

MedFit Classroom

Orthopedic Fitness Specialist Course

Module 6: The Hips

Authors:

Dr. Irv Rubenstein & Christine Conti, M.Ed.

Learning Objectives

- Lesson 1
 - Functional Anatomy
 - Skeletal
 - Muscular
- Lesson 2
 - Common pathologies
 - Hamstring tendinopathy
 - Gluteus medius tendinopathy
 - Groin strains
 - Femoroacetabular impingement
 - Interview with Ashley Campbell, DPT
 - Arthritis
 - Interview with Dr. Andrew Shinar
- Lesson 3
 - Exercises for the Hip
 - Gluteus medius/minimus
 - Gluteus maximus
 - Adductors
 - Rotators

Lesson 1: Anatomy



Images: in2itmedical.com

my.clevelandclinic.org

Femoro-Acetabulum Alignment

Described from a superior viewpoint as the angle of the femur's tilt and rotation

- Normal - anterolateral
- Anteversion - internally rotated
- Retroversion - externally rotated

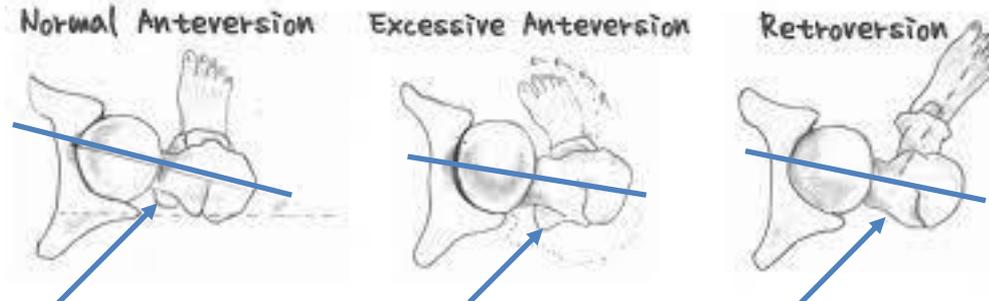
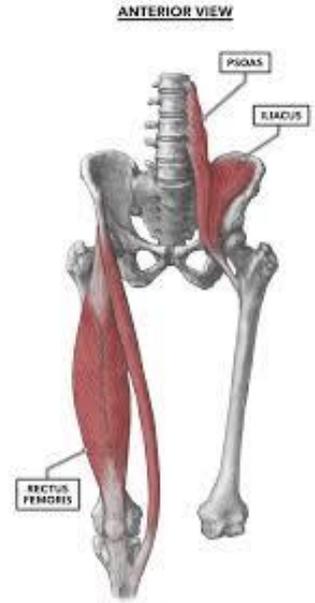


Image: miles4hips.com

Functional Anatomy Hip Flexors

- Psoas/Iliopsoas
- Rectus femoris
- Sartorius
- Tensor fascia lata (secondary)
 - When extended, it helps flex



Hip flexor fatigue or tightness affects swing phase clearance, increasing fall risk

Image: crossfit.com; Hip musculature, Part 1.

The Extensors

Gluteus maximus (Gmax)

Extension + Lateral Rotation

Hamstrings

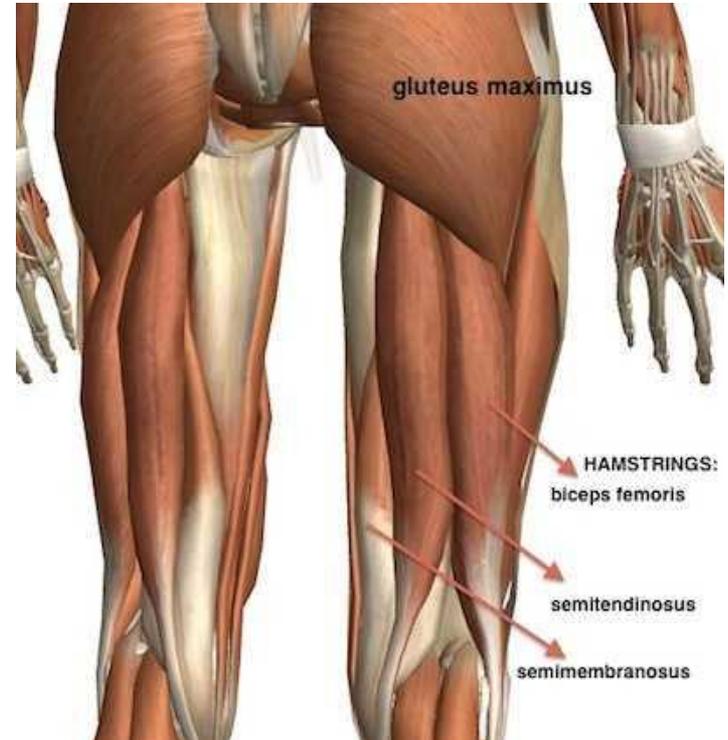
Biceps femoris - lateral, 2-joint
Semitendinosus/Semimembranosus

