Ligament Injury After Side Impact Collisions

The last ten years have seen great progress in our understanding of how people can be injured in rear-end auto collisions. Side impact collisions are also a common occurrence, but researchers have largely neglected these types of injuries. Finally, a new German study has investigated the issue of side-impact collisions.

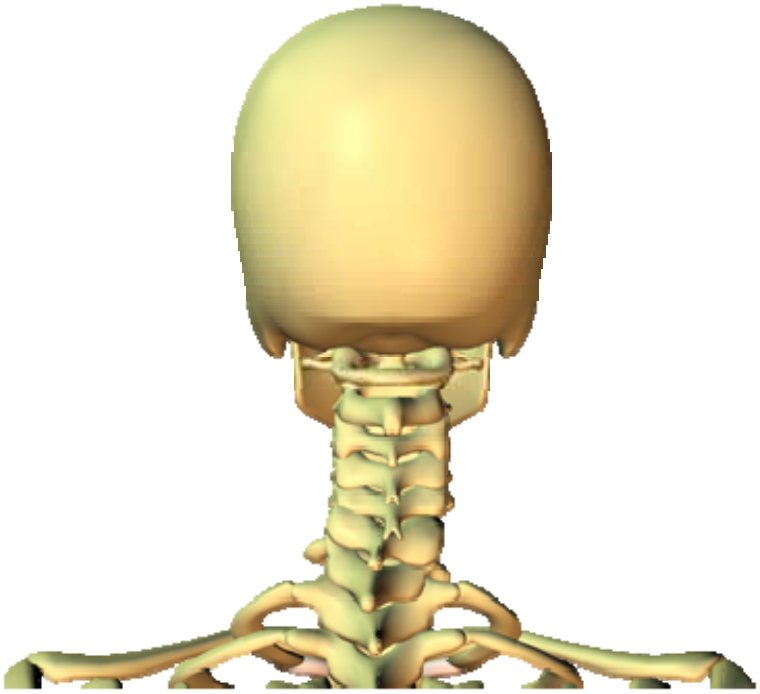
The researchers in this study have used a technique commonly used in studying rear-end collisions: they subjected a number of cadaver cervical spines to simulated impacts, and then studied the spines for signs of injury. Their goal was to determine if these types of collision could be responsible for alar ligament injury in the upper spine; the authors, however, also looked at the entire spine when evaluating injury.

The specimens were subjected to three extremely low speed collisions: 1g (2.65 mph), 2g (5.1 mph), and 3g (7.7 mph).

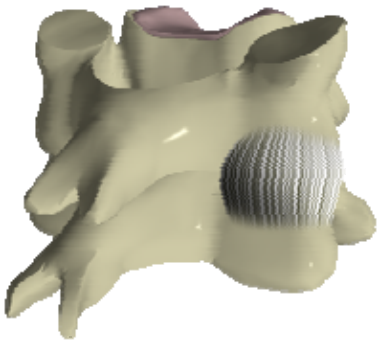
The authors found that the head accelerations of the test specimens were approximately double what the sled accelerations were: for instance, in the 3g test, the head acceleration reached 7.13g. What this means is that during such a side impact collision, the normal 10-pound mass of the human head turns into a 70-pound force rapidly moving to the side of the body.

Not surprisingly the researchers found that this violent force resulted in injury to the test specimens:

- "**A complete rupture of the left facet joint capsule** in combination with a partial rupture of the intervertebral disc was observed in five specimens, and an additional rupture of the right capsule was observed in one specimen." [Emphasis added.]
- "Two specimens were injured at C5–C6, two at C6–C7 and two at C7–T1."
- "No lesions of the alar ligaments were detected in any of the six cases."
- "In four specimens damage occurred during the 2 g collision, in one during the 3 g collision and in one during the 4 g collision."



The authors speculate that lateral impacts create an “s-shaped curve” similar to what is experienced during a rear-end collision. In this scenario, the occupant’s torso moves with the car seat, which is rapidly accelerated to the side. Inertia causes the head to lag behind, which puts tremendous strain on the lower cervical vertebral joints.



One issue that was not addressed by this study was the role played by spinal muscles. Obviously, the test specimens in these experiments did not have the normal muscle activity that a live occupant would have in a real world collision. However, recent studies have shown that the occupant motion that occurs during a collision is so rapid that the muscles don’t have time to react and protect the spine.[2]

This is the first study that has looked at ligament injury after lateral impacts. The authors found objective evidence of ligament trauma in collisions of very low acceleration.

1. *Hartwig E, Kettler A, Schultheiss M, et al. In vitro low-speed collisions cause injury to the lower cervical spine but do not damage alar ligaments. European Spine Journal 2004; June 22, Epub.*
2. *Stemper BD, Yoganandan N, Pintar FA. Influence of muscle contraction on whiplash kinematics. Biomedical Sciences Instrumentation 2004;40:24-29.*