PROXIMAL HAMSTRING AVULSION REPAIR CLINICAL PRACTICE GUIDELINE

Background

The posterior thigh consists of three hamstring muscles: semimembranosus, semitendinosus, and biceps femoris. Proximal hamstring injuries and partial tears are common sports injuries; however, complete avulsion tears are more rare. Complete hamstring avulsion injuries occur most often from a slip or a fall that results in forced hip flexion along with knee extension. These injuries result in either complete or partial loss of hamstring function, depending on the severity of the injury and often times require surgical repair due to difficulty with ADL's and sport activities. Surgical repair is required when there is a complete 3-tendon tear or if there is significant retraction (> 2 cm) of two tendons or for partial tears that have failed conservative treatment. The surgical repair for a hamstring avulsion is an open procedure that requires anchors placed in the ischium, and sutures from the anchors are then used to secure the tendon to the ischium. If an avulsion fracture of the ischium is involved, it may require fixation via hardware and screws. Following surgery, patients are weight bearing as tolerated and use crutches for the first 2 weeks in order to protect the repair.

Disclaimer
Progression is time and criterion-based, dependent on soft tissue healing, patient demographics, and clinician evaluation. If you are working with an Ohio State Sports Medicine patient and questions arise, please contact the author by calling our office at (614) 293-2385.

Summary of Recommendations

General	• No end-range hamstring stretching or long-sitting for 6 weeks • No isolated isotonic hamstring strengthening for 8 weeks • Avoid fast walking for 6 weeks
Weight Bearing	• Weight bearing as tolerated with crutches for 2 weeks or until follow up with MD • Gradually increase weight bearing as able and wean off of crutches thereafter
Patient Reported Outcomes (PRO)	• Lower Extremity Functional Scale (LEFS) at each visit • Consider collecting the Hip Outcome Score (HOS) at 1st visit, monthly, and discharge ○ ADL (17 items) | Sports (9 items)
Criteria to Discharge Assistive Device	• Normalized gait with no increase in pain • SLS for at least 10 seconds without pain or compensation
Criteria to Initiate Plyometric Program	• Full, functional, pain free ROM • >80% quadriceps, hamstring (isokinetic testing if available), and hip strength compared to uninvolved leg • Squat >150% body weight (barbell squat or leg press) • 10 forward and lateral step downs from 8” step with proper mechanics
Criteria to Initiate Running Program	• Full, functional, pain-free ROM • > 80% quadriceps, hamstring (isokinetic testing if available), and hip strength compared to uninvolved leg • Squat >150% BW (barbell squat or leg press) • 10 forward and lateral step downs from 8” step with proper mechanics • Hop and hold with proper mechanics (uninvolved → involved) • Ability to tolerate 200-250 plyometric foot contacts without reactive pain • No gross visual asymmetry with treadmill/over ground running

Criteria for Return to Sport	• Functional testing:
	  ○ >90% Limb Symmetry Index (LSI) with hop testing
	• Isokinetic testing
	  ○ >90% strength LSI at 60°/sec, 180°/sec, and 300°/sec testing
	  ○ Hamstring to quadriceps strength ratio of 55-65% bilaterally
	• Strength: >90% body weight with SL leg press
	• Functional Performance: to date, no return-to-sport criteria have been tested and published for patients undergoing proximal hamstring avulsion repair
	  ○ Patients participating in sports activities should complete a number of sport specific tasks prior to being allowed to return to sport.
	• PROs: Score ≥ 90%
	• No increase in symptoms with sport-specific progression or testing
	• Physician clearance

Phase I: Early Post-Operative Protective Phase (0-4 weeks)

Goals	● Protect repair ● Pain control ● Wean off crutches

Precautions	● Weight bearing status
	  ○ Weight-bearing as tolerated (WBAT) with crutches for 2 weeks or until follow up with MD
	  ○ After 2 weeks or MD clearance, gradually increase weight bearing and wean off of crutches
	  ○ Educate patient on taking smaller steps when weaning off of crutches
	● Avoid combined hip flexion and knee extension (lengthened hamstring position)
	● No fast walking for 6 weeks

Therapeutic Exercises	● Glute sets
	● Ankle pumps
	● Quad sets
	● Abdominal bracing
	● Straight leg raises (abduction only)
	● Compression and cryotherapy
	● Gait training with crutches
	  ○ Shortened step length for involved lower extremity
	● Gentle PROM of hip and knee
	  ○ Perform hip flexion PROM with knee flexed >90 degrees only
	● Gentle soft-tissue mobilization at proximal insertion/incision site once wound is fully closed
	  ○ Consider desensitization techniques if needed
	● Initiate closed-chain terminal knee extensions (TKE's)