Tensor fascia lata

When flexed, it helps extend

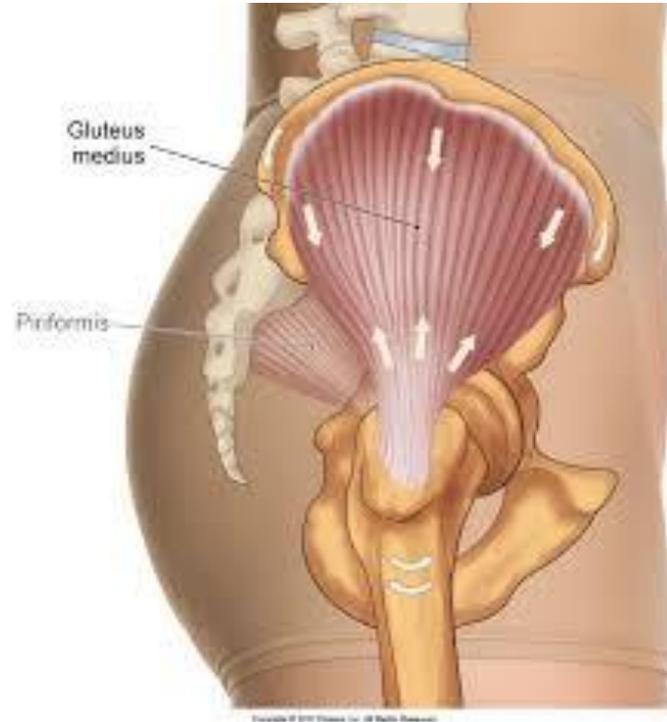
Adductor Magnus

Image: Bodybuilding-wizard.com



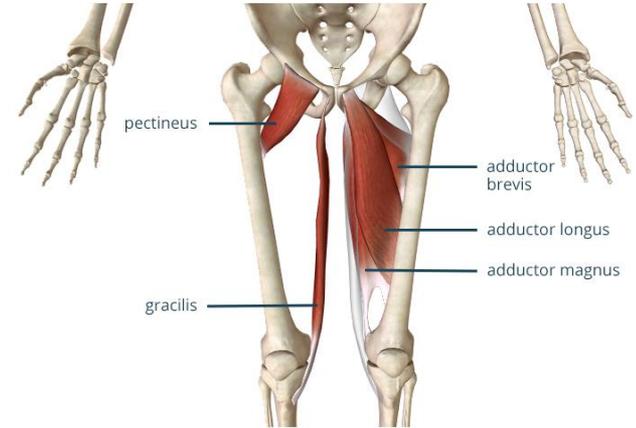
The Abductors

- **Gluteus medius (Gmed)**
- **Gluteus minimus (Gmin)**
- **Gluteus maximus**
- **Tensor fascia lata (TFL)**
 - **When Gmed is deficient**
- **Sartorius**



The Adductors

- **Adductor magnus**
 - 2 nerves: Hip and Hamstring origins
 - Flexes, adducts, ext rotation
- **Adductor longus**
- **Adductor brevis**
- **Gracilis**
- **Pectineus**

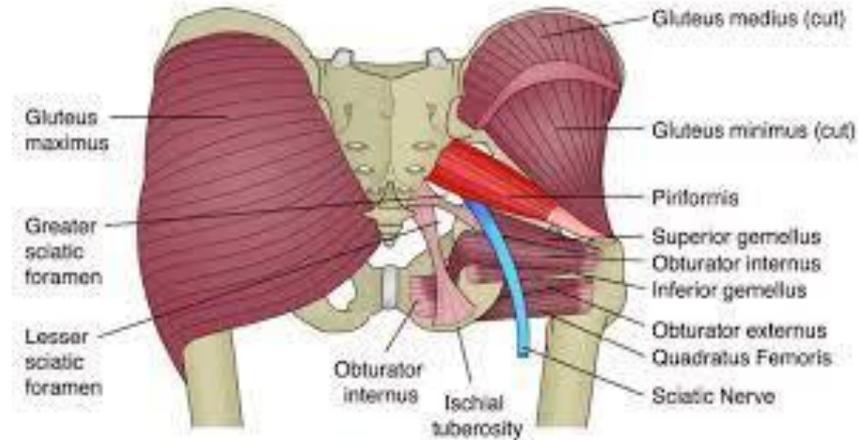


<https://www.kenhub.com/en/library/anatomy/adductor-magnus>

Image: Precisionmovement.coach

The External Rotators

- **GMax** - from flexed position
- **GMed**, posterior fibers - when extending from flexed position
- **Piriformis** - while standing
- **Sartorius**
- **Superior and inferior gemelli**
- **Obturator internus**
- **Quadratus femoris**
- **Adductor magnus**
 - **Adductor part, also hip flexion**



<https://www.kenhub.com/en/library/anatomy/adductor-magnus>

Image: [greenlotusyoga.com](https://www.greenlotusyoga.com)

The Internal Rotators

- **TFL** - standing, from extension
- **GMed**, anterior fibers - when flexing from an extended position
- **GMin**
- **Piriformis** - while seated
- **Obdurator externus**
- **Adductor longus and brevis**



