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Soccer Hip Impingement as it Relates to Postural Restoration™
The Role of Musculature Imbalances Across the Left and Right Lumbo-Pelvic-Femoral Complex: Part II

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Almost everyone assumes that the human body is symmetrical. The human body is symmetrical about the midline of the body for many structures such as eyes, ears, and limbs. While the human body is outwardly symmetrical, most internal organs are asymmetrical with regards to the left and right side of the body. For example, the heart is on the left side, the right lung has more lobes than the left, and the liver lies on the right side of the body. If we look even more closely we may have one side of the pelvis that is higher than the other, one shoulder that may be higher than the other, feet with different degrees of pronation and/or supination and an accumulation of other asymmetries.

Most of us have a dominant brain hemisphere, further complicating matters. The majority of humans are right handed. Many humans are right-sided in general, in that they prefer to use their right eye 71.1%, their right foot 81.0%, and their right hand 88.2% if forced to choose between their right and left side of their body.[6] The left cerebral hemisphere of the brain controls the right side of the body, the right side is generally stronger; it is suggested that the left cerebral hemisphere is dominant over the right in most humans because in 90-92% of all humans the left hemisphere is the language hemisphere.[6]

Despite the fact that there are gross anatomical differences between the two sides of the body we are functionally asymmetrical to variable degrees. Thus the problem exists to understand or appreciate how movement patterns on one side of the body may directly influence movements on the opposite/contralateral side. Symmetry is established when there is a mechanism for specifying different movement patterns between the left and right side of the body. Patterns evolve and exist in all of us to some degree. A pattern usually develops as one trains or repeats the same movement pattern habitually to contribute to an undesirable asymmetrical activity. It is the sequential action of muscles, bones, and joints that lead to differences in the development of the asymmetrical human.

This article is part two of a three part series that will describe in detail the myokinematics and osteokinematics of the pelvic girdle of a Left Anterior Interior Chain (Left AIC) patterned individual and how movements of the right side may directly influence the left side. Furthermore, special consideration will be made to understand how these movement patterns may predispose the soccer athlete to an injury such as hip impingement.

Patterns of Asymmetry

The detection of biomechanical predisposing factors may be beneficial in the case of hip impingement and labral tears. Janda, has described a predictable pattern of muscular imbalance in the pelvis, known as the lower crossed syndrome. He suggests tight hip flexors and lumbar erector spinae and weak gluteals and abdominal musculature characterize the lower crossed syndrome. The subsequent imbalance leads to an anterior pelvic tilt, increased hip flexion, and hyperlordosis of the lumbar spine. Hip flexor tightness may lead to increased weight-bearing upon the anterior acetabulum and labrum predisposing it to injury.[4]

Similarly, Hruska has described a predictable underlying postural pattern of asymmetry known as the Left Anterior Interior Chain (Left AIC) pattern (Figure 1). Hruska's (Left AIC) pattern calls attention to the tendency for the anterior tilt and forward rotation of the left hemipelvis. The position of the pelvis 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 acetabular femoral internal rotation (AF IR) position on the right and acetabular femoral external rotation (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

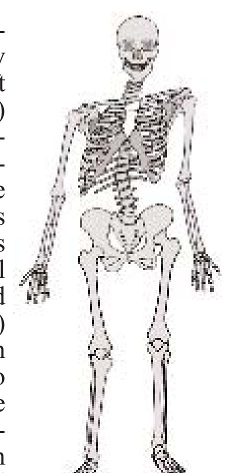
Figure 1

pattern of pelvic, spinal, and diaphragmatic orientation towards the right with compensation usually occurring above the diaphragm (T-8/ T-9) rotating the spine back to the left. Upon observation, the thorax and lumbar spine will be sidebent right with the right shoulder appearing to be lower than the left. [1,2,3]

An individual with a Left AIC pattern will demonstrate an anterior tilt and forward rotation of the left hemi-pelvis. Due to this position, the individual will usually demonstrate weakness and lengthening of specific muscles in all three planes. Muscles that provide movement and control of the lumbo-pelvic-femoral complex have the ability to perform in more than one plane. Symmetry is restored when recruitment of specific muscles are engaged between the left and right side of the body. Individuals with a Left AIC pattern who are positioned in a state of right AF IR and left AF ER will most likely demonstrate the following myokinematic relationships: The left hemi-pelvis is positioned in a state of flexion, abduction and external rotation. The right hemi-pelvis is positioned in a state of extension, adduction and internal rotation (Figure 2). All efforts to restore proper acetabular femoral position in all three planes is desired. Furthermore, it necessitates correction of femoral acetabular compensatory activity once proper acetabular femoral position is obtained.[1, 2,3]

