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Human Cervical Intervertebral Disc Pressure Response During Non-Injurious Quasistatic Motion: A Feasibility Study

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Abstract-

The human neck is highly vulnerable in motor vehicle crashes, and cervical spine response data are essential to improve injury prediction tools (e.g., crash test dummies, human body models). This feasibility study aimed to implement the use of pressure sensors in whole-body post-mortem human subject (PMHS) cervical spine intervertebral discs (IVDs) to confirm the feasibility and repeatability of cervical IVD pressure response to biomechanic research. Two fresh frozen whole-body PMHSs were instrumented with miniature pressure sensors (Model 060S, Precision Measurement Company, Ann Arbor, MI, USA) at three cervical IVD levels (C3/C4, C5/C6, and C7/T1) using minimally invasive surgical insertion techniques. Each PMHS underwent three quasistatic motion test trials, and each trial included multiple head/neck motions (i.e., gentle traction, flexion/extension, lateral bending, axial rotation, and forced tension/compression). Results showed marked pressure differences between both the cervical level assessed and the motion undertaken as well as successful intra-subject repeatability between the three motion trials. This study demonstrates that changes in cervical IVD pressure are associated with motion events of the cervical spine. Cervical IVD response data could be utilized to assess and supplement the characterization of the head/neck complex motion, and data could facilitate the continued improvement of injury prediction tools.

Index Terms- biomechanics; cervical spine; neck; intervertebral disc; cadaver; whole body; PMHS; pressure; injury prevention; non-injurious

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