



# PERFORMANCE SOCCER CONDITIONING

A NEWSLETTER DEDICATED TO IMPROVING SOCCER PLAYERS

## Soccer Hip Impingement as it Relates to Postural Restoration

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on the basis of clinical evaluation. Although the precise cause of hip impingement is not well understood, hip impingement is common in athletes presenting with hip pain. This article is part one of a three part series that will provide the reader with a better appreciation and understanding on the mechanisms of hip impingement, diagnosis, and treatment/management options as it relates to Postural Restoration Institute™ techniques.

### Anatomy

The muscle attachments about the hip and pelvic structures provide this area with significant power accelerating and pivoting as rapid contractile forces are applied. The pelvic girdle is a complex group of skeletal (bone) and soft-tissue (muscles and ligaments) structures that transmit power and weight of the torso and upper body to the lower extremities for ambulation and performance.<sup>22</sup>

In order to comprehend the biomechanics of the pelvis, which is the foundation of the spine, the pelvis must be defined in relationship to the bones contained within it and those affecting it. The pelvic girdle is formed by six joints (two femoral-acetabular joints “hip joints”, two sacroiliac joints, the lumbosacral junction “L5-S1”, and the symphysis pubis joint). The pelvis is formed with the sacrum wedged between the right and left innominate bones. The right and left innominate bones articulate anteriorly to form the symphysis pubis joint and posteriorly to form the sacroiliac joints. The femurs articulate with the acetabulum of the innominates to form the hip and/or femoral-acetabular (FA) joint.

The FA joint exhibits a wide range of motion in all direction in all planes. The hip joint is a ball and socket joint with the femur, or thigh bone (ball) inserting into the acetabulum, or pelvic bone (socket). Both the ball and socket are covered with smooth articular cartilage. The socket is further deepened by a ring of fibrocartilage, the labrum, which attaches around its outer perimeter.

### Biomechanics

Asymmetry and/or pathomechanics of the pelvic structure can lead to a cascade of compensations throughout the axial spine predisposing individuals to dysfunction and potential injury. Human movement is a series of linked movements that can be dissected joint by joint. They typically follow a progression from proximal to distal movement in a successive order. This series of movements is



Soccer is one of the most popular team sports in the world.<sup>6</sup> Soccer requires the athlete to perform kicking, twisting and cutting maneuvers throughout the pelvis and hips, thus exposing these areas to mechanical and soft tissue stress.<sup>21</sup> Hip and pelvic injuries occur in other sports, but probably not to the extent seen in soccer. Most of these injuries involve the lower extremities; accounting for 58%-81% of all injuries in the published studies for all ages.<sup>6</sup> Injuries to the hip and pelvis make up a small but significant proportion of injuries in soccer athletes. Studies that further describe lower extremity injuries show groin injuries account for 2% to 7.1% of total injuries; hip and thigh injuries accounting for 10% to 26%.<sup>19, 23</sup> Hip impingement occurs most frequently in sports involving quick accelerating motions and sudden changes in direction, such as soccer.

Evaluation of the athlete with mechanical hip pain, such as hip impingement, has remained a diagnostic obstacle for most healthcare professionals. Because impingement is a dynamic process, it has been difficult to identify and to define its prevalence

carefully balanced along the entire kinetic chain and leaves little room for substitution.

Femoral-acetabular (FA) motion refers to the femur moving within the acetabulum. Acetabular-femoral (AF) refers to the acetabulum moving on the femur. Movement of the femur relative to the acetabulum does not produce pure arthokinematic motion, rather, combinations of movements.<sup>16</sup> The habitual pattern of motion for the non-weight bearing lower extremity is a combination of flexion, abduction and external rotation (ER) and extension, adduction and internal rotation (IR).<sup>12</sup> Arthrokinematics of both motions are impure swings.<sup>12</sup> Therefore, acetabular-femoral internal rotation (AF IR)/femoral-acetabular internal rotation (FA IR) is a combination of extension, internal rotation and adduction.

