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The Hip's Influence on Low Back Pain: A Distal Link to a Proximal Problem

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Low back pain (LBP) is a multifactorial dysfunction, with one of the potential contributing factors being the hip joint. Currently, research investigating the examination and conservative treatment of LBP has focused primarily on the lumbar spine. The objective of this clinical commentary is to discuss the potential link between hip impairments and LBP using current best evidence and the concept of regional interdependence as tools to guide decision making and offer ideas for future research.

Keywords: strength, rehabilitation

In day-to-day clinical practice it is often difficult to identify the source of symptoms in patients with low back pain (LBP).[1] Abenhaim et al[2] noted that a small percentage of individuals with LBP have an identifiable pathoanatomical source. Further clouding the picture are multiple studies indicating the potential inability of diagnostic imaging to identify the pain source, influence prognosis, or affect outcomes.[3–6] Research has demonstrated the effectiveness of subgrouping patients into a classification system based on signs and symptoms indicating their likelihood to respond to specific treatments. This classification approach has produced improved outcomes and high levels of reliability as compared with clinical-practice guidelines.[7–9] For treating clinicians, these findings help guide decision making and improve results; however, not all patients will fit into a treatment-based subgroup. The treating therapist must then rely on an impairment-based approach, identifying potential local or remote contributors to the patient's area of primary concern. Recent advances in research have begun to indicate the importance of this regional approach to musculoskeletal examination, but the contributing areas remote to the lumbar spine have yet to be identified.

Given the biomechanical relationship between the hip and the low back, specifically the multiple shared muscles (psoas, quadratus lumborum, erector spinae, gluteus maximus, etc), one must consider the hip joint a potential contributor to LBP. Contraction of these muscles will affect motion at the spine, pelvis, and hip because of common attachment sites. It is generally understood that movement at one of these areas will necessitate compensatory movement at the others because

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of these common muscle attachments and the concept of regional interdependence.[10] By understanding the association between the hip and low back, clinicians might gain insight into the management of this challenging patient population.

Recently, clinical prediction rules (CPRs) have begun to help clinicians and have been gaining increased attention in the rehabilitation literature. CPRs are tools that help identify characteristics of individuals who might benefit from specific interventions. Two such rules have been developed pertaining to individuals with LBP that have helped shape the treatment-based classification system. Flynn et al[11] developed a CPR to identify individuals with acute LBP likely to demonstrate short-term benefit from lumbopelvic manipulation, which was later validated.[12] Five factors associated with success were identified for this intervention.[11,12] Similarly, Hicks et al[13] developed a CPR identifying individuals with LBP who might benefit from a lumbar-stabilization program. A common finding in both the manipulation and stabilization CPRs was the presence of adequate hip range of motion (ROM). In the manipulation CPR, patients with internal rotation greater than 35° in 1 or both hips had an increased likelihood of benefiting from manipulation of the lumbopelvic region.[11] In the lumbar-stabilization CPR, patients with a straight-leg raise greater than 91° were more likely to experience reduced disability at the 8-week follow-up.[13] Prediction rules, as outlined here, are meant to classify patients to specific treatments; their purpose is not to explain how or why the variables influence the outcome. Therefore, a full understanding of the relationship between the hip and lumbar spine has yet to be elucidated. The concept of regional interdependence might help explain why hip characteristics influence the classification of individuals with LBP.

Regional interdependence as it applies to musculoskeletal physical therapy refers to "the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with the patient's primary complaint."[10(p658)] Examples in the rehabilitative literature include manipulation of the thoracic spine for mechanical neck pain,[14] lateral epicondylalgia,[15] or shoulder dysfunction.[16,17] Likewise, joint mobilization and strengthening treatments of the hip joint have been advocated for knee osteoarthritis,[18–20] and joint manipulation for the low back has been advocated for knee[21–23] and hip impairments.[24] Currently, manual therapy treatment of the hip joint, including mobilization, manipulation, and stretching, for LBP has only been investigated in a case report[25] and in the spinal-stenosis population[26,27]; however, existing evidence does suggest a relationship between LBP and decreased hip mobility[28–34] and/or strength.[35–39]

Hip–Spine Syndrome

The concept of a biomechanical link between the hip joint and the lumbar spine has been described as hip–spine syndrome (HSS).[40] HSS specifically depicts the influence of a pathological hip joint on the alignment of the spine and subsequent muscle length and joint forces.[40]

The most recent documentation of this relationship has been that of severe hip osteoarthritis (OA) potentially causing abnormal spinal sagittal alignment and ensuing LBP.[41] Ben-Galim et al[41] evaluated the effects of surgical treatment of hip

OA on low back disability in patients preoperative and postoperative total hip replacement and found significant ($P < .01$) improvements in both visual analog scores for LBP and Oswestry Disability Index scores after surgery that remained at the 2-year follow-up.