Criteria to Progress to Phase II	● Full hip, knee and ankle PROM in protected positions ○ Avoid lengthened hamstring position ● Good quad control in NWB position ● Pain and inflammation control ● Normalization of gait

Phase II: D/C Crutches to Pain free with ADLs (4-6 weeks)

Goals	• Protect repair • Initiation of hamstring strengthening
Precautions	• Avoid end range/aggressive lengthened hamstring position • Avoid walking up hills, fast walking

Therapeutic Exercises	• Initiate stationary bike (no resistance at first)
	• Initiate gentle hamstring stretching (minimal to no discomfort)
	• Continue soft tissue mobilization and/or desensitization techniques
	• Aquatic exercises (if available)
	• Initiate single leg stance and static proprioceptive activities
	• Initiate sub-maximal hamstring isometrics in supine
	  ○ Avoid lengthened hamstring positions initially
	  ○ Begin at 30°, 45°, 60°, then 90° knee flexion
	• Supine straight leg raises (flexion of hip 0° to 30° maximum)
	• Hip strengthening
	  ○ SLR abduction and adduction, clamshells, bridges
	• Calf raises
	• Core strengthening (focus on lumbopelvic control)

Criteria to Progress to Phase III	• Achieve 45° supine SLR PROM • Able to perform submaximal hamstring isometrics in all positions

Phase III: Isotonic Strengthening to Initiating Impact Activities (6-12 weeks)

Goals	● Correct compensatory movement patterns with functional movements ● Demonstrate functional control of lumbopelvic region ● Normalize strength of core/trunk and glutes ● Progressing from single to multi-planar movements ● Increase volume/intensity of aerobic activities; restore low-impact cardiovascular fitness ● Initiate progressive plyometric activities ● Straight leg raise 0°-70° PROM initially and progress to full PROM
Precautions	● Avoid aggressive stretching, especially at end-range ● Slow progression for return to walking/elliptical on an incline
Criteria to Initiate Plyometrics (Late phase)	● Full, functional, pain free ROM ● >80% quadriceps and hamstring (hip at 0° and 90° of flexion) strength compared to uninvolved leg ● Squat > 150% body weight (barbell squat or leg press) ● 10 forward and lateral step downs from 8" step with proper mechanics

Therapeutic Exercises	<u>Early Exercises</u>:
	● Elliptical, treadmill walking
	● Gentle isotonic resistive hamstring exercises
	  ○ Supine heel slides, bridge walkouts, standing or prone hamstring curls w/ light resistance
	  ○ Bilateral hamstring curl machine (light resistance)
	  ▪ Begin with mid-range strengthening initially if seated in machine
	● Progress dynamic core strength and trunk stabilization
	● Progress proprioceptive exercises
	  ○ Single leg stance variations with perturbations
	<u>Late Exercises:</u>
	● Gentle terminal/end-range hamstring stretching (avoid pain) at 8 weeks
	● Partial weight bearing plyometrics on shuttle
	  ○ Progress to FWBing hop-downs (light)
	  ▪ Start with 2 inch height box/step and progressively increase height
	  ▪ Progress from DL to SL
	● Progress hamstring and quad strengthening program
	  ○ Bilateral to unilateral
	  ○ Leg press
	  ○ Bridging on swiss ball
	  ○ Lunges (multi-directional)
	  ○ Dead lifts
	  ○ KB swings
	● Advanced core and trunk stabilization exercises
	● Dynamic proprioceptive activities

Criteria to Progress to Phase IV	● Full range of motion and 5/5 MMT
	  ○ > 80% quadriceps and hamstring (hip at 0° and 90° of flexion)
	  ○ Can perform isokinetic testing at 12 weeks to determine readiness to jog
	● SLR range of motion within normal limits

	● Tolerate hop downs with appropriate mechanics and no evidence of dynamic instability ● Squat > 150% body weight (barbell squat or leg press) ● 10 forward and lateral step downs from 8” step with proper mechanics

Phase IV: Return to Full Impact/Running (12-16 weeks)

Goals	● Progression of full-weight bearing plyometric activities without an increase in symptoms ● Isokinetic and functional hop testing for those needing return to sport clearance

Therapeutic Exercises	● Multi-directional plyometrics: DL → SL
	  ○ Incorporate hamstring-biased plyometrics
	● Progress single leg strengthening
	● RDLs (DL→SL) – start with BW only, slight bend in knees
	  ○ Progress to straight leg
	● Progress to eccentric hamstring strengthening
	  ○ Nordic hamstring curls

