AVOID knee flexion greater than 90° while performing this exercise.**



Muscle Strength & Endurance

Quadriceps/Hamstrings:

- Quadriceps isometrics in standing/sitting/lying +/- muscle stimulation or biofeedback
- Sit to stand – progress by gradually decreasing height of seat
- Static lunge forward/side
- Mini wall squat (30 degrees)

Hip/Gluteals:

- Side lying abduction/adduction and clamshells
- Gluteal squeezes supine or standing
- Prone hip extension
- Standing hip flexion/extension, abduction/adduction

Calves:

- Standing calf raises with/without support

Gait

If patient has an antalgic gait pattern with use of 1 crutch, keep patient on 2 crutches until they can exhibit normal gait with 1 crutch.

- Weight shifting: side-to-side and forward/backward
- Progress from 2 crutches to 1 crutch (used by arm opposite from side of injured leg), always maintaining normal walking pattern (heel to toe)

Modalities

- Ice /Heat 15-25 minutes
- Interferential current therapy
- Muscle Stimulation
- Ultrasound

3-6 WEEKS

GOALS

- Achieve near or full ROM in knee flexion and extension
- Continue flexibility exercises of other joints
- Continue strengthening exercises with control: hip, hamstrings, quadriceps, calves
- Strengthen non-injured leg
- Progress proprioception
- Normal WB gait
- Maintain cardiovascular fitness

EXERCISE SUGGESTIONS

ROM & Flexibility

*If patient has had a **meniscal repair** they are to **avoid knee flexion > 90° while weight bearing** (ie. no deep squats)*

- Continue as needed with slider board
- Continue on the bike with full circles forward/backward - begin to lower seat
- Prone assisted knee flexion (belt, opposite leg)
- Progress to standing stretches for gastrocnemius (knee straight) and soleus (knee bent), ensure back foot is straight
- Progress to a standing hamstring stretch (keep back straight)
- Assisted quadriceps stretch in prone or in standing
- Patellar and/or tibial-femoral joint mobilizations if needed to achieve terminal ROM (no ACL strain with passive movement)

Muscle Strength & Endurance

Quadriceps:

- Sit-to-stand with muscle stimulation
- Leg press machine: low weight 2 legs (1/2 – 3/4 range)
- Wall squats with feet 12" from wall (45° - 60°)
- Forward and lateral step-ups 2" - 4" (push body weight up through weight bearing heel slow and with control, also watch for hip hiking or excessive ankle dorsiflexion)

Hamstrings/Gluteals:

- Prone assisted hamstrings (with belt, opposite leg)
- Hip strengthening with pulleys or ankle weights - all directions (do not allow a lot of trunk swaying)
- Supine on floor legs on Swiss ball: isometric hamstrings/gluteals - progress to bridging (if pain free at donor site)

Calves:

- Standing calf raises 2 - 1 foot

Proprioception

With balance drills on unstable surfaces, be aware of and correct poor balance responses such as hip hiking with INV/EVER and trunk extension with DF/PF.

Progression of balance retraining should be from:

Looking forward > looking away, eyes open > eyes closed, on a stable base > on an unstable base

Some patients may not be ready for some proprioception exercises. It will be at the discretion of the physiotherapist to progress the patient's exercises based on observation of the patient's muscular control

- Single leg stance 30 - 60 seconds
- Wobble boards with support (table, bars, poles) through full ROM: side-to-side, forward/backward > full ROM on wobble boards with decreased support - progress to maintaining balance on board
- Standing 747 eyes open/closed – progress to mini trampoline
- Dynadisc™ or BOSU™ (round) 2 leg balance > weight shift forward/backward, side-to-side, eyes open/closed > progress to mini squats (0-30°)
- Standing on 1/2 foam roller: balance > rocking forward/backward

Gait

**Full knee extension is needed for normal gait.*

- “Cup walking”: forced exaggeration of knee and hip flexion during the swing phase of gait rather than a rigid knee with a compensatory hip hike (may use plastic cups/mini pylons/foam rollers to walk over to accentuate hip/knee flexion)
- Progress from a single crutch to full weight bearing. Ensure NO antalgic gait pattern

