عنوان مقاله:

Design and Fabrication of a Drop Tower Testing Apparatus to Investigate the Impact Behavior of Spinal Motion Segments

محل انتشار:

مجله استخوان و جراحی عمومی, دوره 8, شماره 6 (سال: 1399)

تعداد صفحات اصل مقاله: 7

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خلاصه مقاله:

Background: The vertebral column is the second most common fracture site in individuals with high-grade osteoporosis(30–50%). Most of these fractures are caused by falls. This information reveals the importance of considering impactloading conditions of spinal motion segments, while no commercial apparatus is available for this purpose. Therefore,the goal was set to fabricate an impact testing device for the measurement of impact behavior of the biological tissues.Methods: In the present study, first, a drop-weight impact testing apparatus was designed and fabricated to record bothforce and displacement at a sample rate of 100 kHz. A load cell was placed under the sample, and an accelerometerwas located on the impactor. Previous devices have mostly measured the force and not the deformation. Thereafter,the effect of high axial compression load was investigated on a biological sample, i.e., the lumbar motion segment, wasinvestigated. To this end, nine ovine segments subjected to vertical impact load were examined using the fabricateddevice, and the mechanical properties of the lumbar segments were extracted and later compared with quasi-staticloading results.Results: The results indicated that the specimen stiffness and failure energy in impact loading were higher than thosein the quasi-static loading. In terms of the damage site, fracture mainly occurred in the body of the vertebra duringimpact loading; although, during quasi-static loading, the fracture took place in the endplates.Conclusion: The present study introduces an inexpensive drop-test device capable of recording both the force andthe deformation of the biological specimens when subjected to high-speed impacts. The mechanical properties of thespinal segments have also been extracted and compared with quasi-static loading results.Level of evidence: V

کلمات کلیدی:

Drop-weight impact machine, Fracture, Impact loading, Spinal motion segment