As stated earlier, the pelvic girdle is comprised of six joints. The pelvic girdle is a ring and any change in its anatomy or applied forces to one of the six joints that comprise it will most likely result in compensation throughout one or more of the six joints. Therefore, a dysfunction on one side of the pelvis is likely to affect the opposite side. To assess the functional pelvic girdle from a biomechanical standpoint, it is necessary to consider how a structure on one side of the pelvic girdle interacts and/or affects the opposite extremity and/or structure. Very little literature tends to differentiate the right from the left and thus most orthopedic texts assume the body is symmetrical and describe normal mechanics paying very little attention to pathomechanics.

The major function of the pelvic girdle is to transmit forces and weight of the trunk and upper extremities to the lower extremities and to distribute ground reaction forces. The pelvic girdle forms the base of the trunk, supporting the superincumbent body structures and linking the vertebral column to the lower extremities.<sup>1</sup> In bilateral stance, if not symmetrical, muscle activity will be required to either control the motion or to return the FA joint (hip) to a symmetrical state. Shifting ones weight over the right hip results in relative adduction and internal rotation of the right hip (right acetabular-femoral internal rotation "AF IR") and abduction and external rotation of the left hip (left acetabular-femoral external rotation "AF ER"). To return the pelvic girdle to a neutral state, an active contraction of the right hip abductors and/or left hip adductors is required.<sup>15</sup>

The inability to rotate an acetabulum on a non-moving femur and/or the inability to rotate a femur on a non-moving acetabulum results in compensatory shearing forces throughout the pubis symphysis, sacroiliac joints, and the lumbosacral junction. It is imperative to establish stability throughout these aforementioned structures. When these structures are relied upon for compensatory rotational control throughout the transverse plane secondary to decreased rotational control throughout the AF/FA joints, compression and shearing like forces are generated throughout.

Rotary movements of the femur depend largely on the acetabular position, compression of the femur in the acetabulum from muscle activity during open kinetic chain activities, and from weight bearing during closed chain kinetic activities.<sup>7</sup> Anterior rotation of the two hemi-pelvis' on the femur places the femurs in a passively internally rotated position in relationship to the pelvis with accompanying internal rotation weakness. Anterior rotation of one hemi-pelvis places ones center of gravity on the contralateral lower extremity. On the side that the hemi-pelvis is rotated, there is accompanying internal rotation weakness. This occurs as a result of the passive internal orientation of the femur or as a result of compensatory activity of the external rotators to orientate the femur towards midline. The lower extremity on the contralateral side of the rotated

pelvis would most likely demonstrate external rotation weakness secondary to the orientation of the pelvis on the femur.

### **Hip Impingement**

Femoral-acetabular impingement occurs from a combination of mechanical abnormalities of both the ball (femoral head) and the socket (acetabulum).

Femoral-acetabular impingement is a condition characterized by abnormal contact between the femur and acetabulum. Basically the ball (femoral head) and socket acetabulum rub abnormally creating damage to the FA joint. The damage can occur to the articular cartilage (smooth white surface of the ball or socket) or the labral cartilage. The repetitive rubbing between the femur and acetabulum is known to cause damage to the anterior aspect of the acetabular labrum and the underlying articular cartilage.<sup>2</sup> Seldes found labral lesions to be a common occurrence. In a study of 55 hips, the author found 96% to have gross labral tears.<sup>20</sup> McCarthy explored 54 acetabulae and found 93% to have at least one labral lesion.<sup>14</sup> Byers et al investigated 365 hips finding 88% of the patients to have labral lesions.<sup>3</sup>

The differentiation between impingement and labrum tears may be difficult. Both have similar etiology, possibly the association of a click or locking may indicate a tear over impingement. Conversely, impingement may be a precursor to a labrum tear. It is generally accepted that most labral tears occur in the anterior, anterior-superior, and superior regions of the acetabulum. Fitzgerald noted 92% incidence of anterior or anterosuperior location of tears in 55 active adult patients reporting a slipping or twisting injury with catching-type pain.<sup>5</sup> Seldes<sup>20</sup> found 74% of tears to be in the anterosuperior location as well as Byrd<sup>4</sup> reporting the majority of the lesions occurring at the anterosuperior portion.

