

BIOMECHANICAL INFLUENCES ON THE SOCCER PLAYER

Functional performance of the soccer player reflects functional capability of certain specific muscle and muscle groups of the back, pelvis and hip to work cooperatively in three biomechanical “planes”. The muscles and patterns of muscle function that lead to strain, overuse syndromes and sprains of the ankle, knee, hip and back are presented. Suggestions will be offered on how to avoid:

1. **Groin and hamstring strains** by strengthening hip extensors and restoring rotational components through the hips (glutes).
2. **Ankle sprains** by maximizing adduction and abduction activity in the frontal plane at the hips and trunk when landing.
3. **Patella-femoral pain, medial knee strain and meniscal tears** of the knee by optimizing rotational activity in the transverse plane at the hips and mid back when reaching, squatting, and passing on one “loaded” leg.
4. **Hip flexor and low back tightness** by engaging back flexors and hip extensors, activity in the sagittal plane, during shooting, jumping and throwing.

Demonstration of specific tests and performance enhancement techniques should assist the soccer coach, parent and trainer in minimizing the above injuries and future development of asymmetrical biomechanical “learned” patterns.

Planes of Lumbar Pelvic Femoral (Back, Pelvic, Hip) Muscle Function

Frontal

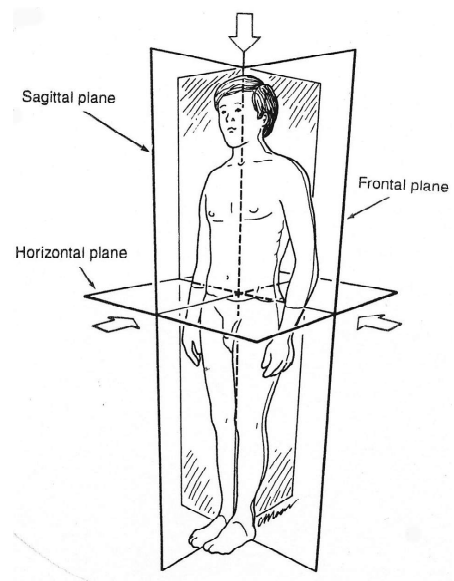
- ❖ Hip adductors (inner thigh) / abductors (outer thigh)
- ❖ Trunk side-benders (lateral abdominals / intercostals)

Sagittal

- ❖ Hip flexors (IT band) and back extensors (paravertebrals or muscles along spine) are a “family” of muscle since they extend the back and flex the hips at the same time.
- ❖ Trunk or back flexors (abdominals) and hip extensors (glutes and hamstrings) are another “family” of muscle that flex or round out the back and extend the hip and leg when you dribble on the move, pass low, or shoot from a squatted position (free throw position).

Transverse

- ❖ Hip rotators (glute max externally rotate leg and glute med internally rotate leg) and trunk rotators (abdominal obliques) are a “family” of muscle that depend on symmetry or neutral position of the pelvis to work correctly. Without good adductor and abductor control, trunk flexion and hip extension, and trunk sidebending capability, compensation, fatigue, and strain will occur in the high school basketball player and control at all three planes will be lost at the hips and lower extremity joints.



PERFORMANCE TESTS & MEASUREMENTS

Adduction Drop Test

Patient lies on their side with knees & hips bent at 70-90°. Stand behind the patient & passively flex the upper hip & knee to 90°. Abduct & extend the hip to a neutral position while keeping knee bent. Passively stabilize the patient's hip from falling backward. Slowly allow the patient to lower their leg to the table. Repeat test on the opposite side.

Positive test: Indicated by a restriction that does not allow sufficient adduction (the medial side of the top knee should touch the heel of the bottom leg).



Positive



Negative

Standing Reach Test



Positive

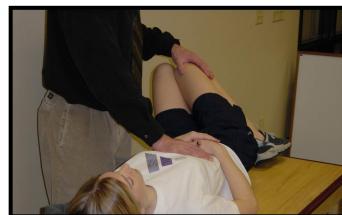


Negative

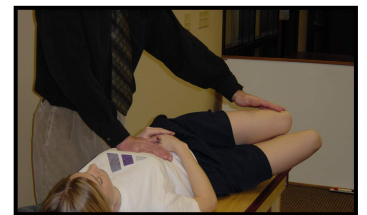
Trunk Rotation

Patient lies on their back with knees bent and feet together. Stand next to the patient and place one hand on the lower ribs to stabilize the trunk and use the other hand to rotate the legs to the trunk's resting state. A yardstick may be used to measure the distance from the table to the upper-most point of the knee. Repeat test on the opposite leg.

Positive test: Indicated when the legs do not rotate in one direction as compared to the other.



Positive



Negative

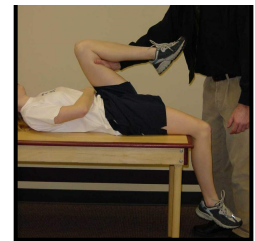
Extension Drop Test

Patient lies on their back with both thighs half off the table. Stand in front of the patient & flex both knees to his/her chest until back is flat. Passively lower one leg over the edge of the table. Do not allow the leg to "turn out". Hold the opposite leg close enough to the chest to maintain the low back against the table. Repeat test on the opposite leg.

Positive test: Indicated by an inability to rest the thigh on the table.



