Hip Rotators: Friend or Foe

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Anatomy/Function/Performance

- Anatomy
  - Deep to the Glutes
  - 6 Muscles
  - Only muscle group in the human body located exclusively in the horizontal/transverse plane.
    - Gravity eliminated plane of motion
    - Categorically distinct and requires unique analysis and training
- Function
  - Goniometric Method – Sitting and non-functional
  - Manual Muscle Testing Method – Again, non-functional
Performance Model

- Implications of Text Book Model
  - Clinical/Training Room/Weight Room
  - Exercise philosophy based on text book definitions yields a model contrary to function in sport
  - Proprioceptively confusing to the tissue & inhibits carryover

- Performance Definition of the Hip External Rotators
  - Foot Strike: The External rotators decelerate femoral (hip) Internal Rotation
  - Along with the Gluteus Max, via its attachment to the IT Band, the hip external rotators decelerate TIBIAL Internal Rotation

Drivers of LE Internal Rotation

- Flexion of the lower extremity is due to GRAVITY
- ROTATION?
  - Rotation is not directly driven by gravity
  - What causes rotation of the lower extremity (Tibia, Femur, Hip)?

- Subtalar Joint
  - Torque Converter Mechanism of the LE
  - Takes frontal plane motion of the heel (calcaneal eversion at heel strike) and converts it into Internal Rotation of the Tibia and up the kinetic chain
  - Likened to a Mitered Hinge
  - The main cause of rotation of the lower extremity

Text Book vs. Performance

- Text Book Definition
  - Piriformis: Externally Rotates the Femur
    - CONCENTRIC

- Performance Definition
  - Eccentrically lengthens and contracts to decelerate femoral Internal Rotation
    - ECCENTRIC
FRIEND

• Decelerates GRF in the entire lower extremity
• Attenuates/Dissipates forces from the knee
• Provides rotational stability to the Ankle
• When doing its job, the Hip Rotators are the most significant players in preventing injuries in the LE

Rotation in Sport

• Football
  – Suh — right foot about to plant and drive LE into internal rotation combined with left hand reaching across further driving LE into IR with increased force and velocity
• Soccer
  – Cristiano — (L) Foot about to plant and drive (L)LE into internal rotation and (L)LE kicking ball ACROSS body to further drive (L) Hip into IR
  – Same for Corner Kick
• Volleyball
  – Dig — (R) Foot plant combined with UE rotational reach across body drives (R) Hip into further and faster internal rotation

Rotation in Sport

• Baseball
  – Hip external rotators ECCENTRICALLY lengthen (S.E.E. Stored Elastic Energy) to generate power for swing
• Main Point
  – Every step drives HIP into internal rotation and external rotators get lengthened and have to decelerate rotational moments
“Foe” - Deficits

• Intrinsic – Inherent in the hip rotators
  – Tight/Weak

• Extrinsic – Biomechanical influences that
  CAUSE the hip rotators to be deficient

INTRINSIC

Decreased Internal Rotation

• Amplified Torque on ACL
• Increased Demand on IT Band
• Patellofemoral out of SYNC
• Achilles takes up the slack for weak hip
  rotators
• Ankle Sprains
• Posterior Tibialis Tendonitis
• Hamstring Strains

ACL

• Deceleration does not occur at the knee but at the
  FOOT and the HIP.
  – The knee is more of a “reactor” and is influenced by GRF
    coming up from the foot as well as strengths/deficiencies
    present in the hip
  – For example, a compensated forefoot varus can drive the
    knee into a valgus position predisposing the ACL to valgus
    stress
  – The well researched occurrence of gross weak hip
    musculature playing into ACL injuries. More importantly,
    tight/weak hip rotators predispose the ACL to increased
torque and valgus stress
IT Band (Chronic)
More of a Rotational problem than Frontal

- Traditionally thought of only in the FRONTAL PLANE
- Yet, the IT Band strongly anchored to the femur by obliquely oriented fibrous strands (therefore reacts in the transverse plane to femoral internal rotation).
  - Key Anatomy – Inserts at Gerdy’s Tubercle on the lateral aspect of the Tibia. Again, at heel strike, the internal rotation of the Tibia influences the IT Band in the transverse plane.
  - Clinical incidence of IT Band Syndrome patients have decreased hip internal rotation on the affected side

Patellofemoral

- The patella is caught in the middle and strongly influenced by the Hip and Foot
  - Only 4 Muscles directly attach to the patella (Quads) while over 21 attached to the femur
  - Not the VMO’s fault. The patella is out of sync with femur and tibia.
    - Tight hip rotators, via its attachment to the patella through the ITB, can directly cause PFP or out of sync.
    - Leg length discrepancy and other biomechanical issues have greater influence on patella than the VMO

Achilles

- During the gait cycle and running, push off is more the result of momentum or the body’s forward movement over its center of mass than actual concentric contraction of the calf group.
- Push off is not because of the Achilles but is due to the energy transfer from the Hip to the Achilles. The hip has a huge impact on push off and GRF. Tight hip flexors in the sagittal plane shorten the stride length, cause early heel rise and premature push off, thereby affecting the Achilles. Not necessarily due to weak calf as in traditional models
  - Tight hip external rotators decreased hips ability to attenuate torque coming up the chain, coupled with hypermobile calcaneus, cause the Achilles to take up the slack for the hip with subsequent strain etc.
Hamstring Strains

