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Fred R. Nelson

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# COMMENTARY & PERSPECTIVE

## Spinal-Pelvic-Femoral Relationships Change After Total Hip Arthroplasty: A Clear Path Forward

Commentary on an article by Moritz M. Innmann, MD, et al.: “Spinopelvic Characteristics Normalize 1 Year After Total Hip Arthroplasty. A Prospective, Longitudinal, Case-Controlled Study”

Fred R. Nelson, MD

Innmann et al. selected the term “spinopelvic characteristics” for the title of their study. However, based on the impact of altered hip flexion in osteoarthritis of the hip, a better term might be spinal-pelvic-femoral relationships. The key components of spinopelvic characteristics are lumbar lordosis, pelvic tilt, and flexion deformity of the hip. In total hip arthroplasty (THA) planning, spinopelvic characteristics can have an impact on component stability and relief of low back pain. Fixed spinopelvic abnormalities have a distinct impact on prosthetic hip alignment that often requires cup adjustment at the time of the THA<sup>1</sup>. However, changes that occur in mobile segments postoperatively are the key issues in this study. Low back pain is seen in 20% to 50% of patients with severe osteoarthritis of the hip and is relieved in the majority of patients after THA. It is possible that correcting the flexion deformity of the hip results in improved pelvic tilt and lumbar lordosis, resulting in relief of low back pain. It has been shown that fixed flexion is ameliorated (the pelvic-femoral angle is slightly increased) with THA. However, in this study, standing spinopelvic measures were similar between the preoperative group and the postoperative group. This begs the questions: does the sitting range of motion change after THA, and are there concurrent changes in the spinopelvic components?

In this study, spinopelvic parameters were measured on standing radiographs and dynamically with the subject seated and the femur aligned horizontally (relaxed-seated) and with the subject leaning forward and the femur aligned horizontally (deep-seated). These positions provided a more comprehensive assessment of the effect of hip mobility on spinal-pelvic-femoral mechanics. Before THA, patients illustrated significantly less hip flexion, greater pelvic tilt, and greater lumbar movements transitioning from standing to relaxed-seated. These measures all returned to close to normal following THA. The higher prevalence of preoperative spinopelvic hypermobility that was observed in patients compared with controls likewise returned to normal. This is associated with the improvement seen in back pain in this study.

This article has immediate clinical impact. Innmann et al. have defined dynamic changes in spinopelvic and pelvic-femoral parameters that change the impact of preoperative measures often used to adjust acetabular cup orientation in preoperative planning. Degenerative hip joint deformity can change spinopelvic and pelvic-femoral relationships; in this study, these measures, when changing from standing to sitting, result in greater pelvic flexion due to decreased femoral flexion. The authors used the term relative pelvic movement as the amount of extension by the pelvis during the transition from standing to relaxed-seated or deep-seated positions. A higher value reflects greater pelvic extension (increased pelvic tilt) in sagittal movement during this transition. A high hip user index indicates that the hip contributes more to motion in sitting down, and a low hip user index indicates that the spine contributes more to motion in sitting down. Aside from improvement in back pain following hip replacement, the take-home message is that these acquired deformities also change following hip replacement. As the authors note, being aware of dynamic measures that change with replacement surgery may reduce inappropriate adjustments in acetabular cup placement based on these measures.

A recent retrospective observational study was designed to determine if the order of THA and lumbar spinal stenosis surgery influences patient-reported outcomes. In the absence of overriding evidence that stenotic symptoms are predominant, those authors supported performing THA first<sup>2</sup>. As spinopelvic mobility normalizes after some THAs, there may no longer be a need for lumbar spine surgery. Of the 2 surgical procedures, spinal decompression will not have much effect on spinopelvic or pelvic-femoral motion. In contrast, hip replacement surgery may lead to changes in spinopelvic and pelvic-femoral motion. However, fixed spinopelvic measures as seen in lumbar fusion will not respond to changes in pelvic-femoral motion as seen in arthroplasty<sup>1</sup>.

A final thought on nomenclature: The description of the spinopelvic and pelvic-femoral motion segments and their measures varies in the literature. Although that does not affect the impact of the authors' message in this study, the clear path to more solid clinical guidelines will be paved by a more consistent terminology for anatomic terms and measurements<sup>3</sup>.

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**Disclosure:** The **Disclosure of Potential Conflicts of Interest** form is provided with the online version of the article (<http://links.lww.com/JBJS/G950>).

### References

1. Ike H, Dorr LD, Trasolini N, Steffl M, McKnight B, Heckmann N. Spine-pelvis-hip relationship in the functioning of a total hip replacement. *J Bone Joint Surg Am.* 2018 Sep 19; 100(18):1606-15.
2. Eneqvist T, Bülow E, Nemes S, Brisby H, Fritzell P, Rolfson O. Does the order of total hip replacement and lumbar spinal stenosis surgery influence patient-reported outcomes: an observational register study. *J Orthop Res.* 2021 May;39(5):998-1006.
3. Darrith B, Nelson FR, Davis JJ, Silverton CD. Letter to the Editor: The effect of postural pelvic dynamics on the three-dimensional orientation of the acetabular cup in THA is patient specific. *Clin Orthop Relat Res.* 2021 Aug 1;479(8):1873-5.