FUNCTIONAL TESTING GUIDELINES FOR ACL RECONSTRUCTION/KNEE INJURY
TESTING INSTRUCTIONS FOR CLINICIANS

A number of criteria should be met before advanced functional testing of ACL reconstruction or ACL deficient knees are tested:

- **No pain**
- **No reports of instability or giving way**
- **No swelling**
- **Full active range of motion**

Generally the below advance testing should not be done earlier than 4 months unless indicated by the surgeon.

TESTS:

1.) Stroke (effusion) Test: (Sturgill et al, 2009)
In supine knee straight, brush/sweep fluid from inside of knee then sweet on outside of knee to see if fluid bulge becomes apparent on inside of knee.

2.) Leg circumference

Measure the circumference of the thigh at 3 inches and 6 inches superior to the top of the patella for both the non operative and operative leg in cm and compare.

3.) Active Knee Range Flexion and Extension

In supine actively bend your knee to its full range and measure and compare to non operative leg where usually 140-160 degrees is considered normal. Do the same for extension and compare to non operative leg where normal is often 5-10 degrees of hyper-extension which should be able to be actively achieved through quad engagement.

4.) Kneeling Heel to Bum – Passive terminal knee flexion range

Sit on your knees and lower your bum to your heels if possible until resting comfortably – do not continue if painful or limited.

5.) Single Leg Balance (Springer et al, 2007).

Subjects stand on one leg with other leg raised 90 degree hip flexion arms crossed over chest/hands on hips. The assessor uses a stopwatch to time how long stance is maintained on one leg with eyes closed, >20 sec is considered good for athletic population while avoiding opening eyes, trunk or hip deviation >30 degrees, movement of stance foot, touch down of opposite foot, lifting hand off hip. **Normative data for 18-39 year olds 43 sec EO, 9 sec EC.**

6.) Tuck Jump - Modified (Meyer et al 2008)

Feet should be positioned shoulder width apart and the athlete will be asked to repeatedly jump for 10 times / seconds. Assessment includes evaluation of valgus on landing, thighs parallel at peak jump and equal through movement, feet shoulder width, parallel and equal contact and soft on landing, without pause on jump or declining technique. A horizontal line of tape can be used as the target for jumping and landing in the same location.

7.) Single Leg Squat - Modified Functional Alignment Test (Crossley et al, 2011).

Subjects stand on one leg arms crossed and perform max (cap at 15) consecutive single leg squats to ~ 90 degrees knee angle in a slow and controlled manner at a rate of 2 seconds per squat. The task is rated as good, fair or poor. Can advance to perform 5 reps or more of pistal squats for high-end athletes with criteria based on:

- participants not loosing balance
- squat is performed >60 degrees, preferably to 90 (can use seat as bench mark for most)
- performed at 2 sec per squat

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- no trunk/thoracic lateral deviation, shift rotation, lateral flexion or flexion
- no pelvic lateral deviation, rotation or tilt (rev lordosis)
- no hip adduction or femoral internal rotation
- no knee valgus or forward translation over toes

8.) Side Plank Endurance Test - Modified (McGill et al, 1999)

Subjects lie on an exercise mat on their side with legs extended. Top foot is placed in front of the lower foot, then subjects lift their hips off the mat to maintain a straight line over their full body length for ideal 30 sec or for as long as able and compare to other side while avoiding dropping hip or twisting through trunk or hips. Advance version by lifting the top leg off and repeatedly flexing hip to 90 degrees and perform ideally 15 reps or more while maintaining straight trunk and compare to other side.

9.) Single extended Bridges

Subjects lie supine on the floor with one heel on a box or plinth ~60 cm high. The knee of the test leg is slightly bent at 20 degrees and the opposite leg is bent to 90 degrees hip and knee flexion with their arms crossed over their chest. Hips are elevated until working leg is straight. Repeat as many times as possible until the subject is unable to bridge to the original height. (Freckleton et al, 2013).

Marching bridges on floor with 20 degree knee bend is also acceptable alternative and considered good when can perform ideal 30 reps or more for each marching leg, 1 sec per leg without losing hip height or rotating.

10) Single Leg Press

A valid test is where the weight is lowered to a depth of at least 90 degrees knee flexion and then extended back to full extension. Can try for a max 1 RM lift or attempt a weight that you can be done for roughly 10 RM. Compare right to left.

Hop Tests x 4 (Reid, 2007)

General: Running shoes are to be worn.