Hyperextension combined with femoral external rotation is the injury pattern most commonly associated with the presentation of acetabular labral tears.<sup>13</sup> It is thought that the labrum takes on a weight-bearing role at the extreme of motion with excessive forces leading to tearing. Sports involving repetitive twisting motions and movements to end-range hyperflexion, hyperextension, and abduction are at greater risk.<sup>18</sup>

When hip impingement occurs there is a recurring contact between the anterior femoral head-neck region and the anterior aspect of the acetabular rim and/or labrum during extreme hip flexion and internal rotation movements that are most prevalent in such a sport as soccer. Hence, it is critical to restore the biomechanics of the FA joint in order to prevent further compensations and pathology across the lumbo-pelvic region.

### **Pathomechanics**

Examination of one's posture may reveal an increased lumbar lordosis or pelvic obliquity that may account for hip impingement.<sup>11,17</sup> Therefore, if the pelvis is more anteriorly rotated, the greater the risk for impingement.<sup>17</sup> The presence of asymmetry throughout the pelvic girdle, as described by Hruska, is known as the Left Anterior Interior Chain (Left AIC) pattern.<sup>8,9,10</sup> This pattern calls attention to the tendency for anterior tilt and forward rotation of the left hemi-pelvis. The position of the pelvic girdle orients the pelvic girdle to the right causing a shift in one's center of gravity to the right. The pelvic girdle is directed into a stance-like AF IR position on the right and AF ER position on the left. This predominate position orients the sacrum and spine to the right. Due to the lack of left AF IR, secondary to the inadequate activation of the left acetabular-

femoral/femoral-acetabular (AF/FA) rotators, this will result in compensatory activity throughout the frontal and transverse planes of the thorax and consequently the right upper extremity. The typical Left AIC pattern involves a pattern of pelvic, spinal, and diaphragmatic orientation towards the right with compensation usually occurring above the diaphragm (usually T-8/ T-9) rotating the spine back to the left.<sup>8,9,10</sup>

**Kicking Mechanics**

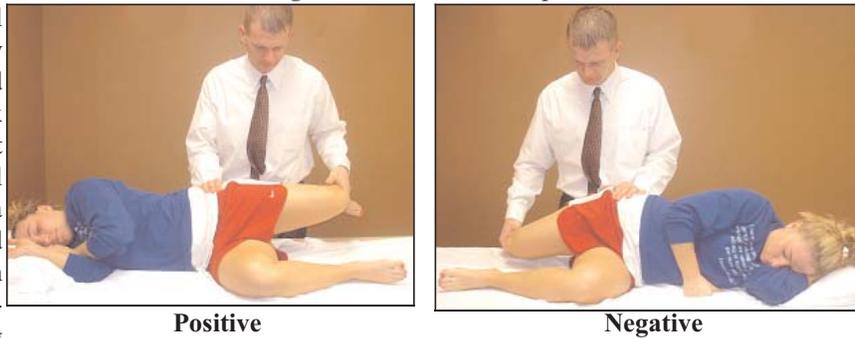
When analyzing the biomechanics of the pelvis and lower limb during the kick, it can be noted how in the first phase, the lower limb kicking moves into extension, abduction and external rotation at the lumbo-pelvic region, while the knee flexes. At the same time, the support limb moves into hip flexion and adduction. In the second phase, the kicking limb moves into hip internal rotation and hip flexion with adduction of the entire lower extremity while the knee remains in extension. The support limb moves into extension while the lower limb adducts. In the third phase, the kicking limb is in an unstable position of maximum internal rotation and adduction while the support limb is placed in adduction and internal rotation.

**Hip Impingement As It Relates to Postural Restoration**

Acetabular movement on the femur (AF) and femoral movement on the acetabulum (FA) occurs with rotation in all three planes of sagittal, transverse, and frontal direction. At foot strike the acetabulum adducts on the femur and then abducts from midstance until terminal swing. At foot stance the femur externally rotates on the acetabulum and then internally rotates during midstance. Regardless of the phase, the inability to decrease the forces of the femur on the acetabulum or the acetabulum on the femur leads to possible hip impingement and/or labral tearing. This lack of congruent rotation and stability of AF/FA movement secondary to asynchronous AF activity and dysynchronous FA activity can lead to undesirable force-coupling and contact during adduction and internal rotation and abduction and external rotation, regardless if the lower limb is loaded or unloaded.<sup>10</sup>

The Postural Restoration Institute has proposed two common types of hip

Figure 1 – Adduction Drop Test



impingement; Anterosuperior Acetabular Femoral Impingement (ASAF) and Anteromedial Femoral Acetabular Impingement (AMFA).<sup>10</sup>

