

ACL

Swelling

1. Sweep Test (Sturgil, 2009)

- Directions
 - Examiner strokes upwards from the medial joint line towards the suprapatellar pouch
 - A downward stroke on the distal lateral thigh from the suprapatellar pouch towards the lateral joint line is performed
 - Observe wave of fluid at medial knee
- Results
 - Zero: No wave produced with downstroke
 - Trace: Small wave on medial side with downstroke
 - 1+: Large bulge on medial side with downstroke
 - 2+: Effusion spontaneously returns to medial side after upstroke *no downstroke necessary)
 - 3+ So much fluid that it is not possible to move the effusion out of the medial aspect of the knee
- Interrater Reliability:
 - Kappa: 0.75 (substantial agreement)

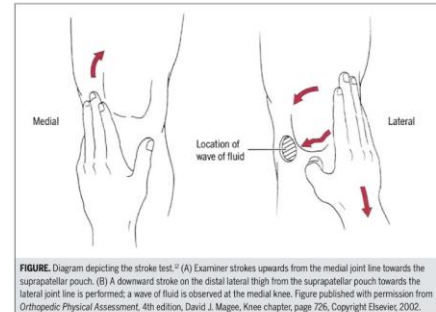


TABLE 1		EFFUSION GRADING SCALE OF THE KNEE JOINT BASED ON THE STROKE TEST	
Grade	Test Result		
Zero	No wave produced on downstroke		
Trace	Small wave on medial side with downstroke		
1+	Larger bulge on medial side with downstroke		
2+	Effusion spontaneously returns to medial side after upstroke (no downstroke necessary)		
3+	So much fluid that it is not possible to move the effusion out of the medial aspect of the knee		

Range of Motion

1. Flexion:
 - a. Supine positioning: pushing heel towards glute
 - b. Should be full, pain free, non-resistive range of motion
2. Extension:
 - a. Supine positioning: prop ankle up with bolster or towel, pushing knee down towards table
 - b. Should be full (hyperextension if patient has contralateral hyperextension), pain free, non-resistive range of motion

Strength Testing

1. Knee Extension Force Output:

a. Sitting Position

- i. Placement of HHD: just above ankle mortise
- ii. HHD fixation with gait belt to no more than 85° knee flexion
- iii. No counter force provided
- iv. 3 practice trials of 50%, 75%, and 100%
- v. 3 maximal efforts lasting 5 seconds
- vi. Rest interval: 60 seconds
- vii. Therapist Direction: “Push as hard as you feel comfortable”

2. Knee Flexion Force Output:

a. Sitting Position

- i. Placement of HHD: just above ankle mortise
- ii. HHD fixated with 90° knee flexion
- iii. No counter force provided
- iv. 3 practice trials of 50%, 75%, and 100%
- v. 3 maximal efforts lasting 5 seconds
- vi. Rest interval: 60 seconds
- vii. Therapist Direction: "Push as hard as you feel comfortable"

b. Prone Positioning

- i. Placement of HHD: just above ankle mortise
- ii. HHD fixation with gait belt to 60° knee flexion
- iii. No counter force provided
- iv. 3 practice trials of 50%, 75%, and 100%
- v. 3 maximal efforts lasting 5 seconds
- vi. Rest interval: 60 seconds
- vii. Therapist Direction: “Push as hard as you feel comfortable”

c. ICC: 0.7 (compared to Isokinetic Dynamometer)

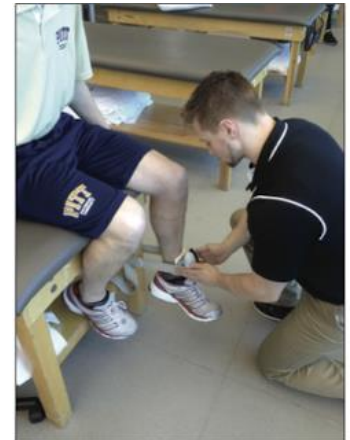
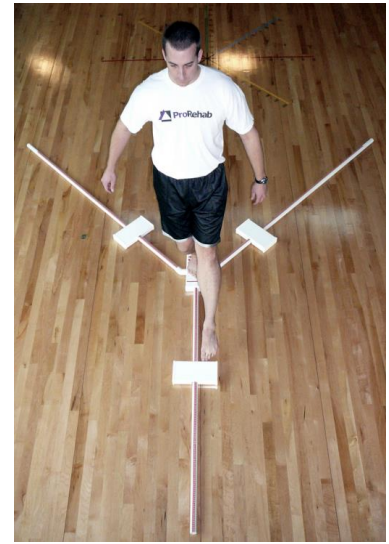


FIGURE 2. Handheld dynamometry setup. The handheld dynamometer was placed just proximal to the ankle mortise. A universal gait belt provided fixation. Knee flexion was set between 90° and 85° for each contraction. Participants were encouraged to grasp the edge of the table for stabilization.

