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## **Key to avoiding whiplash injury may lie in head restraint positioning**

The study by Brian Stemper, Ph.D., assistant professor of neurosurgery, resulted in the most comprehensively validated computer model for whiplash reported in scientific literature.

"The practical aspect of this study is that you want to set your head restraint so that it's very close to the back of your head. Each time drivers and passengers get in a car, they should be sure the head restraint is correctly positioned to minimize injuries," Dr. Stemper suggests.

His work is published in the journal *Accident Analysis and Prevention* and data from the report has been submitted to the U.S. Department of Transportation for possible use in determining safety rules for car manufacturers.

Whiplash injuries affect the soft tissues of the cervical spine (e.g., ligaments and intervertebral discs) and can be sustained in any type of crash but occur most often in low speed rear-end collisions. The injury affects more than one million people in the U.S. each year and results in symptoms of neck pain, headaches and lower back soreness. A high percentage of all patients sustaining whiplash injury report long-term pain. A 1999 Insurance Institute for Highway Safety study found that 26 percent of rear-struck vehicle drivers reported neck injuries.

Dr. Stemper has investigated cervical spine ligament stretch during whiplash by comparing increasing distances between the back of the head and the head restraint. He has developed a mathematical computer model of the head and cervical spine that can be studied under simulated rear-end collision conditions. The model provides quantifiable data on soft tissue distortions in humans.

"The process involved moving the head restraint to different positions to look at spinal ligament distortion and see how it changed with each of these configurations," he says. "Ligament distortions were compared to previously determined failure thresholds. Our team also used

previous studies and computer models to validate our work. In addition, we studied the computer response in 57 different measures of spinal motion. This data was compared to previous experimental research to be sure they were realistic."

"We found that auto head restraints positioned less than 2.4 inches (6 cm) from the back of the head kept ligament stretch within the physiologic range - meaning that no injury would occur. However, as the restraint distance increased beyond 2.4 inches, the ligaments began to exceed failure thresholds, meaning that whiplash injury was more likely to occur," says Dr. Stemper.

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Co researchers with Dr. Stemper on the study are Narayan Yoganandan, Ph.D., and Frank A. Pintar, Ph.D., professors of neurosurgery.

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