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## **REHABILITATION PROTOCOL: Proximal Hamstring Repair**

This protocol is intended to guide clinicians through the post-operative course for proximal hamstring repair. This protocol is time based (dependent on tissue healing) as well as criterion based. Specific intervention should be based on the needs of the individual and should consider exam findings and clinical decision making. The timeframes for expected outcomes contained within this guideline may vary based on surgeon's preference, additional procedures performed, and/or complications. If a clinician requires assistance in the progression of a post-operative patient, they should consult with the referring surgeon.

The interventions included within this protocol are not intended to be an inclusive list. Therapeutic interventions should be included and modified based on the progress of the patient and under the discretion of the clinician.

### **Considerations for the Post-Operative Proximal Hamstring**

Many different factors influence the post-operative proximal hamstring rehabilitation outcomes, including chronicity of injury prior to surgery, length of retraction, number of tendons involved, pre-surgical gluteal motor control/strength and presence of any concomitant sciatic neural tension. It is recommended that clinicians collaborate closely with the referring physician regarding the above.

### **Post-Operative considerations**

If you develop a fever, intense calf pain, excessive drainage from the incision, uncontrolled pain or any other symptoms you have concerns about you should call your doctor.

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**PHASE I: IMMEDIATE POST-OP (0-2 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Allow healing of repaired tendon</li> <li>▪ Initiate early restricted and protected ROM</li> <li>▪ Prevent muscular atrophy</li> <li>▪ Decrease pain and inflammation</li> </ul>
<b>Weight Bearing</b>	<ul style="list-style-type: none"> <li>▪ TDWB with crutches</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>▪ Avoid hip flexion with knee extension</li> </ul>
<b>Range of Motion</b>	<ul style="list-style-type: none"> <li>▪ Active assisted and passive hip and knee flexion</li> <li>▪ Hip flexion ROM limit 60° flexion</li> </ul>
<b>Interventions</b>	<p><b>Manual Therapy</b></p> <ul style="list-style-type: none"> <li>▪ Peri-incisional mobilization</li> <li>▪ STM along hamstring muscle group as needed</li> <li>▪ Myofascial (no lotion) release to posterolateral glute and lateral hamstring fascia/muscle (proximal 1/3 of lateral thigh)</li> <li>▪ Attain and maintain neutral iliac position ipsilateral and contralateral to injured side with manual posterior rotations to ilium</li> </ul> <p><b>Stretching</b></p> <ul style="list-style-type: none"> <li>▪ Nerve gliding (sciatic neural flossing): if neural tension exists – Do not stretch the hamstring</li> <li>▪ Hip flexors in Thomas test position (maintain neutral pelvis/spine throughout stretch)</li> <li>▪ Gastrocnemius/Soleus stretching</li> </ul> <p><b>Therapeutic Exercises</b></p> <ul style="list-style-type: none"> <li>▪ Ankle pumps</li> <li>▪ Quad sets</li> <li>▪ AA and PROM hip flexion (60deg limit) and knee flexion</li> <li>▪ Upper body circuit training or upper body ergometer (UBE)</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ 2+ weeks post-operative</li> </ul>

**PHASE II: INTERMEDIATE POST-OP (2-6 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Reduce/resolve pain and edema</li> <li>▪ Good motor control and pain-free functional movements</li> </ul>
<b>Weight Bearing</b>	<ul style="list-style-type: none"> <li>▪ PWB 50% with crutches</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>▪ Continue post-op brace</li> <li>▪ Hip flexion limit to &lt;60°</li> <li>▪ Increase hip flexion limit at week 4 gradually to 90° by week 6</li> <li>▪ Avoid hip flexion with knee extension</li> <li>▪ No active hamstrings yet</li> </ul>

