Supplementary File 3
PhysioFIRST Clinical testing procedures

Descriptive measures

Height (m)

Body mass (kg)

Leg length (cm): Distal greater trochanter to lateral knee joint line (centre) and distal greater trochanter to distal tip lateral malleolus

Waist circumference (cm): Measured at navel level

Hip circumference (cm): Measured at widest point of greater trochanter

Pain provocation tests

Hip Internal Rotation Pain[1-3]:

Participant Position: Supine

Participant is aligned to right lateral edge of exam table if examining the right hip, aligned to the left lateral edge if examining the left hip.

Method:

Examiner stands on the ipsilateral side of the hip to be examined and passively flexes hip and knee to 90° (zero-degree position). Examiner internally rotates hip to point of resistance, keeping thigh in neutral position (i.e., avoiding abduction, adduction and pelvic tilt). Examiner asks participant if they "feel pain or discomfort in the inner thigh, upper thigh hip or groin area".

Scoring:

Upper/inner thigh, hip or groin pain **present**-rate pain from **1 to 10;** pain **absent** rate **0 out of 10**

Flexion 90°/Adduction/Internal Rotation (FADIR) Pain[1-3]:

Participant Position:

Participant is aligned to right lateral edge of exam table if examining the right hip, aligned to the left lateral edge if examining the left hip.

Method:

Examiner stands on the ipsilateral side of the hip to be examined and passively flexes hip and knee to 90°. Examiner adducts hip to endpoint (while avoiding movement of the pelvis) and then

internally rotates hip, maintaining flexion and adduction components. Examiner asks participant if they “feel pain or discomfort in the inner thigh, upper thigh, hip or groin area”.

Scoring:

Upper/inner thigh, hip or groin pain **present**-rate pain from **1 to 10;** pain **absent** rate **0 out of 10**

Bent Knee Fall Out (BKFO)[1]*:*

Participant position:

Participant is lying supine with knee of test leg bent so that foot touches contralateral knee.

Method:

Participant externally rotates hip of test leg, so that the bent knee lowers toward exam table.

Examiner asks participant if they "feel pain or discomfort in the inner thigh, upper thigh, hip or groin area".

Scoring:

Upper/inner thigh, hip or groin pain **present**-rate pain from **1 to 10;** pain **absent** rate **0 out of 10**

Hip strength tests

All strength tests done with Power track II (Commander). Each strength test will be performed 3 times, 2 seconds to generate maximum force and then 3 seconds as hard as possible. Rest time will be allowed of 5 seconds between each repetition, 30 seconds minimum between each test. Therapist matches participants force (make test).

Supine

Abduction strength[4]

Moment arm measured greater trochanter to lateral malleolus ankle.

Participant stabilises trunk by holding exam table.

Test leg resting in hip neutral

Force plate 5 cm above lateral malleolus.

Participant instructed to *“keep trunk stable and opposite leg still, keep your heel on the bed, toes pointing to the ceiling and push leg out to side against force plate as hard as possible”.*

"go ahead: push-push-push-push-relax"

Adduction strength[4]

Moment arm measured greater trochanter to lateral malleolus ankle.

Participant stabilises trunk by holding exam table.

Test leg resting in hip neutral

Force plate for long lever 5 cm above medial malleolus,

Participant instructed to *"keep trunk stable and opposite leg still, keep heel on the bed, toes pointing towards ceiling and pull leg in to centre against force plate as hard as possible"*

"go ahead: push-push-push-push-relax"

Prone

Extension strength[4 5]

Moment arm measured from greater trochanter to lateral joint line of knee.

Participant prone, with test leg knee bent to 90°and positioned off the edge of the foot of the lowered exam table, chin resting on hands.

Force plate attached to Velcro of seatbelt and placed over centre of patient's heel, patient instructed to *"push foot straight up to ceiling".*

Therapist matches force by placing foot in lower loop of seatbelt using bodyweight as counter resistance.

"Go ahead: push-push-push-push-relax"

External rotation strength[4]

Moment arm measured from greater trochanter to lateral joint line of knee.

Participant stabilises trunk by holding exam table.

Force plate 5cm proximal to medial malleolus of ankle, therapist on same side of bed, close to lower leg, with two hands on HHD.

Participant instructed to *"keep your trunk and opposite leg still and turn shin inwards towards the centre as hard as possible"*

"go ahead: push-push-push-push-relax"

Internal rotation strength[4]

Moment arm measured from greater trochanter to lateral joint line of knee.