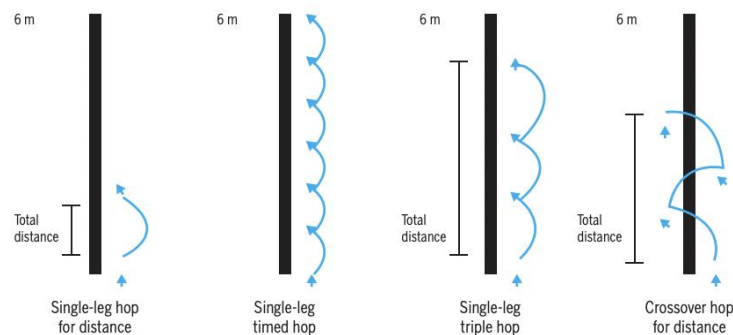
TABLE 5	CUT POINTS FOR HHD ALTERNATIVE MEASURE TO IDENTIFY CLINICAL THRESHOLD QI SYMMETRY*					
	Clearance for Return to Running (80% QI)			Clearance for Return to Play (90% QI)		
	Cut Point	Observed Specificity	Observed Sensitivity	Cut Point	Observed Specificity	Observed Sensitivity
Minimum specificity						
80%	85.9	83.3	72.2	99.1	80.0	41.7
85%	86.5	88.9	72.2	102.8	86.7	33.3
90%	100.7	94.4	36.1	103.7	90.0	33.3
Area under the curve [†]		872 (76.6, 97.8)			73.3 (60.2, 86.5)	
Abbreviations: HHD, handheld dynamometry; QI, quadriceps index.						
*Values are percent.						
†Values in parentheses are 95% confidence interval.						

Neuromuscular Control

1. Anterior Portion of Y Balance (Plisky et. al 2009):
 - a. Standing position with hands on hips and toe at 0 line
 - b. Patient should be in socks or barefoot to eliminate external factors of shoes
 - c. Patient reaches as far as possible with the reaching limb in an anterior direction
 - d. Lightly touching most distal portion of the reaching foot without shifting weight or coming to rest on this foot of the reaching limb
 - e. Returns the reaching limb to the beginning position
 - f. Practice Trials: 2
 - g. Complete 3 consecutive trials per limb
 - h. Average score utilized
 - i. Cut off score ≤ 4 cm

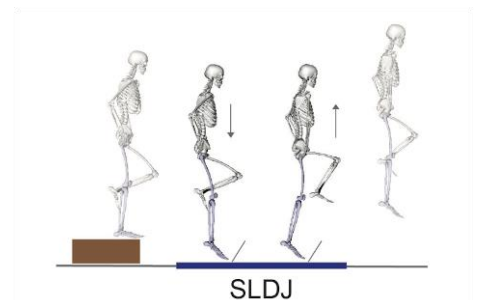
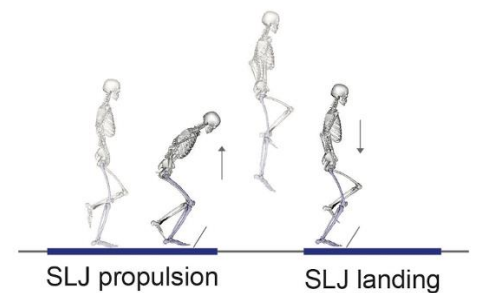


Power



1. Single Leg Hop For Distance (Noyes, 1991)
 - a. Starting Position: Standing on one limb with toe behind the line
 - b. Patient hops as far as possible and lands on the same limb
 - c. 2 practice trials
 - d. 2 testing trials
 - e. Patient must stick landing for 2 seconds
 - f. Score measured from starting line to heel of athlete
 - g. Average score taken
 - h. Cut off: 95%, qualitative assessment of landing mechanics
2. Single Leg Timed Hop (Noyes, 1991)
 - a. Starting Position: Standing on one limb with toe behind the line
 - b. Distance of 6m is measured
 - c. Patient performs series of hops over the total distance which is timed
 - d. Patient encouraged to use large forceful one-legged hopping motions
 - e. 2 practice trials
 - f. 2 testing trials
 - g. Average score taken

