

Lower Extremity Physical Performance Testing

Physical performance testing is completed with patients in order to collect data and make observations regarding the overall function of the limb integrated into the entire functional unit of the body, rather than specific clinical tests merely looking at the integrity of the involved body part/joint(s). Data is collected to draw limb to limb comparisons and comparisons between the subject and any existing normative data. Qualitative observations are made to comment on the level of control, ease, and efficiency with which the individual executes the task. This is useful for assessing the true return of function and the individual's risk for potential future injury.

Testing Protocol

10 minute warm-up on the bike + brief stretching

- 1) Explain/demonstrate the physical task
- 2) Patient practices x 2 trials
- 3) Patient performs 3 testing attempts
- 4) Record the **best** of the 3 attempts

0-5 point perceived exertion scale: (0) very easy << >> (5) maximal exertion

Return to Function (Level I): Core Stability

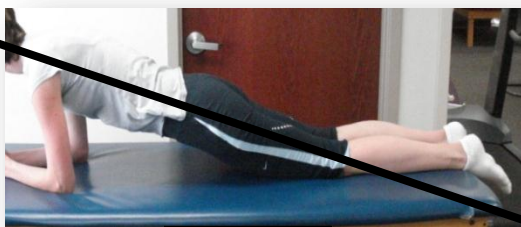
With all core stability tests, the patient is asked to maintain a pose or perform repetitions of a task with special attention to postural alignment. **The patient is allowed one verbal cuing episode to correct faulty alignment.** Upon any additional cuing, the testing effort will be terminated and time/ reps to failure is recorded at that point. *Poses can be modified from basic to advanced per level of fitness

Prone Plank Hold

Patient assumes the prone plank position with bilateral forearm and flexed toe support. Cue the patient to maintain level alignment from shoulders through the hips, knees, down to the ankles, maintaining a neutral spine/pelvic orientation without excessive lordosis.

Patient holds this position, maintaining perfect plank alignment and height. Cue height with yard stick.

Measurements Gathered: 1. Time to failure (Goal = 60 seconds) 2. Perceived exertion (0-5 point scale)



Basic



Advanced

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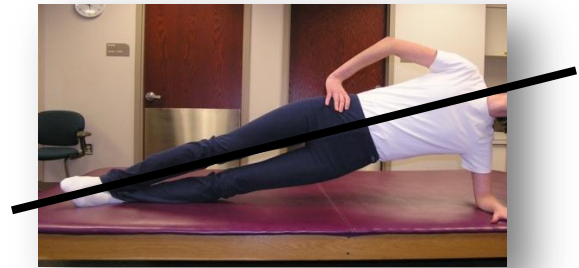
Side Plank Hold

Patient assumes the side plank position, with forearm support directly below the shoulder of the bottom arm, and foot support with feet stacked one on top of the other. Perfect linear alignment from the sternum down through the pubic symphysis to the ankles is to be achieved. Excessive forward rotation of the trunk or excessive lumbar lordosis is not permitted. Cue plank height with yard stick.

Measurements Recorded: 1. Time to failure (Goal = 60 seconds) 2. Perceived exertion (0-5 point scale)



Basic

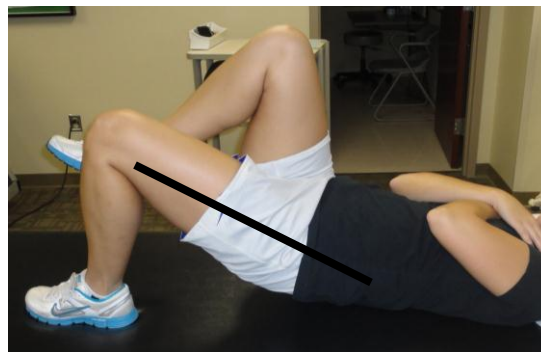


Advanced

Single Leg Bridge Repetitions

Patient lies supine with knees flexed to 100° and arms folded across the chest. The patient raises one knee to bring the femur to a vertical orientation with a comfortable degree of knee flexion. The patient performs a maximal single leg bridging effort with the height recorded and marked at the opposite hip height with a measuring stick. The patient then begins repetitions of single limb bridging, achieving the peak height at each repetition with a steady tempo of 60 bpm (1 bridge per 2 seconds) not allowing for rest between repetitions or accelerated upward thrusting with a single effort. The patient is to maintain a neutral lumbar and pelvic orientation without excessive lordosis or contralateral pelvic collapse.