Participant stabilises trunk by holding exam table.

Force plate 5cm proximal to lateral malleolus of ankle, therapist standing on same side of bed close to lower leg, with two hands on HHD laterally.

Participant instructed to *"keep trunk and opposite leg still and turn shin outwards as hard as possible, keeping both knees together"*

"go ahead: push-push-push-push-relax"

Sitting (on end of plinth)

Flexion strength[4]

Moment arm measured greater trochanter to lateral joint line knee

Both legs in resting position (hip 90º flexion), belt across contra-lateral thigh (placed firmly over middle of thigh)

Force plate 5 cm proximal to superior pole patella

Ensure participant is sitting in upright sitting position

Ensure that the contralateral leg is in 90° knee flexion and not being used to stabilise against the underneath of the bed.

Be aware that if you position someone in EOR hip flexion pain will potentially limit the force they can produce. Ensure that the testing leg is raised 1cm off the bed in a comfortable range
Participant instructed to *"sit with arms folded, chest up, not to lean backwards and pull knee up towards chest against force plate"*

"go ahead: push-push-push-push-relax"

Participant instructed to "*keep arms folded, chest up, thigh and knee flat on the bed and turn shin outward, as far as possible, keeping knees together*"

Functional tests

Trunk Muscle Endurance Test[6]

The patients will be positioned in side lying on a plinth/bench or a mat on the floor, with one leg resting directly on top of the other.

Participant instruction will be: "*lift your hips off the bed, supporting your weight through your feet and forearm and hold the position for as long as possible. If you get to 3 min we will stop*"

Encouragement will be given at 30 second intervals throughout the test. The time (seconds) will be recorded from the start of the test until the participant's hips touches the plinth, which represents the end of the test.

One leg rise test[6]

Subject seated on side of plinth, foot placed in position on floor measured 10cm forward from a plumb line at the edge of the plinth, other leg held straight out in front of body, arms at rest by sides

Height of plinth adjusted so knee angle is 90º

Subject instructed to "*keep back of heel on marker, stand as many times as possible on one leg keeping arms by your side, in time with my counting. If you get to 50 we will stop.*

Star Excursion Balance test[7]

We will use the procedures described by Hertel et al (2000), where three test directions are measured; anterior, posteromedial and posterolateral. In addition, we will measure balance in the anterolateral direction. From a centre point identified as a cross, 4 tape measures will be attached to the floor in the anterior, anterolateral, posteromedial and posterolateral directions (see Figure).

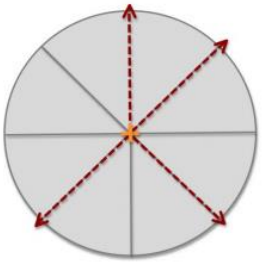


Figure. The test directions of the Star Excursion Balance Test for left leg stance

The test will be performed without shoes, starting with the uninvolved leg as the stance leg and the involved leg as the test leg. The starting position is a single-leg stance in the centre of the cross, with the most distal aspect of the great toe at the starting line and hands on hips.

While maintaining single-leg stance, the patient will be asked to reach with the free limb to touch the tip of their big toe as far as possible in all 4 directions, starting from anterior direction and moving around clockwise. The test leader will mark the reach distance in all four directions. The trial will be judged invalid if the patient i) fails to maintain unilateral stance, ii) lifts or moves the stance foot from the starting point, iii) touches down with the reach foot, or iv) fails to return the reach foot back to the starting position.

The patients will be allowed 1 practice trial in all 4 directions on both legs. Each of the four directions will be recorded on each stance leg, then the same process repeated. Two measures will be recorded for 4 directions on each stance leg, with the best reach for each direction recorded online.

Participant instruction will be: "*Keep your stance foot flat on the floor and hands on hips. Make a reach with your other leg as far as you can and lightly touch the tip of your big toe on the measuring tape, without stepping on it. Without pushing off the ground with your reaching leg, return it back to the centre of the testing grid next to stance foot. You move as much as you like to keep your balance as long as your stance foot is flat and hands are on your hips, otherwise we will repeat test, eg if you slide your foot, miss the tape, lift your heel, move hand off hips or can't return foot to start position.*"

Hop for distance test[6]

Subjects stand on starting line on one foot in bare feet hands held behind back

Instructed to "*hop as far forward as possible landing on the same foot*"

Distance recorded from the back of the landing foot with an inflexible tape measure

Subjects will be given 1 practice and then 3 trials each leg, with the greatest distance for each leg recorded.

