

CAN DELTA V PREDICT INJURY LIKELIHOOD OR SEVERITY?

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Of what predictive value is Delta V, exactly? In their report, defense engineers imply that one can simply calculate Delta V and then accurately predict the likelihood and severity of injury for any particular individual. Truly, nothing could be further from the truth. This may have been the thinking of a few engineers in the mid-1990s, but the current consensus of the relevant scientific communities is far different.

Engineer Siegmund, an authority cited by most defense engineers, lists 13 factors that must be taken into account when predicting injury likelihood and severity. Only one of the 13 is Delta V, referred to as “collision severity.” Dr. Siegmund’s 2000 study concluded: “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. (Siegmund et al, 2000) The engineers only consider collision severity/Delta V and ignore the other 12 factors, thus rendering their conclusions meaningless.

Another scientific peer-reviewed published journal article concluded that in order to predict injury likelihood and severity, one would need to know information about the individual’s tissue strength and elasticity and “any multitude of variables that evade accurate determination” along with the Delta V, defined as “velocity” and “force.” No engineer has specific information about any plaintiff’s tissue strength or elasticity, or any of the following variables which one must know in order to predict injury likelihood or severity: “head position, head-torso angles, restraint placement, anticipation, tissue elasticity, tissue strength, and any multitude of variables that evade accurate determination.” (Duffy et al, evade accurate determination.”

The authors state it is impossible to simply calculate a figure for Delta V and then accurately predict the risk or severity of injury. In addition to Delta V, one must know about all factors listed above and this obviously gets extremely complicated if not impossible. It is clear that no one knows the answers for all of these questions. Again, this renders the engineers’ conclusions meaningless.

To emphasize the objectivity and authority of this study, it is important to note that it was published in *The Spine Journal* which is the preeminent peer-reviewed medical journal relied upon by orthopedic surgeons and chiropractors. Author credentials are also very important. Dr. Duffy, an M.D., was with the Department of Orthopaedic Surgery, Munroe Meyer Institute, and Division of Plastic Surgery, University of Nebraska Medical Center, Omaha, Nebraska. Dr. Duffy’s conclusion reflects the thinking of the overall biomechanical/accident reconstruction community. The defense engineer’s opinion that one can draw conclusions from Delta V alone has not been generally accepted by the biomechanical and accident reconstruction community.

The following four journal articles are from the peer-reviewed scientific literature and reflect the general consensus of the clinical biomechanical and accident reconstruction

communities. The journal studies and their noted conclusions are supported by numerous references cited by the authors. The conclusions drawn by these multiple authors were approved by the independent peer-reviewers, have achieved general consensus in the scientific community, are in full agreement with the positions I have taken herein.

In 2005, a study was published in *Pain Research Management* entitled: “A Review Of The Literature Refuting The Concept Of Minor Impact Soft Tissue Injury.” The article notes: “Minor impact soft tissue (MIST) is an insurance industry concept that seeks to identify late whiplash as a psychosocial phenomenon. However, the medical literature in this area has not been systematically reviewed since the Quebec Task Force’s review in 1995.” The article’s objective was: “To review the medical literature which claims that late whiplash is an organic phenomenon causing significant disability.” The authors examined the theory that “it is virtually impossible to sustain a permanent or severe injury from a low-damage car crash and, therefore, these claims should be handled differently.” Their conclusion was that “A review of the literature did not support the validity of MIST.” Sixty-three medical journal articles were reviewed. (Centano et al, 2005)

Another recent study concluded: “A substantial number of injuries are reported in crashes of severities that are unlikely to result in significant property damage. Thus, property damage is neither a valid predictor of acute injury risk nor of symptom duration. Other factors, such as head restraint geometry, awareness of the impending crash, sex, and prior injury are likely to impose competitive or stronger outcome effects, particularly as regards long-term outcome. Based upon our best evidence synthesis, the level of vehicle property damage appears to be an invalid construct for injury presence, severity or duration. The MIST (Minor Impact Soft Tissue) protocol for prediction of injury does not appear to be valid.” (Freeman and Croft, 2005)