Other specific related interactions of the hip and spine in HSS can include a hip-flexion contracture resulting in compensatory hyperlordosis of the lumbar spine or a posteriorly inclined pelvis with increased kyphotic posture and primary or rapidly destructive hip OA.[40,42–48] In each of these examples, although there is a relationship between the hip and spine, the evidence demonstrating the significance of its effect on LBP is deficient.

Although the biomechanical influences of the hip on LBP are not fully evident at this time, the current level of evidence does support a regional relationship between the 2 areas. From the preliminary work of Ben-Galim et al,[41] one can begin to appreciate the importance of further investigating hip ROM, as well as regional soft-tissue characteristics, in patients with LBP.

Hip ROM and LBP

The proposed regional relationship between hip ROM and LBP based on the preliminary work noted in HSS has been further substantiated through numerous studies. Ellison et al[28] compared the hip rotation of patients with LBP with that of unmatched controls without LBP. Patients with LBP more frequently demonstrated asymmetrical hip-rotation ROM, with internal rotation (IR) being less than external rotation (ER). Chesworth et al[29] also compared hip-rotation ROM in subjects with LBP with a control group matched for age, gender, height, and weight. Both IR and ER were significantly limited in the LBP group compared with the control group. Cibulka et al[30] observed subjects with LBP to have bilateral asymmetries in hip IR, whereas patients with LBP and sacroiliac-joint dysfunction had unilateral asymmetries. A cross-sectional study by Vad et al[32] demonstrated that symptomatic, as compared with asymptomatic, professional golfers had significantly decreased hip ROM in a combination of flexion, abduction, and external rotation (FABER) of the lower extremity that leads in the golf swing when compared with the opposite leg. In addition, these same symptomatic golfers had significantly decreased hip IR ROM of the lead leg compared with the nonlead leg (11.8° vs 16.9°, respectively). No hip-ROM asymmetries were reported in the asymptomatic subjects. The aforementioned studies support the idea that ROM restrictions, whether pathological in the case of hip OA or nonpathological in the case of soft-tissue restrictions, are correlated with LBP.

Hip-Muscle Performance and LBP

The work investigating the effects of hip strength on LBP has focused primarily on athletes. In 2000 Nadler et al[35] examined the relationship of hip-extension and -abduction strength in athletes and their effect on future LBP and lower extremity injury. Female athletes with a history of LBP demonstrated a significant side-to-side asymmetry in hip-extensor strength.[35] No difference was found in hip-extensor strength for male athletes with or without a history of injury or in hip-abduction-strength differences for either gender. In 2001 Nadler et al[36] examined hip-abductor and -extensor strength in college athletes. Logistic-regression analysis indicated a difference in side-to-side hip-extension strength as a potential predictive variable of future treatment for LBP among female athletes only.

Kankaanpää et al[38] investigated hip- and back-extension fatigability in subjects with chronic LBP. Using EMG spectral analysis, they reported that paraspinal fatigability was similar between groups, whereas the gluteus maximus fatigued more rapidly in the chronic LBP group. In addition, in a multifactorial cross-sectional study of 600 subjects with LBP, it was determined that hip-flexor, hip-adductor, and abdominal-muscle fatigability had a significant association with LBP.[39] The cited research indicates the evolving body of evidence linking strength decrements of the hip region to LBP.

Table 1 Level of Evidence Supporting Relationships Between Specific Hip and Low Back Dysfunction

Hip and low back relationship	Studies	Level of evidence supporting relationship
Hip–spine syndrome	Offierski & McNab[40]	Level III
	Ben-Galim et al[41]	Level II
	Murata et al[42]	Level III
	Nakamura et al[43]	Level III
	Yoshimoto et al[44]	Level III
	Takemitsu et al[45]	Level III
	Sato et al[46]	Level III
	Itoi[47]	Level II
	Watanabe et al[48]	Level III
Hip range of motion and low back pain	Ellison et al[28]	Level III
	Chesworth et al[29]	Level III
	Cibulka et al[30]	Level III
	Sjolie[31]	Level III
	Vad et al[32]	Level III
	Coplan[33]	Level III
	Mellin[34]	Level III
Hip-muscle performance and low back pain	Nadler et al[35]	Level III
	Nadler et al[36]	Level III
	Nadler et al[37]	Level III
	Kandaanpää et al[38]	Level III
	Nourbakhsh & Arab[39]	Level III

