

Acute failure modes of intervertebral discs (IVDs) have long been a topic of disagreement among the spine research community. There have been several studies evaluating acute failure modes in the human lumbar spine, including notable work by Adams and Hutton in the early 1980's that demonstrated that disc herniation was unlikely to be induced during traumatic overload events [1]. However, there continues to be substantial disagreement as to whether the same can be said of smaller diameter (e.g., cervical) intervertebral discs. To date, little work has been done evaluating acute failure modes for smaller IVDs. Biomechanically, there are reasonable arguments to be made that IVDs will fail differently depending on their size or location. The purpose of the present work was to investigate failure modes of small diameter IVDs under various acute (e.g. single event) loading conditions. The results demonstrated that regardless of loading protocol, the predominant failure mode and location for a healthy, intact specimen were consistent across all tests. All failures occurred in the vertebrae, just inferior to the bony endplate. However, when the anterior surface of the annulus fibrosus was scored with a scalpel while under extreme hyperflexion, traumatic herniation at the site of the damage occurred. The results show that in smaller diameter IVDs acute disc herniation of healthy IVDs is unlikely to occur, as the IVD is not the weakest mechanical point of the vertebral segment. However, pre-existing damage to the annulus fibrosus may allow acute disc herniation to occur during acute overload events.

1. Adams, M.A. and W.C. Hutton, Prolapsed intervertebral disc. A hyperflexion injury 1981 Volvo Award in Basic Science. *Spine (Phila Pa 1976)*, 1982. 7(3): p. 184-91.