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	<ul style="list-style-type: none"> <li>▪ No active hip extension exercises</li> </ul>
<b>Range of Motion</b>	<ul style="list-style-type: none"> <li>▪ Active-assisted and passive hip and knee flexion</li> </ul>
<b>Additional Interventions</b> *Continue with Phase I interventions	<p><b>Manual Therapy</b></p> <ul style="list-style-type: none"> <li>▪ Scar mobilization</li> <li>▪ Gentle cross friction massage to proximal tendon including proximal to attachment on ischial tuberosity</li> <li>▪ Manual trigger point release as needed (common area is within distal 1/3 of biceps femoris)</li> <li>▪ Manual trigger point release as needed with ART (active release therapy) to piriformis, quadratus femoris</li> <li>▪ Anterior hip glides with and without external rotation at the hip (hip in neutral to slightly extended)</li> <li>▪ Posterior/inferior belted hip mobilizations as needed for full flexion (belted quadruped position with active movement into child's pose)</li> </ul> <p><b>Stretching</b></p> <ul style="list-style-type: none"> <li>▪ Hip external rotation in flexion</li> <li>▪ Limit/avoid piriformis stretching (massage instead)</li> </ul> <p><b>Therapeutic Exercises</b></p> <ul style="list-style-type: none"> <li>▪ Gluteal setting in prone</li> <li>▪ Gluteal setting in supine *above must be mastered before progressing any gluteal or hamstring muscle strengthening*</li> <li>▪ Low Double Leg (DL) Bridge</li> <li>▪ Side-lying hip abduction</li> <li>▪ Standing calf raises</li> <li>▪ Strengthening of uninvolved limb ok</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ 6 weeks post-operative</li> </ul>

**PHASE III: LATE POST-OP (6-12 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Normalized gait</li> <li>▪ Gradually progress to full ROM</li> <li>▪ Improve neuromuscular control</li> <li>▪ Increase strength</li> <li>▪ Enhance proprioception and kinesthesia</li> </ul>
<b>Weight Bearing</b>	<ul style="list-style-type: none"> <li>▪ Progressively wean crutches over the next 2 weeks to FWB</li> </ul>
<b>Precautions</b>	<ul style="list-style-type: none"> <li>▪ Discontinue brace at 6-8 weeks, per MD</li> </ul>

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<b>Range of Motion</b>	<ul style="list-style-type: none"> <li>▪ Progressive active hip and knee flexion</li> <li>▪ Active stretching all uninvolved muscle groups</li> </ul>
<b>Additional Interventions</b> *Continue with Phase I-II interventions	<b>Therapeutic Exercises</b> <ul style="list-style-type: none"> <li>▪ DL Bridge with band around thighs</li> <li>▪ DL Bridge with ball squeeze</li> <li>▪ DL Bridge with Upper back on the bench</li> <li>▪ Plank with alternating leg lifts</li> <li>▪ Side plank with leg lift (on left knee until stronger) or oblique twists</li> <li>▪ Straight Leg Raise (SLR)</li> <li>▪ Hamstring (HS) curls antigravity</li> <li>▪ Hip extension antigravity</li> <li>▪ 10 weeks postop:             <ul style="list-style-type: none"> <li>○ Single Leg (SL) bridge, back on floor, foot on bench</li> <li>○ Progress to ankle weight for all leg lifts PRE</li> <li>○ Wall slides</li> <li>○ Clam shells</li> <li>○ Partial squats</li> <li>○ Step ups</li> <li>○ Step downs</li> </ul> </li> </ul> <b>Cardiovascular Exercise</b> <ul style="list-style-type: none"> <li>▪ Stationary bike</li> <li>▪ Progressive slow walking on level surfaces</li> <li>▪ No running</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ Normalized gait all surfaces</li> <li>▪ Good control with functional movements without antalgic movement patterns</li> <li>▪ Hamstring strength 5/5 in prone with knee at 90° flexion</li> </ul>

**PHASE IV: TRANSITIONAL (13-16 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Full ROM</li> <li>▪ Improve neuromuscular control</li> <li>▪ Improve strength/power/endurance</li> <li>▪ Enhance dynamic stability</li> </ul>
<b>Precautions/ Guidelines</b>	<ul style="list-style-type: none"> <li>▪ Neoprene support as needed</li> <li>▪ No pain during strength training</li> </ul>
<b>Additional Interventions</b> *Continue with Phase I-III interventions	<b>Therapeutic Exercises</b> <ul style="list-style-type: none"> <li>▪ Gentle hamstring stretching</li> <li>▪ Cautious use of weight training machines</li> <li>▪ Single leg closed chain exercises</li> <li>▪ Resisted step ups using sports cord around waist from behind</li> </ul>

