

## **In-vivo Spine Biomechanics**

- Investigation of Lumbar Disc Biomechanics Using a Combined *In Vivo* and *In Silico* Approach

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The development of adjacent segment degeneration (ASD) is a major concern after lumbar spinal fusion surgery, but the causative mechanisms remain unclear. This paper discusses our research using a combined in vivo and in silico method that investigates the changes of biomechanical responses of the adjacent segments after lumbar fusion of patients under weight-bearing standing conditions. The in vivo adjacent disc height changes before and after fusion were measured using a dual fluoroscopic imaging system (DFIS), and the measured in vivo intervertebral positions and orientations were used as boundary conditions of the patient-specific three-dimensional (3D) finite element (FE) models to simulate intrinsic biomechanical responses of adjacent discs to fusion of the diseased segments. Our data demonstrated that fusion could cause alterations in adjacent disc biomechanics, and the combined in vivo and in silico method could be a valuable tool for investigating causative factors of ASD after lumbar fusion surgery.