# *Editorial Commentary*: Lumbosacral Anatomy and Mechanics Influence Femoroacetabular Impingement Syndrome and Surgical Outcomes: The Hip Bone Is Connected to the Back Bone

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**Abstract:** The hip joint in general and femoroacetabular impingement (FAI) in particular do not exist in a vacuum. Impingement kinematics are very closely tied to the relationship between spinopelvic motion and posture, and that of the hip joint itself. While the relationship of lumbar degenerative disease, fusion, and sagittal balance to hip arthroplasty has been well studied, there is a paucity of data on the analogous relationship of the stiff spine with hip arthroscopy and FAI. While further studies are critical in advancing our understanding of this relationship in this unique population, surgeons still must consider the relationship of lumbosacral motion and posture, including the anatomic variant of lumbosacral transitional vertebrae, when evaluating and treating patients with FAI.

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The anatomy of femoroacetabular impingement (FAI) is quite common, with a prevalence of pincer and cam deformities of 67% and 37%, respectively, in asymptomatic hips.[1] However, despite a relatively high prevalence of these radiographic findings, only a limited number of patients develop symptomatic FAI syndrome or osteoarthritis.[2,3]

When patients present with hip-related complaints and positive provocative hip maneuvers on physical examination, it is easy, and tempting, to home in on the radiographic hip findings as an etiology of these complaints. Unfortunately, it is not always so simple. The concept of hip–spine syndrome was introduced in the early 1980s by Offierski and Macnab, who noted that a "failure to recognize concurrent disease at both the hip and spine may lead to misdiagnosis and possibly erroneous treatment."[4] This was later validated, as the literature began to show clinical improvement of low back pain with hip replacement alone.[5] Since that time, a great deal of research has gone into the relationship between concurrent disease processes in the hip and spine, as well as the relationship between mechanics at these joints.

Our understanding of the hip–spine relationship has evolved, first with regard to hip arthroplasty. The hip arthroplasty literature has demonstrated that lumbar spine disorders result in inferior outcomes following hip arthroplasty. Such lumbar spine disorders tend create less motion at the lumbar spine.[6-10] As spinopelvic anatomy and mechanics can dictate acetabular position and orientation, stiffness of the lumbar spine results in the need for the hip to accommodate that missing motion to create the correct position for daily activities such as sitting.[11-14] Decreased lumbosacral motion is generally related to degenerative changes or previous hip surgery and fusion in the hip arthroplasty population, but these concepts are being translated to the evolution of our understanding of hip arthroscopy as well, where anatomic variants, in addition to previous surgery, may result in decreased lumbosacral motion. Our understanding of the relationship between lumbosacral anatomy and hip arthroscopy has begun to follow. Recent literature suggests significantly worse clinical outcomes following hip arthroscopy for FAI syndrome in patients with a history of spine pathology (such as lumbosacral fusion, disc or vertebral pathology, or lumbosacral fractures) compared with those without

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pathology, although it is important to note that patients did significantly improve from their preoperative baseline, nevertheless.[15,16]

Given the evidence that spine pathology causing decreased motion results in potentially inferior outcomes following hip arthroscopy, it follows that anatomic variants that alter spinopelvic mechanics may have similar effects. Luo, Barsoum, Ashraf, Cheng, Hurwitz, Goldsmith, and Moley help advance our understanding of the complex relationship between lumbosacral anatomy and mechanics and hip outcomes with their study in the current issue, "Prevalence of Lumbosacral Transitional Vertebrae in Patients With Symptomatic Femoroacetabular Impingement Requiring Hip Arthroscopy."[17] In this outstanding study, the authors found both no correlation of unilateral lumbosacral transitional vertebrae (LSTV) sidedness and hip symptoms, as well as no association between LSTV anatomy and patient-reported outcomes measures following hip arthroscopy. Furthermore, the authors describe a similar incidence of LSTV to the low back pain literature, including a preponderance of this condition on the left side versus the right.

These findings differ from other reports in the literature, although this difference is hardly irreconcilable. Heaps et al.[18] recently reported less benefit of hip arthroscopy in patients with LSTV, with patients with LSTV having significantly lower patient-reported outcomes measures 5 to 11 months postoperatively, 12 to 23 months postoperatively, and 24 to 35 months postoperatively versus patients without LSTV. We would certainly benefit from further study to understand why patients with LSTV did worse than that of the current study by Luo et al., but it is important to note that a significantly greater proportion of patients with LSTV had Castellvi type 3 or 4 on this study (52% of patients included with LSTV) compared with the study by Luo et al. (7.7% of patients included with LSTV).[17,18] This difference between cohorts may highlight the importance of lumbosacral motion loss on hip outcomes. This is in line with biomechanical and finite element studies that show that even with more stiffness, low-grade transitional vertebrae do retain some degree of mobility that may not be present in those with fused vertebrae.[19,20] Future investigations can certainly evaluate whether these patients with more fusion, hence less lumbosacral motion, indeed perform more poorly following hip arthroscopy.

Unfortunately, there remains a paucity of particularly high-quality studies on the pathomechanics of FAI, which limits our ability to translate our findings in clinical studies to anatomic and mechanical findings.[21] However, Luo et al.[17] make a very salient point, as they begin to wrap up the discussion of their findings, when they "hope clinicians can consider the potential role of the lumbosacral junction in their examinations and treatments of symptomatic patients"—a sentiment that I second, wholeheartedly. The posture and anatomy of the lumbosacral spine are intimately related to hip motion in general, and FAI in particular. For instance, pelvic tilt has been shown to be significantly related to the presence of FAI. Specifically, increased anterior tilt results in more impingement, as increased pelvic tilt leads to a loss of internal rotation and earlier occurrence of FAI, whereas increased posterior pelvic tilt results in less impingement through an increased availability to internally rotate.[22,23] As physical therapy can help change pelvic tilt, and even small changes in pelvic tilt can have a significant effect on terminal hip range of motion,[22] this relationship may help explain why some patients improve with physical therapy, or perhaps remain symptomatic, and may suggest limited room for improvement or coping in those with decreased lumbosacral motion.[24] Furthermore, alterations in pelvic tilt alter the location of impingement,[23] and can even influence radiographic parameters,[25] thus it is important to consider factors that could limit lumbosacral motion during workup of FAI syndrome. While further well-done clinical studies will help us further understand this relationship, it is not too soon to keep lumbosacral anatomy in consideration during the workup of patients.

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