

# Spine Stiffness Leads to High Pelvic Mobility &dash; Uncoupling Native Mechanics and Explaining Why Patients with Stiff Spines have Increased Dislocation-Risk

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## INTRODUCTION:

The importance of studying the hip-spine interaction prior to total hip arthroplasty (THA) is increasingly being recognized by arthroplasty surgeons. Patients with stiff spines are at increased risk of instability post-THA, presumably due to pelvic stiffness leading to postures such as “stuck seated/ stuck standing.” However, these hypotheses have not been validated in patients without hip arthritis, which is necessary to understand the body’s compensation mechanisms (i.e., what is demanded of the native hip in the presence of stiff spine). This study aimed to compare spinopelvic characteristics in different groups (healthy; spine-fusion only; hip-arthritis only) and identify compensation mechanisms necessary for maintenance of function.

## METHODS:

This is a case-control study using prospectively collected data from a single academic center. Three groups were studied: asymptomatic volunteers without hip or spine disease (Controls); patients with hip osteoarthritis, without spinal disease, prior to THA, (Hip-Group); and patients with spinal fusions *in situ* without hip arthritis/pain (Spine-Group). The groups were matched for age (63±11 years-old; p=0.9), sex (60%male; p=0.9), and BMI (28±6; p=0.6) from a prospective database that includes 820 patients. All underwent standing and deep-seated radiographs to determine spinopelvic characteristics. The difference in sacral slope, lumbar lordosis, and pelvic-femoral angles allowed for calculation of pelvic-, spinal-, and hip- motion respectively.

## RESULTS:

When standing no differences in lumbar lordosis or pelvic incidence were detected between groups; the Spine-Group had greater pelvic tilt (18° vs. 14° vs. 14°; p<0.001) and hips more extended (PFA: 194° vs. 183° vs 186°; p<0.001). When seated, all parameters differed. The Spine-Group had less lumbar flexion (32° vs. 48°; p<0.001) but significantly greater pelvic (20° vs. 6°; p<0.001) and hip (105° vs. 87°; p<0.001) flexion to Controls. The Hip-Group had similar lumbar (44° vs. 43°; p=0.7) but significantly reduced pelvic- (-7°; p<0.001) and hip- (68°; p<0.001) flexion to Controls.

## DISCUSSION AND CONCLUSION:

A stiff spine leads to high pelvic mobility, contrary to current thinking, because the stiff spine increases lever forces on the pelvis with different movements. In the presence of a stiff spine, the demand on the hip is significantly increased. When standing, the hip is extended while the pelvic tilt is increased (anteverting acetabulum), increasing posterior impingement/ anterior instability risk. When bending forward, the pelvis flexes forwards more than in controls (level arm by stiff spine), leading to anterior pelvic tilt, acetabular retroversion, increasing anterior impingement/posterior instability risk. Careful preoperative planning and execution (with or without dual-mobility bearings) are necessary to maximize impingement-free range in such patients.