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	<ul style="list-style-type: none"> <li>▪ Double Leg Hamstring ball roll out (eccentric portion only) → DL eccentric and concentric → SL eccentric portion only → SL eccentric and concentric</li> <li>▪ Double Leg deadlift, short range → progressing to Single Leg no rotation</li> <li>▪ Double Leg deadlift – wide abducted leg stance with band around forefeet – pushing into abduction during eccentric phase of deadlift</li> <li>▪ Progress to single leg with spine rotation deadlift</li> <li>▪ Bridge on ball – eccentric portion only double leg → progressing to single leg</li> </ul> <p><b>Cardiovascular Exercise</b></p> <ul style="list-style-type: none"> <li>▪ Walk progression on level surface with gradual increase in speed and distance</li> <li>▪ Preparing to run</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ Good neuromuscular control in all planes without pain</li> <li>▪ HHD testing: To initiate plyometrics:           <ul style="list-style-type: none"> <li>○ LSI hamstring strength &gt;70/80%</li> <li>○ LSI glute med strength &gt;80%</li> <li>○ LSI quad strength &gt;80%</li> </ul> </li> <li>▪ To initiate running:           <ul style="list-style-type: none"> <li>○ LSI hamstring strength &gt;80/90%</li> <li>○ LSI glute med strength &gt;90%</li> <li>○ LSI quad strength &gt;90%</li> <li>○ Single leg hop cluster (distance, triple, cross over, 6 meter timed) &gt;85%</li> </ul> </li> </ul>

**PHASE V: EARLY RETURN TO SPORT (16-20 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Emphasis on gradual return to recreational activities</li> </ul>
<b>Precautions/ Guidelines</b>	<ul style="list-style-type: none"> <li>▪ Neoprene support as needed</li> </ul>
<b>Additional Interventions</b> *Continue with Phase II-IV interventions	<p><b>Therapeutic Exercises</b></p> <ul style="list-style-type: none"> <li>▪ Progressive strengthening avoiding overload to HS</li> <li>▪ Progress speed of resisted steps and add forward lean</li> <li>▪ SL dead lift with band under stance leg: hold for resistance</li> <li>▪ Reverse Lunge on Slider: Progress load bearing and add concentric/eccentric phase:           <ul style="list-style-type: none"> <li>○ Part 1: Eccentric hamstring with core strength exercise:</li> <li>○ Part 2: in full lunge position:</li> </ul> </li> <li>▪ Short range Nordic HS to physio ball height → progress range to ground depth</li> <li>▪ Kettle bell swing</li> <li>▪ Retro lunge slide</li> </ul> <p><b>Cardiovascular Exercise</b></p> <ul style="list-style-type: none"> <li>▪ Walk-to jog progression</li> <li>▪ No sprinting</li> </ul>

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	<ul style="list-style-type: none"> <li>▪ No speed work</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ Full ROM</li> <li>▪ No pain/tenderness</li> <li>▪ Satisfactory clinical exam including isokinetic testing</li> <li>▪ Walk to jog progression</li> </ul>