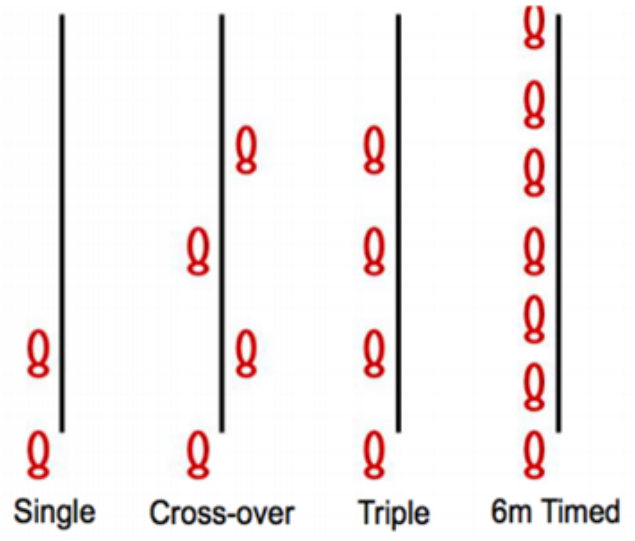
Criteria to Initiate Running	● Hop and hold with proper mechanics (uninvolved → involved) ● Ability to tolerate 250-350 plyometric foot contacts without reactive pain ● No gross visual asymmetry and rhythmic strike pattern with treadmill or over ground running ● Start on flat ground, decreased speed
Criteria to Progress to V	● Jog on treadmill and even surfaces with symmetrical mechanics and no symptoms ● Functional hop testing: > 80% LSI (Appendix A) ● Y balance 85% of greater on anterior and posterior lateral reach (Appendix B)

Phase V: Return to Sport/Full Activity (16-24 weeks)

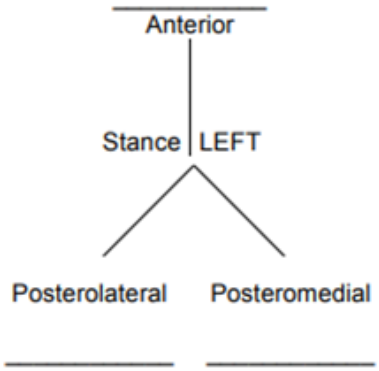
Goals	● Progressing multi-directional and advanced plyometrics ● Sport specific drills ● Physician clearance for return to sport
Therapeutic Exercises	● Multidirectional running ● Resisted forwards running ● Initiating sport specific drills ○ Progress from 50% to 75% to full speed/effort
Criteria for Discharge and Return to Sports	● Physician clearance ● Isokinetic testing: >90% LSI ○ Hamstring to quadriceps strength ratio of 55-65% bilaterally ● Functional hop testing: >90% LSI (see appendix) ● No increase in symptoms with sport specific progressions or testing

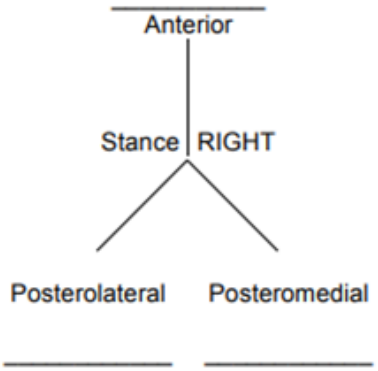
Appendix A: Single Leg Hop Series

1) **Single hop for distance:** Have the subject line their heel up with the zero mark of the tape measure, wearing athletic shoes. The subject then hops as far as he/she can, landing on the same push off leg, for at least 3 seconds. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
2) **Cross-over hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot, crossing fully over the center line each time. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
3) **Triple hop for distance:** The subject lines their heel up with the zero mark of the tape measure and hops 3 times on one foot. Each subject should hop as far forward as he/she can on each hop, but only the total distance hopped is recorded. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb distance/Uninvolved limb distance X 100%.
4) **Timed 6-meter hop:** The subject lines their heel up at the zero mark of the tape measure and hops, on cue with the tester, as fast as they can the length of the 6-meter tape. The arms are allowed to move freely during the testing. Allow him/her to perform 2 practice hops on each leg. Then, have the subject perform 2 testing trial, recording each distance from the starting point to the back of the heel. Average the distanced hopped for each limb. The Limb Symmetry Index: Involved limb time/Uninvolved limb time X 100%.



Appendix B: Y Balance





	Left	Right	Difference
Anterior			
Posteromedial			
Posterolateral			

Difference should be less than 4 cm for return to sport and preparticipation screening.

$$\text{Composite Score} = \frac{(\text{Anterior} + \text{Posteromedial} + \text{Posterolateral})}{(3 \times \text{Limb Length})} \times 100$$

Right	
Left	

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