Image: core advantage.com.au

Lesson 2: Common Pathologies

- **Hamstring strain/tendinopathy**
- **Medial Tendinopathy/trochanteric bursitis**
 - **Trendelenburg sign**
- **Groin strain/symphysis pubitis**
- **Femoroacetabular impingement (FAI)**
- **Osteoarthritis**

Hamstring Tendinopathy

- **2-joint muscle**
- **Injured during high-speed/high-force eccentric phase of gait; usually proximal biceps femoris**
- **Might entrap sciatic nerve with adhesions or scarring; hematoma**

Grade I - edema but no tear

Grade II - partial tears (<50% of cross-sectional area)

Grade III - >50% or full tear

“Hamstring Syndrome”

Coined by Puranen and Orava

“...posttraumatic or congenital fibrotic hard bands irritate sciatic nerve at the insertion site of hamstring muscles to ischial tuberosity. The tendon-like or scarred bands are located deep to the biceps femoris insertion, on its anterolateral or anterior side. They compress the sciatic nerve while sitting and, especially, when hip joint is flexed with knee extended.”

Factors Contributing to Hamstring Injuries

- Eccentric strength (Nordic hamstring) - relative or absolute
- Fascicle length (especially Biceps Femoris)
- Strength imbalance (9% - 10%)



Opar, Ruddy, Williams, Maniar, Hickey, et. Al. MSSE Feb. 2022

Image: [5280cryo.com](https://www.5280cryo.com)

Training the Hamstrings Right

Preventive: Heavy eccentrics - Nordics, RDLs, DLs, Squats, Lunges, Multi-directional Lunges; running, agility, cutting drills; core

Corrective: IMs, OKC hamstring curls - high rep, low load, slow eccentrics, CKC hamstring curls with stability ball, squats, lunges, RDLs, Nordics

Gmed Tendinopathy

- aka Trochanteric bursitis
- Creates/created by a Trendelenburg gait pattern
 - Could result from impact from a fall, LLD, overpronation
 - Test by standing on one leg for 30 sec. with hips level
- Noticeable limp with pelvis dropping on opposite side

Neuro- fascial considerations for Gluteal Tendinopathy

- Nervous system only activates the glutes to around 10% of maximum capacity during the sit-to-stand
- Any injury from low back to foot/toe can inhibit
- Many could also be caused by it

Bret Contreras, How to fix glute imbalances, Jan. 2013. <https://bretcontreras.com/how-to-fix-glute-imbances/>

Not All Is What It Seems

- Hip Add known related to many knee injuries, especially in female runners
- Gmed activation is not predictive of hip Add
- Femoral anteversion (where femoral neck leans forward) causes leg to medially rotate and is more predictive of hip Add during late swing and early stance

Managing Gmed Tendinopathy

- Isometrics
- Low-to-medium-load symmetrical bilateral exercises (squats)
- Bilateral moves with resistance bands
- Single-leg and core movements
- Self-myofascial release, dynamic stretching

Groin Strain, Symphysis Pubitis

(Aka osteitis pubis, pubic symphysis)

