/// 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.

This rehabilitation protocol spans over a 6 month period and is divided into 7 timelines. Each timeline has goals and exercise suggestions for several domains: range of motion and flexibility, strength and endurance, proprioception, gait, and cardiovascular fitness. Criteria for progression within each timeline are based on the attainment of specific goals and on their Lower Extremity Functional Scale (LEFS) score. 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.

/// KEY POINTS

1/ LOWER EXTREMITY FUNCTIONAL SCALE (LEFS)

The LEFS is a self report questionnaire used to evaluate the functional status of an individual with a lower extremity musculoskeletal dysfunction. It is easy to administer and easy to score in the clinical and research environment. The LEFS consists of 20 items, each scored on a 5-point scale (0 to 4). Item scores are summed and total LEFS scores vary from 0 to 80, with higher values representing better functional status. The LEFS is a reliable and valid tool for assessing change in functional status. True clinically important change has occurred if the score changes 9 or more scale points from a previous score[51]. In each corresponding timeline of the protocol the ranges of the LEFS scores are presented. These scores were derived from data on 55 ACLR patients between the ages of 18-65 years of age from our facility. The LEFS scores provided should not be used in isolation as they are intended to be an adjunct to the protocol, the functional testing guidelines and to sound clinical reasoning.

2/ PRE-OPERATIVE REHABILITATION

Rehabilitation should commence prior to surgery. After an ACL injury, deficits occur in strength[39], proprioception[40,56], muscle timing[55] and gait patterns[13]. In fact, strength and proprioceptive alterations occur in both the injured and uninjured limb[10,21,52,55]. The primary impairment with an ACL deficient knee is instability. This is manifested by episodes of 'giving way', which can lead to further joint damage and ultimately, long term degenerative changes[19]. Research has demonstrated that physiotherapy provided pre-operatively is effective in increasing strength and balance which may limit the number the episodes of 'giving way' and decrease the incidence of re-injury in the ACL deficient knee[18,26]. The main goals of a 'pre-habilitative' program prior to surgery include: full range of motion equal to the opposite knee, minimal joint swelling, adequate strength and neuromuscular control, and a positive state of mind[45]. All of these factors facilitate optimal post-operative recovery. It is important to maintain the highest level of strength and function possible in the unaffected leg as it will be used for comparison to assess the progress of the reconstructed knee, in the later stages of rehabilitation[22,23].

3/ RANGE OF MOTION & FLEXIBILITY [1,47,48]

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[44]. Attaining full knee extension as early as possible is not deleterious to the graft or to joint stability[43] 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)[34]. 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.

4/ 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[11,13,15,30]. 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[53]. Treadmill training in the middle stages of rehabilitation can further assist in normalizing lower extremity ROM across all joints, especially with incline or backwards walking. Backwards treadmill walking has been shown in the literature to increase ROM and increase functional quadriceps strength, while minimizing patellofemoral stress. It is also beneficial for specific return-to-sport preparation requiring a re-training of backwards locomotion[49].

5/ MUSCULAR STRENGTH & ENDURANCE TRAINING

Muscle analyses of the quadriceps post ACL injury have shown: i) similar degrees of atrophy in both type I (oxidative/endurance) and II (glycolytic/fast-twitch) muscle fibres, and ii) physiological metabolic shifts in muscle fibres from gylcolytic into oxidative compositions[35,50]. This means that ACL rehabilitation must include variable training parameters, which range from an endurance program of low load/high repetitions to a strength oriented phase of high load/low repetitions to focus on these deficits. Depending on the graft type used for ACLR (patellar tendon vs. semitendonosis/gracilis), specific strength deficits have been found. With the patellar tendon graft, there are low velocity concentric extensor deficits specific to 60-95°; with the hamstring graft, there are high velocity, eccentric flexor deficits specific to 60-95°[23]. Strengthening exercises need to be velocity, ROM and contraction specific to address these deficits.

- **Open (OKC) and Closed (CKC) Kinetic Chain Exercises**

  OKC exercises have previously been contraindicated in ACLR patients for 6 months up to a year post-operatively, although the concern about the safety of OKC training in the early period after ACLR may not be well founded. It was originally thought that OKC exercises increased anterior tibial translation, with the possibility of increasing strain on the new graft. However, research has demonstrated that there are minimal strain differences between OKC leg extension and CKC activities such as squatting[4,5]. With the addition of OKC training, subjects have shown increased quadriceps torque increases without significant increases in laxity[25,37]. Researchers are now advocating the addition OKC exercises, at the appropriate time and within a restricted range, to complement the classic CKC rehabilitative program[25,37,38].

