Lower Extremity Injuries: Is It Just About Hip Strength?

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Patellofemoral pain and iliotibial band syndromes continue to puzzle and oftentimes frustrate both patients and clinicians alike. While a myriad of treatments, including footwear, orthoses, bracing, patellar taping, and quadriceps strengthening, have been traditionally promoted and sometimes shown to be moderately effective,[4,31] improvements in symptoms and function are not universal. In recent years, a trend toward consideration of more proximal influences on knee injuries (ie, lumbopelvic and hip regions) has continued to grow as insights are gained into this potential mechanism.

While the attention paid to proximal factors is increasing, the presumed association between hip impairments and knee injuries has been suggested for some time.[18] Quite simply, the anatomy and joint mechanics dictate that an interdependence exists between the hip and knee in weight-bearing postures.[17] Therefore, it follows that an impairment at either joint has the potential to produce a compensation and injury at the other. Indeed, treatment programs incorporating exercises designed to address hip impairments have demonstrated positive short- and long-term outcomes on knee injuries.[6,16,30] However, the specific cause-effect relationship is not as clear as we might anticipate.

Hip muscle weakness, specifically of the abductors and external rotators, is believed to contribute to the increased hip adduction and internal rotation that has been observed in females with pain approximating the patellofemoral joint or iliotibial band.[6,10,15,19,27] However, it is not apparent that muscle weakness is necessary for these abnormal kinematics to occur. For example, in 2 studies, females with a history of iliotibial band syndrome demonstrated approximately 30% greater peak hip adduction motion during running, despite having essentially identical hip abductor torque profiles as females without prior knee injury.[5,20] Additional studies have also demonstrated a disconnect between muscle strength and observed joint motions, indicating this rather intuitive relationship should not be viewed as absolute.[1,2,8,13,24-26,28]

If muscle weakness were the sole cause of the abnormal joint motion, then it stands to reason that the abnormal joint motion would only be apparent when the demands on the muscle exceeded its capabilities. That is, excessive hip adduction and internal rotation would be observed only when the hip abductors' and external rotators' torque-producing capacity was surpassed. However, this does not seem to be the case. For example, increased hip adduction appears to be present across the stance phase of running, from initial foot-ground contact through toe-off.[5,20] Thus, the abnormal joint motion is even apparent when the muscular demands are rather minimal (ie, initial foot-ground contact). Further, abnormal hip mechanics do not appear to worsen as muscle weakness (in the form of fatigue) is introduced.[34] Additional factors such as altered proprioception[35] and neuromuscular control[14] should be considered as contributing to the abnormal motion and, when warranted, addressed in the treatment plan.

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Given the inconsistent relationship between hip muscle weakness and abnormal joint motion, the question remains as to whether successful recovery can be obtained if the treatment is limited to only one aspect. That is, can a treatment strategy focused solely on strengthening achieve successful outcomes? For example, individuals with a history of iliotibial band syndrome (ie, those who no longer experience symptoms or receive care) continue to display altered hip motion during running,[5,11] suggesting that movement reeducation may not be an essential aspect of care. However, the persistence of abnormal joint motion may compromise long-term benefits, as the symptoms may be more prone to recur. Conversely, is movement re-education alone sufficient for recovery? For example, improved joint mechanics during landing were achieved regardless of the individual's muscle strength, suggesting that strength may not always be a prerequisite for movement re-education.[13] Not surprisingly, a recent study has found the combination of strengthening exercises and movement reeducation to be the more effective approach in achieving favorable outcomes.[9] Indeed, the authors of the 2 case reports in this issue utilize this combined approach, resulting in successful recovery through a 1-year follow-up, with a full return to sport-related activities.[29,32] Certainly, well-controlled clinical trials are needed to better define treatment strategies required to achieve optimal clinical outcomes.

It should be noted that the majority of investigations into these knee injuries have focused on females. While this is likely due, in part, to the greater incidence of these injuries in females, thus a faster rate of subject enrollment, biomechanical differences between genders cannot be discounted. Substantial differences in hip joint motion and muscle activation patterns during walking and running have been reported between noninjured males and females.[3] Further, trunk and pelvis proprioception[35] and hip strength[15] deficits have been found in females but not males with lower extremity injuries. Therefore, additional study is certainly warranted to better define if gender-specific mechanisms exist. However, this should not prevent us from considering hip muscle strength and neuromuscular control strategies in the management of males with overuse hip and knee injuries, as illustrated in the 2 case reports in this issue of *JOSPT*.[29,32]

This special issue of the *Journal* provides a compilation of papers focused on further defining the contribution of proximal factors to knee/lower extremity injury. In 2 separate contributions, detailed summaries of the muscle mechanics[33] and kinesiology[17] of the hip are presented, providing a foundation from which clinical application can evolve. In a separate manuscript, this information is integrated to develop the conceptual basis for the potential role abnormal hip mechanics may have on both overuse (patellofemoral pain and iliotibial band syndromes) and traumatic (anterior cruciate ligament sprain) knee injuries.[23] Original research papers are included that demonstrate differences in hip mechanics during running in females with a history of tibial stress fracture[12] or iliotibial band syndrome.[5] Finally, incorporating these concepts into clinic practice, novel case reports involving individuals with piriformis syndrome[29] and recurrent hamstring cramping[32] are presented, as well as a clinical commentary describing the management of hamstring strain injuries with an emphasis on achieving dynamic stability of the lumbopelvic and hip regions.[7] Collectively, we hope these papers will provide direction to both patient care and patient-related research.

Any of us would be amiss not to recognize the influences the lumbopelvic and hip regions have on knee loading and, therefore, potentially, knee injury. However, consideration of these regions should be made in addition to, not at the expense of, other contributing factors, such as patellar alignment, quadriceps strength, foot posture, and fear-avoidance beliefs,[21,22] as it is improbable that any one cause can account for all episodes of knee injury. It is only through this approach that we can begin to identify specific clinical characteristics that can best direct the care and management of the individual.

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