Measurements Recorded: 1. Reps to failure (Goal = 20 reps) 2. Perceived exertion (0-5 point scale)



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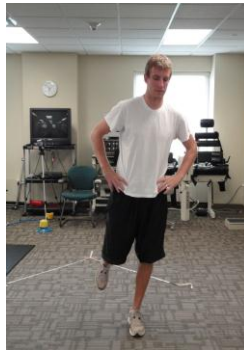
Lower Extremity Physical Performance Testing

Return to Function (Level I): Balance

Single Limb Balance

Patient stands on one leg with both hands kept at the hips. This test may be performed with eyes open and/or eyes closed, depending on the competence level of the patient. The patient maintains his/her balance, with time stopping if the stance foot shifts position, if the opposite foot touches down, or if the arms wave off the hips. The patient performs 3 attempts and the maximal value is recorded.

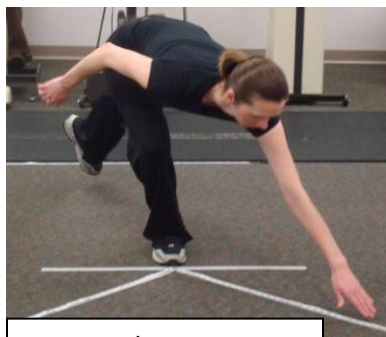
Measurement Recorded: Time to failure per leg (Maximum value = 60 seconds)



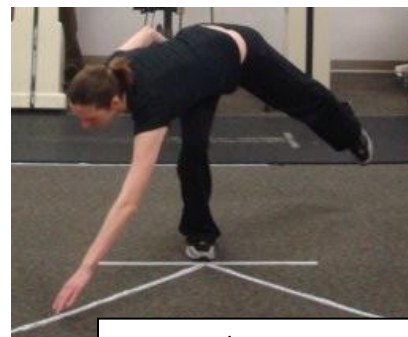
Stand and Reach

The patient stands at the apex of a 90 degree angle “V” taped onto the floor. Each line of the “V” is at a 45° off-set from the patient’s neutral orientation. While standing on one leg with the foot along the “neutral line”, the patient lowers him/her toward the ground and reaches with the **opposite hand** out along one of the diagonals, attempting to touch as far out as possible, still being able to return back to standing without losing balance. One clean, controlled touch with a finger is allowed, without “walking out” on the fingers or bracing with the thumb. This is repeated along each diagonal for each leg (anteromedial, anterolateral), with the best of 3 attempts recorded.

Measurement Recorded: Maximal distance obtained for each diagonal for each leg (centimeters)



Anterior/Medial Reach



Anterior/Lateral Reach

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Lower Extremity Physical Performance Testing

Return to Function (Level I): Muscular Strength

Star Excursion Balance Test

The patient stands with his/her toes at center of the “Y” grid taped onto the floor. Each posterior line of the “Y” is at a 45° off-set from the neutral angle of anterior arm of the “Y”. While standing on one leg the patient lowers him/herself toward the ground and reaches with the **toes of the free leg** out along one of the diagonals, attempting to touch as far out as possible WITHOUT allowing the heel of the stance leg to come off the ground. This is repeated along each line of the “Y” for each leg (anterior, posteromedial, posterolateral), with the best of 3 attempts recorded.

Failure: 1) Losing balance/single limb support and touching down at any point during the lowering/raising motion, 2) Transferring body weight off the center leg onto the reaching leg, 3) Heel of the stance leg comes off the ground, 4) Free leg does not fully return to the starting position

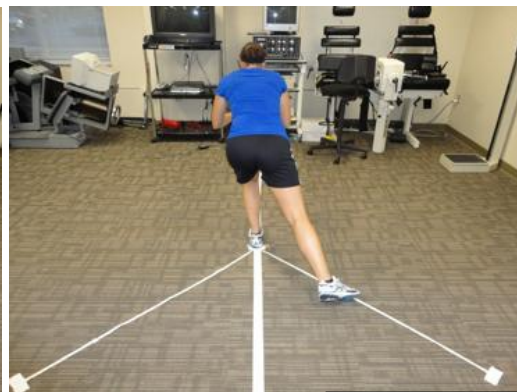
Measurement Recorded: Maximal distance obtained for each diagonal for each leg (centimeters)