- **Quality vs. Compensation**

  Physiotherapists often feel compelled to progress patients by giving them new exercises each time they are in for therapy. It cannot be stressed enough that it is not beneficial to give patients exercises they are not neuromuscularly ready for. It is very important to observe the quality of the exercises that are being performed, specifically with CKC exercises. Weaknesses in specific muscle groups lead to compensations, which produce faulty movement patterns. These faulty patterns are then integrated into unconscious motor programs, which perpetuate the original weakness. Specifically, the research has indicated that knee extensor moment deficits are compensated for by hip and/or ankle extensor moments(11,15). If these are allowed to occur and are not corrected, any joint or structure along the kinetic chain may be exposed to injury.

  For example: A squat[16] or lunge must be performed with the trunk perpendicular to the ground (to avoid excessive hip flexion), the iliac crests must be level (to avoid Trendelenburg/hip hiking), and the knee must be over the foot with the tibia perpendicular to the floor (to avoid excessive dorsiflexion). It is better to decrease the range of movement (half squat vs. full squat) than to do the exercise at a level that is too difficult to perform correctly without compensation.

- **Precautions with Hamstring Grafts**

  The typical donor graft for ACLR at this facility is the hamstring (semitendinosis / gracilis). Careful measures must be taken to avoid overstressing 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.

6/ NEUROMUSCULAR & PROPRIOCEPTIVE RETRAINING

Ideally proprioception should be initiated immediately after injury (prior to surgery), as it is known that proprioceptive input and neuromuscular control are altered after ACL injury[10,55]. By challenging the proprioceptive system though specific exercises, other knee joint mechanoreceptors are activated that produce compensatory muscle activation patterns in the neuromuscular system that may assist with joint stability[9]. Post-operatively, proprioceptive training should commence early in the rehabilitation process in order to begin neuromuscular integration and should continue as proprioceptive deficits have been found beyond 1 year post ACLR[11,15,21,32]. Proprioceptive exercises have been shown to enhance strength gains in the quadriceps and hamstring muscles post ACLR[31,57]. In the later stages of rehabilitation, anticipated and unanticipated perturbation training is effective in improving dynamic stability of the knee[8,18]. A dynamically stable joint is the result of an optimally functioning proprioceptive and neuromuscular system and functional outcome has been proven to be highly correlated with balance in the reconstructed ACL[46].

7/ RETURN 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. LEFS scores should be 76 points or greater at this point in rehabilitation. The individual must also be able to demonstrate the appropriate strength and endurance needed for their specific sport. This recommendation is based on the evidence that knee cartilage and subchondral bone are damaged during the initial ACL trauma and may need additional time to recover in order to minimize the predisposition for future joint arthrosis[17,54,58]. A further consideration when returning the patient to sport is that a cautionary approach should be taken with the use of the uninjured limb as a comparison for a rehabilitation endpoint. It has been demonstrated in the literature that a significant detraining effect occurs in the quadriceps and hamstring muscles in both injured and uninjured extremities[22].

8/ BRACING

Bracing should be discussed with the physiotherapist and surgeon prior to return to sport or strenuous activities post ACLR. The decision will be dependent on a number of factors including: type of sport, position, activity level and complexity of the initial injury. Some surgeons may recommend a rigid, functional knee brace or a neoprene sleeve. Research has demonstrated that a rigid knee brace does not provide superior outcomes when compared with a neoprene sleeve after ACLR[6]. Bracing has not been proven to prevent re-injury or improve clinical outcomes after ACLR[33]. However, there is evidence that any type of knee bracing (rigid /soft) improves proprioception measures[7,27].

/// 0-2 WEEKS

LEFS range: 14-24

// GOALS

- Patient education re: weight-bearing status; changes to rehab guidelines with any concurrent pathologies (i.e. PF pain, MCL injury, meniscal repair vs debridement, etc.)
- Decrease pain and swelling
- Increase range of motion & restore full extension*
- Maintain flexibility of hamstrings, calves
- Quadriceps activation(44)
- Proprioceptive/balance re-education(46)
- Maintain cardiovascular fitness

// 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[43].*

- Heel slides (+/– slider board)
- Supine with legs up wall – heels slides with gravity assisted
- Bike pendulums: high seat ½ circles forward/backward full circles – lower seat
- Sitting passive leg extension with roll under heel OR prone leg hangs off end of bed/plinth
- Seated calf stretch with towel - knee bent (soleus), knee straight (gastrocnemius)
- Seated hamstring stretch (back straight)

