Experimental investigation of failure load and fracture patterns of C2 (Axis)

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ABSTRACT

The injury mechanism and magnitude of failure load of C2 fracture are important in the clinical treatment of its fracture fixation. The magnitudes of the failure load of C2 and the mechanism of injury in vivo are uncertain. Accordingly, nine C2 vertebrae obtained from cadaver spines, ranging in age from 51-73 years, were used for the study. Special restraint conditions were applied to yield specific fracture of C2. With the posterior element potted postero-anteriorly up to one-quarter of the inferior facet, posterior shear force ranging from 840-1220N was required to cause fracture across the pars interarticularis. For odontoid fracture study, a special rig was fabricated to encapsulate the body of C2 in the cell using ISOPON, and a thin layer of ISOPON sandwiched between the inferior facets and two lateral plates. The assembled rig permits slight sagittal movement of C2 about the cup lateral pivot supports. Failure load of between 900-1500N was recorded for odontoid fracture. These values are in agreement with published data. The experiment carried out under these two different restraint conditions had specifically resulted in different fractures of C2. In reality, depending on factors such as the inclination of this force vector applied to the head, the precise posture at the time of trauma, the spinal geometry, and the physical properties, different types of fracture patterns of C2 may be produced. This additional data will be useful in the biomechanical study of C2 vertebra using analytical approaches, and in the surgical anterior/posterior fixation using screws.

Keywords: odontoid fracture, hangman fracture, cervical spine, experimental study