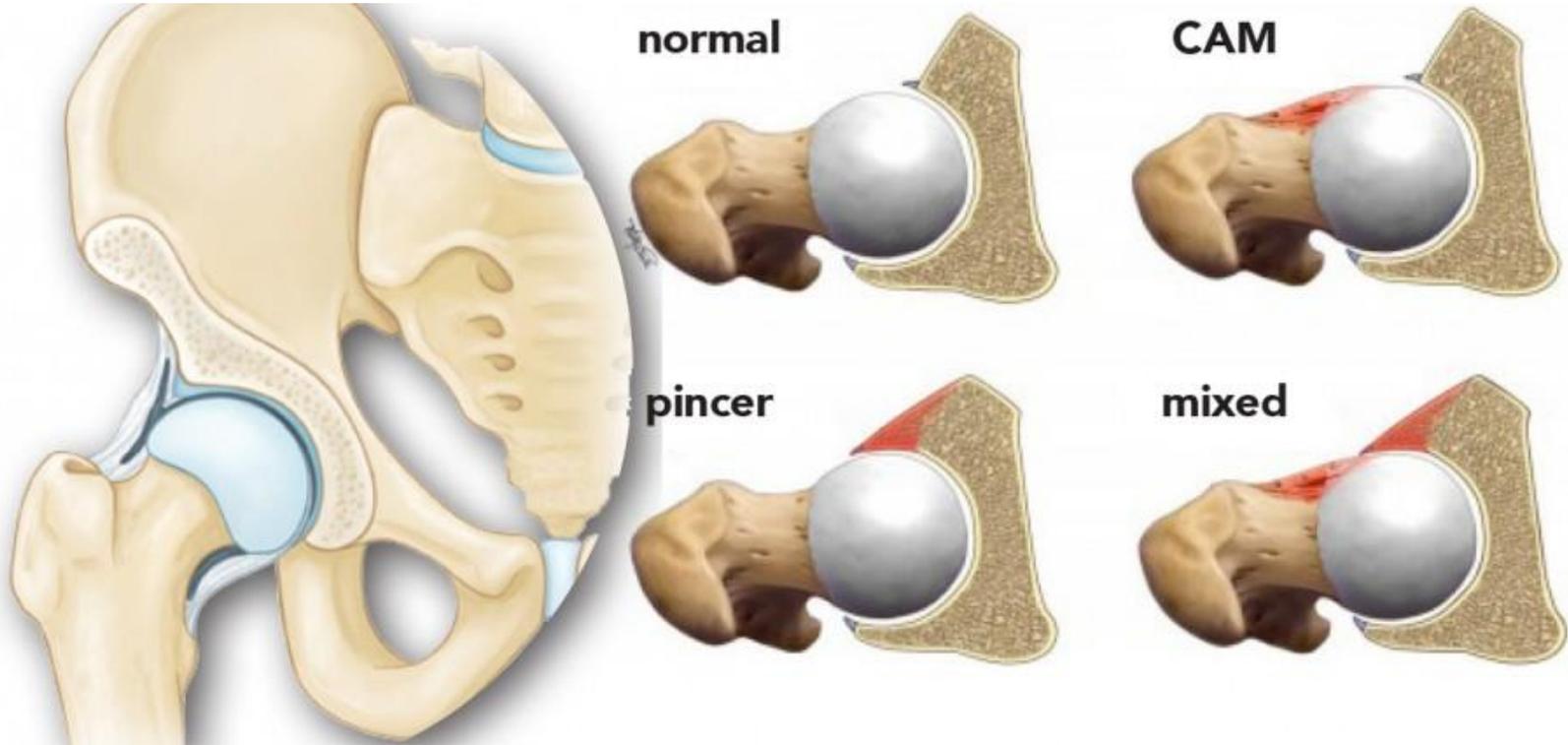
- Pubic symphysis is non-synovial, cartilaginous joint, ligaments prevent motion (except in pregnancy and delivery) - becomes unstable
- Generally an **overuse** injury - splits, landing hard, high kicking, changing direction, gait dysfunction
- Pain in groin and radiating into abdomen and thigh; often mistaken as muscle strain
- Requires rest, gentle adductor ROM, core ex

https://www.physio-pedia.com/Pubic_Symphysis_Dysfunction

Managing Adductor Strains

- To stretch or strengthen? That is the question...
 - Is a weak muscle a flexible one?
- IM strength improved after a year but not up to that of uninjured controls
- Copenhagen adductor exercise for IM, heavy eccentric loading

Femoroacetabular Impingement (FAI)



Does Physical Activity Contribute To Hip Morphology?

- Cam - 15-25% in males, 5-15% in females
- Do power sports (hockey, basketball, et al.) contribute?
- REPETITIVE HIP FLEXION & EXTERNAL ROTATION stimulate osseous overgrowth
 - Possibly due to higher rates of acetabular alignment
 - adolescence or early adulthood

“...increased stress on an open capital femoral physis leads to pathologic bone overgrowth at the anterolateral head-neck junction”

Ashley Campbell, DPT, ScS, CSCS

- Board-Certified Sports Physical Therapist, Nashville, TN.
- Director of Rehabilitation for Dr. Thomas Byrd's Nashville Sports Medicine and Orthopaedic Center, specializing in the care of non-arthritic hip pathologies.
- Worked with athletes of all ages, all levels - MLB, PGA, NFL, NHL, and NBA
- Adjunct faculty member for Belmont University's School of Physical Therapy
- Managing Editor of the International Journal of Sports Physical Therapy

Ashley Campbell Interview

Hip Arthroscopy & PT Guidelines

- **Routine arthroscopy (remove loose bodies, debride labrum, chondroplasty)**
 - Weight Bearing as tolerated (WBAT)
 - ROM - pain as guide
- **Femoplasty/Acetabuloplasty**
 - WBAT - avoid loaded twisting/turning
 - ROM - pain as guide
- **Labral repair**
 - 50% BW
 - <90 deg hip fx, no ext for 4 wks; after 6 wks, full AROM/PROM

Hip Arthroscopy (cont'd)

- **Capsular closure**
 - Weight bearing depends on concomitant procedures
 - ROM - no hip ext beyond what's present

- **Microfracture**
 - 30# Partial-weight bearing with flat foot
 - ROM - no limits

Hip Arthritis

2nd most common

Risk factors, other than age, include:

- “High exposure prior to age 50 was found to increase the odds of hip OA” with track and field and rackets sports having highest odds
- Physical activity in “early adult life”
- Work-related stair climbing (men) and heavy lifting (women)
- BMI >28.0 kg/m

Hip OA



Image: svuhradiology.ie

Hip Arthroplasty for Osteoarthritis

Benefits

vs

Risks

Pain reduction

Functional mobility

Athleticism including near-full ROM

Infection

Subluxation/Dislocation

LLD

Scarring/adhesions

pain and reduced ROM

Death

Hip Arthroplasty Components

- Acetabular with metal (larger, but metal shavings) or highly-cross linked polyethylene plastic or ceramic (newer) liner
- Femoral stem
- Femoral head - metal (larger but metal shavings), polyethylene/plastic, ceramic

Best? femoral head made of ceramic or metal and the acetabular socket is made of either cross-linked polyethylene or ceramic.

