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Editorial | Open Access

The Relationship Between Lumbo-Pelvic-Hip Complex and Knee Joint Dysfunctions

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Editorial

Among physically active individuals the knee joint is the most often injured part of lower extremity [1,2]. Approximately 70% of ACL injuries have noncontact mechanisms, and occur during landing from a jump, forceful deceleration, cutting, or pivoting over a planted foot [3-5]. Some studies have suggested that abnormal movement patterns at the trunk, hip, and knee are associated with an increased incidence of ACL injury [6-8]. Interestingly, similar factors have also been linked to repetitive strain injuries like iliotibial band friction syndrome and patellofemoral pain syndrome [3].

It was described by Stecco et al. [9] that gluteus maximus muscle (GM) via fascia lata is inserted to the iliotibial tract and may influence the knee movements. Moreover a hypertonicity of the gluteus maximus may cause an iliotibial band friction syndrome and may be related to knee dysfunction. As was reported by Vleeming et al. [10] the GM muscle also has an important insertion into the thoracolumbar fascia, which allows load transfer from the spine to the pelvis. Those observations was supported by Stecco et al. [9] who have added that load transfer via GM exist also from pelvis to the knee, and suggested that the GM is important part for the mechanical coordination of the lumbo-pelvic region and the lower limb. Also the insertion of the GM muscle to the thoracolumbar fascia may transmits the forces from thoracolumbar region to the knee [9]. It was also reported that the GM muscle is a strong hip extensor and external rotator of the hip [1,11]. Therefore this muscle can control the movement of the pelvis in frontal and transverse plane and in this way may protect the knee [1].

Recently it was suggested that impaired muscular control of the hip, pelvis, and trunk can affect tibiofemoral and patellofemoral joint kinematics and kinetics in multiple planes [1,12,13]. It was reported by Powers [1] that excessive hip adduction and internal rotation may cause the medial shift of knee joint center relatively to the foot, what causes the tibia abduction and foot pronation and finally excessive knee valgus [14-16]. However, internal rotation of the femur on a relatively fixed tibia would strain the tissues and lead to knee injuries [8]. Suoza et al. [13] observed increased hip internal rotation, decreased hip muscle strength, and increased gluteus maximus muscle activity in females with patellofemoral pain syndrome.

The increasing understanding of the fascial system's role in locomotion, sensorimotor and load transfer activities along kinetic chains helps us to better understand the postural torsional consequences of the asymmetrical muscles and fascia tension as well as their role in the development of body axial rotation [17,18]. Therefore, the function of the deep fascia should be the key point in functional analysis of connections between proximal body parts and the knee [9,18].

Zink et al. [19] found that approximately 80 percent of healthy people had rotated body patterns due to increased fascial tension in specific parts of the body. In Zink's fascial common compensatory pattern of rotation, the pelvic girdle is rotated to the right with the upper parts of the spine contra rotated [19-21]. Thus the pattern of rotation and fascial tension in specific body parts may cause the lumbo-pelvic-hip complex to be more prone to asymmetry. On the other hand Kouwenhoven et al. [22] have reported that restrictions in spinal rotation in the transverse plane may be important in the development of lumbo-pelvic-hip complex dysfunctions. They observed that the normal non-scoliotic spine demonstrated predominant rotation to the left of the high thoracic vertebrae, and to the right of the mid and lower thoracic vertebrae. It was suggested that rotation in the lower thoracic spine may be related to right sacroiliac joint pain, anterior pelvic tilt and restriction in right hip range of motion [18,23,24].

As reported by some authors, the asymmetrical and restricted hip and pelvis range of motion may lead to changes in muscle and tendons length and function [23,25]. This may create the alterations in force transmission and non-optimal condition for effective contraction and neuromuscular control [26,27]. Problems with the sacroiliac joint, as well as with the low back, have often been related to reduced or asymmetric range of motion in the hip [24]. Some authors have reported that the patients with low back pain had significantly greater external hip rotation than internal rotation bilaterally, whereas those with sacroiliac joint dysfunction had significantly more external hip rotation than internal rotation unilaterally, specifically on the side of the posteriorly tilted innominate [24,28]. The other studies have reported that the restrictions in hip rotation and extension may be strongly related to the sacroiliac joint subluxations and following restrictions in force closure as well as form closure mechanism [23,29]. It may change the direction and magnitude of forces transmitted through the lumbo-pelvic-hip complex and may lead to muscle imbalances [24,29].

It was also reported that the pelvic floor muscles are closely connected to the pelvis structures and to the hip [29-31]. The endopelvic fascia is linked to the hip via connections to the arcus tendineus fasciae pelvis, to the obturator internus muscle, and to the hip greater trochanter [30]. It has been shown that pelvic floor muscle contraction can alter femoral head position [30,31]. Also Bendova et al. [32] demonstrated change in load distribution detected under the feet when pelvic floor muscles were unilaterally activated. They also confirmed in their later study the influence of pelvic floor muscles contraction on pelvic and hip structures alignment. They have demonstrated the femoral head, the innominate and the coccyx displacements due to unilateral pelvic floor muscles activation. They concluded that pelvic floor muscles contraction influence relative alignment of pelvis and hip structures [25].

Some authors have indicated that core stability has an important role in injury prevention, and they suggested that the knee may be a "victim of core instability" during athletic movements [2]. It was also suggested that the deficit in trunk control may be a predictor of knee injury [6,33]. Inappropriate level of core stability were also linked to gait disorders and following lower limb injuries. The need of appropriate trunk and pelvis mobility and stability was emphasized by Gracovetsky [34]. He indicated that the appropriate force transmission during gait needs adequate core stabilization from the deep abdominal muscles and the adequate spinal, upper girdle and lumbopelvic motion. He has reported that spinal rotation is produced by spine lateral bending. So, spinal rotation causes pelvis rotation which in turn powers the lower limb in walking. The legs recover the energy received from the spine and recycle it back into spinal rotation [34]. The deficit in core stability as well as in spine or pelvis mobility may disrupt this highly coordinated mechanism and lead to many strain injuries located distally in lower limbs or in upper trunk [34].

An improved understanding of the potential contribution of the lumbo-pelvic-hip problems, in relationship to knee injury, is needed for the development of more efficient and effective knee rehabilitation and injury prevention programs.

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