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Abstract

Understanding load-sharing in the spine during *in-vivo* conditions is critical for better spinal implant design and testing. Previous studies of load-sharing that considered actual spinal geometry applied compressive follower load, with or without moment, to simulate muscle forces. Other studies used musculoskeletal models, which include muscle forces, but model the discs by simple beams or spherical joints and ignore the articular facet joints.

This study investigated load-sharing in neutral standing and flexed postures using a detailed Finite Element (FE) model of the ligamentous lumbosacral spine, where muscle forces, gravity loads and intra-abdominal pressure, as predicted by a musculoskeletal model of the upper body, are input into the FE model. Flexion was simulated by applying vertebral rotations following spine rhythm measured in a previous *in-vivo* study, to the musculoskeletal model. The FE model predicted intradiscal pressure (IDP), strains in the annular fibers, contact forces in the facet joints, and forces in the ligaments. The disc forces and moments were determined using equilibrium equations, which considered the applied loads, including muscle forces and IDP, as well as forces in the ligaments and facet joints predicted by the FE model. Load-sharing was calculated as the portion of the total spinal load carried along the