# Return to sport

Screen, Tests and Criteria

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November 2021

10/30/2021

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### **Decision Making**



## Defining return to sport

- Return to the activity
- Return To Participation
- Return to the training
- Return to sport
- Return to Performance
- Return to competition
- Return to competitive play
- Return at the pre lesion level



## Return To Participation (RTPa)

 The athlete returns to activity with restrictions and / or limitations to training, rehabilitation, or general sport training. In other words, the athlete is physically active, but not yet "ready" (clinically, physically and / or psychologically) for RTS.

## Return To Sport (RTS)

• The athlete has returned to his/her specific sport in terms of intensity, volume and quality of the training but s somewhat limited from training and competing at a maximum level (i.e., athletic values still unsatisfactory, in the match / training. psychological problems, kinesiophobia...)

### Return to Performance (RTPe)

This is the final phase of RTS. The athlete is reintroduced to his/her sport performing at pre-lesion level or greater. For some athletes this phase can be characterized by personal best performance or by progress in technical / physical performance.

### Return to Sports

- • Ultimately we need MD clearance.
- We also need to make sure our athletes are fully prepared for RTS before their full release back to sport.
- Progression back to sport should involve: functional testing with progression to non-contact practice, to contact practice at 100% effort without any increased pain, edema, warmth or episodes of giving way, with progression to competition.
- Something to think about: is it more important to get athletes back quickly with high risk of re-injury or to get our athletes to reach their fullest rehab potential prior to RTS decreasing the chances for re-injury.

### General Criteria For Return To Sport

Tests and methods	criteria
Pain	None
Swelling	None
Active and passive range of motion	Full in bilateral comparison

	Tests and methods	Specific criteria for progression
	Soft tissue healing	Time-based
	Patient-reported outcomes	Within 75-80% of normal limits
	Kinesiophobia	Minimal
	Pain	None in lower extremities
	Swelling <sup>a</sup>	None
	Active and passive range of motion	Full in bilateral comparison
	Single leg balance: eyes open	30 s
	Single leg balance: eyes closed	30 s
	Muscle strength: total leg strength with handheld dynamometer	20% bilateral comparison
	Muscle power: rate of quadriceps force development with isokinetic testing	20% bilateral comparison, 20% to allometric scaling
	Muscle endurance-isokinetic testing	20% bilateral comparison
	Neuromuscular control	Qualitatively good movement patterns with no compensations or aberrant movement patterns
	Single-leg half-squat	No pain and qualitatively good movement patterns with no compensations
	Free weight squat	1.5-2.5 times body weight
	Squat: 60% of body weight, five times in 5 s	No pain and qualitatively good movement patterns with no compensations
	Double-leg jump	80% of height, ability to control landing, no aberrant movement patterns
	Single-leg hop	80% limb symmetry index; 70% of height, ability to control landing, no aberrant movement patterns
	Triple hop	80% limb symmetry index; ability to control landing, no aberrant movement patterns
	Cross-over hop	80% limb symmetry index; ability to control landing, no aberrant movement patterns
	Lower extremity functional test (LEFT) <sup>b</sup>	Time based on normative data; may perform at submaximal intensity to determine patient tolerance
10/30	Lower-level plyometric drills /2021	No pain and qualitatively good movement patterns with no compensations

 Table 13.1
 Criterion-based clinical guidelines for application of plyometrics of the knee [16, 35, 111, 133–136]

# LSI

- limb symmetry index
- (Affected limb value / un-affected limb value) \* 100.

### 90-95%≤ limb symmetry index

## Selection of test

- Safety
- Relevance
- Specificity
- Validity
- accuracy



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## Strength Test

• Isokinetic

90-95%≤ limb symmetry index

Agonist / Antagonist



### lower Extremity Functional Tests

- 1- single hop for distance
- 2-dubble/triple hop for distance
- 3-cross over hop for distance
- 4- Side hop
- 5- Square hop
- 6-6meter timed hop
- 7-lateral rotation hop for distance
- 8-medial rotation hop for distance
- 9-vertical jump for height
- 10-tuck jump
- 11-drop vertical jump



## Single leg hop 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. (measured to the nearest cm)



### Triple hop 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. (measured to nearest 10th of a cm)



### 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)



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### Side and Square Test

 The side-hop test consists in jumping on one leg between two lines at a distance of 40 cm as Side for 30 seconds.



### lateral & Medial rotation hop for distance



### Medial Rotation Hop

## Single leg 6 m timed hop

• Perform large one-legged hops in series over 6 metres. (timed to nearest 10th of a second)



### Single Leg Vertical Jump for Height

 Stand sideways on one leg, unsupported, next to a wall. 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 reSingle Leg Vertical Jump for Height corded for the L and R legs.



## The tuck jump, ≥6 flawed techniques

- The players performed repeated tuck jumps for 10 seconds.
- lift the knees to hip height and attempt to land in the same place.
- consists of 10 criteria. The criteria were scored as either 1 (indicating flawed technique) or 0 (indicating no flaw)
- resulting in a total score ranging from 0 to 10.
- Flawed techniques were, for example, lower extremity valgus at landing, thighs not equal side to side, foot placement not parallel, pause between jumps, and technique declining during the 10 seconds

## The tuck jump, ≥6 flawed techniques

Tuck Jumps



### lower Extremity Functional Tests

- 12 -Step-Down Test (SD)
- 13-Y balance Test
- 14- Single leg squat Test
- 15-Lower Extremity Functional Test (LEFT) 10 yard lower extremity
- functional test (sprint, back peddle, shuffle, carioca, sprint)
- 16-Timed lateral step-down
- 17-Figure-of-8
- 18-Multiple Single-Leg Hop-Stabilization Test (MSLHST)
- 19-Stair Hopple Test



### Step-Down Test (SD)

- the SD test is performed without shoes and the starting position is on a 20 cm high step.
- Subjects stand upright on one leg with the toes of the standing leg close to the edge of the step. The free leg is extended in front of the step with the ankle in maximum dorsiflexion.
- With as much control as possible, subjects are asked to bend the knee of the standing leg until the heel of the extended leg touches the floor and then immediately return to the starting position. During the test execution, the following criteria should be used to mark invalid attempts:

### Step-Down Test (SD)



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### Lower Body Y balance Test



![](_page_28_Figure_0.jpeg)

#### Greatest Successful Reach

	Right	Left	Difference
Anterior (A)			
Posteromedial (PM)			
Posterolateral (PL)			

#### Composite Score

Right	(Anterior + Posteromedial + Posterolateral	~ 100
Left	3 x Right Limb Length	× 100

## Lower Body Y balance Test

Test Faults

- kicking push box
- not returning to starting position under control
- touching down during reach
- foot on top of stance plate

### Lower Extremity Functional Test (LEFT)

- for the measurement of athletic fitness, fatigue resistance, and speed by performing a series of 16 specific maneuvers as fast as possible (including forward and backward sprinting, sidestepping, cross-stepping, 45° and 90° cutting).
- The layout is a combination of four cones in a diamondshape (9.14 m × 3.05 m).
- Subjects started in an upright standing position with both feet behind the starting point at cone A. On the command of the instructor, the subjects performed eight different agility tasks, with each task being performed twice (once to the right and once to the left direction).

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![](_page_31_Figure_0.jpeg)

### Balance Error Scoring System (BESS)

• This test will consist of 6 - twenty second tests with three different stances on two different surfaces

![](_page_32_Picture_2.jpeg)

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## Timed lateral step-down

- the timed lateral step-down involves continuous single-leg squats on a step with hands on hips, and requires that subjects gently tap the heel to the ground with the toe pointed upward during each squat
- (Step height was adjusted such that a 60° to 70° knee flexion angle was achieved when the heel touched the ground. A metronome was used to keep an 80-bpm pace, with each click signaling the subject to flex or extend the knee. Subjects were instructed to maintain neutral limb alignment during the test, which continued until 3 faulty movement-pattern strikes were made, the athlete chose to stop for reasons such as pain or inability to continue, or 180 seconds had passed. Strikes were given for the presence of knee valgus, loss of balance, falling off pace, or the hands coming off the hips. The recorded measure was the total time (seconds) prior to obtaining 3 strikes, as recorded by each rater using a stopwatch.

### Timed lateral step-down

![](_page_34_Picture_1.jpeg)

## For the figure-of-8 hop test

- For the figure-of-8 hop test, a 5-m
- course outlined by cones was used (FIGURE 1). Each participant was instructed to
- hop on 1 limb, twice around the course,
- as fast as possible. We marked any trials
- in which a participant put the contralateral foot down, fell, missed the stopwatch
- pad, or did not complete the course as
- outlined as unacceptable and asked to
- perform the trial again.10,20 Prior to data
- collection, trial reliability was conducted
- for each test
## For the figure-of-8 hop test



#### Figure-of-Eight Hop Test

# Single Leg Squat (SLS) Test

- procedure: Stand on one leg while the other leg is lifted off the ground in front of the body so that the hip is flexed to approximately 45° and the knee of the non-stance leg flexed to approximately 90°. The arms are held straight out in front, with the hands clasped together. From this position, squat down until about 60° knee flexion, then return to the start position. Note the leg that was tested.
- scoring: clinical observation usually involves assessment of knee and hip stability.

### Single Leg Squat (SLS) Test

#### Single Leg Squat - Squat position



### Carioca test

• The carioca test was performed by requiring the patient to run laterally two lengths of a 12 m distance with a crossover step. The patient ran the course from left to right and then in reverse direction and the fastest speed was recorded



# Single Leg 8-inch Jump

(a)

 Landing Stand on one leg and perform a jump landing off a 8-inch box. The landing must be held for 5 seconds with balance maintained. The entire sequence is to be completed with good mechanics, including proper landing stance, knees flexed and in line with foot, level pelvis, and vertical alignment of trunk.



#### LESS(Landing Error Scoring System)

- is a clinical screening tool, which provides objective scoring, designed to determine ACL injury risk based on jumping/landing biomechanics. Allows for assessment of motion and biomechanics in the frontal and sagittal planes using video analysis.
- It assesses 9 landing concepts and has 17 questions which are scored out of 19 points
- A maximal score of 19 can be reached for exceptionally poor performances and a score of <5 is considered to be good i.e the athlete is considered to be at low risk

#### LESS(Landing Error Scoring System)



#### LESS(Landing Error Scoring System)



# Effect of graft type on Return to sport time

 Athletes who received a bonepatellar tendon-bone autograft took longer than those who received a soft tissue allograft or a hamstring tendon autograft to reach important postoperative clinical milestones, including recovering quadriceps strength and meeting return-to-sport criteria. Multiple Single-Leg Hop-Stabilization Test (MSLHST)

 The Multiple Single-Leg Hop-Stabilization Test (MSLHST) is a dynamic and static balance test used to examine the balance capabilities of an athlete, one leg at a time. The test was designed for the sporting population and based on the similar BASS balance Test. The test involves performing dynamic forward and diagonal one-legged jumps while statically maintaining landing positions



## stair hopple test

 This is a new test in which the patients jumped on the uninvolved leg up and down 22 steps (each step 17.5 cm high) on a stair case) and then for involved leg. Time measured for both of leg.



International Knee Documentation Committee (IKDC) – Subjective Knee Form

• IKDC subjective knee form is a reliable and valid tool for the athlete to subjectively rate their knee symptoms, function, and ability to return to sport following knee injury.

- IKDC score= sum of items/87 (max poss score) X 100
- Higher scores represent higher levels of function.
- IDKC score > 70 indicates higher functional abilities and readiness to enter RTS phase of rehab or RTS.
- IDKC score < 70 may indicate that an athlete in in need of extra rehab and recovery time prior to RTS

# Ankle

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#### Pain severity

- During sport participation
  - Over last 24 hours

#### Ankle impairments

- Ankle range of motion
- Ankle muscle strength, endurance and power



#### Athlete perception

- Perceived ankle confidence/reassurance
- Perceived ankle stability
- Psychological readiness

#### S

#### Sensorimotor control

- Proprioception
- Dynamic postural control/balance

#### ς

#### Sport/functional performance

- Hopping and jumping
- Agility
- Sport-specific activities
- Ability to complete a full training session

# Ankle injury

• PAASS: Pain (during sport participation and over the last 24 hours), Ankle impairments (range of motion; muscle strength, endurance and power), Athlete perception (perceived ankle confidence/reassurance and stability; psychological readiness), Sensorimotor control (proprioception; dynamic postural control/balance), Sport/functional performance (hopping, jumping) and agility; sport-specific drills; ability to complete a full training session).

# Upper Extremity Functional Tests

- Upper body Y balance Test
- closed kinetic chain upper extremity stability test
- Seated Medicine Ball Throw
- Single Arm Seated Shot Put Test
- Timed push up test
- Modified pull up test
- Upper Quarter Y Balance Test
- Closed Kinetic Chain Upper Extremity Stability Test
- one-arm hop test.
- Assessment of mechanics

# Upper body Y balance Test

Test Faults

- Shoving push box
- Not returning to starting position under control
- Touching down with reach hand before all three reach directions are completed
- Hand on top of stance plate
- Not maintain both feet in contact with the floor

### Upper body Y balance Test



closed kinetic chain upper extremity stability test (Davise test)

- two strips of athletic tape with a width of 1.5 inches were placed parallel to each other 36 inches apart on a tile floor .
- starting position ( push up).one hand to reach across their body and touch the piece of tape lying under the opposing hand.
- After touching the tape line the hand would be returned to the original starting position.
- The total time for the trial was 15 seconds. Each subject performed a warm up trial and then three real trials of the test with a rest period of 45 seconds between trials. An average of the three trials was used for data analysis

#### closed kinetic chain upper extremity stability test Good score: female:23 and male: 21



#### Single Arm Seated Shot Put Test

The participants sat on the floor, with knees flexed at 90° and feet flat, while half of his back and head kept contact with the wall.

The participants were instructed to hold a 3-kg medicine ball at shoulder-height while flexing the elbow and then to push it as far as possible in the horizontal direction, with the opposite hand placed on the belly

The right side was assessed first. Each testing session began by one submaximal and one maximal trials for familiarization during which the examiner gave additional instructions on the pushing direction if necessary.

Then the participant performed three maximal trials for assessment.

A 30-s recovery period was set between each trial.

The medicine ball was coated with talcum powder to identify its impact on the ground

For each trial, the distance between the wall and the talcum mark (edge closest to the wall) was measured in centimeter After deducting the C7-middle finger length of the corresponding sides, the distances were scaled allometrically as proposed by Chmielewski et al. [8] (i.e. distance / body mass with the exponent 0.35)

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## Single Arm Seated Shot Put Test



## Timed Push up Test

- How many you can do in 1 minute
- Male: > 18 reps, Female: > 12 reps
- Also can do to exhaustion
- Male: >39, Female: >27

## Ball Drop Test

 Patient is in prone position on table with 2 lb plyoball in hand performs ball drops & catches for 30 second with the shoulder abducted to 90° and elbow extended.



## one-arm hop test.

- The subject placed his non-weight-bearing hand on the posterior aspect of the low back.
- A 10.2-cm step placed immediately lateral to the subject's test hand.
- After the subject was in the proper start position, the investigator said, "Ready, set, go," to signal the beginning of the trial.
- The subject used the weight-bearing arm to hop onto the step and landed on the rubber portion of the step with the entire hand.
- The subject then used the weight-bearing arm to hop off of the step and return his hand to the start position next to the step.
- Subjects repeated this movement 5 times as quickly as possible. If the subject performed the test with improper technique, he rested for 1 minute, and then performed another practice test

### one-arm hop test.





# Starting position for the Seated Medicine Ball Throw Test

- seated on the floor, supporting their backs against a wall and keeping their legs extended over a distance of 60 cm between them. A measuring tape was placed on the floor and extended at a distance of 10m
- A 2 kg medicine ball was then delivered to the participants and they were instructed to hold it with both hands close to the midline at chest height, and then to throw it horizontally as far as possible in relation to the tape measure placed on the floor.
- The distance (centimeters) covered by the ball was marked with the same measuring tape.
- Two attempts were allowed with an interval of 1 min between them. If the participant moved their back off the wall or launched the ball in a non-horizontal trajectory, the repetition was not valid

## Seated Medicine Ball Throw Test



## Seated Medicine Ball Throw

Rating	Distance (Meters)
Excellent	5.76+
Good	5.00-5.75
Average	4.25-4.99
Below Average	3.50-4.24
Poor	0-3.49

# Phase 1 – Early Rehab to return to light training/exercise

	Phase 1 – Early Rehab to return to light training/exercise
/	No Pain at Rest
	Pain less than 4/10 during activity
	Pain lasting less than 48 hours after activity
	Acceptable scores on psychometric testing (FOTO, DASH, ASES, KJOC)
	No/Trace Edema
	100% symmetrical ROM to other UE (for overhead athletes, check total arch)
	Within normative ranges for sport when available
	Minimum of 5/5 per MMT of involved and adjacent joints
	FMS score >14

# Phase 2 - to allow for graduated return to sport training

Phase 2 - to allow for graduated return to sport t	training
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Upper Quarter Y-Balance Test (Right vs. Left symmetry)

Single Arm Seated Shot Put Test (< 10% difference Right vs. Left)

Timed Push-Up Test (Men: > 18 reps? , Female: > 12 reps?)

Modified Pull-Up Test (Men: > ???, Female: ???)

Closed Kinetic Chain Upper Extremity Stability Test (Male: \*\*\* reps. Female: \*\*\* reps) (>21 touches)

# Phase 3 – To allow for full return to sport participation

Phase 3 - To allow for full return to sport participation
Throwing
Beyond body weight, weight bearing activities (???)
Greater than body weight, pulling activities (???)
Sport/position specific progressions

#### RETURN TO SPORT PARTICIPATION CRITERIA FOLLOWING SHOULDER INJURY

#### Table 2. Criteria to begin participation in practice.

- Western Ontario Shoulder Index (WOSI) Shoulder Score of  $\geq 90$
- Full, non-painful passive range of motion (PROM)
- Satisfactory clinical examination without positive findings or apprehension
- Ball Drop Test: 90% involved to uninvolved
- Push-up Test: Ability to perform more repetitions in second testing bout
- Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST)  $\geq$  21 repetitions
- Bench Press  $\geq$  75% of pre-injury 1 repetition maximum (1RM) without substitution
- Unilateral Pulling Assessment (>95% limb symmetry index)
- Unilateral Pushing Assessment (>95% limb symmetry index)
- Isokinetic test that fulfills criteria (Bilateral comparisons for limb symmetry index, Unilateral ratios, allometric scaling, sport specific normative data, position specific normative data)

#### RETURN TO SPORT PARTICIPATION CRITERIA FOLLOWING SHOULDER INJURY

#### Table 3. Clearance Criteria for Return to Sport.

- Western Ontario Shoulder Index (WOSI) Shoulder Score of  $\geq 95$
- Full, non-painful passive range of motion (PROM)
- Satisfactory clinical examination without positive findings or apprehension
- Ball Drop Test: 100% involved to uninvolved
- Push-up Test: Ability to perform more repetitions in second testing bout
- Closed Kinetic Chain Upper Extremity Stability Test  $\geq$  25 repetitions
- Bench Press  $\geq$  95% of pre-injury 1 repetition maximum (1RM) without substitution
- Unilateral Pulling Assessment (>100% limb symmetry index)
- Unilateral Pushing Assessment (>100% limb symmetry index)
- Isokinetic test that fulfills criteria
  - External rotator peak torque/Body weight ratio @180°/sec: 18-23%
  - o Internal rotator peak torque/Body weight ratio@ 180°/sec: 26-32%
  - o External Rotation/Internal Rotation (ER/IR) ratios @180°/sec: 72-76%
  - o Bilateral comparison: ER 95-100%, IR 100-110%
  - No pain or apprehension during test

#### • The psychological readiness of the player is a major factor in successful safe return to sport (SRTS) decision making. Although strength, performance, and functional tests presently form the mainstay of SRTS criteria, there exists very little scientific evidence for their validity. More protection should be provided to athletes with known risk factors. Movement quality is important, if not more important than the quantifiable measures
Table 4
 Recommended testing to be included at the end of a football-specific on-field rehabilitation programme to support the decision-making process on player readiness to return to team training

Additional considerations for RTS	Suggested tests and criteria
Neuromuscular performance	Complete recovery of isolated muscle strength LSI 100% for quadriceps and hamstring strength (isokinetic or isometric test) knee flexor: extensor ratio > 0.60 [25, 114] Isometric RFD assessment of knee flexors and extensors (LSI > 90%) Leg press/squat assessment of isometric RFD (LSI > 90%) and peak force (LSI > 95%) Jump performance (CMJ) [143], drop jump and/or hopping performance] (LSI > 95%) [144]
Movement quality	<ul><li>High load qualitative movement evaluation (assessment in frontal and sagittal planes) of basic sports movements, ensuring correct mechanics (e.g. drop jump, hop tests, cut manoeuvre [planned and unplanned]).</li><li>Other specific available movement quality tests include the LESS [145]</li><li>Qualitative movement evaluation during sport-specific movement tasks on-field</li></ul>
Physical conditioning	Complete recovery of aerobic and anaerobic conditioning (AT2>11 km h <sup>-1</sup> and AT4>13.5 km h <sup>-1</sup> for professional footballers) [114] and/or Yo-Yo intermittent recovery test on-field [146] Complete recovery of speed (30-m acceleration test, peak speed using GPS data) and change of direction ability (505 agility or T-test)
Technical and tactical re-training	Complete a step-wise on-field rehabilitation programme, with increasing sport-specificity and complexity of technical and tactical re-training [114, 115]
Training load	<ul> <li>Progressive loading with GPS monitoring and ACWR &lt; 1.5 for each variable during the final week's on-field training at 90% of the normal acute week (7 days) with the team [104]</li> <li>Achieve the necessary chronic loading demands to cope with team training and subsequent match play (e.g. &gt; 70% chronic training load across all relevant GPS and HR metrics) [101]</li> </ul>

ACWR acute chronic workload ratio, AT anaerobic threshold, CMJ countermovement jump, GPS global positioning system, HR heart rate, LESS landing error score system, LSI limb symmetry index, RFD rate of force development, RTS return to sport

- 1- Favourable opinion of the clinician
- 2- Absence of pain on palpation
- 3. Absence of pain during strength and flexibility tests
- 4. Absence of pain during / after functional tests
- 5. Symmetrical flexibility of the Hamstrings
- 6. Positive field performance tests
- 7. Psychological preparation

## Return to Sport After Acute Adductor Injuries



## "THANK YOU FOR YOUR ATTENTION"



10/30/2021

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