- h. Cut off: 95%
- 3. Single Leg Triple Hop (Noyes ,1991)
 - a. Starting Position: Standing on one limb with toe behind the line
 - b. Patient performs three consecutive hops as far as possible and land on the same foot
 - c. 2 practice trials
 - d. 2 testing trials
 - e. Average score taken
 - f. Cut off: 95, qualitative assessment of landing mechanics
- 4. Crossover Hop For Distance (Noyes, 1991)
 - a. Set up: Two 6m lines in parallel 15cm apart
 - b. Starting Position: Standing on one limb on same side of line as limb being tested
 - c. Patient performs 3 consecutive jumps, crossing over the center strip on each hop
 - d. 2 practice trials
 - e. 2 testing trials
 - f. Total distance for each trial recorded and average of 2 trials taken
 - g. Cut off: 95%, qualitative assessment of landing mechanics
- 5. Single Leg Jump (Vertical Jump) (Kotsifaki, 2021)
 - a. Starting Position: Single leg standing position
 - b. Athlete countermoves to self-selected depth and then jumps vertically with maximum effort and lands on same leg
 - c. 2 testing trials
 - d. Height or time in air recorded with My Jump 2 App
 - e. Cut off: 95%
- 6. Single Leg Drop Jump (Kotsifaki, 2021)
 - a. Starting Position: on 15cm step in single leg standing position
 - b. Athlete is asked to drop form the step and on hitting the ground, immediately jump as high as possible while spending as little time as possible on the ground
 - c. Heigh or time in air recorded AND contact time on ground with My Jump 2 App
 - d. Cut off: 95%



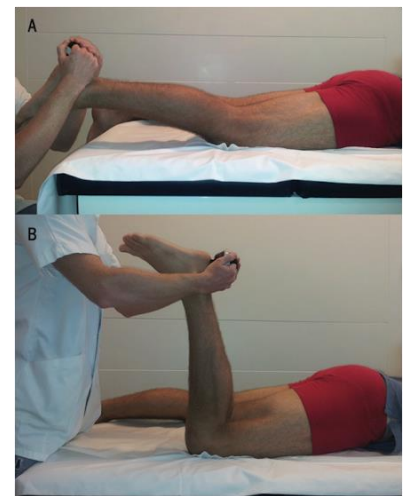
Hamstring

Range of Motion (Reurink et al 2013)

1. Passive Straight Leg Raise
 - a. Patient position: supine
 - b. Inclinator placed on tibia just below tibial tuberosity
 - c. Testing limb passively raised to onset of localized pain or maximum tolerable stretch
 - d. 3 Trials
 - e. Highest value recorded
 - f. ICC: 0.77
2. Active Straight Leg Raise
 - a. Patient position: supine with testing hip flexed to 90°, contralateral limb secured to table
 - b. Inclinator placed on tibia just below tibial tuberosity
 - c. Patient actively extends knee to onset of localized pain or maximum tolerable stretch
 - d. 3 Trials
 - e. Highest value recorded
 - f. ICC: 0.89

Strength Testing

1. Prone Position knee ~60° knee flexion
 - a. Placement of HHD: just above ankle mortise
 - b. HHD fixation with gait belt to ~60° knee flexion
 - c. No counter force provided
 - d. 3 practice trials of 50%, 75%, and 100%
 - e. 3 maximal efforts lasting 5 seconds
 - f. Rest interval: 60 seconds
 - g. Therapist Direction: "Push as hard as you feel comfortable"



Functional Strength (Freckleton et. al)

1. Single Leg Bridge Test

a. Starting Position:

- i. Supine with one heel on a 60cm high box
- ii. Test leg positioned to 20° knee flexion
- iii. Arms crossed across chest

b. Patient instructed to push down through the heel to lift their bottom off the ground with goal being to complete as many repetitions as possible

c. Patient must touch bottom to the ground between reps, without resting, and extend hip to 0°

d. Contralateral limb is required to be held stationary in a vertical position

e. Patient allowed 1 warning prior to stopping test

f. Scoring

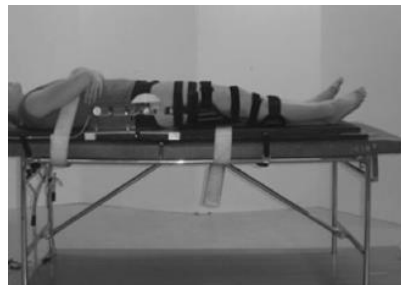
- i. < 20 = poor
- ii. 25 = average
- iii. ≥ 30 = good



