

## **Title**

Spine Stiffness Leads to High Pelvic Mobility – Uncoupling Native Mechanics and Explaining Why Patients with Stiff Spines Have Increased Dislocation-Risk

## **Authors**

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## **Introduction**

Stiff spines patients are at increased risk of instability post-THA, due to pelvic stiffness leading to “stuck seated/stuck standing” postures. These hypotheses have not been validated in patients without hip-arthritis. This study aimed to compare spinopelvic characteristics of asymptomatic volunteers without hip/spine-disease (Controls), patients with hip-osteoarthritis, without spine-disease (Hip-Group), and patients with spinal fusion, without hip-disease (Spine-Group) and identify compensation mechanisms.

## **Methods**

This is a prospective, single-center, case-control study at a tertiary referral center. Groups were matched for age, sex and BMI from a database including 820 patients. All underwent standing and deep-seated radiographs to determine spinopelvic characteristics. Difference in pelvic tilt (PT), lumbar lordosis (LL) and pelvic-femoral angles (PFA) allowed for calculation of pelvic-, lumbar-, and hip- motion respectively.

## **Results**

When standing, no difference in LL or PI was detected between groups. The Spine-Group had greater PT ( $18^\circ$  vs.  $14^\circ$  vs.  $14^\circ$ ;  $p < 0.001$ ) and hips more extended ( $194^\circ$  vs.  $183^\circ$  vs.  $186^\circ$ ;  $p < 0.001$ ). When seated, all parameters differed. The Spine-Group had less  $\Delta$ LL ( $32^\circ$  vs.  $48^\circ$ ;  $p < 0.001$ ), but greater  $\Delta$ PT ( $20^\circ$  vs.  $6^\circ$ ;  $p < 0.001$ ) and  $\Delta$ PFA ( $105^\circ$  vs.  $87^\circ$ ;  $p < 0.001$ ) to Controls, whilst the Hip-Group had similar  $\Delta$ LL ( $44^\circ$  vs.  $43^\circ$ ;  $p = 0.7$ ), but reduced  $\Delta$ PT ( $-7^\circ$ ;  $p < 0.001$ ) and  $\Delta$ PFA ( $68^\circ$ ;  $p < 0.001$ ).

## **Discussion**

A stiff spine increases pelvic mobility, contrary to current thinking, because the stiff spine increases lever forces on the pelvis. Standing, the hip is extended whilst posterior PT is increased, increasing posterior impingement/anterior instability risk. When bending forwards,

the pelvis tilts more anteriorly than controls, increasing anterior impingement/posterior instability risk. Careful pre-op planning is necessary to maximize impingement-free range in such patients.