1. Perform tests in the order they appear.
2. One practice trial is given for each limb. Two measurements are taken and the average is recorded.
3. No restrictions are given on arm movement.
4. Begin with non-operated leg.
5. Two alternating trials on both limbs are measured and means for each recorded
6. Start with lead toe behind marked line.
7. Measurement is taken to either the nearest 10^{th} of a second (stopwatch) or nearest10cm^{t} of a centimetre (measuring tape).
8. A failed jump consists of loss of balance, touching the floor with arms or opposite leg, or an additional short hop on landing.
9. To calculate "Limb Symmetry Index" values, average the two-recorded trials on each limb; divide the operative limb average by the non-operative limb average, and multiply by 100 (percentage). Once "Limb Symmetry Index" values are calculated for each of the 4 hop tests, the average of these is taken for the "Overall Combination" score, should be > than 90 %.

11.) Single Broad Jump for distance

Stand on one limb and hop as far forward as possible, landing on the same limb. Maintain the landing for a minimum of 2 seconds while the toe measurement is recorded wih no skip steps. (measured to the nearest cm)

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12.) Single 3 Broad Jump for distance

Perform 3 successive hops as far as possible and land on the same leg. Maintain the final landing for a minimum of 2 seconds while the toe measurement is recorded with no skip jumps. (measured to nearest 10th of a cm)

13.) Single 3 Crossover hop for distance

Perform 3 hops as far as possible crossing over a 15cm wide strip marking on each hop and maintain landing after the 3rd hop for 2 seconds. The first of the 3 hops is lateral with respect to the direction of the crossover. (measured to the nearest 10th of a cm)

14.) Medial Hop for Distance

Perform near max effort single jump facing side ways starting on outside leg medially and landing with control

15.) Lateral Hop for Distance

Perform near max effort single jump facing side ways starting on inside leg laterally and landing with control

16.) Single Leg Couter Movement Vertical Jump for Height or to step (tib tuberosity height)

Stand sideways on one leg, unsupported, next to a wall / stick with hands free. Bend your knees and jump as high as possible, tap your hand on the wall at the maximum vertical height. One practice trial is given for each limb. Perform two alternating trials on the unaffected and affected sides. The vertical height is measured and the averages recorded for the L and R legs.
This can also be achieved by getting athete to perform single leg counter movement jump from stationary to step ideally to tibial tubersoity height or greater.

17.) Side Hops (Gustavsson et al, 2006)

With 2 lines 40 cm apart perform as many lateral hops as you can in 30 sec and compare to non operative side. If you touch the line more than 25% take a 3 min break and repeat.

18.) Landing Error Score System (LESS) Test

The athlete jumps forward from a standard plyometric box (30 cm) with both feet a distance equal to half their body height. This spot can be marked prior to the test. After landing on both feet, the athlete jumps vertically for maximal height. Both the landing from the jump and the subsequent rebound to vertical jump are assessed. 3 successive jumps are recorded for best clinical utility. Sum of reaches ÷ (3xleg length - greater trochanter to bottom of lateral malleolus) x 100.

≥4cm L-R diff or ≤94% leg symmetry index relates to significant injury risk. (Darin et al, 2009, 2011).

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LESS: The Landing Error Scoring System

1. Knee Flexion @ Initial Contact
____ Greater than 30° (0)
____ Between 20-30° (+1)
____ Less than 20° (+2)

2. Knee Flexion Displacement
____ Greater than 30° (0)
____ Between 20-30° (+1)
____ Less than 20° (+2)

3. Knee Valgus @ Initial Contact
____ Knees over mid-foot (0)
____ Knees over great toe (+1)
____ Knees over great toe (small) (+2)
____ Knees over great toe (large) (+3)

4. Knee Valgus Displacement
____ Knees over mid-foot (0)
____ Knees over great toe (+1)
____ Knees over great toe (small) (+2)
____ Knees over great toe (large) (+3)

5. Trunk Flexion @ Initial Contact
____ Greater than 30° (0)
____ Between 20-30° (+1)
____ Less than 20° (+2)

6. Lateral Trunk Flexion @ Initial Contact
____ Trunk centered over hips (0)
____ Lat. deviation of trunk over hips (+1)

7. Ankle Plantar Flexion @ Initial Contact
____ Toe-to-heel: toe strike (0)
____ Flat foot (+1)
____ Heel-to-toe: heel strike (+2)
*if asymmetrical, score 1st foot to contact

8. Foot Position @ Initial Contact
____ Toes straight ahead (0)
____ Toes in (+1)
____ Toes out (+1)
*if asymmetrical, score 1st foot to contact

9. Stance Width @ Initial Contact
____ Shoulder width (0)
____ Less than shoulder width (+1)
____ Greater than shoulder width (+1)