Power

1. H-Test (Askling et. al)

- a. Patient position: supine, testing limb locked into extension with contralateral leg secured to mat table in extension



- b. Patient taken through passive straight leg raise
- c. Patient instructed to “perform straight leg raise as fast as possible without taking any risk of injury
- d. Passing: Able to complete with 0 apprehension
- e. Self reported insecurity: medial value of 52 (29.98) versus 0
- f. ICC: 0.94-0.99

Ankle

Swelling (Cameron et. al 2008)

1. Patient Position: Seated with knee fully extended
2. Measurement
 - a. Place zero point between anterior tibial tendon and lateral malleolus
 - b. Pull tape medially over the navicular tuberosity, and then infero-laterally across the medial arch to the proximal aspect of the base of the fifth metatarsal
 - c. Pull superiorly and medially over the tarsal bones across the inferior aspect of the medial malleolus, and posterior-laterally around the Achilles tendon over the distal lateral malleolus to finish at the zero point
3. Intra-rater
 - a. Change due to treatment: $\geq 0.4\text{cm}$ is due to change in swelling
 - b. Standard error of measurement (SEM): 0.2cm
 - c. ICC: 0.9
4. Inter-rater
 - a. Change due to treatment: $\geq 0.7\text{cm}$ is due to change in swelling
 - b. SEM: 0.3cm
 - c. ICC: 0.9
5. Cut off: none reported
 - a. utilize change to determine effect of activity



Range of Motion (Clanton et. al 2012)

1. Dorsiflexion Lunge Test
 - a. Patient Position: Standing next to wall
 - b. Patient lunges forward to touch knee to wall while keeping the heel down
 - c. Foot is sequentially moved farther away from the wall until the maximum range of dorsiflexion is achieved
 - d. Cut off:
 - i. $<9-10\text{ cm}$ is considered restricted
 - ii. $< 35-38^\circ$ tibial shaft angle is considered restricted
 - e. Intra-rater reliability
 - i. Change due to treatment: 0.8cm
 - ii. SEM: 0.4cm
 - iii. ICC: >0.9
 - f. Inter-rater reliability
 - i. Change due to treatment: 0.8cm
 - ii. SEM: 0.4cm
 - iii. ICC: >0.9

Strength Testing

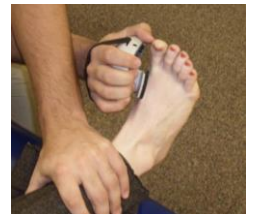
1. Ankle Eversion

- a. Patient Position: Supine with hip and knee extended, foot in neutral
- b. Clinician Position: Ipsilateral side of limb tested, LE stabilized proximal to ankle joint
- c. HHD Position: lateral border of the foot at the midpoint of the fifth metatarsal
- d. Cut off: Everion : Inversion < 1.0
- e. ICC: 0.78-0.88



2. Ankle Inversion

- a. Patient Position: Supine with hip and knee extended, foot in neutral
- b. Clinician Position: Opposite side as leg tested, LE stabilized proximal to ankle joint
- c. HHD Position: Medial border at mid point of shaft of 1st metatarsal
- d. Cut off: Everion : Inversion < 1.0
- e. ICC: 0.77-0.88



3. Hip Abduction

- a. Supine
 - i. The person being tested is in the supine position, with the hip in neutral position. The test-leg and the resistance point are placed over the end of the table. The opposite leg is flexed. The person being tested holds on to the sides of the table with both hands. The examiner applies resistance in a fixed position and the person being tested exerts a maximum effort against the dynamometer and the examiner. The resistance is applied 5 cm proximal to the proximal edge of the lateral malleolus, against hip abduction. The standardized command by the examiner is “go ahead- push-push-push-push and relax” (lasting 5 s)
 - ii. ICC: 0.98
- b. Sidelying:
 - i. The person being tested is in the side-lying position, with the hip in neutral position. The opposite hip is in 90 degrees of hip flexion. The person being tested holds on to the side of the table with the upper hand and rest his head on the lower arm. The examiner stabilizes the pelvis with one hand and applies resistance in a fixed position with the other. The person being tested exerts a maximum effort against the dynamometer. The resistance is applied 5 cm proximal to the proximal edge of the lateral malleolus, against hip abduction. The standardized command by the examiner is “go ahead- push-push-push-push and relax” (lasting 5 s)
 - ii. ICC: 0.76