Another 2005 study concluded that “there is no established minimum threshold of significant spine injury. The greatest explanation for injury from traumatic loading of the spine is individual susceptibility to injury, an unpredictable variable.” Also: “. . . significant spinal injury can result from low-level accelerations.” (Freeman et al, 2005)

A peer-reviewed study was recently published (2009) in a standard journal, *Patient Safety Surgery*, entitled: “Deceleration during 'real life' motor vehicle collisions – a sensitive predictor for the risk of sustaining a cervical spine injury?” It is available full text at U.S. National Library of Medicine at <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2657117/>

In this study, the actual Delta V was determined for 57 real-life car accidents. Then, the clinical findings of the involved passengers were carefully evaluated and classified. Finally, the Delta V was compared to the clinical findings. The conclusion was: “The results of this study indicate that ΔV is not a conclusive predictor for cervical spine injury in real-life motor vehicle accidents. This is of importance for surgeons involved in medicolegal expertise jobs as well as patients who suffer from whiplash-associated disorders (WADs) after motor vehicle accidents.”

It is clear that the modern peer-reviewed scientific literature supports the position that one cannot calculate Delta V and then predict injury likelihood or severity. There are literally NO peer-reviewed journal studies that state otherwise. The entire hypothesis that injury likelihood or severity can be predicted based on a determination of Delta V has been thoroughly

disproven and discredited. Furthermore, it has never been generally accepted by any relevant scientific community. Nonetheless, defense engineers write report after report pretending that their methodology has been generally accepted when it most certainly has not.

There is even more proof that if the true Delta V is known, it is impossible to accurately predict injury risk or severity from this number alone. “In rear-end collisions, it is obvious that car occupants often sustain neck injuries even in crashes of very low impact severity . . . 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; Jakobsson, et al, 2000) Deformation depth can be converted into Delta V using accepted methods.

Engineers calculate the forces applied to the subject vehicle. Yet engineers have found that even when the Delta V is identical for multiple crashes involving the same vehicles, the forces to which the head and neck are exposed varied by a considerable amount. Research found that when the Delta V was 5 mph, peak head acceleration varied from 6.7 to 12.0 g's. When the Delta V was 2.5 mph, peak head acceleration varied from 1.6 to 5.0 g's. Therefore, even when the Delta V can be calculated exactly, the amount of force applied to an occupant's head is literally anyone's guess. (Seigmund, et al, 1997) Therefore, engineers do not know how much force was applied to the plaintiff's body. Clinicians are not concerned with the forces applied to the vehicle. They are only interested in the forces actually applied to the person.

In order to further understand why Delta V cannot be used alone to predict presence or absence of injury in an individual, it is important to understand the difference between predicting an injury outcome in the general population and in an individual. While it may be correct to state, for example, that a 5 mph Delta V rear impact collision will only result in a significant injury in 1 in 100 individuals, this low probability of injury is unrelated to the actual result of the crash in an individual, as they may very well be the one in 100 who was injured.

The low probability of injury in the general population does not help determine the presence of injury in the individual any more than the low probability of dying in a plane crash helps to determine whether an individual is dead following a crash. Using probability to predict a non-injury outcome of a crash, in spite of medical evidence to the contrary, is a classic application of junk science. “The pre-event probability of an occurrence is not a valid measure of whether the occurrence took place; either it did or it did not (0.0 or 1.0). As a simple example, deaths resulting from plane crashes are exceedingly rare, however, a pathologist's clinical observations of a decedent following a plane crash would not be considered to be in error because the death was unlikely to have occurred.” (Freeman et al, 2008)