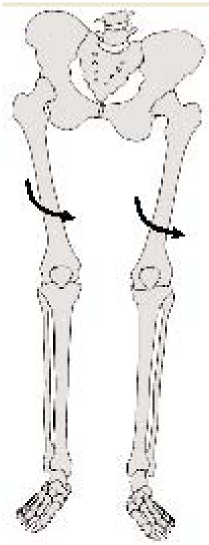

Figure 2

Prolonged postural adaptations can result in muscle length changes. The time muscle spends in the shortened range and the amount the muscle is contracted in the shortened range determines whether it becomes shortened. Conversely the rationale for lengthening a muscle is the amount of tension placed on the muscle over a prolonged period. Sustained postures, particularly postures that are maintained in faulty alignments can induce changes in the muscle's length. These adaptations in the muscle length not only contribute to being responsible for the faulty posture but also contribute to altered length-tension properties and subsequent force couple action of muscles, thereby ultimately affecting performance. The clinical importance of these adaptaions in a muscles length-tension relationship is that it may be unable to develop the required tension in the position imposed by the joint or body posture and may therefore necessitate the use of other muscles with similar actions to control the action otherwise carried out by the prime mover. This in turn may lead to abnormal movement patterns.[7] Balance between musculature across the left and right side of the lumbo-pelvic-femoral complex is essential in the development and maintenance of correct postural alignment and consequently avoids the development of a faulty posture. (Table 1)

Hip Impingement

In part one of this series Anterosuperior Acetabular Femoral Impingement (ASAF) and Anteromedial Femoral Acetabular Impingement (AMFA) were described. The subsequent musculature length-tension considerations are proposed by the Postural Restoration Institute™ in differentiating such conditions.

Anterosuperior Acetabular Femoral Impingement

An individual with a Left AIC pattern will demonstrate an anterior tilt and forward rotation of the left hemi-pelvis. Due to this position, the individual will usually demonstrate weakness and lengthening of specific muscles in all three planes on the left and right side.

Individuals with a Left AIC pattern will demonstrate decreased left FA IR. The patients left femur or leg is abducted if in a Left AIC pattern or L AF ER position when placed in a seated position with the legs directly in front of the examiner. The left femur will hit the posterior inferior rim of the acetabulum upon FA IR. Due to the acetabular femoral position (AF ER), the individual must compensate by recruiting the femoral acetabular (FA) external rotators to orientate the femur towards midline.[1, 2, 3]

The joints of the lumbo-pelvic-femoral complex are also stabilized by a dense system of ligaments. The femoral-acetabular joint is reinforced by the strong spiral iliofemoral, ischiofemoral and pubofemoral ligaments. The iliofemoral ligament is made up of two bands resembling a "y" which prevents hyperextension of the femoral-acetabular joint. Furthermore, the lateral band of iliofemoral ligament limits adduction whereas the medial band of iliofemoral ligament limits lateral rotation. The pubofemoral ligament tightens during extension and abduction of the femoral-acetabular joint (the pubofemoral ligament prevents excessive abduction of the hip joint). It appears logical that if ligaments are compromised secondary to compensatory activity, the femoral acetabular joint will become unstable and if the muscles are compromised secondary to compensatory activity, pelvic-femoral dysfunction will result. Thus an individual may present with a compromised iliofemoral and pubofemoral ligament secondary to compensatory external rotation of the lumbo-pelvic-femoral complex.

Due to the flexed, abducted, and externally rotated left hemi-pelvis there is accompanying extension, adduction and internal rotation weakness. This occurs as a result of passive internal orientation of the femur secondary to the acetabular position and/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 rotational weakness secondary to the orientation of the acetabulum on the femur.

Left anterosuperior acetabular femoral impingement usually occurs in the third phase of kicking, when the support limb is placed in adduction and internal rotation. Due to the fact that the left hemi-pelvis is in a state of flexion, abduction, and external rotation; 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 during this phase. These findings are consistent with Mason in which he postulates that femoral external rotation is the injury pattern most commonly associated with anterior hip pathology in that this may be due to a slight subluxation and subsequent glide of the femoral head onto the anterior acetabular labrum.[5]

Anteromedial Femoral Acetabular Impingement

Due to the extended, adducted, and internally rotated right hemi-pelvis there is accompanying flexion, abduction and external rotation weakness. This occurs as a result of the passively internal orientation of the femur secondary to the acetabular position. Therefore there is compensatory and/or lack of the external rotators to orientate the femur towards midline due to the acetabular position of the right hemi-pelvis. Thus, the right femur will "impinge" on the anterior, superior and medial acetabular rim upon FA ER.

Right anteromedial femoral acetabular impingement usually occurs in the third phase of kicking, when the support limb is placed in adduction and internal rotation while the kicking limb is an unstable position of maximum internal rotation and adduction. Due to acetabular position of the right hemi-pelvis and the inability for the femur to abduct and externally rotate impingement will most likely result during the follow through phase of the kicking limb.