Cumulative Score: LL = Limb Length, A = Anterior, PM = Posteromedial, PL = Posterolateral

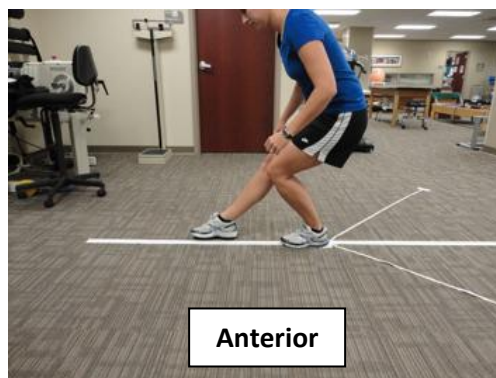
$$\{(A + PM + PL / (LL \times 3)) \times 100\}$$



Posterolateral



Posteromedial



Anterior

****Correction****

Toes should be at the center of the “Y”
(NOT the heel, as shown)

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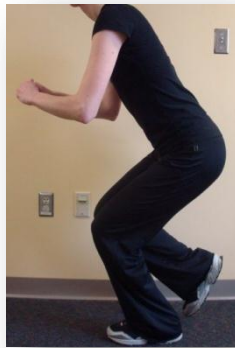
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Lower Extremity Physical Performance Testing

Single Leg Squat

Patient stands on one leg, without upper extremity support, hands at hips or out to side for balance. Patient squats down to a maximal depth on one leg and returns to standing. The patient is not allowed to brace the opposite leg against the squatting leg or the floor at any point during the squatting effort.

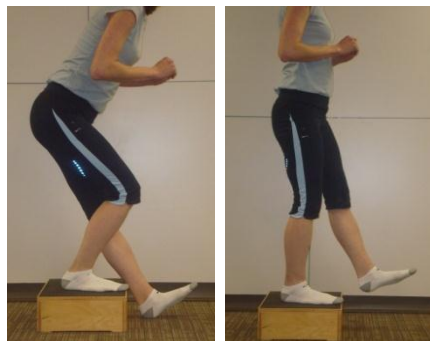
Measurement Recorded: Angle of knee flexion at maximal squat depth per leg



Retro Step-up

Patient stands in front of a step, places test leg back onto step with neutral foot rotation, and shifts back into hip and knee flexion. The front leg is straight, with the toes pulled up off the ground and knee extended, to avoid compensation at the knee or ankle with the non-test leg. The patient presses through the step leg to concentrically raise themselves up the height of the step, and then slowly lowers down eccentrically to a controlled touch of the opposite heel. Both phases must be controlled without compensation or uncontrolled acceleration. The patient progressively moves up higher steps, testing each limb, until failure. 3 attempts to master each step height are allowed, however, if the step is successfully completed on the first trial, no more efforts are necessary at that height.

Measurement Recorded: Maximal step height achieved per leg (inches)



Note: Test can be normalized to leg length

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Lower Extremity Physical Performance Testing

Return to Sport (Level II): Muscular Endurance, Power

Level II Functional Pre-requisites:

- 1) All Level I tests $\geq 85\%$ of uninjured side or maximal value
- 2) 2 leg squats: $\geq 90^\circ$ knee flexion x 20 reps with good trunk and lower extremity alignment control

Squat Repetitions to Fatigue

Patient performs a single limb squat with no hand support to an angle of 60 degrees knee flexion. A chair or stool is used to mark this squat depth for testing purposes. The patient then completes squatting repetitions at a tempo of 60bpm (1 squat every 2 seconds), going from an unlocked knee position in upright stance to the 60 degree mark, lightly touching the buttocks to the stool.

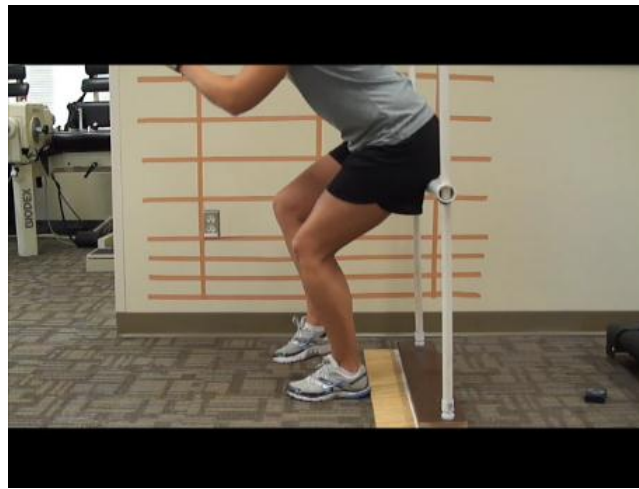
Patient completes as many squats as possible over a 2 minute interval following the guidelines of:

