

HAMSTRING and QUADRICEP INJURIES

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No Disclosures



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Objectives

- Anatomy and Physiology of the hamstring and quadricep muscles
- Pathology and Pathophysiology of the hamstring and quadricep muscles
- Discuss treatment plans and anticipatory guidance
- Discuss current concepts for prevention and treatment

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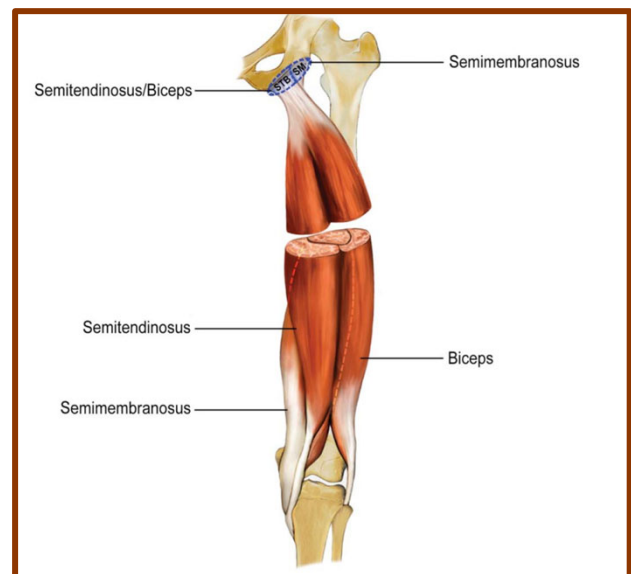
Anatomy

Hamstrings

- Origin: ischial tuberosity
- Insertion
- **Semitendinosus**
 - Medial surface of the tibia
- **Semimembranosus**
 - Medial tibial condyle
- **Biceps Femoris**
 - Long Head
 - Lateral head of proximal fibula
 - Short Head
 - Lateral head of proximal fibula
 - (*origin* – linea aspera of the femur and lateral supracondylar ridge of the femur)

Role of the **hamstring**:

EXTEND the **HIP** and **FLEX** the **KNEE**

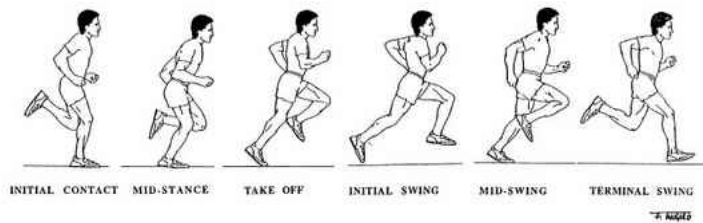


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Biomechanics

- Active for the entire running gait cycle
 - **Peaks** in activation during **terminal swing** and **early stance**
 - Terminal swing
 - Contract forcefully whilst lengthening to decelerate the extending knee and flexing hip
 - Hamstrings reach maximum length (107 – 110%)
 - **Most dangerous**



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Injury

- Epidemiology
 - **High** incidence per 10,000 athlete exposures
 - Indoor track
 - Soccer
 - Football
 - Loss of training time
 - **More than 28 days**
 - High recurrent rate
 - Football
 - Rugby
 - Soccer
- Risk factors
 - Modifiable
 - Inadequate warm-up
 - Increased training volume
 - Muscle fatigue
 - Hamstring inflexibility
 - **Hamstring weakness (strength imbalance)**
 - Lumbar-pelvic weakness
 - Poor biomechanics
 - Non-modifiable
 - Age
 - **Previous HSI**
 - Ethnicity

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Pathophysiology

- *Range*
 - Mild strain at the myotendinous junction to proximal hamstring injury
- **Strain**
 - Partial disruption of the MT unit
- **Avulsion**
 - Discontinuity or complete disruption of the unit from the origin
- By the numbers
 - Majority of hamstring injuries – MT junction of the biceps femoris
 - **Muscle belly injuries** > Tendon tears
 - 90% of injuries occur without contact



