# Severe Hip and Knee Osteoarthritis Worsens Patient-Reported Disability in Adult Spinal Deformity Patients

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INTRODUCTION:

The complex interplay between lower extremity OA and sagittal alignment is of growing clinical interest. Here, we aim to quantify the sequential effects of lower extremity OA on PROMs in ASD patients. Our hypothesis is that hip and knee osteoarthritis (HOA and KOA) incrementally affect baseline patient-reported outcome measures (PROMs) in adult spinal deformity (ASD) patients.

METHODS:

Patients with no prior thoracolumbar surgery, and baseline PROMs and standing radiographs were included. 2 independent reviewers graded OA with the Kellgren-Lawrence (KL) scale. Patients were categorized into **Spine** (KL <3 bilateral hips and knees), **Spine-Hip** (KL>3 bilateral hips, KL <3 bilateral knees), **Spine-Knee** (KL>3 bilateral knees, KL>3 bilateral hips), **Spine-Hip-Knee** (KL>3 bilateral hips and knees). Baseline demographics, spinopelvic alignment, and PROMs were compared. Multivariate linear regressions, using forward stepwise selection, assessed the incremental impact of demographic, radiographic parameters, and OA severity with significant Pearson correlation on each PROM.

RESULTS:

160 patients were included: 56 Spine, 32 Spine-Knee, 20 Spine-Hip, and 52 Spine-Hip-Knee. Spine-Hip-Knee patients were older (Spine=62.2, Spine-Knee=61.2, Spine-Hip=59.1, Spine-Hip-Knee=68.5; $p<0.001$) but similar in sex, comorbidities, and frailty (all $p>0.05$). Spine-Hip-Knee patients had higher SVA (50.0, 30.6, 60.5, 83.5; $p<0.001$), T1PA (25.2, 20.4, 20.3, 27.8; $p=0.004$), GSA (3.7, 2.3, 4.3, 7.5; $p<0.001$), and KA (0.0, 2.1, 2.9, 10.5; $p<0.001$). SRS total and VR12 PCS scores were similar but VR12-2b climbing stairs (1.73, 1.91, 1.55, 1.40, $p=0.014$) and SRS-8 back pain at rest (2.29, 2.84, 1.95, 2.71, $p=0.012$) were lower in Spine-Hip-Knee and Spine-Hip, respectively. ODI (42.75, 35.88, 50.30, 44.59, $p=0.040$) and ODI Pain (2.88, 1.84, 2.90, 2.46, $p=0.019$) were higher in Spine-Hip patients. ODI lifting was higher in patients with hip pathology but not significant (2.95, 2.69, 3.45, 3.35, $p=0.055$). In multivariate analyses, KOA increased the prediction of ODI pain from $R^2$ 0.052 to 0.086 and SRS-8 from $R^2$ 0.077 to 0.147. HOA increased the prediction of VR12-2b from $R^2$ 0.113 to 0.140 and ODI Lifting from $R^2$ 0.175 to 0.202. Frailty significantly influenced PROMs across all evaluated models ($p<0.001$) and GSA improved models for ODI, ODI pain, and VR12 question 2b scores (all $p<0.05$).

DISCUSSION AND CONCLUSION:

Severe hip and knee osteoarthritis worsen patient-reported disability and physical function in ASD patients. These results quantify the impact of lower extremity arthritis on patient reported outcomes, and highlight the need for integrated assessment and management of both spinal alignment and joint health in patients.

| PROM | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| ODI | $R^2$ 0.295<br>Frailty (B: 4.321, SE: 0.532, p<0.001) | $R^2$ 0.310<br>Frailty (B: 4.066, SE: 0.541, p<0.001)<br>GSA (B: 0.521, SE: 0.253, p=0.041) | | |
| ODI Pain | $R^2$ 0.052<br>Frailty (B: 0.163, SE: 0.053, p=0.002) | $R^2$ 0.086<br>Frailty (B: 0.173, SE: 0.052, p=0.001)<br>Knee OA (B: -0.206, SE: 0.079, p=0.010) | $R^2$ 0.116<br>Frailty (B: 0.145, SE: 0.052, p=0.006)<br>Knee OA (B: -0.247, SE: 0.080, p=0.002)<br>GSA (B: 0.062, SE: 0.025, p=0.015) | |
| ODI Lifting | $R^2$ 0.143<br>Frailty (B: 0.206, SE: 0.040, p<0.001) | $R^2$ 0.175<br>Frailty (B: 0.210, SE: 0.226, p<0.001)<br>Gender (B: 0.527, SE: 0.212, p=0.014) | $R^2$ 0.202<br>Frailty (B: 0.198, SE: 0.039, p<0.001)<br>Gender (B: 0.615, SE: 0.213, p=0.004)<br>Hip OA (B: 0.163, SE: 0.072, p=0.025) | |
| VR12-2b | $R^2$ 0.113<br>Frailty (B: -0.101, SE: 0.012, p<0.001) | $R^2$ 0.140<br>Frailty (B: -0.091, SE: 0.012, p<0.001)<br>Hip OA (B: -0.099, SE: 0.024, p<0.001) | $R^2$ 0.148<br>Frailty (B: -0.082, SE: 0.013, p<0.001)<br>Hip OA (B: -0.078, SE: 0.025, p=0.002)<br>GSA (B: -0.012, SE: 0.005, p=0.026) | $R^2$ 0.155<br>Frailty (B: -0.081, SE: 0.013, p<0.001)<br>Hip OA (B: -0.074, SE: 0.025, p=0.003)<br>GSA (B: -0.045, SE: 0.016, p=0.004)<br>SVA (B: 0.003, SE: 0.001, p=0.023) |
| SRS-8 | $R^2$ 0.077<br>Frailty (B: -0.138, SE: 0.038, p<0.001) | $R^2$ 0.147<br>Frailty (B: -0.148, SE: 0.037, p<0.001)<br>Knee OA (B: 0.203, SE: 0.056, p<0.001) | | |

**Table:** Results from multivariate linear regression with forward selection. Variables listed are associated with each sequential model.