Cardiovascular Fitness

- Bike with increasing time parameters
- May start elliptical trainer and progress to Stairmaster™ if adequate strength has been achieved (must have no hip hiking when pressing down on step)

Modalities

- Ice /Heat 15-25 minutes
- Interferential current therapy
- Muscle Stimulation
- Ultrasound

6-9 WEEKS

GOALS

- Full and pain free knee range of motion
- Functional quadriceps strength
- Initiate isokinetic quadriceps strengthening in a **specific & limited** range ****only if:** ROM is full, no swelling, adequate muscle control, and no meniscal or patellofemoral pathology
- Address documented quadriceps strength deficits (high and low velocity, concentric and eccentric, 0-95°)

- Continue strengthening lower extremity muscle groups, specifically through full range hamstrings/quadriceps (without pain at donor site)
- Advance proprioception exercises
- Increase cardiovascular fitness

EXERCISE SUGGESTIONS

ROM & Flexibility

- Mobilizations if needed to achieve end ranges

Muscle Strength & Endurance

Quadriceps:

- Terminal extension with tubing – forward and backward facing
- Walking in Bungee™ cord forward/backward/side step with slow control on return
- Lunging in Bungee™ – forward/backward/diagonal
- Step-ups 6-8" step forward/lateral (vertical trunk, watch for hip hiking or excessive ankle dorsiflexion)
- Eccentric lateral step down on 2" > 4" > 6" step with control (watch for hip hiking or excessive ankle dorsiflexion)
- Static Lunge (1/4 - 1/2 range) > progress to dynamic lunge step (1/4 - 1/2 range) with proper trunk and leg alignment
- Full wall squats to 90°
- Initiate isokinetic program if patient is appropriate and equipment is available

Hamstrings/Gluteals:

- Continue hip strengthening with increased weights/tubing resistance
- Supine on floor legs on swiss ball: bridging plus knee flexion (heels to buttocks)
- Prone active hamstring curls – progress with 1-2 lb. weights
- Standing hamstrings curls – when able to attain 90° ROM against gravity add 1-2 lbs weights
- Sitting hamstring curls with light tubing/pulley system for resistance
- Tubing kickback (mule kicks)

Calves:

- Shuttle™ heel drops 2 > 1 leg
- Mini trampoline: weight shift heel drops/bouncing

Proprioception

- Continue on wobble boards and begin to add basic upper body skills (i.e. throwing)
- Mini trampoline: single leg stance, +/- Bodyblade™ above/below head
- BOSU™ marching: progress with high knees
- Progress Dynadisc™ or BOSU™ 1 leg balance with/without support

- Dynadisc™ or BOSU™ squats (60-90°)
- Dynadisc™ or BOSU™ stand on 2 legs, with throwing to Rebounder™

Hydrotherapy / Pool

Hydrotherapy also known as water physical therapy and aquatic physical therapy is the use of a warm water environment to facilitate certain range of motion and strengthening exercises. If you have difficulty or pain with movement, problems with your balance or mobility, or find exercising on land challenging, then aquatic physiotherapy may be beneficial. This is a particularly effective and comfortable way for patients to rehabilitate from a sports injury. (This may not be available locally).

- Knee ROM
- Walking forward/backward, static lunge, lunge walking, squats, side shuffles, step up/down, calf raises (2-1 foot)
- Hip extension/flexion, adduction/abduction
- Deep water: stride walking, cycling, flutter kick

Cardiovascular Fitness

- Bike, increasing time or resistance
- Stairmaster™: forward/backward – progress to no hand support
- Swim - Flutter kick only
- Pool jogging – deep water jogging
- Treadmill – walking, increase speed +/- visual (mirror) or auditory (metronome) feedback

Modalities

- Ice /Heat 15-25 minutes
- Interferential current therapy
- Muscle Stimulation
- Ultrasound

9-12 WEEKS

GOALS

- Continue flexibility exercises
- Quadriceps strength progression
- Address documented hamstring strength deficits (high speed, eccentric 95-60°)
- Continue lower chain concentric/eccentric strengthening of quadriceps & hamstrings, both inner range (60–95°) & full range
- Proprioceptive progression
- Sport specific cardiovascular fitness

EXERCISE SUGGESTIONS

Muscle Strength & Endurance

Quadriceps:

- Static Lunge (full range) > dynamic lunge > lunge walking all with proper trunk and leg alignment
- Backward step up 4" - 6" - 8" step
- Clock face lunges with Bungee™ using mini pylon markers
- Quick walk forward/backward with Bungee™
- Quick side stepping with Bungee™
- Quick lunge forward with control (upright trunk, no forward thrust, no hip hiking)
- Eccentric Bungee™
- Eccentric step down with control on 6" > 8" step
- Continue / progress isokinetic program if patient is appropriate and equipment is available

Hamstrings/Gluteals:

- Prone/standing pulley knee flexion
- Chair walking
- Prone eccentric hamstrings with pulleys/tubing, alternating inner range and full range
- Continue hip strengthening with increased weights/tubing resistance
- Sitting and standing hamstring curls – Bungee™/pulleys/ weights sitting and standing positions - address full range concentrically and inner range from 95-60° eccentrically and high velocity (if pain free & without difficulty)
- Supine eccentric hamstrings with knee in extension

Calves:

- Eccentric heel drops

Proprioception

- On boards/Dynadisc™/BOSU™/foam roller/mini trampoline: catch and throw (2 hands/1hand) at varying angles and directions with partner or using rebounder
- Dynadisc™ or BOSU™ throwing on rebounder feet side-to-side, forward/backward, 2-1 foot
- Perturbation drills with tubing on boards/ Dynadisc™/BOSU™/foam roller/mini trampoline
- Single leg stance on Dynadisc™ or BOSU™ with unaffected leg performing kicking drills +/- tubing/pulleys
- Single leg stance on Dynadisc™ or BOSU™ performing kicking drills +/- tubing/pulleys
- Single leg stance on Dynadisc™ or BOSU™ performing higher end upper body skills

Hydrotherapy / Pool

- Increase time, speed, repetitions of exercises
- Pool running

Cardiovascular Fitness

- Bike: increased resistance and time parameters
- Treadmill walk +/- incline > quick walk

Modalities

- Ice /Heat 15-25 minutes
- Interferential current therapy
- Muscle Stimulation
- Ultrasound

12-16 WEEKS

GOALS

- Continue with flexibility exercises for the lower chain
- Continue strengthening of the lower chain
- Sport specific quadriceps & hamstrings strengthening
- Sport specific proprioception training
- Sport specific cardiovascular fitness

EXERCISE SUGGESTIONS

Muscle Strength & Endurance

- Continue with concentric and eccentric strengthening of hamstrings and quadriceps, working through full & inner range
- Backward lunge – progress to backward lunge walking (with proper trunk and leg alignment)
- Bungee™ jogging - progress to running
- Split squat jumps – progress to BOSU™
- Single leg drop landing 2” step

Agility

Agility is the ability to move, and change direction and position of the body quickly and effectively with control.

- Ladder drills – forward/backward, side-to-side (focus on footwork/speed/timing)
- 2 legged lateral and forward jumping
- Side step-overs (hurdle) – progress to side hop-overs
- Carioca patterning
- Tuck jumps
- Skipping
- Initiate 2 legged hop tests (hop for distance, 6-m timed hop, triple hop, crossover hop) prior to single leg hop tests in next stage - ensure patterning and landing is proficient prior to 1 leg progression

Proprioception

- Mini trampoline: 2 feet jump & land > jogging > 1 leg hopping (1L/1R, 2L/2R, 3L/3R...)
- Continue progressing skill difficulty
- Single leg stance – tap down clock drill with mini pylons
- Dynadisc™ or BOSU™: 1 leg balance with upper body or opposite leg skill i.e. throwing, phantom kicking with Bungee™ resistance, hockey shot....