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Evaluation

- **HPI**
 - Posterior thigh pain, possibly a sensation of pulling
 - May have heard a "pop" and had to "pull up"
 - Bruising, swelling, muscle spasms
 - Pain with weight bearing exercises and difficulty with hip and knee flexion
- **PE**
 - Inspection: Bruising, swelling of posterior hip and thigh, straight leg gait
 - Palpation: TTP over area of interest
 - Strength: Noted weakness with knee flexion against resistance
 - Special tests
 - **Modified Bent-Knee**
 - Supine with leg extended
 - Flex knee and hip, then rapidly extend the knee.
 - **TOST**



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Diagnostic Studies



- XR pelvis and hip
 - r/o ischial tuberosity avulsion fracture
- Ultrasound
 - POCT
- MRI
 - **Gold standard**
 - More sensitive for follow-up imaging of healing injuries

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Grading

Grade 1

Mild

Grade 2

Partial tear

Grade 3

Severe, complete tear
hematoma



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Treatment

Grade I or II

- PRICE
- **Early PT**
 - Later focus on gluteal and core muscle strength
- NSAIDs
- **Early tx minimizes scar tissue** formation and aid in myofiber regeneration
- Early pain free ROM and controlled monitored exercises

Grade 3

- Surgical
 - Complete, Grade 3 proximal
 - High grade **distal** hamstring tear



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Orthopedics & Biomechanics Thieme

Semimembranosus Muscle Injuries In Sport. A Practical MRI use for Prognosis

Authors
Ramon Balius¹, Mireia Bossy², Carles Pedret¹, Lluís Capdevila³, Xavier Alomar⁴, Bry...

» Fig. 1 Diagram of the different regions of the SM muscle and their correspondence with axial planes MRI.

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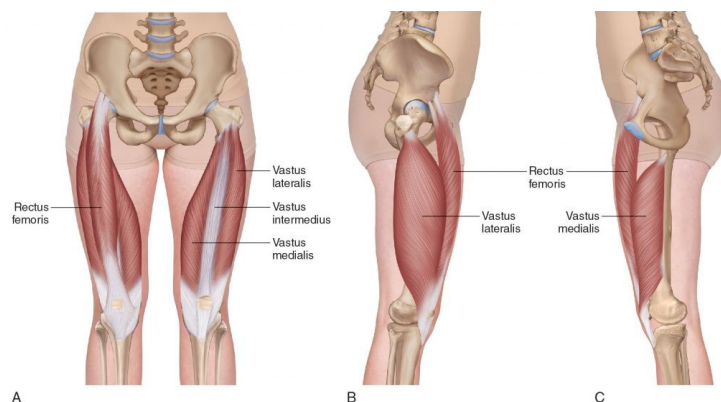
Proximal Hamstring Tendinopathy

- MOI
 - Inefficiency of hamstring eccentric contraction during the swing phase
 - Inadequate lengthening of the hamstrings during active hip flexion with knee extension
- TX
 - Rehabilitation and NSAIDs

Anatomy

Quadriceps

- *Insertion:* Tibial tuberosity via patella
- *Origin*
 - Vastus Lateralis
 - Greater Trochanter
 - Lateral lip of linea aspera
 - Vastus Medius
 - Intertrochanter line
 - Medial lip of linea aspera
 - Vastus Intermedius
 - Anterior and lateral surface of the femoral shaft
 - Rectus Femoris
 - AIIS

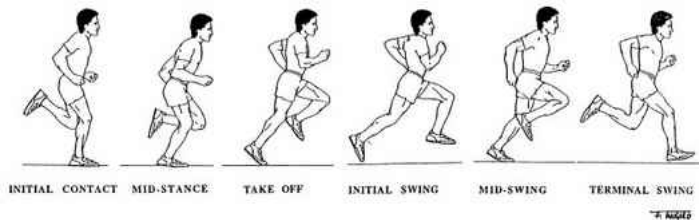


© Dr. Joe Muscolino (www.learnmuscles.com), art by Giovanni Rimasti

Role of the **Quadriceps**:
EXTEND the knee and **FLEX** the hip

Biomechanics

- Essential for kicking, cycling, running and jumping
 - All muscles work to **extend** the knee
 - **Rectus femoris flexes the hip**
 - Vastus medialis helps adducts thigh and stabilizes the kneecap
 - Running
 - Stride
 - Contraction of the quadriceps forces propulsion and absorbs impact during foot strike