Subjects must keep their balance on landing but can put the other foot down to record the distance of the landing foot.

Single Leg Squat[8]

The order of limb testing will be right followed by left to reduce order effects.

Single-leg squat recording:

Performance will be recorded with a digital video camera (HDR-XR150, Sony, Tokyo, Japan) fixed to a tripod. The camera will be positioned at a height of 37 cm, perpendicular to the frontal plane, 3 m in front of the participant.

The participant's unique code will be filmed prior to single-leg squat performance to allow later identification.

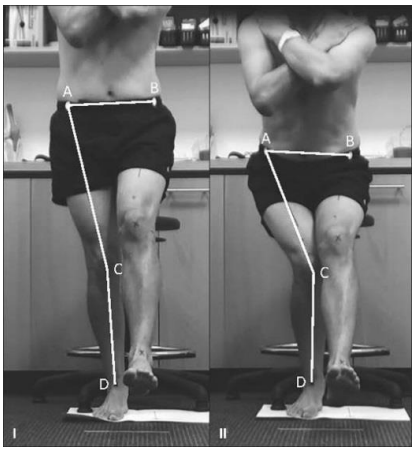
Single leg squat set-up:

Bilateral surface landmarks will be marked with black ink over the anterior superior iliac spine, the midpoint between the lateral and medial femoral condyles anteriorly, and the midpoint between the lateral and medial ankle malleoli anteriorly.

Participants will stand in front of standard height stool 65cm from floor to seat, with their foot position standardized on a template whereby the medial edge of the first metatarsophalangeal joint and the center of the posterior aspect of the heel were lined up on parallel lines 12 cm apart, and heel 10 cm from point where a vertical line at edge of stool touches the floor.

Single leg squat performance:

Participants will stand on their right leg with the trunk upright and contralateral leg in approximately 20° of hip flexion, with the knee extended and toes off the floor (Figure I).



Participant instruction will be “Hold this starting position for 3 seconds, then lower pelvis down until the buttocks lightly touch the stool (Figure II) and return to the starting position, taking 4 seconds in total.

Five consecutive squats will be performed, and the procedure repeated on the left leg.

Range of motion tests

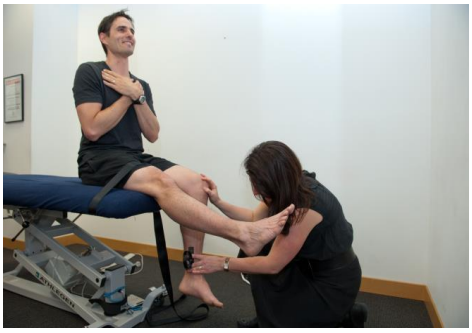
Flexion range of motion[9]

Both legs extended at rest, contra-lateral leg restrained with seat belt (placed firmly over middle of thigh), arms crossed over chest

Centre of inclinometer triangle placed on testing thigh 5cm above superior pole of patella, starting angle noted.

Participant instructed to *"keep arms folded and bend knee towards chest as far as possible"*.

Active external rotation range of motion



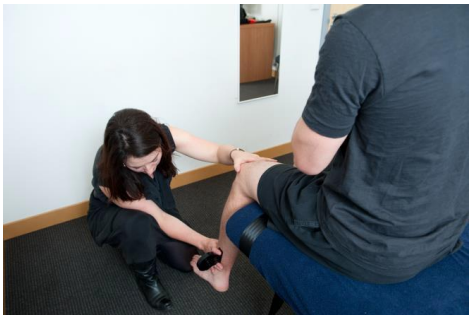
Sitting on the end of the plinth, belt over contra-lateral thigh

Centre of inclinometer triangle held to inside of shin 5 cm proximal to medial malleolus of ankle, starting angle at zero.

Ensure participant is sitting in upright position

Participant instructed "*keep arms folded, chest up and turn shin inward as far as possible, keeping thigh and knee flat and keeping other knee extended to allow clearance"*

Active internal rotation range of motion



Sitting on end of plinth, belt over contra-lateral thigh (placed firmly over middle of thigh)

Centre of Inclinometer triangle held to inside of shin 5 cm above lateral malleolus of ankle, starting angle at zero.

Ensure participant is sitting in upright sitting position

Participant instructed "*keep arms folded, chest up and turn shin outward as far as possible, keeping thigh and knee flat and buttocks flat on the bed"*

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