Longest? Metal head, poly liner.

THA Components



Better Patient Outcomes with Shared Decision-making

- When patients engage in “high-quality, informed, patient-centered (IPC) decisions” there were no significant differences shortly after and at 6 months after arthroplasty for those who got THA
 - Remember: TKA patients did have greater satisfaction and less regrets when IPC decisions were made

Traditional Postero-lateral Approach

- Advantages

- Easier access, larger field of view
- Preferred after acute fractures

- Disadvantages

- Longer recovery due to cut Gmed and Gain
- Similar but later functional outcomes at 6 mos.
- Higher risk of subluxation/dislocation
- Restrictions against flexion >90 deg + internal rotation

Anterior Approach

- Advantages

- Incision on front of thigh
- No muscles cut, just moved aside
- Less post-op pain
- Faster mobility/stability recovery
- Fewer post-op precautions

- Disadvantages

- Slightly higher rates of wound healing
- More difficult in obese or heavily-muscled patients
- Similar potential for nerve damage but not sciatic - maybe lateral cutaneous

Comparison of Femoral Prosthesis and Surgical Approach

- Investigated whether certain prosthetic stems are more prone to complications as a function of approach
- No difference in all-cause cumulative percent revisions but the anterior had a higher rate of loosening and fracture.

Dr. Andrew Shinar

- **Hip and knee replacement specialist at Vanderbilt University**
- **Stanford University - BS, Columbia University - MD, and Harvard University - joint replacement fellowship**
- **Associate Professor at Vanderbilt since early 2000**
- **Currently president of Southern Orthopaedic Association**

Dr. Andrew Shinar Interview

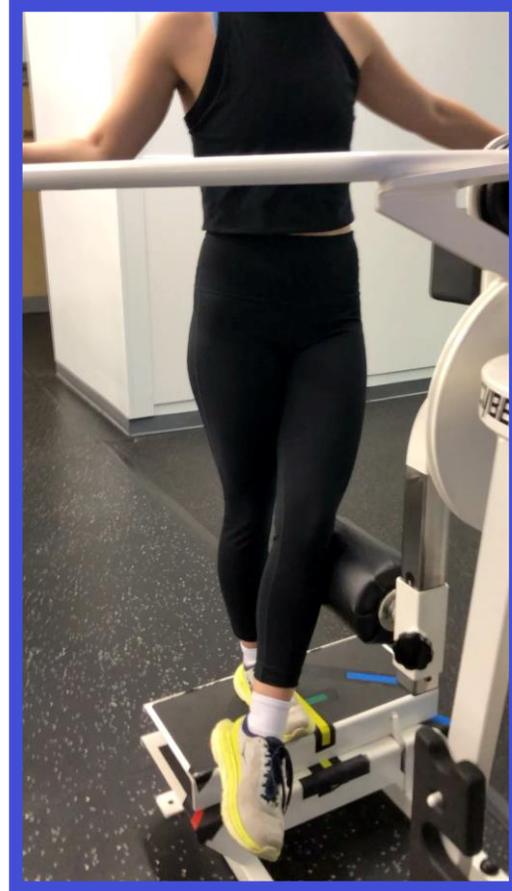
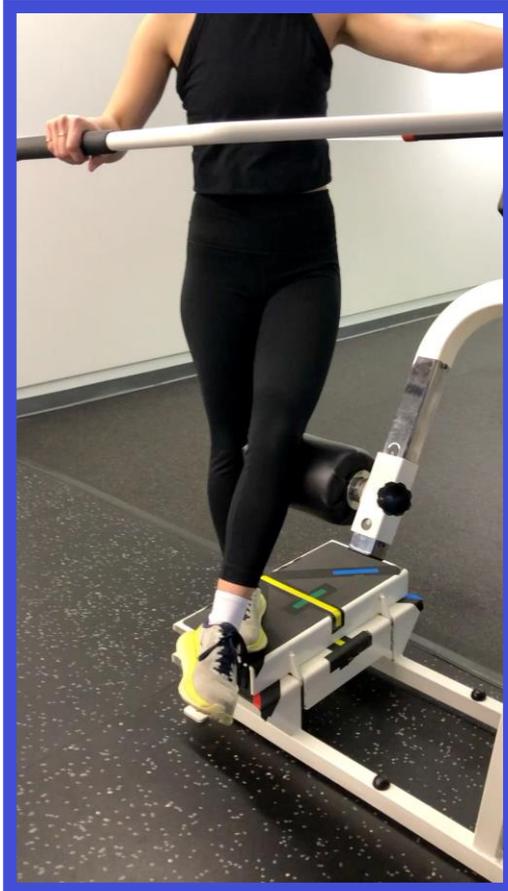
Lesson 3: Gmed Exercises

