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Effect of Flexion Angle during Impact on the Replication of Spinal Fractures

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Extended Abstract

In the U.S, there are 150,000 high energy trauma fractures per year according to Reitman et al. (2004) and the majority of these fractures occur in the thoracolumbar junction with Roche et al. (2008) recording 43.8% of fractures occurring at the thoracolumbar junction. The change of the seat belt restraint from lap belt to three-point restraint systems has greatly reduced the severity of fractures from frontal collisions and it has reduced the number of cervical and thoracic fractures but not thoracolumbar and lumbar fractures (Wang et al. (2009)). Also, Ball et al. (2000) stated that patients with spinal fractures from frontal collisions, that used a three point restraint, are more likely to incur a burst fracture.

This study analysed the effect that the flexion angle, upon impact, has on the creation of spinal fractures in animal models. In this study, twelve sika deer L4 vertebrae were tested with impact angles of 0˚, 10˚ and 20˚. For the zero degree tests, an incremental impact drop test method was adopted which was shown by Panjabi et al. (2000) to be a superior method, to the single impact method, of replicating burst fractures. For tests at ten and twenty degrees, a new, alternative drop test method was used; this method induces both axial compression and a bending moment. With this method, the specimen is attached to the drop test cross head. The impact force is created by the compression plate and the flexion angle is altered by adjusting the compression plate angle.

After impact testing, all twelve specimens were scanned by computed tomography and the fracture types created were classified by an orthopaedic surgeon. One specimen which was subjected to Panjabi's incremental method, at 0° angulation, was scanned between loads and on inspection no evidence of a fracture was present however, on inspection of the CT scans, it can be seen that the specimen was fractured on the laminae.

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