Hydrotherapy / Pool

- Progress to plyometrics: 2 leg hopping, forward/backward/side-to-side
- Split squat jumping

Cardiovascular Fitness

- Bike – standing with interval training
- Sport specific cardiovascular training: aerobic vs. anaerobic training
- Jogging – straight on flat ground, no cuts/no downhill
- Treadmill – jog > interval running > running

**Note: Progression to running may only occur once a symmetric and proficient pattern has been attained to prevent abnormal tissue/joint loading in the lower extremity. Running should NOT be initiated if swelling, loss of motion or patellofemoral pain is present.*

16-20 WEEKS

GOALS

- Sport specific quadriceps, hamstrings and lower chain strengthening progressing to plyometrics
- Proprioception training
- Sport specific cardiovascular fitness

EXERCISE SUGGESTIONS

Muscle Strength & Endurance

- Continue with lower extremity strengthening with specific emphasis on client-specific deficits
- 2 > 1 leg progression for all exercises

Plyometrics and Agility

Plyometrics are exercises that enable a group of muscles to reach maximal strength in as short a time as possible. They help bridge the gap between speed and strength training. Adequate concentric & eccentric strength is essential before initiating plyometrics. If needed, start them in the pool in shallow water to decrease stress on the tibiofemoral and patellofemoral joints; otherwise initiate on land as tolerated.

Agility drills should commence by introducing proper footwork, timing and speed. Once the client is able to successfully and appropriately run in a straight line, without difficulty, non-linear activities may be initiated, such as cutting and pivoting. These drills should commence by introducing large angle and low speeds (ie. large figure 8s) and progress to more advanced drills with sharper angles and increasing speeds.

- Ladder drills – incorporate lateral movements/diagonals, adding single leg and crossover patterns
- Running/lunging/vertical jump/ run-plant-sidestep with Bungee™ - may incorporate upper/lower body skill – kicking, jumping, catching, pass & shoot
- Carioca 3/4 jog
- Mini trampoline: 2 leg jump off – 2 leg land with progression to one leg land on/off balance pad/BOSU™ (watch for proper landing mechanics)
- Single leg forward and lateral hopping
- Hop tests: single hop, 6m timed hop, triple hop, crossover hop
- Vertical jumps – single leg
- Box hop up /down
- Box jump down with sprint forward
- Box drop jump 2 legs with proper form may progress to drop jump with vertical hop for maximum height
- Single leg drop landing 4” - 6” - 8” - 10” step

Proprioception

- Continue progressions e.g. mini trampoline with upper skills
- Forward hop and lateral hop – maintain balance for 5 sec on landing
- Cutting drills with quick stop and maintain balance
- Bungee™ run plant/push off L&R

Cardiovascular Fitness

- Increase distance, duration or intensity with bike, Stairmaster™, treadmill, outdoor running/cycling depending on the demands of the particular sport
- Treadmill: running > sprinting: assess sprinting form - should have normal pain-free rhythmic stride (audible monitoring of foot contact)
- Jogging and running on an uneven surface
- Jogging with turns 90°/180°/360°
- Jogging and cutting with 45° change of direction
- Acceleration and deceleration running, add on tight turns and hills as tolerated
- Cycling outdoors
- Swimming - no whipkick

20-24 WEEKS

GOALS

- Adequate cardiovascular fitness, strength, power, agility neuromuscular control, symmetry and stability
- Continue with upper body strengthening
- Back to sport practice for upper skills (as able)
- Return to sport skills on own at practice with minimal risk of re-injury

EXERCISE SUGGESTIONS

Plyometrics and Agility

- Single leg drop jump 6" step
- Large Figure 8's
- Carioca running full speed
- Last minute decision drills
- 2 and 1 foot hopping with control
- Forward and lateral hop with control and comparable distance L&R
- Triple jump and landing with control and comparable distances L&R
- Single limb hop for distance (within 15% of uninvolved side)
- Single-limb crossover triple hop for distance (within 15% of uninvolved side)

- Single-limb timed hop over 6m (within 15% of uninvolved side)
- Single limb vertical power hop (within 15% of uninvolved side)
- Single limb drop landing (within 15% of uninvolved side)
- Single limb drop-jump
- 10 second single limb maximum vertical hop (both sides)

RETURNING TO SPORT

- Gradual return to sport is initiated at the 6-9 month mark only if the individual's knee does not present with pain or effusion during or after functional sport specific training drills. The individual must also be able to demonstrate the appropriate strength and endurance needed for their specific sport.
- A return to sport assessment should be successfully completed prior to returning to sport participation. Successful completion requires achieving scores on a battery of tests that are within 85-100% of the results from the opposite leg.