- 1) staying on tempo
- 2) achieving full squat depth
- 3) maintaining normal L/E and trunk alignment (requiring ≤ 2 cuing episodes)
- 4) Pain $\leq 3/10$ at the involved joint
- 5) Fatigue or cramping

Measurement Recorded: 1. Number of squatting repetitions completed in 2 minutes per leg

2. Perceived Exertion (0-5 point scale)

*Squats that deviate from ideal alignment or depth are not counted toward total



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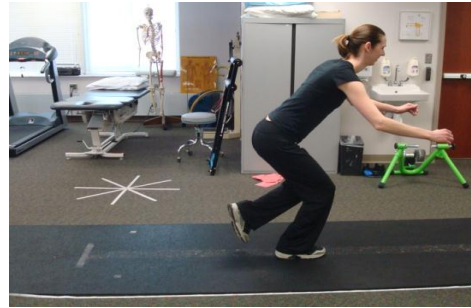
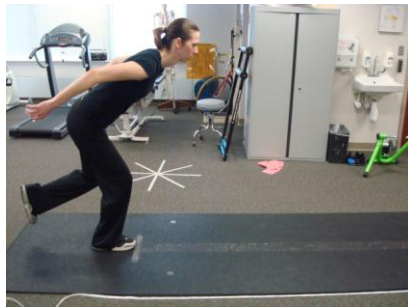
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Lower Extremity Physical Performance Testing

Single Leg Hop

The patient stands on one leg and leaps forward as far as possible, “sticking the landing” on one leg with good knee/hip flexion and balance control. The test is void if the patient double-hops on the landing, collapses into knee flexion and steps onto the opposite leg, or steps off to the side before demonstrating adequate balance control. The goal is to achieve maximal distance.

Measurement Recorded: Maximal distance obtained (toe to toe) in meters per leg



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Lower Extremity Physical Performance Testing

<h3>Return to Sport (Level III): Power</h3>

Level III Functional Pre-requisites:

- 1) All Level I tests $\geq 85\%$ of uninvolved side or maximal value
- 2) All Level II tests $\geq 85\%$ of uninvolved side

6M Timed Hop

A 6M distance is marked within the clinic space with adequate clearance to decelerate beyond the finish line. The patient starts **standing on one leg** and hops as quickly as possible on that leg all the way through the finish line with time recorded. The goal is to achieve the quickest time possible.

Measurement Recorded: Quickest time achieved per leg (nearest tenth of a second; ie. 2.3 seconds)

Triple Cross-over Jump

The patient completes a series of 3 consecutive jumps on one leg, crossing a 12 cm wide center line with each effort, and “sticking the landing” from the final jump. The goal is to achieve maximal distance. The pattern of movement is “zig, zag, stick”. The test is void if the patient pauses between hopping efforts, double-hops on the landing, collapses into knee flexion and steps onto the opposite leg, or steps off to the side before demonstrating adequate balance control upon the final landing.

Measurement Recorded: Maximal distance obtained (toe to toe) in meters per leg

Lower Extremity Physical Performance Testing

Data Collection/Reporting

All test values are recorded and compared side to side to calculate a **limb symmetry index (LSI)**, which is expressed as a percent return of function of the involved limb compared to the uninvolved limb. A value of $\leq 85\%$ LSI has been cited as abnormal (*Noyes AJSM 1991*).

Patients complete only portions of the test that are appropriate for their rehabilitation needs, injury status, or post-operative status. Portions of the test that have been previously mastered ($\geq 85\%$ LSI) need not be re-tested.

A qualitative assessment at the end of the test is useful to describe movement control, degree of challenge/exertion, and any symptoms reported with each activity. The physical performance test is a useful tool for therapists to make both qualitative and quantitative observations of a patient throughout the rehabilitative process.

The outcomes of this test are useful to refine and progress subsequent therapy, educate and motivate patients, and communicate critical status information to the treating physician for determining appropriateness of return to activity. These outcomes also help team members appreciate the role of the functional return of strength, balance, power and endurance in overall patient outcomes, for both operative and non-operative care.

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