

MEDICOLEGAL NEWS

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NEW RESEARCH ENDS THE DEBATE ON LOW SPEED IMPACTS

Consider the following breakthrough articles and key quotes:

The relationship between clinical and kinematic responses from human subject testing in rear-end automobile collisions

Experts analyzed the findings of the Brault et al, 1998 study and concluded that “factors other than the selected peak kinematic responses influenced symptom production . . . Given the limited ability of the kinematics-based model to reliably predict symptoms, it can be assumed that other variables, such as variations in the injury tolerance of biological tissue or differences in pain perception, also play a role in injury causation and symptom production.”

“Event-related factors which may be related to the presence, severity or duration of WAD (whiplash associated disorders) have been grouped into three categories: seat factors, occupant factors, and external factors. Seat factors include seat and head restraint geometry, stiffness, strength, and inclination; occupant factors include gender, anthropometry, seated posture and preparedness; and external factors include vehicle mass, stiffness, bumper design and collision severity.” (Siegmond et al, 2000) (Many references cited.)

Clearly, Delta V is not the only factor that must be considered in evaluating the likelihood or severity of injuries.

WHIPS – Volvo’s whiplash protection study

For the past ten years, Volvo has performed extensive research to find out how to build a seat that will help protect occupants involved in low speed rear end impacts. The findings prove that serious injuries are possible when there is no hyperflexion or hyperextension of the neck.

Analysis of 1,297 Volvo cars involved in rear end impacts found that “the injury risk is shown to be almost constant irrespective of impact severity.”

“It is obvious that in rear end impacts people frequently sustain neck injuries even in crashes with very low impact severity.”

“WHIPS (the new Volvo seat) is primarily designed to provide protection at low and moderate impact speeds, at which many whiplash injuries occur.” (Jakobsson et al, 2000)

“Accident investigation findings and the results of credible injury mechanism research

must be evaluated to enable an engineering approach to be defined. In the context of the present study, this resulted in the formulation of three guidelines expressing a holistic approach to the whiplash problem, with the aim of addressing all current theories and dealing with all possible conditions. These are:

- § to reduce occupant acceleration;
- § to minimize relative movements between adjacent vertebrae and in the occipital joint; in other words, *to minimize changes in the curvature of the spine during the crash* (emphasis added);
- § to minimize forward rebound into the seat belt.”

Volvo research has also proven that the “no crash = no injury” argument is false:

“In rear-end collisions, it is obvious that car occupants often sustain neck injuries even in crashes of very low impact severity (5, 23). This is seen in Fig. 3 which is based on a subset of 1,467 belted drivers in Volvo cars involved in rear-end impacts . . . Since the chart in Fig. 3 shows the risk of injury to be almost constant, regardless of the degree of deformation of the car body, severity descriptors based on deformation depth are obviously not good predictors of this type of risk.” (Jakobsson et al, 1998)

Biomechanical assessment of soft tissue cervical spine disorders and expert opinion in low speed collisions

“The injury mechanism which may cause soft tissue neck disorders are multiple and not all of them are fully understood biomechanically.” (Four references listed.)

“. . . expressions like ‘walking speed’ . . . seem to describe the collision rather accurately, but the expert can not draw any reliable and quantitative conclusions out of such pseudo-quantitative expressions.” (Walz et al, 2000)

Influence of seat characteristics on occupant motion in low speed rear impacts

“2. Injury mechanism

It has generally been accepted that hyperextension of the neck is the cause of whiplash, and research has been conducted to examine the tolerance of humans to hyperextension of the neck. The results of recent studies have shown, however, that factors other than hyperextension also deserve attention. It has been reported that whiplash can occur even in situations that do not lead to hyperextension. Although the mechanism of whiplash is not fully understood at present, the motions thought to be involved . . . include (a) ramping-up and straightening of the spine in the initial to middle period of the impact; (b) abrupt backward movement of the head relative to the torso; and (c) hyperextension of the neck . . . It is thought that the ‘facet joint injury mechanism’ would likely occur as a result of the simultaneous occurrence of motions (a) and (b).

The internal pressure changes in the cervical spinal canal would occur with motion (b) . . . (Watanabe et al, 2000) (Multiple references listed.)

Head restraints – the neglected countermeasure

This journal article was written by Brian O’Neill of the Insurance Institute for Highway Safety, an insurance company funded organization.

“Strains of the neck caused by hyperextension still may explain many whiplash injuries with symptoms lasting a few days or weeks but do not account for all whiplash injuries, especially the ones that have prolonged symptoms such as tingling and numbness in the arms and/or chronic pain that can last for months. The longer lasting symptoms are likely to involve neurological damage.” (O’Neill, 2000)

The author then discusses the pressure spike mechanism of injury that was discovered in experiments in Sweden with pigs. Another recent article found the same pressure spikes in post-mortem human subjects. (Eichberger et al, 2000)

CONCLUSION

Some engineers state that a neck injury is not possible in the absence of hyperextension or hyperflexion of the neck. The above-listed articles prove, beyond a reasonable doubt, that injurious movements occur in the neck following a low speed rear end impact. No one understands the exact nature of the injury mechanism but considerable research supports the facet joint and pressure spike injury mechanisms. Hyperextension and hyperflexion are not required for these mechanisms to come into play.

Volvo has researched this issue for more than ten years and developed a new seat that helps reduce the injurious movements of the neck which occur in the absence of hyperextension and hyperflexion. Additional published Volvo research proves that the amount of deformation of a vehicle is not directly correlated with the likelihood or severity of injury.

All of the listed articles are available from the University of Arizona Health Sciences Library. Call 520.626.6850 to order. You can get articles faxed to you immediately.

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