Positive



Negative

Bilateral Step Around



Top Five Goals: Achieve & Maintain

1. Full standing reach to floor capability (sagittal)
2. Symmetrical reach with arms on contralateral flexed hips (transverse)
3. Ability to balance on single leg with contralateral abs (frontal)
4. Ability to flex trunk without hip extension (sagittal)
5. Equal trunk rotation bilaterally

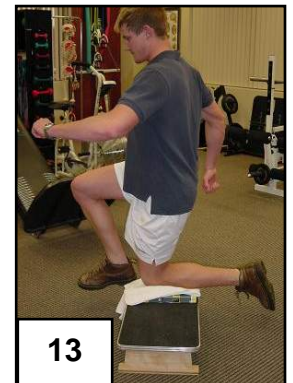
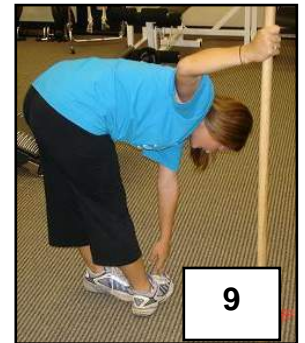
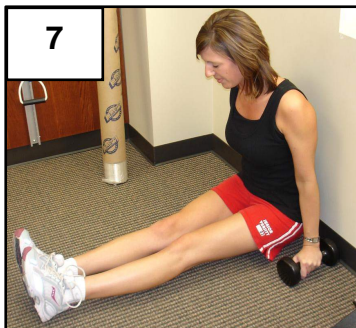
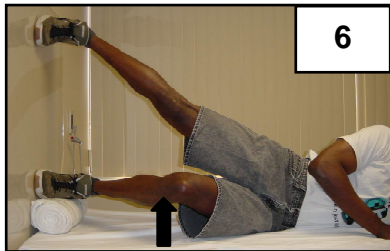
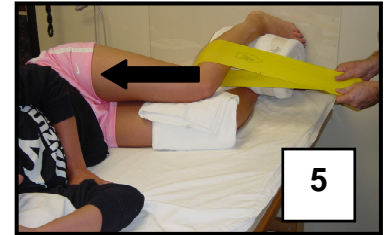
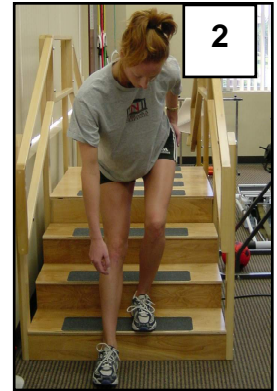
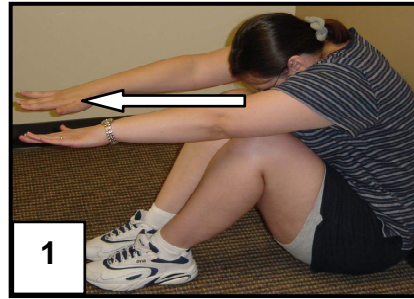
Functional Performance Equipment

- ❖ 4-6" Ball
- ❖ Stairs
- ❖ Dumbbells
- ❖ Dowel
- ❖ 2" block or phonebook
- ❖ Elastic Band (FitLoops™)



Active Functional Performance Tests & Drills in Sagittal & Transverse Planes

1. Short-Seated Reach
2. Retro Stairs
3. Retro Walking
4. Standing Wall Reach
5. Adductor Pull Back
6. Sidelying Adduction with Abduction
7. Long Seated Press Downs
8. Seated Reciprocal Pull Backs with IR
9. Step Arounds
10. Standing Trunk Around
11. Gorilla Walk
12. Adductor Pull-In
13. Single Leg Knee



FUNCTIONAL TRAINING

Integrated, Multi-Planar Movements that Involve Joint Acceleration, Stabilization & Deceleration

Traditional Training

- Less emphasis on kinetic chain integration
- Focus upon body building techniques
- Force production
- Joint isolation & single plane movements
- Often utilizes external stabilizers (chairs, benches)

Functional Training

- Facilitates motor learning & neuromuscular adaptations
- Force reduction (deceleration of joints)
- Multi-joint & multi planar movements
- Recruit body's stabilizers & neutralizers to facilitate movements

Goals of Functional Training

1. Train movement patterns, not isolate muscles. "Integrate, not isolate"
2. Not to develop aesthetically pleasing muscles, but rather to help athletes better meet the demands of the specific sport. "Function is always relative"
3. Emphasis upon quality of movement over the quantity of movement.

Multi-Planar Movement

- Functional tasks typically involve movement in three planes: sagittal, frontal, transverse
- Most exercises are performed in only one plane, the sagittal plane.
- If the hip does not extend properly in the sagittal plane, does not rotate properly in the transverse plane, or does not move in the frontal plane, the stress is transferred to the back.
- Many skills rely on lower body movements (running, multi-directional changes, throwing, batting, and kicking) that are performed entirely or predominantly from a unilateral weight-bearing phase.

One Versus Two Legs

- The hip & knee extensors are recruited during unilateral & bilateral closed kinetic chain exercises.
- Single leg squat requires greater recruitment of the hip abductors (glutes)
- Hip abductors provide the necessary force to stabilize the pelvis in the frontal plane, preventing sagging of the pelvis toward the non-weight bearing leg.
- The contralateral leg in the double-leg squat provides this frontal plane, pelvic stabilization.