

## EFFECTS OF TORSO FLEXION ON FATIGUE FAILURE OF LUMBOSACRAL MOTION SEGMENTS

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Twelve fresh, frozen lumbosacral spines (average age 81 + 9 years) were dissected into three motion segments (L1-L2, L3-L4, L5-S1). Care was taken to reproduce the postures, spinal loads, and loading rates associated with lifting a 9 kg box in three torso flexion angles. An EMG-assisted model was used to develop loads and load rates at three torso flexion angles (0, 22.5, and 45 degrees). Motion segments were randomly assigned to torso flexion postures using a partially-balanced incomplete block design.

Specimens were potted in trays containing polymethylmethacrylate, with proper flexion angles being confirmed using multiple radiographs during fixation. Motion segments were placed in a humidified environmental chamber at 37 deg C, creep loaded for 15 minutes, and then repetitively loaded at 0.33 Hz (up to 10000 cycles) using an MTS servohydraulic test frame [Bionix 858, MTS Systems, Eden Prairie, MN].

Failure was defined as displacement of the specimen by 10 mm (after creep loading). Torso flexion angle had an immense impact on fatigue life ( $p < 0.0001$ ). Motion segments loaded in the 0 degree condition averaged 8253 cycles to failure (+ 2895), specimens at 22.5 degrees lasted 3257 (+ 4443), while those at 45 degrees lasted an average of 263 (+ 646) cycles. No differences in fatigue life was observed by lumbar level or flexion\*level interaction ( $p > 0.05$ ).

Logistic regression uncovered associations between specific damage patterns and loading and/or motion segment characteristics. As examples, stellate endplate fractures were associated with less degenerated discs ( $p < 0.01$ ) and increased shear forces ( $p < 0.05$ ), while lateral endplate fractures were seen in larger segments ( $p < 0.01$ ). Damage to facets was more common at 0 degrees torso flexion ( $p < 0.01$ ). Results of this study imply greatly increased risk of fatigue failure of spinal tissues while lifting in flexed torso postures.

**ABSTRACT BOOK**

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