**PHASE VI: UNRESTRICTED RETURN TO SPORT (20-24 WEEKS AFTER SURGERY)**

<b>Rehab Goals</b>	<ul style="list-style-type: none"> <li>▪ Progressively increase activities to prepare for unrestricted functional return</li> </ul>
<b>Additional Interventions</b> *Continue with Phase II-V interventions	<p><b>Therapeutic Exercises</b></p> <ul style="list-style-type: none"> <li>▪ Continued isotonic strengthening exercises above</li> <li>▪ Continue ROM exercises</li> <li>▪ Progressive running/speed and agility</li> <li>▪ Jump training after 22 weeks</li> </ul> <p><b>Cardiovascular Exercise</b></p> <ul style="list-style-type: none"> <li>▪ Progress step ups to resisted jump onto steps</li> <li>▪ Plyometric progression             <ul style="list-style-type: none"> <li>○ Double leg up/down</li> <li>○ Double leg forward/back</li> <li>○ Alternating lateral bounding</li> <li>○ Single leg jump</li> <li>○ Progress plyometrics to resisted plyometrics using sports cord around waist</li> </ul> </li> <li>▪ Ladder drills</li> <li>▪ Falling start runs- see below for details</li> <li>▪ Mini hurdle runs</li> <li>▪ Sprint progressions (5 times each)             <ul style="list-style-type: none"> <li>○ 10 yard → 20 yd → assisted deceleration with band around waist deceleration lean</li> </ul> </li> <li>▪ 40 yard sprints at 90%</li> </ul>
<b>Criteria to Progress</b>	<ul style="list-style-type: none"> <li>▪ To Return to Play:             <ul style="list-style-type: none"> <li>○ LSI Hamstring strength &gt; 95%</li> <li>○ LSI Glute strength &gt;95%</li> <li>○ LSI quad strength &gt;95%</li> <li>○ Single leg hop cluster (distance, triple, cross over, 6 meter timed) &gt;95%</li> <li>○ Good acceleration, deceleration, change of direction control</li> <li>○ 60 second timed step-down test 80 bpm, with excellent control</li> <li>○ 60 second timed Lateral leap 60 bpm, with excellent control</li> </ul> </li> </ul>

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## Return to Running Program

This program is designed as a guide for clinicians and patients through a progressive return-to-run program. Patients should demonstrate > 80% on the Functional Assessment prior to initiating this program (after a knee ligament or meniscus repair). Specific recommendations should be based on the needs of the individual and should consider clinical decision making. If you have questions, contact the referring physician.

### PHASE I: WARM UP WALK 15 MINUTES, COOL DOWN WALK 10 MINUTES Day 1 2 3 4 5 6

Day	1	2	3	4	5	6	7
Week 1	Walk 5 min, Jog 1 min x 5 reps		Walk 5 min, Jog 1 min x 5 reps		Walk 4 min, Jog 2 min x 5 reps		Walk 4 min, Jog 2 min x 5 reps
Week 2		Walk 3 min, Jog 3 min x 5 reps		Walk 3 min, Jog 3 min x 5 reps		Walk 2 min, Jog 4 min x 5 reps	
Week 3	Walk 2 min, Jog 4 min x 5 reps		Walk 1 min, Jog 5 min x 5 reps		Walk 1 min, Jog 5 min x 5 reps		Return to Run

\*\*Only progress if there is no pain or swelling during or after the run

### PHASE II: WARM UP WALK 15 MINUTES, COOL DOWN WALK 10 MINUTES

Day	1	2	3	4	5	6	7
Week 1	20 min		20 min		20 min		25 min
Week 2		25 min		25 min		30 min	

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Week 3	30 min		30 min		35 min		35 min
Week 4		35 min		40 min		40 min	
Week 5	40 min		45 min		45 min		45 min
Week 6		50 min		50 min		50 min	
Week 7	55 min		55 min		55 min		60 min
Week 8		60 min		60 min			

**Recommendations**

- Runs should occur on softer surfaces during Phase I
- Non-impact activity on off days
- Goal is to increase mileage and then increase pace; avoid increasing two variables at once
- 10% rule: no more than 10% increase in mileage per week

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## Agility and Plyometric Program

This program is designed as a guide for clinicians and patients through a progressive series of agility and plyometric exercises to promote successful return to sport and reduce injury risk. Patients should demonstrate > 80% on the Functional Assessment prior to initiating this program. Specific intervention should be based on the needs of the individual and should consider clinical decision making. If you have questions, contact the referring physician.