10. Foot Contact Symmetry
____ Symmetric (+0)
____ Asymmetric (+1)

11. Joint Displacement (Overall)
____ Large ("soft landing") (0)
____ Average (+1)
____ Small ("stiff landing") (+2)

12. Overall Impression
____ Excellent (0)
____ Average (+1)
____ Poor (+2)

Total: _____ Excellent (0-3), Good (4-5), moderate (6), poor (7 or greater)

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ACL RETURN TO SPORT ASSESSMENT

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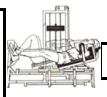
Name: _____ **Date:** _____

All achieved = 3
Most Achieved = 2
Some = 1
Pain = 0

√	Achieved Criteria
X	Not Achieved
P	Pain

Rate OP Leg — 3 Good / 2 Fair / 1 Poor; 0 = if pain

OP | N.OP | **LSI** L R **Leg Symmetry Index** — Operated / Non op x100 (> 90% is the goal)

1	Stroke (effusion) test						0 - trace no swelling (good) 1+ small/med bulge with down stroke (fair) 2-3+ large or not posible to move effusion (poor)
2	leg circ (cm)	3" 6"		cm cm cm cm	%		within 1 cm considered WNL
3	Active knee range	F Ext		° °	% %		no pain no pain, no quads lag
ADV 4	Kneeling Heels to bum			cm	%		full range bum to heal (measure distance) no pain
5	Single eye closed 20s			/10 /10	%	L R L R L R	1 pt ea. Error open eyes, foot touch, foot mvt trunk or hip deviation >30deg lift hand off hip, out of position >5s
6	Tuck Jump Modified x10						thighs equal and parallel at peak jump No knee valgus, soft, equal, shoulder width No pause or declining technique
7	SLS Squat to fatigue		*pistal		%	L R L R L R L R	~90 Depth, mostly stable, > 15 reps No trunk lateral deviaiton, rotation, Flexion No pelvic deviaiton / hip add, rev lordosis No Knee valgus or anterior to toes
8	Side Plank bottom leg				%	L R L R	able to keep body straight without dropping able to perform 15+x each side
9	Side Plank Top leg				%	L R L R	able to keep body straight without dropping able to perform 15+x each side
10	Single straight Bridge		*slide		%	L R L R L R	can peform with ~20 degree knee bend no torsion or dropping of hips able to perform minumum of 15x
11	Single Leg Press (lbs)				%	L R L R	able to perform through full range no pain

Brzycki: 1RM = W x (36 / (37 – R))

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P	Pain
√	Achieved Criteria
X	Not Achievec

All achieved = 3
Most Achieved = 2
Some = 1
Pain = 0

Operated / Non op x100 (> 90% is the go

Rate OP Leg	3 Good	2 Fair	1 Poor	OP	N.OP	**LSI**
	0 = if pain					

ADV	12	Single broad jump (cm)				cm	cm	%	L R L R L R	balanced and soft on land good hip and knee control
ADV	13	SLS Tripple Broad Jump				cm	cm	%	L R L R L R	balanced and soft on land good hip and knee control
ADV	14	SLS 3 cross over jump (cm)				cm	cm	%	L R L R L R	balanced and soft on land good hip and knee control
ADV	15	Medial Distance Hop						%	L R L R L R	balanced and soft on land good hip and knee control
ADV	16	lateral Distance Hop						%	L R L R L R	balanced and soft on land good hip and knee control
ADV	17	SLS C.V. jump (cm)				cm	cm	%	L R L R	jump to step - tib tuberosity ht. minimum jump for max height
ADV	18	Side Hop 30 sec						%	L R	2 lines 40 cm apart, number of jumps in 30 sec, if touch line >25% repeat

19 LESS Test double

* single
Score: /22
<4 good, 4-5 fair, >6 poor

	hip/knee > 30d bend on land, soft landing
	no knee valg, symet. feet & should width

TOTAL: /

57/57: best score that can be achieved for Lv 1, 2 sport clearanc
36/36: best score that can be achieved for Lv 3 sport clearance

RTS Activity/Risk Recor **(Circle**

	Participation - individual skills / light ris i.e. hike, bike, swim, skate, easy ski
ADV	**Sport - non comp. game play / mod risk s** i.e. run, light court/field sport, mod terrain ski
ADV	**Performance - competing / high risk sports** i.e.field/court sports, gymnastics, diff. terrain ski

Take time with RTS:
Start with high control - low speed/activity load & easy terrain and ease into more diff/chaos type scenarios

Comments: