

# Aspetar Hamstring Protocol



Orthopaedic & Sports Medicine Hospital  
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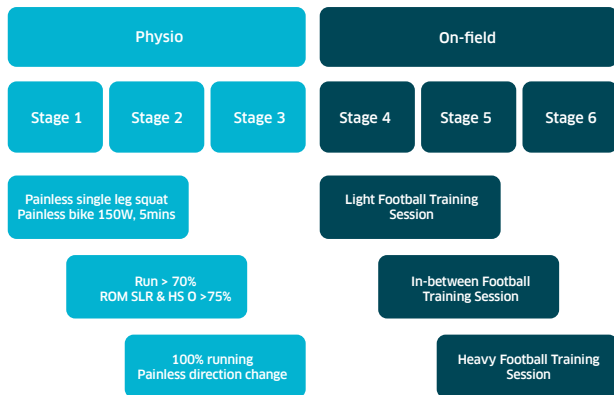


## Introduction

The central tenet of the rehabilitation protocol is a requirement for set criteria (specific physical testing) to be proven prior to allowing progression to the next stage. Daily measurements of subjective pain, pain with palpation, range of movement or flexibility, and strength allows the clinician to adapt the protocol for the athlete on that particular day depending on the presentation of the individual, as well as identify the response to the previous day's treatment. Although we suggest specific exercises and progressions within each stage, clinical reasoning is continuously required from the clinician to execute the protocol optimally for each session.

Arbitrarily the rehabilitation protocol consists of 6 stages, three "physiotherapy" stages and 3 sport specific stages. An overlap of exercises between the stages is allowed, recognizing the fluidity of the rehabilitation process and reflecting an integrated protocol with set criteria for progression. The main feature of the protocol repeated in each stage is the early but safe resumption of repeated high speed running and direction change movements.

### CRITERIA BASED PROGRESSION PROTOCOL



# ASSESSMENT

### **In general:**

- All exercises should be performed close to pain free limit. If the exercise/movement provokes pain ( $\geq 2$  VAS) from the injured area, the exercise is immediately adjusted or terminated.
- The patients should be instructed to perform the exercises with adequate control/stabilization of the hip and trunk.

### **Variations:**

- Depending on the localization of the injury (medial/lateral), tibial IR or ER is applied when appropriate during exercises with knee flexion movements appropriate.

### **GOALS:**

#### **• STAGE I: PROMOTE HEALING OF THE INJURED TISSUE**

- 1) Protect scar tissue development (promote neuromuscular control within protected ROM)
- 2) Minimize muscle atrophy
- 3) Minimize pain

#### **• STAGE II-III: REGAIN FULL MUSCLE FUNCTION AND NEUROMUSCULAR CONTROL**

- 1) Regain full voluntary neuromuscular control over the injured muscle
- 2) Regain pain-free hamstring strength, from mid-range progressing to longer hamstring lengths
- 3) Develop neuromuscular control of trunk and pelvis with progressive movement speed
- 4) Pain free running up to maximal speed and with changing directions

#### **• STAGE IV-VI: INTEGRATE FULL SPORTS SPECIFIC PARTICIPATION**

- 1) Symptom-free during all activities
- 2) Complete 3 progressive sports specific sessions with no pain and full

# FUNCTION

## GAIT – WALKING

**GAIT-WALKING** The use of crutches and the ability to walk and jog without pain and/or antalgic pattern is noted as normal, antalgic, not able, or has not tried.



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# STANDING TRUNK FLEXION

Stand Straight



**Start in upright position.**





**Trunk flexion is performed with hands touching the legs until pain from injured area or a general “stretching pain” is felt.**

**Level is noted as finger touch level:knees, mid-shins, ankles or floor**

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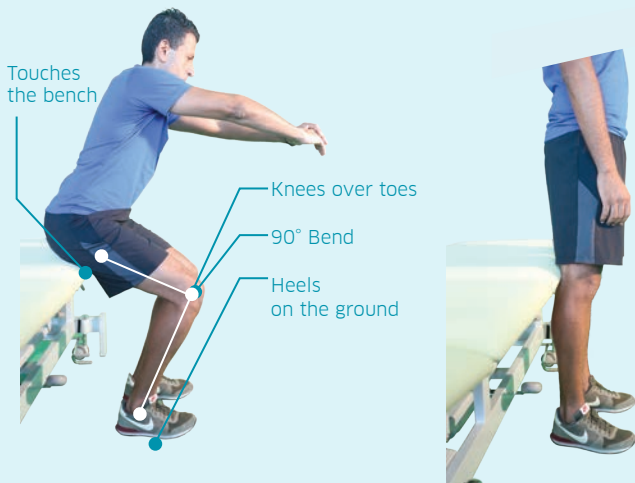


# DOUBLE LEG SQUAT → 90°



Bench height equal  
to the knee joint

**Standing with hands on hips with feet shoulder-width apart, examination table at height similar to the knee joint line.**



**The athlete is asked to lower his body by bending his knees until he touches the examination table.**

**Maintain upright position.**

**Knee joint aligned over 2nd toe.**

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# SINGLE LEG SQUAT - 45°



Bench height equal  
to the mid-thigh

**1 leg squat - bench  
position close up**

**The patient is asked to lower his body by bending his knees until he touches the bench, keeping the knees directly in line above the feet (2nd toe).**

**The upper body is maintained in an upright position.**



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# PALPATION



The athlete indicates the most painful area.

Palpation of the uninjured leg is used as reference to the athlete to identify the known pain.

The total length, width and the distance between ischial tuberosity and the area with maximal pain are measured in centimeters



The clinician palpates the full length of the medial and lateral hamstrings to localize painful area.

The painful area borders are marked cranially, caudally, medially and laterally.

The distance from the ischial tuberosity is noted.

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# RANGE OF MOTION

## PASSIVE STRAIGHT LEG RAISE (SLR) TEST

The maximal degrees  
of hip flexion ROM  
and pain registered as  
yes/no

Theta Angle Hand-held  
inclinometer

Full Knee  
Extension







**The athlete is lying supine while the clinician is fixating the untested leg.**

**The clinician passively raises the leg, ensuring full knee extension or to the point where the athlete reports pain/onset of discomfort.**

**Range of motion (i.e. the hip flexion angle from the horizontal plane) is measured by a hand held inclinometer.**

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# **PAIN FREE PASSIVE KNEE EXTENSION TEST (PKET)**



**The athlete is lying supine with hip flexed to 90° while the clinician is fixating the untested leg.**

**The clinician gradually extends the knee to the point of resistance or the onset of pain/discomfort.**



**Range of motion (i.e. the knee extension angle) is measured by a hand held inclinometer.**

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# MAXIMAL HIP FLEXION ACTIVE KNEE EXTENSION (MHFAKE) TEST



The athlete is lying supine with hip towards the maximal flexion using the arms to pull the thigh to the chest.

The contralateral leg is fixated with a belt.



**The athlete performs active knee extension until reaching maximal tolerable stretch or the onset of pain/discomfort.**

**Range of motion (i.e. knee extension angle) is measured by hand held inclinometer.**

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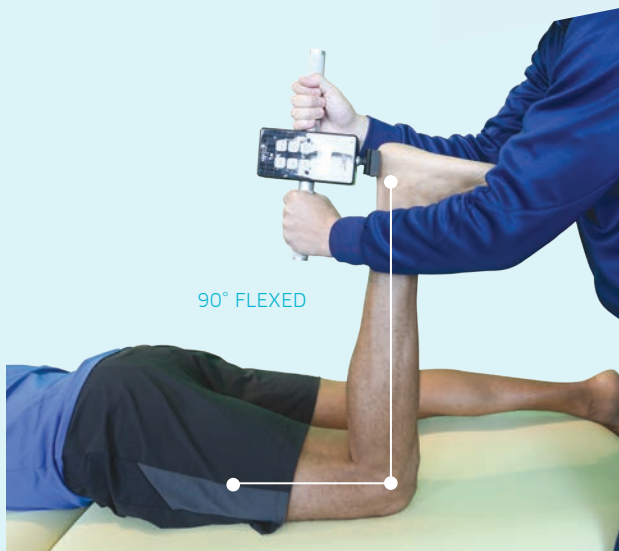
# STRENGTH MEASUREMENTS

## ISOMETRIC INNER-RANGE STRENGTH TEST

The athlete is prone with 90° knee flexion of the tested leg.

The clinician holds the HHD horizontally with both arms against the athlete's posterior heel.

The athlete performs 3 isometric knee flexion for 3 seconds.  
(Maximal effort-hard as possible)



90° FLEXED

**Standard instructions:**  
**"Ready - GO! - Push-push-push"**

HHD – Hand Held Dynamometer

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# ECENTRIC MID-RANGE STRENGTH TEST



The athlete is lying prone.

The clinician raises the heel one foot length above the examination table holding the HHD vertically against the athlete's posterior heel.

The athlete performs 3 isometric knee flexion for 3 seconds.  
(Maximal effort-hard as possible)





**The clinician applies an eccentric brake test.**

**Standard instructions:**

**“Ready - GO! - Push-push-push-push”**

**HHD – Hand Held Dynamometer**

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# ECENTRIC OUTER-RANGE STRENGTH TEST



The athlete is lying supine while ASIS/pelvis and the contralateral leg fixated with a belt.

The clinician passively flexes the player's leg to 90° knee flexion, holding the HHD vertically against the athlete's posterior heel.

The athlete performs 3 isometric knee flexion for 3 seconds. (Maximal effort – hard as possible)

The clinician applies an eccentric brake test.

**Standard instructions:**

**“Ready - GO! - Push-push-push-push”**

HHD – Hand Held Dynamometer

### 90° KNEE FLEXION



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# DOUBLE TO SINGLE LEG BRIDGE

1



Lift buttocks into hip extension with:

Stage 1-3

Two legs  
(knees flexed to  $\pm 90^\circ$ )



Stage 4

Single leg  
(knee flexed to  $\pm 90^\circ$ )



Stage 5

Injured leg positioned on a bench or the clinician's shoulder

2



3



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# **RETURN TO SPORT (RTS)** **(All assessments repeated)**

**+**

## **Askling H-test** **Nordic Hamstring Exercise** **Isokinetic Strength Test**

### **DYNAMIC FLEXIBILITY** **H-TEST BY ASKLING**

The athlete is lying supine with the contralateral leg and the upper body fixed with a belt.

A knee brace ensures full extension of the tested knee (0°).  
No warm-up exercises!

Passive flexibility test where the clinician slowly raises the testing leg towards maximal hip flexion. Strong, but tolerable stretching in the hamstring muscle.

The active flexibility test consists of 1 practice trial (submaximal effort) 3 consecutive test trials: The athlete performs a straight leg raise as fast as possible to the highest point without taking any risk.



°0 Full Knee  
Extension



No Warm-up  
Exercises



**The athlete is asked to estimate experience of insecurity and pain on a VAS-scale from 0 to 100.**

**(Askling et al 2010)**

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# NORDIC HAMSTRING EXERCISE WITH NORDBORD



The athlete is kneeling on either the Norbord with ankles fixed in the stirrups.

The athlete is then instructed to fall forward, and resist the fall to the ground for as long as possible using his hamstring muscle.





**Hip and lumbo-pelvic control alignment good control throughout the movement**

**1 set of 3 repetitions**

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# ISOKINETIC STRENGTH TESTING



The athlete is seated upright on the dynamometer and fixated with straps

Instructed to grip the chair handles throughout the test.

The axis of knee rotation is aligned collinear to the lateral femoral condyle and gravitational correction is performed at 30° of knee flexion.

During the test, the athlete is given vigorous verbal encouragement to exert maximal effort throughout the test.

Quadriceps and Hamstrings Concentric 60°/s

(5 trials) Concentric 300°/s (10 trials)

Hamstrings Eccentric 60°/s (5 trials)

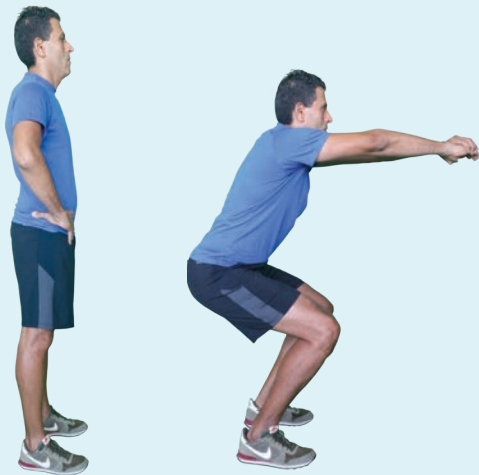


# EXERCISES

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## 2 LEG SQUAT EXERCISE



### Instructions:

The athlete is asked to lower his body by bending his knees until he reaches 45°-90° (or pain is felt).

The upper body is supposed to be as straight as possible.

\*Knees over toes, heels on the ground.

3 x 15



**Progression:**

**The exercise is performed with weights**

**3 x 8**

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# EXERCISE BIKE



**1st session: start at 50 Watt for 30 sec.**

**Increase the load/intensity with 25 W every 30 seconds until it reaches the highest level of cycling continuously for 5 minutes.**



**Aim:**

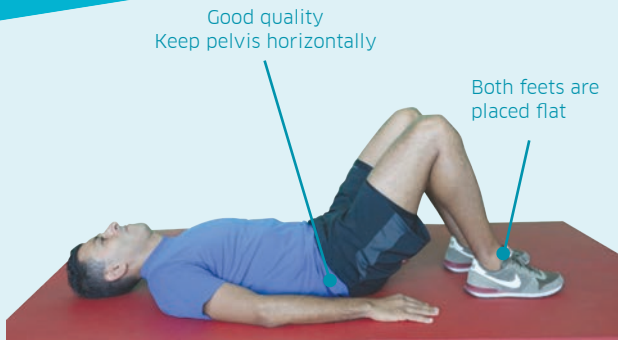
**2 X Bodyweight = Power output (W)**

**5min warm up, 5min hard!**

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# SUPINE 2 LEG BRIDGE



## Starting position

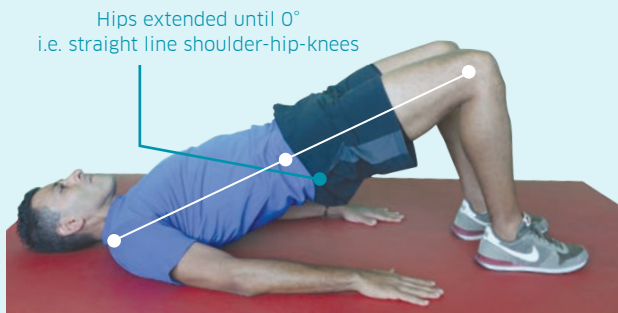
One knee is flexed and placed beside medial knee joint line of the other leg, which is then placed similarly, leaving both knees flexed approximately 90°.

## Instructions

The athlete is instructed to perform 3 repetitions of hip extension, where he pushes down through the heels and lifts the hips off the ground towards full hip extension.

**3 X 12**





**\*Good quality, i.e.: ASIS/pelvis horizontally throughout the whole movement**

**\*Hips extended until 0°, i.e. straight line  
shoulder - hips - knees**

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# SUPINE ISOMETRIC HEEL DIGS



## Starting position

The athlete is lying supine or sitting on the bench with the knees flexed at an angle of approximately 90°.

## Instructions

The athlete is instructed to push down through the heel by activating the hamstrings and hold the position for approximately 5 seconds.

**3 X 12**



**Isometric contractions in different angles towards end ROM; 90° - 60° - 30°**

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# SINGLE LEG SQUAT

## EXERCISE



### Starting position

The athlete is standing with the uninjured leg slightly bent with hands on hips.



### Instructions

The athlete is asked to lower the body in a squatting position by bending his knees while the knee in the standing leg is directly in a line above the feet (2nd toe).

**3 X 8**

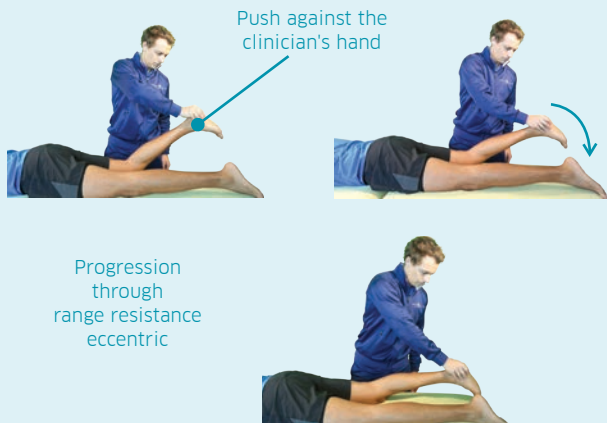
**Progression:**

The exercise is performed with weights

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# MANUAL RESISTED HAMSTRINGS



## Starting position

The athlete is lying in prone position with knees flexed. The therapist applies isometric resistance in varying angles..

## Instructions

The athlete is instructed to push against the therapist's hand, which is placed on the posterior calcaneus.

**3 X 12**



### Progression:

**In supine position with hip flexed: resistance towards the end ROM (eccentric)**

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# MANUAL RESISTED

## Soft tissue mobilization

### Starting position

The athlete is lying in prone position. Effleurages/lymphatic drainage is performed distal and proximal to injury site.

### Instructions

The athlete is instructed to be relaxed and report if he feels pain or any kind of discomfort during the treatment.

**5-10 minutes**

### Progression:

Massage of the injured area allowed in Stage 2





# ACTIVE RANGE OF MOTION (ROM)

## Starting position

Athlete is lying in prone position with both legs extended.

## Instructions

The athlete is instructed to actively bend the knee of the injured leg until the heel touches the buttock and then slowly extend the knee towards a straight leg position again.

**3 X 8**



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# THE EXTENDER

(Askling et al)



## Starting position

The athlete is lying supine, holding and stabilize the thigh of the injured leg with the hip flexed approximately 90°.



### Instructions

The athlete is instructed to perform slow knee extensions to a point just before pain is felt.

3x12) x 2

Progression:

Increase speed.

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# THE DIVER



## Starting position

The athlete is standing with full weight on his injured leg and the opposite knee slightly flexed backwards.



### Instructions

The athlete is asked to perform the exercise as a simulated dive (hip flexion from an upright trunk position) of the injured, standing leg and simultaneous stretching arms forward and attempting maximal hip extension.

**3 X 6**

**\*Good quality, ASIS/pelvis horizontally throughout the whole movement**

**\*Maintain 10–20° knee flexion in the standing leg.**

Scan to watch the video



# THE GLIDER



## Starting position

The exercise is started with the patient positioned with upright trunk, one hand holding on to a support and legs slightly split. All the body weight should be on the heel of the injured leg with approximately 10–20° knee flexion.





### Instructions

The athlete is instructed to perform a gliding backward movement on the other leg and stop the movement before pain is reached. The movement back to the starting position should be performed by the help of both arms, not using the injured leg.

**3 X 6**

Progression is achieved by increasing the gliding distance and performing the exercise faster.

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# SUPINE 1 LEG BRIDGE

## Starting position

The athlete is lying supine with arms placed in a comfortable position with knees flexed.

## Instructions

The athlete is instructed to raise his untested leg off the examination table and then perform repetitions of hip extension, where he pushes down through the heel of the tested leg and lifts the hips off the ground towards full hip extension.

**4 X 15**

## Progression

Exercise performed on a step/clinician's shoulder



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# STRETCHING



SLR position

**The athlete is instructed to relax and the therapist perform a gentle stretch with the leg in:**

**1) Straight leg raise (SLR) position**



MHFAKE position

## **2) Maximal hip flexion + knee extension**

**(MHFAKE position).**

**Towards the end ROM where the athlete either reports a stretch or onset of pain, 5 isometric contractions are performed (hold-release), before a gentle passive stretch is applied further.**

**3 x 30 seconds**

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# RESISTED HAMSTRING CURL EXERCISE



## Starting position:

The athlete is lying prone in the leg curl machine. Make sure the length of the lever arms are adjusted to the patients leg length.

## Instructions:

The athlete is instructed to perform slow continuous knee flexions and knee extensions with the injured leg, only, starting with a load that is acceptable and pain free.



### **Progression:**

**I: Increasing load (kg)**

**II: Increasing load in eccentric phase**

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# ECCENTRIC NORDIC HAMSTRING EXERCISE



## Starting position:

The athlete is kneeling on either the Nordbord with ankles fixed or on a mat with the therapist fixating the ankles.

## Instructions:

The athlete is then instructed to fall forwards, and resist the fall to the ground as long for as possible using their hamstring muscle.





Complete 2 painfree sessions before progression to next level

Complete all 3 sessions, drop only, then progress through session again with drop and curl



**\*That the loading of the injured leg is similar to the uninjured leg (without pain)**

**3 times per week**

**1) 2x 5 reps, drop only**

**2) 2(3)x 5 – 8, drop only**

**3) 2(3)x 8 – 12 , drop only**

**4) Repeat sessions 1-3 with drop AND curl**

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# **RUNNING PROGRAM**

## **A DRILL-HIGH KNEE WITH KICKS**



### **“A” Drill**

**High knee with “Kicks”**

**(Each lap = 25-50m x2)**



### Instructions

The athlete is instructed to lift his knee as high as possible and extend the knee down in a circular motion “sweeping” the floor.

3 X 4 laps

# **RUNNING PROGRAM**

## TRIPLE EXTENSION WALK HIGH KNEES



### **Triple Extension Walk**

#### **High knee only**

**(Each lap = 25-50m x2)**

#### **Instructions:**

**The athlete is instructed to lift the knee as high as possible in a jumping motion, and repeat on the other side.**

**3 X 4 laps**



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# **RUNNING**

## **PROGRESSION**

The running progression programme includes volume, intensity and running mechanics. It is performed under supervision to facilitate these components are executed well

When the athlete starts with the running progression, he is asked to rate the running from the very first lap.

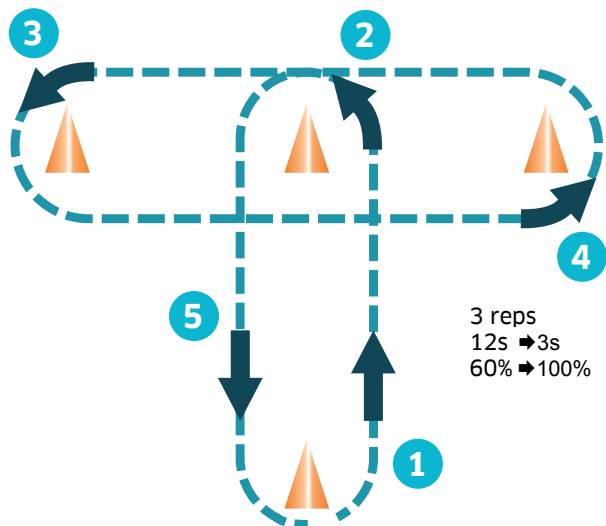
Both the % rated by the athlete, as well as the timed run/sprint is recorded to allow for gradual progression of the running.

**3 X 4 laps**

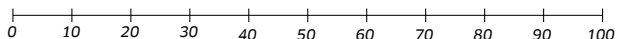
**Progression**

**0 – 100%**





Modified T-drill where the run starts at 1 and follows the numbers sequentially running around cones (indicated by Δ).



% linear scale where the athlete is asked to indicate the speed at which he/she is running

The athlete is asked to run (from a standing start) and touch each of the cones, continuously in a forward motion while changing direction without any side stepping or backwards running



## HAMSTRING PROTOCOL

### Daily assessments

Injured leg: **LEFT** ☐ **RIGHT** ☐ **NO** = no pain, **P** = pain, **NA** = not able, **SLR** = straight leg raise, **MHFAKE** = maximal hip flexion active knee extension, \* = degrees, **kg** = kilograms

	/ / 201_ Days Post:										/ / 201_ Days Post:										/ / 201_ Days Post:									
	Sign:					Sign:					Sign:					Sign:					Sign:									
	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED										
Self-reported readiness	VAS /10										VAS /10										VAS /10									
Average pain today	No P NA										No P NA										No P NA									
Walking	No P NA										No P NA										No P NA									
Jogging	No P NA										No P NA										No P NA									
2 leg squat x 3	No P NA										No P NA										No P NA									
1 leg squat x 3	No P NA										No P NA										No P NA									
Trunk flexion	No P NA										No P NA										No P NA									
Total palp. length:	cm P										cm P										cm P									
Mid range	kg P /10										kg P /10										kg P /10									
Outer range	kg P /10										kg P /10										kg P /10									
SLR	* P /10										* P /10										* P /10									
MHFAKE	No P NA										No P NA										No P NA									
Bent leg bridge 3x	No P NA										No P NA										No P NA									
Straight leg bridge 3x	No P NA										No P NA										No P NA									
Comments:																														

	/ / 201_ Days Post:										/ / 201_ Days Post:										/ / 201_ Days Post:									
	Sign:					Sign:					Sign:					Sign:					Sign:									
	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED	INJURED	UNINJURED										
Self-reported readiness	VAS /10										VAS /10										VAS /10									
Average pain today	No P NA										No P NA										No P NA									
Walking	No P NA										No P NA										No P NA									
Jogging	No P NA										No P NA										No P NA									
2 leg squat x 3	No P NA										No P NA										No P NA									
1 leg squat x 3	No P NA										No P NA										No P NA									
Trunk flexion	No P NA										No P NA										No P NA									
Total palp. length:	cm P										cm P										cm P									
Mid range	kg P /10										kg P /10										kg P /10									
Outer range	kg P /10										kg P /10										kg P /10									
SLR	* P /10										* P /10										* P /10									
MHFAKE	No P NA										No P NA										No P NA									
Bent leg bridge 3x	No P NA										No P NA										No P NA									
Straight leg bridge 3x	No P NA										No P NA										No P NA									
Comments:																														

# HAMSTRING PROTOCOL

Patient label

Weight:

Weight: \_\_\_\_\_  
 Leg injured: ☐ LEFT ☐ RIGHT

[illegible]

Criteria for progression from Stage 1 to Stage 2:

Criteria for progression from Stage 1 to Stage 2:

1. Painless Single Leg Squat
2. Painless Bike, W: 2x Body Weight, 5 minutes (level 6-7)

Criteria for progression from Stage 2 to Stage 3:

Criteria for progression from S
1. Run $\geq 70\%$ Patient-rated
2. Pain mid-range test $\leq$ VAS 2

Criteria for progression from Stage 3 to Sports Spec Rehab:

1. 100% running speed
2. Painless high speed direction changes
3. Must demonstrate ability to acceleration/decelerate without any discomfort during high speed running

# HAMSTRING PROTOCOL Running Progression

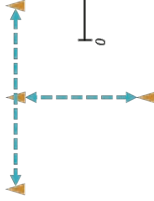
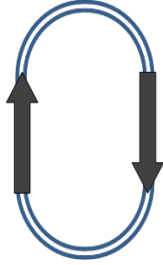
Patient label

Leg injured: ☐ LEFT ☐ RIGHT

WEEK:		Date	/	/	201_	Date	/	/	201_	Date	/	/	201_	Date	/	/	201_	Date	/	/	201_
STAGE	PREPARATION	Sets/ Laps			Best Time	Sets/ Laps			% max	Sets/ Laps			% max	Sets/ Laps			% max	Sets/ Laps			% max
2+3	Triple Extension Walk High knee only (Each lap = 100m x2)	3 x 1																			
2+3	"A" Drill High knee with "X" kicks (Each lap = 100m x2)	3 x 1																			
	RUNNING ROUGH SHUN	Sets/ Laps			Best Time	Sets/ Laps			% max	Sets/ Laps			% max	Sets/ Laps			% max	Sets/ Laps			% max
2+3	Walk – Jog (10-70%) Jog – Run (70-100%)	3 x 4																			
3	Timing																				
3	Modified T-Drill (70 – 100%) (≤ 11 sec.)	3 x 1																			
	Timing																				
	Comments																				
	PROGRESSION																				

Walk – Jog: Begin running at 10-25% (patient-rated), progression by 10% steps to max 70%.

Jog – Run and Modified T-Drills: Begin running at 70% (patient-rated), progress as able by 10%. At 90%, progress by 5%.



**Orthopaedic & Sports Medicine Hospital**

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