Hyperextension combined with femoral external rotation is the injury pattern most commonly associated with the presentation of acetabular labral tears. It is thought that the labrum takes on a weight bearing role at the extreme motions with excessive forces leading to tearing.[5] Furthermore, sports involving repetitive twisting motions and movements to end-range hyperflexion, hyperextension, and abduction are at greater risk.[8]

In summary, many soccer athletes suffer hip impingement as a result of poor acetabular position and from compensatory femoral acetabular activity secondary to acetabular position. Often times even the slightest deviations result in poor distribution of forces to the lumbo-pelvic-femoral complex, which in turn leads to strain patterns as the pelvic girdle compensates for these forces in the least favorable way. These adaptive firing patterns may occur as a result of improper lower extremity pathomechanics, which influence further compensations. Assessment of the length-tension relationships of the left and right side of the lumbo-pelvic-femoral complex are crucial in treating hip impingement. Part three of this series will illustrate integrative exercises that promote proper acetabular position as well as restoring proper femoral acetabular activity of a Left

AIC patterned individual.

More Information Please! To contact Jason go to the Postural Restoration Institute™ web sit at www.posturalrestoration.com

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Table 1

Positional and Compensatory Influences of the Left AIC Pattern On Musculature of the Lumbo-Pelvic-Femoral Complex	
Left Lumbo-Pelvic-Femoral Complex	**Right Lumbo-Pelvic-Femoral Complex**
Sagittal Plane	**Sagittal Plane**
Iliacus/Psoas-Shortened and strong secondary to flexion of the left hemi-pelvis (Positional)	**Iliacus/Psoas-**Lengthened and weak secondary to extension of the right hemi-pelvis (Positional)
Tensor Fascia Latae-Shortened and strong secondary to flexion of the left hemi-pelvis (Positional)	**Tensor Fascia Latae-**Lengthened and/or normal length secondary to extension of the right hemi-pelvis (Positional)
Hamstrings-Lengthened and weak secondary to flexion of the left hemi-pelvis (Positional)	**Hamstrings-**Shortened and strong secondary to extension of the right hemi-pelvis (Positional)
Gluteus Maximus-Lengthened and weak secondary to flexion of the left hemi-pelvis (Positional)	**Gluteus Maximus-**Shortened and strong secondary to extension of the right hemi-pelvis (Positional)
Frontal Plane	**Frontal Plane**
Posterior Gluteus Medius-Shortened and strong secondary to abduction (Compensatory)	**Posterior Gluteus Medius-**Lengthened and weak secondary adduction (Positional)
Anterior Gluteus Medius-Shortened and strong secondary to abduction (Positional)	**Anterior Gluteus Medius-**Lengthened and weak secondary adduction (Positional)
Adductor Magnus & Longus-Lengthened and weak secondary to abduction (Compensatory)	**Adductor Magnus & Longus-**Shortened and strong secondary to adduction (Positional)
Ischiocondylar Adductor Magnus- Lengthened and weak secondary to abduction (Compensatory)	**Ischiocondylar Adductor Magnus-**Shortened and strong secondary to adduction (Positional)
Transverse Plane	**Transverse Plane**
Iliacus/Psoas-Shortened and strong secondary external rotation (Compensatory)	**Iliacus/Psoas-**Lengthened and weak secondary internal rotation moment (Positional)
Tensor Fascia Latae-Shortened and strong secondary external rotation (Compensatory)	**Tensor Fascia Latae-**Shortened and/or normal length and strength secondary to internal rotation (Positional)
Gluteus Maximus-Shortened and strong secondary external rotation (Compensatory)	**Gluteus Maximus-**Lengthened and weak secondary internal rotation (Positional)
Anterior Gluteus Medius-Lengthened and weak secondary external rotation (Compensatory)	**Anterior Gluteus Medius-**Shortened and/or normal length and strength secondary to internal rotation (Positional)
Posterior Gluteus Medius-Shortened and strong secondary to external rotation (Compensatory)	**Posterior Gluteus Medius-**Lengthened and weak secondary internal rotation (Positional)
Adductor Magnus & Longus-Lengthened and weak secondary to external rotation (Compensatory)	**Adductor Magnus & Longus-**Shortened and strong secondary to external rotation (Compensatory)
Ischiocondylar Adductor Magnus-Lengthened and weak secondary to external rotation (Compensatory)	**Ischiocondylar Adductor Magnus-**Shortened and strong secondary to internal rotation (Positional)
Piriformis-Shortened and strong secondary to external rotation (Compensatory)	**Piriformis-**Lengthened and weak secondary internal rotation (Positional)
Obturator Internus-Shortened and strong secondary to external rotation (Compensatory)	**Obturator Internus-**Lengthened and weak secondary internal rotation (Positional)