

# Impact of Hip and Knee Osteoarthritis on Full Body Compensation for Sagittal Spinal Deformity

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**INTRODUCTION:** Patients with adult spinal deformity (ASD) often present with overlapping symptoms of hip-spine, knee-spine, or hip-knee-spine pathologies. Limited data exists on how hip and knee osteoarthritis (OA) impact compensation for ASD such as pelvic retroversion, knee flexion, and pelvic shift.

## METHODS:

A total of 527 preoperative ASD patients with full body radiographs were included. Two independent reviewers graded patients with Kellgren Lawrence (KL) classification for hip and knee OA. Patients were grouped by KL of bilateral (BL) hips and knees: G1: BL KL <2, G2: Uni KL 3, contra <3, G3: BL KL3, G4: Uni KL4, Contra 3+. The entire cohort of patients were stratified into 4 groups by quartile of T1 pelvic angle (TPA) severity. For each quartile, full body alignment and compensation were compared. Incremental impact of severe hip and knee OA on compensatory mechanisms was examined using regression analysis controlling for PI/Age.

**RESULTS:** The 4 TPA-severity groups means were 7.3°, 19.5°, 27.8°, 41.6°. For Hip OA severity, % pts in each group were G1: 46%, G2: 16 %, G3: 29%, G4: 9% and Knee OA 49%, 12%, 29%, 10%. Pts with worse hip OA had less recruitment of PT (24 for G1 vs. 16 for G4) and hip extension (SFA: 207 vs. 197), greater knee flexion, worse SVA (45mm for G1, 90mm for G4) and GSA with mean TPA of 19.5, and similar PI-LL. As TPA increases to mean (27.8), PT variance was minimal across OA groups (25.6 – 29.6) with less SFA in severe OA (209, 211, 201, 204) but greater knee flexion angle. Regression revealed as TPA increased, PT decreased with greater Hip OA severity while Knee OA increased PT by means of knee flexion ( $r^2=0.812$ ). Hip OA also decreased compensation via SFA (B Coef -0.206). Knee and Hip OA contributed to greater compensation via knee flexion (B Coef 0.215, 0.101 respectively). For pelvic shift, Hip OA contributed positively to the model while Knee OA did not (B Coef .100).

**DISCUSSION AND CONCLUSION:** Increased severity of OA decreased hip extension (SFA), thereby diminishing pelvic retroversion (PT). For the same magnitude of spinal deformity increased hip OA severity is associated with worse truncal and full body alignment with posterior translation of the pelvis. Independent of spinal deformity severity, patients with severe hip and knee OA exhibit increased knee flexion that may occur due to compensation for sagittal deformity, lower extremity

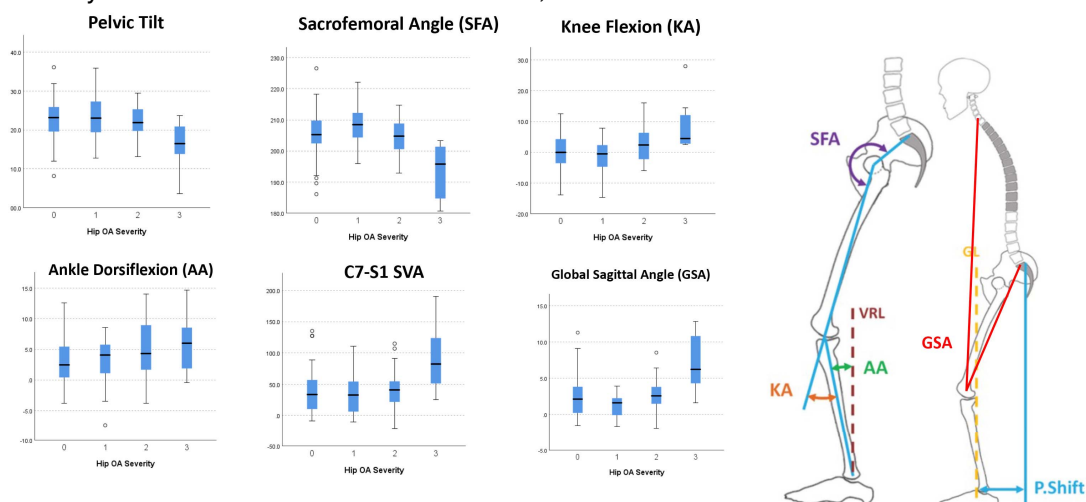


Figure: Chain of compensation by Hip OA severity, for a spinal deformity group with mean TPA of 19.5°