- Clamshells - external/reverse (internal)
- Side-lying hip abduction
- Standing hip abduction - machine/band/loop
- Monster walk - loop/Monster band/APT
- 2-leg to 1-leg bridge - floor, stability ball
 - Unbanded, banded, IM
- Biased static/stepping flexed-hip lunge
 - Contralateral weight
 - Contralateral tube

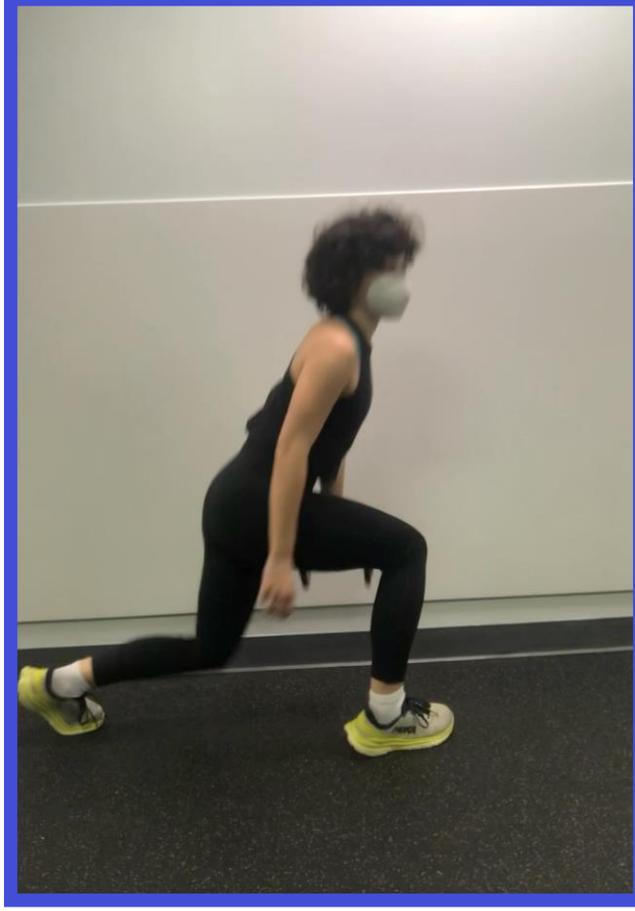
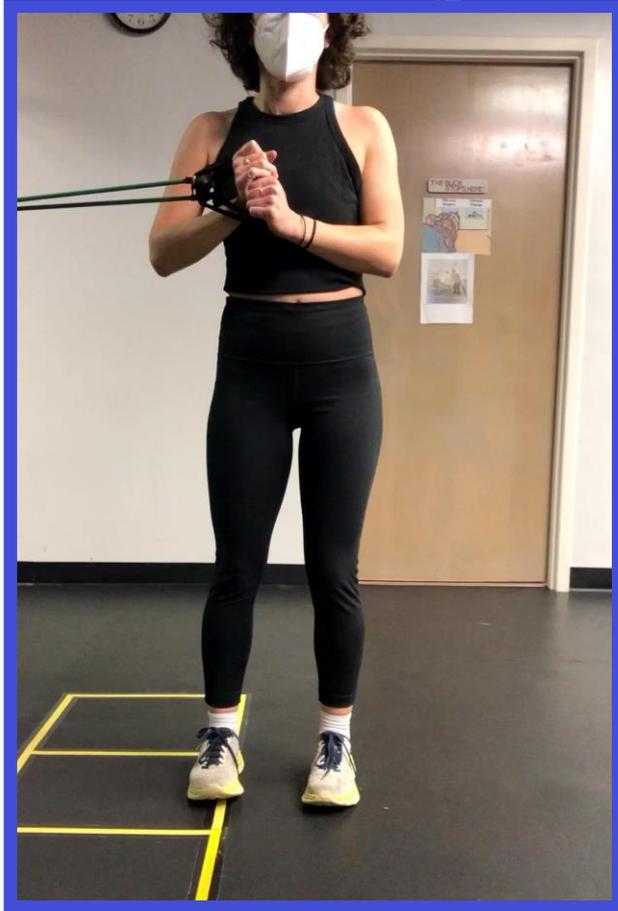
Lateral Pelvic Tilts



