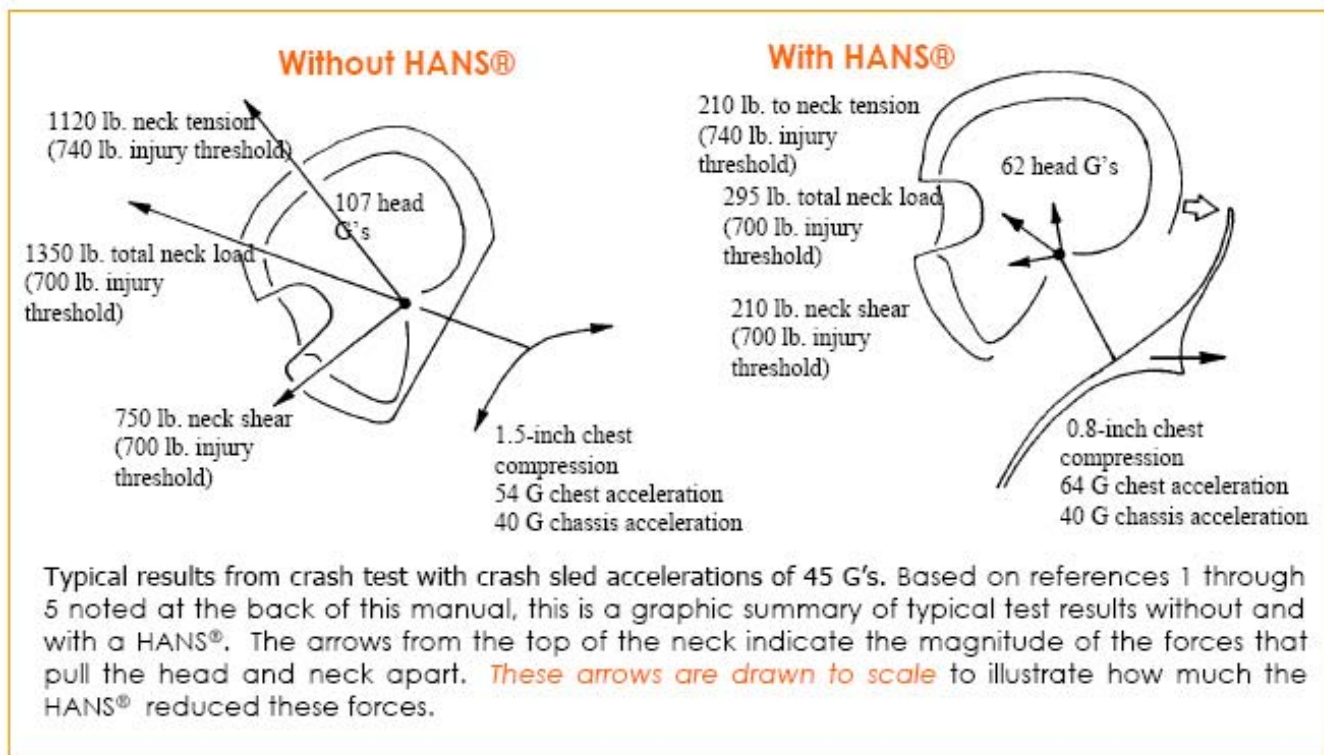


Frames from high-speed video of GM crash sled tests simulating a NASCAR cockpit at Wayne State University in 2000. The sled acceleration was 45 G's. The left frame shows the test without a HANS®; the right is with a HANS® (highlighted in orange, tethers in yellow)

Basic Concept: In a crash without a HANS®, the shoulder harness and seat restrain the driver's torso but only the neck restrains the head and helmet.

The HANS® device reduces the whipping action of the head and keeps the driver's head from being pulled away from his upper body. With a HANS®, forces stretching the neck in a frontal collision are typically reduced by 80%. In a frontal crash, the tethers restrain the head with forces that directly counteract the head's forward movements while the torso and HANS® are restrained by the shoulder harness. By restraining the head to move with the torso in a crash, the head motions and forces in the neck are dramatically reduced. In crash tests without a HANS®, head accelerations, like neck loads, are largest due to the swinging motion of the head.



Without a HANS®, the head pulls the neck forward with a shearing load that may exceed the injury threshold limit. The neck tension (pull) may be much larger than the injury threshold limit because the head swings violently forward. Neck shear and tension combine for a total neck load that can greatly exceed the injury threshold. These extreme neck loads are the cause of basilar skull fractures. The basilar skull fracture is the most common cause of death in a racing accident.