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Injury

- Epidemiology (NCAA)
 - 1.07 per 10,000 athlete exposures
 - Soccer, Track
 - Women > Men
 - Preseason > Season
 - Noncontact and overuse
 - Loss of training time
 - About 1 week
- Risk factors
 - Modifiable
 - Inadequate warm-up
 - Increased training volume
 - Muscle fatigue
 - Inflexibility
 - Quad weakness
 - Lumbar-pelvic weakness
 - Poor biomechanics

JAT JOURNAL OF ATHLETIC TRAINING

J Athl Train. 2017 May; 52(5): 474-481. doi: 10.4085/1062-6050-52.2.17

PMCID: PMC5455251 | PMID: 28383282

Epidemiology of Quadriceps Strains in National Collegiate Athletic Association Athletes, 2009–2010 Through 2014–2015

Timothy G. Eckard, PT, DPT, OCS,¹ Zachary Y. Kerr, PhD, MPH,¹ Darin A. Padua, PhD, ATC,¹ Aristaroune Djoko, MS,² and Thomas P. Dornier, PhD, ATC²

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Pathophysiology

- Range
 - Mild strain at the myotendinous junction to proximal hamstring injury
- Strain
 - Partial disruption of the MT unit
- Avulsion
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Pathology

- **Quad strains**
 - Rectus femoris is most common
 - Occurs in sports that require forceful repetitive concentric and eccentric contraction
 - Sprinting, Football
 - Soccer
 - Kicking the ball with abruption during kicking motion
- **Evaluation**
 - HPI
 - Sharp pain
 - Loss of function
 - PE
 - Pain w/ resisted muscle activation, passive stretching and palpation
 - Possible Palpable defect
 - Assess strength
 - **Diagnostics**
 - XR, US, MRI



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Treatment and Anticipatory Guidance

- Treatment
 - RICE
 - Immobilization for Grade II – III strains for 3-5 days
 - Subsequent muscle activation and progress as pain and strength allows



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Pathology

Quad contusion

Rectus femoris is most common

Occurs in contact sports

Football, Soccer, Rugby

- Evaluation
 - HPI
 - Sharp pain
 - Loss of function
 - PE
 - Pain w/ resisted muscle activation, passive stretching and palpation
 - Possible Palpable defect
 - Assess strength
 - Diagnostics
 - XR, US, MRI

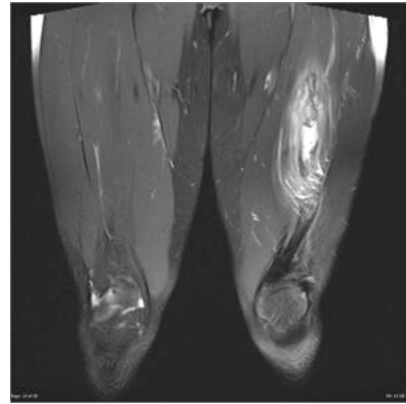


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Treatment and Anticipatory Guidance

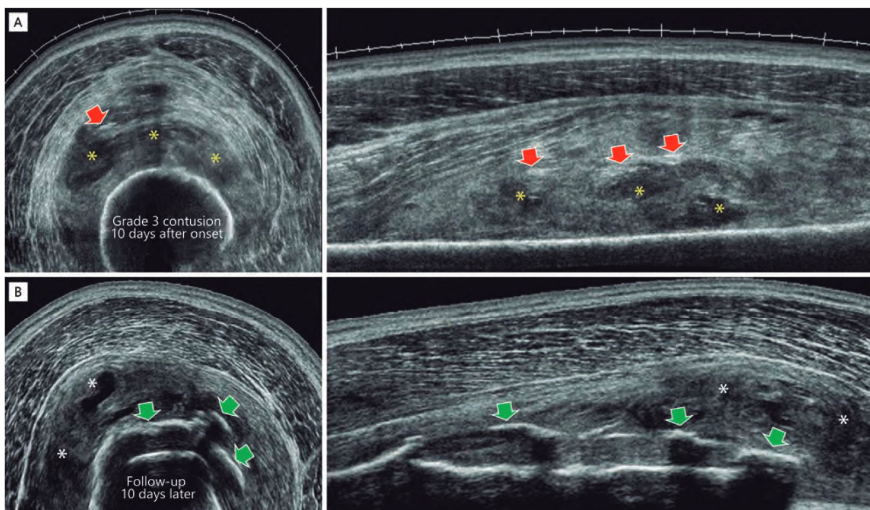
- Treatment
 - RICE
 - **Quadriceps flexion for 24 hours**
 - Reduces the likelihood of **myositis ossificans traumatica** formation
- **Myositis ossificans traumatica**
 - Painful firm area in the region of contusion
 - Occurs within 2-3 weeks
 - Reduced knee flexion and strength
 - Occurs in 9-17% of quad contusion
 - Consider early evaluation with POCT US
 - TX
 - NSAIDS, stretching, ROM and strengthening
 - Consider surgical excision in recalcitrant cases (1-2 years out without improvement)