Multi-Hip Machine



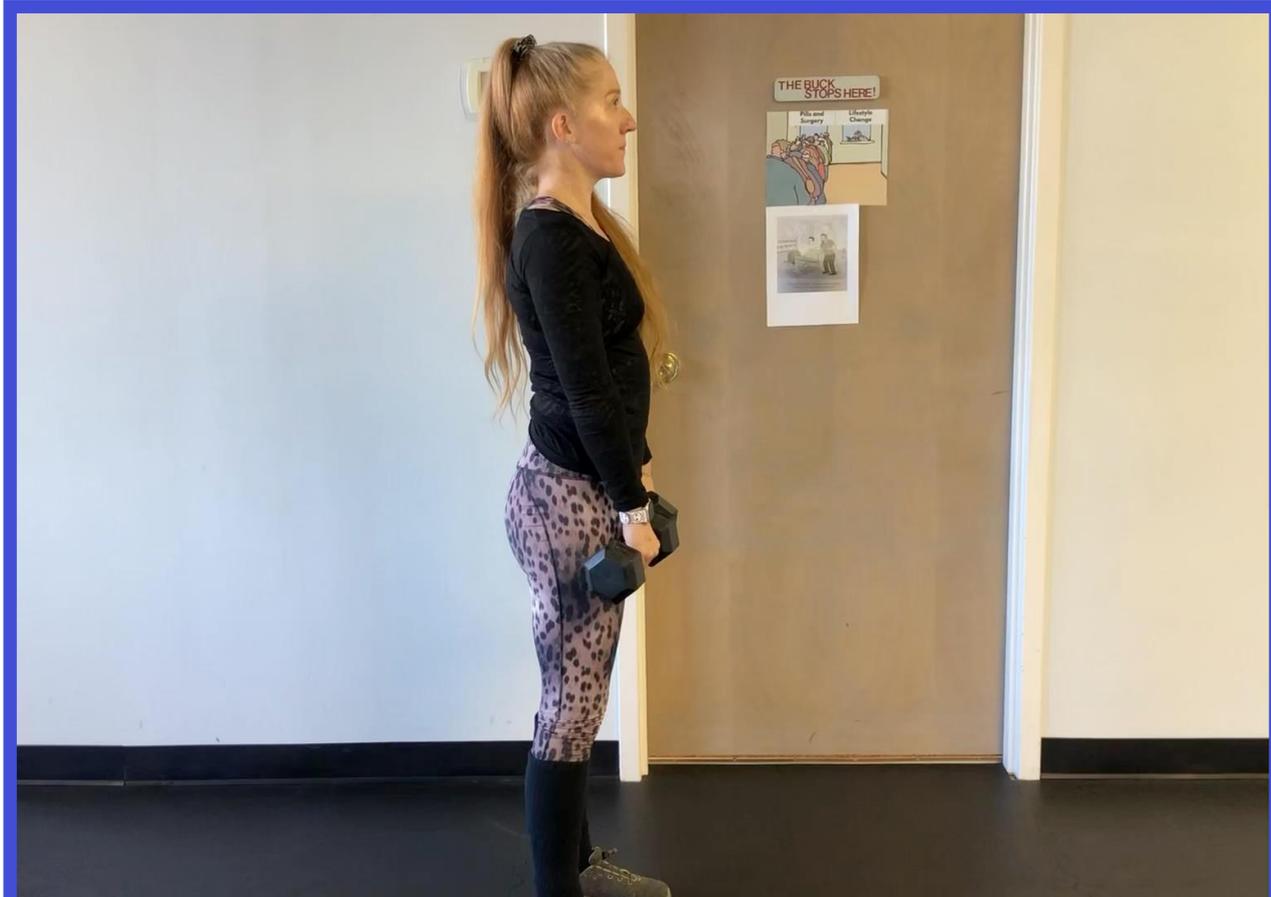
Asymmetric Loading



Gmax Exercises

- RDL - 2-leg, toe-down, 1-leg
- Reverse lunge
- Flexed-hip step up - forward, lateral
- Hip thrusters - proven horizontal thrust for sprinters so why not walkers?
- Swiss ball Table Tops
 - Unilateral upper body exercises, e.g. bench press, chest fly

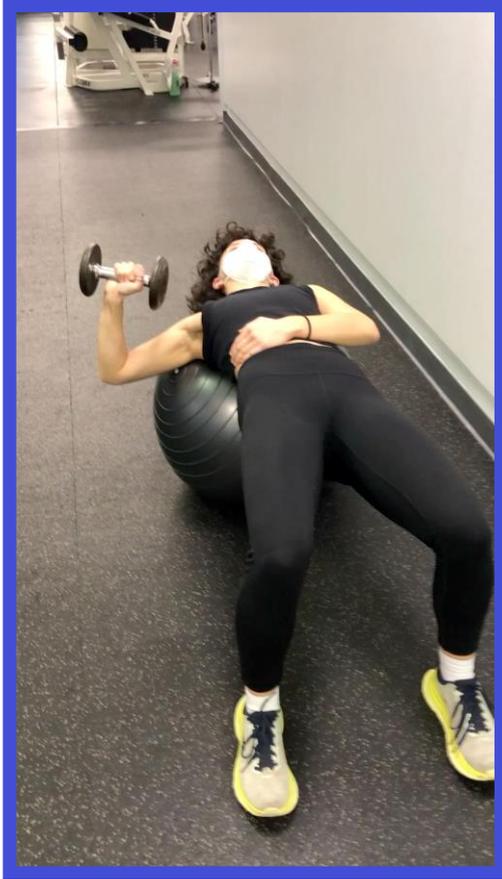
RDL Variations



Gluteus Maximus Exercises



Gmax + Core



Hip Adductor Exercises

- Squats, lunges
- Supine or seated IM (pillow squeezes)
- Machine - seated, standing
- Tubes - standing
- Copenhagen adductors - side-lying plank with foot on chair or held by trainer