Recommendations

Although there is a lack of strong evidence (Table 1) with respect to the efficacy of treating the hip for LBP, this relationship still warrants consideration. Given the association of impaired hip ROM and LBP, treatment of hip-ROM deficits might be a beneficial treatment strategy. There have been studies that support the ability to improve hip-ROM deficits in patients with hip[19,49] and knee[20] OA. MacDonald et al[49] explored the effects of manual therapy and exercise in patients with hip OA (as classified by the American College of Rheumatology criteria[50]) in a case-series format. Mobilizations included both thrust and nonthrust techniques directed at the hypomobile areas of the hip capsule as determined by the treating clinician. All 7 subjects experienced decreased hip-region pain, increased function, increased hip ROM (especially into flexion and IR), and a median improvement of total hip ROM (summation of flexion, extension, abduction, IR, and ER) of 82°. Hoeksma et al[19] conducted a randomized controlled trial to investigate the difference between a stretching and long-axis thrust hip-mobilization group versus an exercise group in patients with hip OA. Results indicated that the hip-mobilization and stretching group achieved greater increases in hip flexion–extension and IR–ER ROM, as well as decreased pain and improved function and walking distance. Cliborne et al[20] investigated the short-term responses to hip mobilization of hip ROM and hip pain during provocative testing in individuals with knee OA. Manual therapy techniques were directed at either the anterior or posterior capsule of the hip, depending on where patients felt pain during provocative testing. Subjects demonstrated a significant ($P < .05$) increase in mean composite hip ROM (sum of hip flexion, functional squat, and FABER ROM) of 12.1° immediately after mobilization.

Evidence to support treating the hip for LBP is limited to a case study,[25] a case series,[27] and 1 randomized controlled trial.[26] Cibulka[25] described the case of a 35-year-old male with unilateral LBP diagnosed as sacroiliac dysfunction. The subject was found to have hip-ER asymmetry that was treated with an impairment-based stretching and strengthening program aimed at the hip, as well as the low back. Results indicated a 38% reduction in disability as measured by the Oswestry Disability Index, which was maintained at 1-year follow-up. Whitman et al[27] examined the effect of manual therapy and exercise applied to the lumbar spine, hip, and lower extremity in patients with lumbar spinal stenosis in a case series, as well as a randomized controlled trial.[26] In both studies, impairment-based manual therapy treatments of the hips and lumbar spine were applied with accompanying home exercises. Outcomes indicated positive functional improvements at both the short- and long-term follow-ups.

Given the role that hip-extensor strength and endurance,[38,39] along with the role hip-abductor and -adductor muscles, plays in lateral stability of the pelvis,[51] it is suggested that clinicians carefully examine the strength of these groups. Based on exam findings, clinicians can implement strengthening or stretching exercises with an emphasis on hip-extensor endurance given the findings of Kankaanpää,[38] as well as extensor strength given the work of Nadler et al.[35–37] The effect of hip-musculature strengthening on LBP is an area that requires further research to determine whether increased hip strength leads to decreases in pain and improvements in function. Research is also needed to determine more specifically whether there is a certain subset of patients with LBP that would benefit the most from such strengthening.

In addition to producing improvements in ROM, hip mobilizations have been found to improve hip-extensor[52] and -abductor[53] strength in normal individuals. Specifically, patients treated with grade IV mobilizations addressing the anterior hip capsule demonstrated immediate improvement in gluteus maximus[52] strength, and those treated with grade IV mobilizations addressing the inferior capsule demonstrated immediate improvement of hip-abductor[53] strength, compared with control groups. Although these studies were conducted on unimpaired individuals, their results might be relevant to those with hip-joint dysfunction, because it has been demonstrated that the muscles of the pelvic girdle most commonly affected with hip pathologies are the gluteal muscles.[54] This assumption has yet to be proven in the current literature, and future research is suggested before implementing it in treatment.

Conclusion

Best current evidence supports the link between impairments at the hip and LBP. Research suggests that decreased hip ROM, hip-extensor strength, and hip-adductor or -flexor endurance might contribute to pain in the lumbar area. Because of this emerging relationship, we suggest that hip-joint ROM, muscle performance, anatomical alignment, and mobility be considered during examination of patients with LBP.

Identifying hip impairments would lead to an impairment-based approach to treatment because current evidence has not identified the subgroup of LBP patients who would specifically benefit from treatment aimed at the hip. Because of the lack of high-quality research to help guide decision making, clinicians are left to intervene with impairment-level treatments. Interventions should focus on restoring hip ROM through both thrust and nonthrust mobilizations aimed at the areas of restriction. Treatments might also include both strength and endurance training of the identified impaired hip musculature.

Future research should further test the theoretical basis of treating the hip for LBP. Case studies or case series investigating the effects of hip mobilization or specific hip strengthening in LBP and HSS populations would be helpful in describing how clinicians use these techniques to treat this population. CPRs to identify subgroups of LBP and HSS patients who will benefit from specific interventions aimed at the hip could help clinicians decide when it is most appropriate to use these techniques. Most important to substantiate this relationship would be randomized controlled trials to determine whether treating the hip adds benefit to treatment of lumbar-spine impairments, which would also be necessary to validate the CPR.

Until such research is has been done to better direct treatment, it is recommended that clinicians consider taking a regional approach to the examination and treatment of LBP. Attention should be paid to the hip joint and its surrounding soft tissue, and interventions should be applied based on the impairments identified.

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