• Traditionally viewed exclusively in the Sagittal Plane
• However, has a significant role in the transverse plane.
  – Decelerates INTERNAL ROTATION of the femur and the TIBIA via the insertion of the Biceps Femoris on the head of the fibula & lateral tibial condyle
• Clinical incidence of patients with hamstring strains with concurrent tight hip external rotators with decreased hip internal rotation

Hamstring Strains

  – Subsequent attenuation of forces (torque) occurring at the hamstring due to transverse plane deficiencies at the hip. In other words, the hamstring takes the hit for decreased hip IR.
  – The dissipation of forces to the hamstring from the hip (top down) can be exacerbated by biomechanical factors at the foot (bottom up) such as a hypermobile rearfoot varus, leg length discrepancy, late pronation of the forefoot in the gait cycle, etc. causing either increased amount or velocity of tibial internal rotation which in turn increases moments or torque attenuated to the hamstring.

Hamstring Strains/LE Injuries

• Strategy – Rehab and Train the hamstring through facilitating hip internal rotation.
• Once the affected tissue has been treated (such as in the above slide of the ACL, IT Band, PFP, Achilles, Ankle Sprain) attention given to increasing the motion and eccentric strength of the hip external rotators will address the CAUSE and be missing link to attaining improved performance.
EXTRINSIC

• Biomechanics
  – Leg Length Discrepancies
    • Longer Leg – Compensation of increased pronation to functionally shorten the LE causing increased Internal Rotation and torque but tight hip rotators won’t allow for it. Tug – O – War at knee
      – Patellofemoral
      – IT Band Syndrome
      – Quad Strains

EXTRINSIC

• Leg Length Discrepancy
  – Short Leg – Compensates by externally rotating at the hip which shortens the hip external rotators
    ▶▶▶ Decreased Hip Internal Rotation
      • ACL
      • Medial Meniscus
      • Hamstring Strains (Decreased hip IR)
      • Hip Flexor Strains
      • Achilles Tendonitis

EXTRINSIC

• COUPLING
  – External rotators are tight (decreased hip IR) compounded with biomechanical deficits layered on top of this, thereby amplifying its affects.
    • Example: Compensated Forefoot Valgus – The forefoot (LAMTJ) is everted or down and the 1st Ray gets to the ground before the rest of the foot and undergoes increased GRF. The rearfoot (RF) comes in to help (RF Compensation) and INVERTS in order to unload the 1st Ray. This inversion of the RF causes the lateral border of the foot to get overloaded (if rigid LAMTJ) leading to subsequent instability and ankle sprains.
Extrinsic Coupling

- Compensated Forefoot Valgus Example
  - Stress Fracture to 5th Met
  - Lateral Ankle Instability (As above)

HIP Approach

- Hip Approach
  - Focus on Compensatory Deficits at the Hip
    - Cause/Compensation – The foot may be the Cause (Compensated FF Valgus, etc.) with possible orthotic for treatment. For the sake of this course, we will focus on the HIP (Compensation) because it’s ALWAYS a component of the deficiency.

The PROBLEM

- Lack of Assessment
  - Current trends neglect testing of unilateral hip function, especially Hip Rotation Testing
- Lack of Training
  - Emphasis on linear and lateral movements with neglect of movements to train the hip into internal rotation
Performance Model vs. Traditional Model

- Traditional Model
  - Concentric Textbook Exercises/Nonfunctional and not sport specific
- Performance Model
  - Takes into account the FOOT and GRF
  - Dynamic vs. Static
  - Agility Drills to drive Hip IR
  - Explosive Drills to drive Hip IR
  - ECCENTRIC ECCENTRIC ECCENTRIC

Lab Session

- Ladder Drills
  - Lateral Lunge with UE Contra-lateral rotational reach to touch floor on outside of lunge leg
  - Not just a lateral lunge but a ROTATIONAL Reach
  - Warm-Up Forward
  - Forward and Backward
  - Once form is good, increase SPEED
  - Add dumbbells for progression

Lab Session

- Star Drill
  - 9 Cones
  - 3 steps plus approx. 6” from center cone to perimeter cones
  - Use step length of person doing drill if possible
  - Always TIME this drill and document
  - As with ladder drill, contra-lateral reach
  - Once forwards is mastered, progress to backwards
  - Add bands at ankles for resistance as well as dumbbells
Lab Session

- 3D Lunges
  - Front Lunge with Contra-lateral reach
  - Side Lunge with Contra-lateral reach
  - Rotational Lunge with Contra-lateral reach
    - Right: Right foot rotates back to between 4:00-5:00 on a clock. Left foot stays STRAIGHT
    - Left: Left foot rotates back to between 7:00-8:00 on a clock. Right foot stays straight.
    - Reach low to touch floor outside of foot. Do not reach high – just rotates through back instead of hip

Bibliography

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