Anterosuperior Acetabular Femoral Impingement (ASAF) is most often seen on the left side when the individual attempts to “shift” or pull their femur into the acetabulum with the ischiocondylar adductor. Contributing factors include an anteriorly rotated, forwardly positioned left innominate with laxity of the iliofemoral and pubofemoral ligament structures. Often times these individuals present with, and are not limited to, long and weak adductors, overactive FA external rotators and abductors, weak AF extensors, and overactive FA hip flexors acting as

Figure 2 –Extension Drop Test

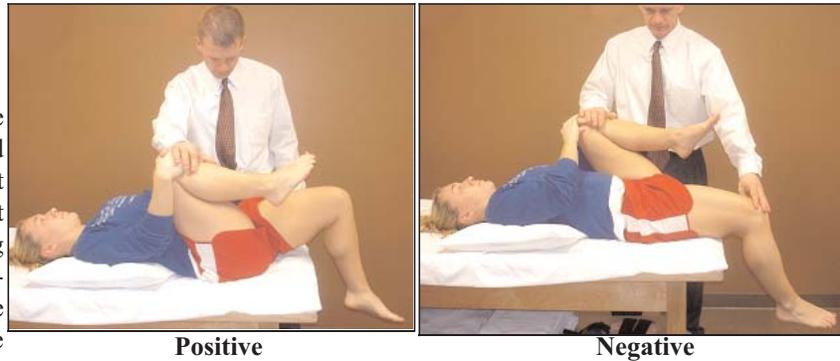


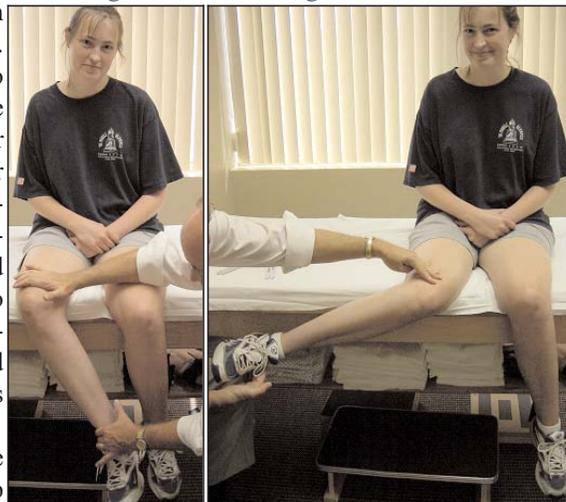
Figure 3 –Seated Left FA ER



femoral-acetabular internal rotators such as the tensor fasciae latae (TFL). Common clinical findings are: positive left adduction Drop test (Figure 1); Positive or negative left extension drop test (Figure 2), increased left seated femoral acetabular external rotation (Figure 3).

Anteromedial Femoral Acetabular Impingement (AMFA) is often seen on the right side. A Left AIC patterned individual with a right AF IR positioned pelvis will demonstrate impingement of the right femur on the acetabulum upon femoral acetabular external rotation. Contributing factors include an anteriorly rotated, forwardly positioned left innominate, right posterior capsular instability, weak inferior gluteus maximus, and laxity of the ischiofemoral ligament and tightness of the adductor musculature on the right. Common clinical findings include: decreased right FA ER (Figure 4), increased FA IR and decreased right passive FA abduction (Figure 5).

Figure 4 – Seated Right FA ER / FA IR



Hip impingement is a common and often disabling problem incurred by soccer athletes. Repetitive kicking, side-to-side movement and twisting are common motions which seem to provide the greatest risk of causing hip impingement. What becomes essential is to match the clinical signs and symptoms to the structural or biomechanical abnormalities in order to arrive at a possible explanation for the cause and pathomechanics of the particular musculoskeletal disorder in question. This article provides the reader with a possible explanation of hip impingement as it relates to Postural Restoration. Part two of this series will discuss treatment/management of hip impingement as it relates to Postural Restoration. R

Figure 5 – Passive FA Abduction Test



Positive



Negative

**More Information Please!** To contact Jason go to the Postural Restoration Institute™ web sit at [www.postural-restoration.com](http://www.postural-restoration.com)

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