Muscle Strength & Endurance

Quadriceps/Hamstrings:

- Quadriceps and hamstring co-contraction(2,41)
- Quadriceps isometrics(44) in standing/sitting/lying +/– muscle stimulation or biofeedback
- Sit to stand – progress by gradually decreasing height of seat

0-2 WEEKS (continued)

- Static lunge forward/side
- Mini wall squat (30°)
- Shuttle™: (one bungee cord) – 2 leg squat (¼ - ½ range) and 2 leg calf raises

Hip/Gluteals:

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

Calves:

- Ankle pumping +/– with leg elevation
- Standing calf raises with/without support

// PROPRIOCEPTION

With balance drills on unstable surfaces, be aware of and correct poor balance responses such as hiphiking with INV/EVER and trunk extension with DF/PF. GOAL: maintain stance on board regardless of ability to control board position[20]

- Single leg stance 30-60 seconds
- Wobble boards with support (table, bars, poles) through full ROM: side-to-side, forward/backward

// 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(28)
- Progress from 2 crutches to 1, always maintaining normal walking pattern

Modalities

- Ice 15-25 minutes(24)
- Interferential current therapy (pain relief)
- Muscle Stimulation(49)

/// 6-9 WEEKS

LEFS range: 45-59

// GOALS

- Full and pain free knee range of motion
- Functional quadriceps strength
- Initiate isokinetic quadriceps strengthening in a specific & limited range[37] ***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°)[23]
- 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
- Shuttle™: full and inner range squats, 2 1 leg, increasing resistance
- 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)[15]
- Static Lunge (¼ - ½ range) progress to dynamic lunge step (¼ - ½ range) with proper trunk and leg alignment
- Full wall squats to 90°

  Initiate isokinetic program if patient is appropriate and equipment is available *(see reference for timelines and ROM restrictions)*[37]**

6-9 WEEKS (continued)

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 lb weights
- Sitting hamstring curls with light tubing/pulley system for resistance
- Fitter™: hip abduction and extension (poles for support)
- Shuttle™ standing kick backs (hip/knee extension)
- 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

- 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

6-9 WEEKS (continued)

// 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[12,20]

/// 9-12 WEEKS

LEFS range: 55-66

// GOALS

- Continue flexibility exercises
- Quadriceps strength progression
- Address documented hamstring strength deficits (high speed, eccentric 95-60°)[23]
- 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:

- Progress resistance of Shuttle™: full ROM and inner range (60-95°), working on strength & endurance, 2 1 leg
- 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
- Shuttle™ jumping (low resistance) 2 legs alternate legs (jogging) single leg
- Shuttle™ ski hops (side-to-side)
- Continue / progress isokinetic program if patient is appropriate and equipment is available *(see reference for timelines and ROM restrictions)* [37]**

9-12 WEEKS (continued)

Hamstrings/Gluteals:

- Prone/standing pulley knee flexion
- Chair walking
- Prone eccentric hamstrings with pulleys/tubing, alternating inner range and full range
- Hydrafitness™ (hamstrings & quadriceps): 90-30°, resistance 1-3
- 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(8,42) with tubing on boards/ Dynadisc™/BOSU™ /foam roller/mini trampoline
- Single leg stance on Dynadisc™ or BOSU™ with unaffected leg per forming 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
- Fitter™: slalom skiing without ski pole support
- Treadmill walk +/– incline(29) quick walk

/// 12-16 WEEKS

LEFS range: 55-66

// 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 - en sure patterning and landing is proficient prior to 1 leg progression

12-16 WEEKS (continued)

// 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 patello-femoral pain is present.*

/// 16-20 WEEKS

LEFS range: 61-76

// 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 difficult, non-linear activities may be initiated, such as cutting and pivoting. These drills should commence by introducing large angles and low speeds (ie. large figure 8s) and progress to more advanced drills with sharper angles and increasing speeds[20]

- 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
- Shuttle™ hopping 2 – alt – 1 (high resistance, increased speed)
- Shuttle™ Ski hops (high resistance, increased speed)
- Carioca ¾ 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, 6-m timed hop, triple hop, crossover hop
- Vertical jumps – single leg

16-20 WEEKS (continued)

- 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)[20]
- 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

LEFS range: 61-76

// 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 6 m (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)

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