Copenhagen Adductors



Hip Rotator Exercises

- For Internal Rotators
 - 90-90 with tension from contralateral direction
 - Sit, squat/leg press with ball squeeze
 - Lunge with ipsilateral resistance
- For External Rotators
 - 90-90 from ipsilateral side
 - Lunge with contralateral resistance

Internal Rotation



External Rotation



Flexibility & Mobility

- Passive stretching for both
 - Long, slow - muscle creep
- Active/dynamic stretching for mobility
 - Cardinal and rotational and diagonal planes
- PNF for both
 - Take care at end ROMs

ITB



Piriformis



Hip Rotators Stretches

Manual 90-90



Prone



Hip Flexors/Iliospsosas

Bed



Chair



Standing



Kneeling



Hip QUIZ

At this time, please complete and successfully pass the “Hip Quiz” before continuing to the next section.



References

MD, G. S. (2022, February 16). *Adductor Magnus muscle*. Kenhub. Retrieved April 6, 2022, from <https://www.kenhub.com/en/library/anatomy/adductor-magnus>

TRUNZ, L.M., LANDY, J. E., DODSON, C. C., COHEN, S. B., ZOGA, A. C., & ROEDL, J. B. (2021). Effectiveness of hematoma aspiration and platelet-rich plasma muscle injections for the treatment of hamstring strains in athletes. *Medicine & Science in Sports & Exercise*, 54(1), 12–17. <https://doi.org/10.1249/mss.0000000000002758>

PURANEN, J., & ORAVA, S. (1988). The hamstring syndrome. *The American Journal of Sports Medicine*, 16(5), 517–521. <https://doi.org/10.1177/036354658801600515>

OPAR, D. A., RUDDY, J. D., WILLIAMS, M. D., MANIAR, N., HICKEY, J. T., BOURNE, M. N., PIZZARI, T., & TIMMINS, R. Y. (2021). Screening hamstring injury risk factors multiple times in a season does not improve the identification of future injury risk. *Medicine & Science in Sports & Exercise*, 54(2), 321–329. <https://doi.org/10.1249/mss.0000000000002782>

How to fix glute imbalances. Bret Contreras. (2016, December 14). Retrieved April 6, 2022, from <https://bretcontreras.com/how-to-fix-glute-imbalances/>

LIU, J. A., LEWTON, K. L., COLLETTI, P. M., & POWERS, C. M. (2021). Hip adduction during running: Influence of sex, hip abductor strength and activation, and pelvis and femur morphology. *Medicine & Science in Sports & Exercise*, 53(11), 2346–2353. <https://doi.org/10.1249/mss.0000000000002721>

References

- Pubic symphysis dysfunction*. Physiopedia. (n.d.). Retrieved April 6, 2022, from [https://www.physio-pedia.com/Pubic Symphysis Dysfunction](https://www.physio-pedia.com/Pubic_Symphysis_Dysfunction)
- Westermann, R. W., Scott, E. J., Schaver, A. L., Schneider, A., Glass, N. A., Levy, S. M., & Willey, M. C. (2021). Activity level and sport type in adolescents correlate with the development of Cam Morphology. *JBJS Open Access*, 6(4). <https://doi.org/10.2106/jbjs.oa.21.00059>
- Richmond, S. A., Fukuchi, R. K., Ezzat, A., Schneider, K., Schneider, G., & Emery, C. A. (2013). Are joint injury, sport activity, physical activity, obesity, or occupational activities predictors for osteoarthritis? A systematic review. *Journal of Orthopaedic & Sports Physical Therapy*, 43(8). <https://doi.org/10.2519/jospt.2013.4796>
- Jonathan Cluett, M. D. (2020, August 19). *Why the bearing surface is critical to hip replacement longevity*. Verywell Health. Retrieved April 6, 2022, from <https://www.verywellhealth.com/hip-replacement-part-material-4157864>
- Sepucha, K. R., Vo, H., Chang, Y., Dorrwachter, J. M., Dwyer, M., Freiberg, A. A., Talmo, C. T., & Bedair, H. (2021). Shared decision-making is associated with better outcomes in patients with knee but not hip osteoarthritis. *Journal of Bone and Joint Surgery*, 104(1), 62–69. <https://doi.org/10.2106/jbjs.21.00064>
- Kevin Anbari, M. D. (n.d.). *Advantages and disadvantages of anterior hip replacement*. Arthritis. Retrieved April 6, 2022, from <https://www.arthritis-health.com/surgery/hip-surgery/advantages-and-disadvantages-anterior-hip-replacement>

References

Hoskins, W., Rainbird, S., Peng, Y., Graves, S. E., & Bingham, R. (2021). The effect of surgical approach and femoral prosthesis type on revision rates following total hip arthroplasty. *Journal of Bone and Joint Surgery*, *104*(1), 24–32.
<https://doi.org/10.2106/jbjs.21.00487>