### PHASE I: ANTERIOR PROGRESSION

Rehab Goals	<ul style="list-style-type: none"> <li>▪ Safely recondition the knee</li> <li>▪ Provide a logical sequence of progressive drills for pre-sports conditioning</li> </ul>
Agility	<ul style="list-style-type: none"> <li>▪ Forward run</li> <li>▪ Backward run</li> <li>▪ Forward lean in to a run</li> <li>▪ Forward run with 3-step deceleration</li> <li>▪ Figure 8 run</li> <li>▪ Circle run</li> <li>▪ Ladder</li> </ul>
Plyometrics	<ul style="list-style-type: none"> <li>▪ Shuttle press: Double leg alternating leg single leg jumps</li> <li>▪ Double leg:               <ul style="list-style-type: none"> <li>○ Jumps on to a box jump off of a box jumps on/off box</li> <li>○ Forward jumps, forward jump to broad jump</li> <li>○ Tuck jumps</li> <li>○ Backward/forward hops over line/cone</li> </ul> </li> <li>▪ Single leg (these exercises are challenging and should be considered for more advanced athletes):               <ul style="list-style-type: none"> <li>○ Progressive single leg jump tasks</li> <li>○ Bounding run</li> <li>○ Scissor jumps</li> <li>○ Backward/forward hops over line/cone</li> </ul> </li> </ul>
Criteria to Progress	<ul style="list-style-type: none"> <li>▪ No increase in pain or swelling</li> <li>▪ Pain-free during loading activities</li> <li>▪ Demonstrates proper movement patterns</li> </ul>

### PHASE II: LATERAL PROGRESSION

Rehab Goals	<ul style="list-style-type: none"> <li>▪ Safely recondition the knee</li> <li>▪ Provide a logical sequence of progressive drills for the Level 1 sport athlete</li> </ul>
Agility *Continue with Phase I interventions	<ul style="list-style-type: none"> <li>▪ Side shuffle</li> <li>▪ Carioca</li> <li>▪ Crossover steps</li> <li>▪ Shuttle run</li> </ul>

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	<ul style="list-style-type: none"> <li>▪ Zig-zag run</li> <li>▪ Ladder</li> </ul>
Plyometrics *Continue with Phase I interventions	<ul style="list-style-type: none"> <li>▪ Double leg:             <ul style="list-style-type: none"> <li>○ Lateral jumps over line/cone</li> <li>○ Lateral tuck jumps over cone</li> </ul> </li> <li>▪ Single leg (these exercises are challenging and should be considered for more advanced athletes):             <ul style="list-style-type: none"> <li>○ Lateral jumps over line/cone</li> <li>○ Lateral jumps with sport cord</li> </ul> </li> </ul>
Criteria to Progress	<ul style="list-style-type: none"> <li>▪ No increase in pain or swelling</li> <li>▪ Pain-free during loading activities</li> <li>▪ Demonstrates proper movement patterns</li> </ul>

### PHASE III: MULTIPLANAR PROGRESSION

Rehab Goals	<ul style="list-style-type: none"> <li>▪ Challenge the Level 1 sport athlete in preparation for final clearance for return to sport</li> </ul>
Agility *Continue with Phase I-II interventions	<ul style="list-style-type: none"> <li>▪ Box drill</li> <li>▪ Star drill</li> <li>▪ Side shuffle with hurdles</li> </ul>
Plyometrics *Continue with Phase I-II interventions	<ul style="list-style-type: none"> <li>▪ Box jumps with quick change of direction</li> <li>▪ 90 and 180 degree jumps</li> </ul>
Criteria to Progress	<ul style="list-style-type: none"> <li>▪ Clearance from MD</li> <li>▪ Functional Assessment             <ul style="list-style-type: none"> <li>○ Quad/HS/glut index <math>\geq 90\%</math> contra lateral side (isokinetic testing if available)</li> <li>○ Hamstring/Quad ratio <math>\geq 70\%</math></li> <li>○ Hop Testing <math>\geq 90\%</math> contralateral side</li> </ul> </li> <li>▪ KOOS-sports questionnaire <math>&gt;90\%</math></li> <li>▪ International Knee Committee Subjective Knee Evaluation <math>&gt;93</math></li> <li>▪ Psych Readiness to Return to Sport (PRRS)</li> </ul>