Source: Physiopedia



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Source: *Ultrasound of the Musculoskeletal System: Anatomical exploration and pathology ebook*

Figure 14-32. Myositis ossificans. **(A)** Transverse and panoramic longitudinal sections after a contusion in the vastus intermedius muscle, presenting a clearly delimited image with a hypoechoic, homogeneous center (asterisks) surrounded by a poorly defined, more or less echogenic ring (red arrows). This sonographic pattern corresponds to the so-called "zone effect" and suggests the development of myositis ossificans. **(B)** 10-day follow-up: the same sections showing myositis ossificans in the vastus intermedius muscle. The hyperechoic ring corresponding to the zone effect has gradually become more prominent to the point of producing heterotopic ossification with posterior acoustic shadowing (green arrows).



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Current Concepts

- **Prevention**

Incidence and prevalence of hamstring injuries in field-based team sports: a systematic review and meta-analysis of 5952 injuries from over 7 million exposure hours

Nirav Maniar ^{1,2} Declan Singleton Carmichael,¹ Jack Thomas Hickey ^{1,2}
 Ryan Gregory Timmins ^{1,2} Argell Joseph San Jose,¹ Jessica Dickson,³
 David Opar ^{1,2}



Heiderscheit et al.
 BMC Sports Science, Medicine and Rehabilitation (2022) 14:128
<https://doi.org/10.1186/s13102-022-00520-3>

BMC Sports Science, Medicine and Rehabilitation

STUDY PROTOCOL Open Access

The development of a HAMstring InjuRy (HAMIR) index to mitigate injury risk through innovative imaging, biomechanics, and data analytics: protocol for an observational cohort study

Bryan C. Heiderscheit^{1*}, Silvia S. Bliemker², David Opar³, Mikel R. Stiffler-Joachim¹, Asheesh Bedi⁴, Joseph Hart⁵, Brett Mortensen⁶, Stephanie A. Kliethermes^{1,2} and The HAMIR Study Group

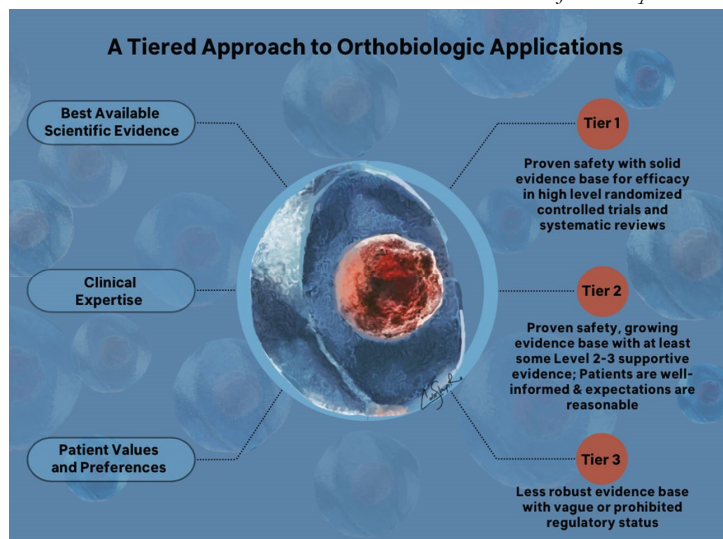
San Antonio

Current Concepts

- **Treatment**

- Orthobiologics
- Shockwave therapy

Source: BJSM. Shapiro et al



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Thank you

