Effects of hip joint orientation and skeletal torsion on human locomotor biomechanics: Implications for interpretations of hominin locomotor diversity

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Bipedal locomotion is a defining feature of the human lineage. However, the form of bipedality in different hominin taxa and the timing of emergence of a human-like striding bipedal gait have long been a subject of debate. Morphological features of the hip and pelvis have been used to argue for kinematically different gaits in *Australopithecus*, early *Homo*, Neanderthals, and modern humans. However, limited comparison of morphology and locomotor performance in living humans has left a weak base upon which to build hypotheses of locomotor diversity in fossil hominins. In this study, we address these problems by quantifying skeletal torsion features in the pelvis and lower limb and directly evaluating their relationships with transverse plane kinematics during walking in a sample of adult humans. Individually, femoral version, tibial torsion, acetabular version, and iliac blade orientation are not correlated with transverse plane walking kinematics in our sample. However, correlations between femoral version and tibial torsion and between femoral version and iliac blade orientation suggest that there may be anatomical compensatory mechanisms for lower limb skeletal torsion to maintain a forward-facing foot and relative lengths of hip abduction and internal rotation moment arms during walking. These results suggest that caution is warranted in interpretations of musculoskeletal function and performance based on features of skeletal morphology alone, especially in anatomical regions that are highly variable or functionally integrated. Future analyses will evaluate relationships of skeletal torsion features with moments acting about the hip and knee, which may better reflect functional differences in walking mechanics.