4. Hip Extension

- a. Prone Position Long Lever
 - i. The person being tested is in the prone position, with the hip in the neutral position. The person being tested holds on to the sides of the table with both hands. The examiner applies resistance in a fixed position and the person being tested exerts a maximum effort against the dynamometer and the examiner. The resistance is applied 5 cm proximal to the proximal edge of the medial malleolus, at the posterior aspect of the lower leg, against hip extension. The standardized command by the examiner is “go ahead-push-push-push- push and relax” (lasting 5 s).
 - ii. ICC: 0.88
- b. Prone Position Short Lever
 - i. The person being tested is in a prone position, with the hip in neutral position and the knee in 70–90 degrees of flexion. The person being tested holds on to the sides of the table with both hands. The examiner applies resistance in a fixed position and the person being tested exerts a maximum effort against the dynamometer and the examiner. The resistance is applied 5 cm proximal to the knee joint line, at the posterior aspect of the thigh, against hip extension. The standardized command by the examiner is “go ahead-push-push-push- push and relax” (lasting 5 s).
 - ii. ICC: 0.81

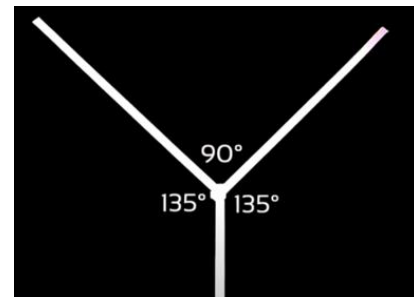
Neuromuscular Control

1. Foot Lift of Test (Linens et. al 2014)
 - a. Static Balance (Proprioception)
 - b. Patient Position: Single limb stance on firm surface with eyes closed
 - c. Test Time: 30s
 - d. Error:
 - i. Any part of the foot that lost contact with the ground (eg, lifting toes from the floor)
 - ii. Any touch down from contralateral leg (1 error added for each second the foot remained on the floor)
 - iii. Abduction or flexing hip by more than 30°
 - e. Average of 3 trials
 - f. Cut off: ≥ 5
2. Y Balance (Plisky et. al 2009)
 - a. Standing position with hands on hips
 - i. Anterior: toe at 0 line
 - ii. Posterior-medial/Posterior-lateral: heel at 0 line
 - b. Patient should be in socks or barefoot to eliminate external factors of shoes
 - c. Patient reaches as far as possible with the reaching limb in the anterior, posteromedial, and posterolateral
 - d. Lightly touching most distal portion of the reaching foot without shifting weight to or coming to rest on this foot of the reaching limb
 - e. Returns the reaching limb to the beginning position

- f. Practice Trials: 2 (literature states 4-6)
- g. Complete 3 consecutive trials per limb
- h. Testing completed as follows:
 - i. 3 trials uninvolved in anterior direction followed by 3 trials involved anterior direction
 - ii. 3 trials uninvolved in posterior-lateral direction followed by 3 trials involved posterior-lateral direction
 - iii. 3 trials uninvolved in posterior-medial direction followed by 3 trials involved posterior-medial direction
- i. Average score utilized
- j. Cut off score:
 - i. anterior ≤ 4 cm,
 - ii. posterior-medial/posterior-lateral: ≤ 6
 - iii. LSI: $> 90\%$
 - 1. (Average Direction in each direction / leg length) * 100
 - 2. Involved / Uninvolved



Figure 2. The star excursion balance test to evaluate balance and proprioception.



Power

1. Figure-of Eight Hop Test (Caffery et. al 2009)
 - a. Set up: two cones 5m apart
 - b. Starting Position: Standing on one limb with toe at zero line on same side of cone as the limb that is being tested
 - c. Patient instructed to hop on 1 limb, twice around the course in figure 8 pattern, as fast as possible
 - d. Testing Trials: 3
 - e. Cut off score: non noted - best to use LSI $\geq 95\%$
 - f. ICC: 0.95
2. Side Hop Test (Caffery et. al 2009)
 - a. Set up: two lines parallel 30-cm apart

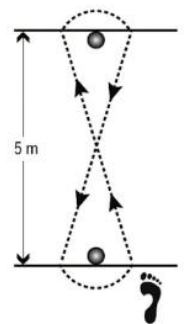
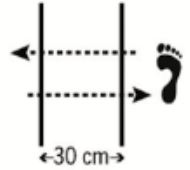


Figure-of-Eight Hop Test

- b. Patient position: Standing on one limb on same side as foot being tested
- c. Patient instructed to hop on 1 limb laterally over lines for 10 repetitions as quickly as possible
 - i. 1 repetition = hopping laterally over 30cm and back
 - ii. Cut off score: non noted - best to use LSI $\geq 95\%$
- d. ICC: 0.84



Side Hop Test