Dynamic Chiropractic

WHIPLASH / NECK PAIN

Whiplash Injury Threshold: New Lower Speed Defined

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A couple of years back I went up to British Columbia to visit with the principals of Macinnis Engineering Associates. Knowing that they had been collecting data on human volunteer crash tests for some time, I approached them with the prospect of doing the engineering and crash work for a project I had in mind. Unfortunately, we could not come to an agreement on the details of the relationship and that project was scrubbed.

Recently two papers were jointly published by researchers at Macinnis Engineering and Biomechanics Research and Consulting, Inc.: one in the engineering literature;[1] the other in the medical literature.[2] These papers answered the questions we had been looking to answer.

The question of a threshold for cervical soft-tissue injury has been hotly debated for many years. It is complicated by a daunting collection of human and physical variables which are difficult to define and even more difficult to test, particularly when there is a risk of injuring test subjects. The earliest published work involving a human volunteer was that of Severy et al.,[3] who conducted limited 8-10 mph delta V tests. (Delta V is defined as a change in velocity. When two like-sized vehicles collide in the typical colinear arrangement seen in rear-impact crashes, a 10 mph impact by the bullet vehicle will typically result in a delta V of about 6-8 mph in the target vehicle.)

Subsequently, several other human volunteer crash tests have been conducted.[4-7] These researchers, nearly all of whom are also actively engaged in medicolegal defense work, have generally presented their purposes for such work in relatively vague terms (if they presented them at all). Because much of this work is funded by auto insurance companies and manufacturers (agents who stand to gain from the outcome), a cynic might argue that to satisfy institutional review boards and/or Helsinki guidelines which generally frown on research in which human subjects are placed at risk of injury, these researchers' stated quest for pure kinematic data had at least a slight flavor of subterfuge. Since the subjects (for the most part the researchers themselves) were all given some form of (usually rudimentary) medical examination after the tests; since some were injured slightly in all of these studies; and since the principal investigators have typically been used (extensively in one case and to the tune of over $7 million over a three-year period) as insurance company experts to testify that the risk of injury in low-speed rear-impact collisions (LOSRIC) is negligible; one might cynically conclude that demonstrating that the injury potential was quite low was probably more of a priority than was admitted to. In any case, as my loyal readers know well, I am no cynic.

In other papers and in my textbooks I have described these crash tests in some detail. They are very important for us and allow us to develop a fairly good model of the LOSRIC. Where they have no value at all is, paradoxically, the area where they are used most: in predicting whether a specific person in a specific real-world crash should, would, or could have been injured. After all, one need go no further than the common case in which one occupant is so severely injured that he is killed outright, while another suffers only bruises. Such accidents might be reconstructed for liability and/or criminal reasons, but clearly, more information about the two occupants is needed in order to explain the death of one and minor injury of the other. In other words, it is not sufficient to know merely the delta V and acceleration of the vehicle in which they were riding.

Yet, as obvious as this seems to us, many defense strategies rely on the general lack of serious injury to the very small number of generally healthy adult male (and a few female) volunteers, under mostly ideal laboratory conditions and in the above-mentioned crash tests. Rarely are known risk factors even mentioned in the reports of accident reconstructionists or engineers. There are many other parlor tricks used by defense engineering experts which have been recently exposed.[8] (This, by the way, is a handy article for plaintiff lawyers to have. To my knowledge, no such compendium of cheap tricks has been published elsewhere.)

Even more interesting is the fact that most of these researchers seem to have very poor memories when they testify in court for the defense, forgetting completely that some of the volunteers were actually injured. To hear them spin their yarns in court (and I have had some experience with a few), you'd think it was nearly impossible to be injured in LOSRIC. In fact, you'd think they were talking about some other research entirely. This, of course, is why experts and treating doctors alike, simply must be familiar with this literature: for self-defense purposes if nothing else.

Many of these researchers also seem to have forgotten their first science lesson. First we make an observation, then we develop a hypothesis to explain it, and then we test our hypothesis. If we take the rather extensive epidemiological data on whiplash injuries as the observation, it makes no sense to essentially test hypotheses that find such injuries unlikely. Consider, for example, that there are about three million whiplash injuries each year (about the population of South Carolina); about 59% of the LOSRIC cases do not fully recover (about the population of Nebraska); and about 10% become disabled (about the population of Wyoming). These are not the figures of a rare or unlikely disorder. Nor are whiplash-associated disorders, as the Quebec Task Force erroneously concluded, self-limiting or benign conditions.

The studies of McConnell et al.,[3,4] Szabo et al.,[5] and West et al.,[6] generally point to a threshold of injury of about five mph delta V. These were minor injuries. However, they occurred, as I stated, in mostly male healthy adult volunteers engaged in purposeful and controlled research, in which the volunteers themselves were the researchers. Moreover, the long-term follow-up of these volunteers is rarely reported. And, of course, one might be concerned with conflicts of interest based on the funding sources and future employment as expert witnesses. But again, only a cynic would contemplate these things.

Among the known risk factors for injury and/or poor outcome are surprise collision, having the head turned at impact, out-of-position occupant, female gender, significantly larger (>50%) striking vehicle, advanced age, and significant pre-existing neck/back pain or headaches. With few exceptions, most were missing in these crash tests. Thus, the risk of marginal external validity rears its ugly head in these studies, and became the reason for an Arizona judge to exclude the testimony of a prominent defense engineer in a recent case. His testimony regarding the probability of injury to the plaintiff was to be based entirely upon the results of limited, controlled crash tests.

The latest installment in human volunteer crash tests is the best conceived and executed to date.[1,2] Both males and females were recruited by newspaper advertisement and subjected to rear-impact crash tests at 4 kmph (2.5 mph) and 8 kmph (5 mph). Pre- and post-crash examinations were more involved than in previous tests, and these factors may help to explain the incidence of minor injury reported, which was somewhat higher than in previous studies: 29% in the 2.5 mph delta V crashes, and 38% in the 5 mph delta V crashes. Again, those with physical conditions predisposing themselves to greater injury were excluded. This means the results were naturally biased toward a less severe injury. The symptoms primarily reported were those most common to typical whiplash injuries: headaches and neck pain. As pointed out by the authors,[2] these tests contribute to the construct validity of the whiplash phenomenon.

So now the bar has been lowered in a sense. It appears that the threshold for injury, even in adult healthy volunteers under ideal laboratory conditions, may be as low as 2.5 mph. And, of course, these injuries produced transient symptoms only. But add a few known risk factors, and who knows how low this mysterious threshold might actually be. Certainly these results seem to be consistent with the literature that shows that about half of all such injuries occur at speed changes of 6-12 mph.[9] And only at the upper end of that speed range do vehicles typically sustain structural damage.[10] Thus, the popular insurance company hack, "no crash -- no cash," holds no water at all because the data clearly indicate that injury is more common with little or no structural damage occurring to vehicles. But then I think it all started as a typographical error on an internal memo anyway. It was supposed to read, "no cash -- no cash."

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