Also: “The fallacy can be further illustrated with the example of the roll of a six-sided die. The probability that a six will be rolled is 1 in 6 (17%), and the probability that something other than a six will be rolled is 5 in 6 (83%). In this example, the result of the roll is recorded by a hypothetical machine that has been found to have an error rate of one in 50 observations, so that the roll is misidentified in 2% of cases. The Prior Odds Fallacy would occur if a 6 was rolled and subsequently identified as such by the machine (with a 2% error rate), but it was asserted that there was an 83% probability that the result was something other than a 6 (83% probability the machine is wrong).” (Freeman et al, 2008)

A simple analogy is seen in the game roulette; before the ball is dropped on the spinning wheel the probability of landing in a single slot is one out of however many slots there are in the wheel (for this example we'll say 50). So if a gambler wants to bet on the number 10, he or she has a one in 50 chance of winning. If the ball drops into the slot for number 10, the pre-event odds of one in 50 cannot be used to prove that the ball is not in the number 10 slot after the event.

By the same logic, a prediction after the fact that an individual should not have been injured because the probability of injury was low before the crash is irrelevant as to whether the injury actually occurred. Just as the presence of the roulette ball in slot number 10 is verified by a visual examination of the roulette wheel, and not negated by the low probability of the occurrence, the presence of injury following a crash is verified by *medical evidence of the presence of injury*, and speculation regarding the low probability of injury is irrelevant. Unscientific speculation regarding the low probability of injury following a crash in spite of *real medical evidence* to the contrary is not valid forensic evidence and should be given no weight at all.

The defense engineer in essences makes the claim that when he played roulette the ball did not land on 50, and therefore he would never expect it to land on 50. This is not appropriate forensic testimony, since it promotes a fallaciously derived probability over the medical facts of the case. (Freeman et al, 2008)

Defense engineers generally place no weight on medical records, not surprising since engineers have no medical education and thus no ability to read and comprehend medical records. A case file might include records from multiple doctors documenting objective evidence of injury immediately following the subject trauma but all such records are dismissed as irrelevant by the engineer. This denial of medical reality has actually been legally banned in Arizona which requires "genuine reliance" on medical records in all biomechanical/accident reconstruction analyses. The independent Arizona Department of Insurance, considered a referee in this state, agrees with this position as stated in Circular Letter 2000-2:

"A fair and reasonable investigation includes a genuine effort to determine the nature and extent of the injuries actually sustained by the claimant. Though a claims investigation may begin with an assessment of the likelihood of the claimed injury based on certain characteristics of the collision and its observable consequences, the investigation must progress to an evaluation of all the reasonably available relevant evidence to determine what injury the particular claimant actually sustained. If an insurer merely determines that it has an arguable basis to assert that it is unlikely that a claimant could have been injured at all or beyond a certain extent based solely on the relative speed of the collision and the extent of resulting physical damage, the insurer has not completed a fair and reasonable investigation of the claim.

Generally, a fair and reasonable investigation of a first or third party claim for bodily injury arising out of a vehicular collision should include consideration of, at a minimum, if reasonably available: (1) claimant statements; (2) witness statements; (3) police reports; (4) visual evidence depicting the full nature and extent of the physical damage to all vehicles involved in the collision and any other property damage; and (5) relevant medical records and physician statements pertaining to both medical history of

the claimant and treatment arising out of the subject collision. If the insurer is unable to obtain any of this basic information, the claim file should reflect the attempts to obtain the information and an explanation as to why the information was unavailable. An insurer may not refuse to accept or consider relevant information offered by the claimant.

These same general principles apply to the use of biomechanical or injury causation analyses to evaluate low impact claims. This kind of analysis is an attempt to extrapolate the severity of bodily injuries resulting from a collision through assessment of the objective consequences of the collision, particularly the physical damage to the vehicles. Because it is a predictive exercise that ultimately cannot yield more than an opinion as to the likelihood of bodily injury, it cannot constitute the sole basis for a final claim decision that comports with the requirements of A.R.S. § 20-461. Before it may arrive at a final decision, the insurer must also genuinely consider the other available relevant evidence to determine what specific injuries the particular claimant actually sustained as a result of the collision.”

If a defense engineer does not genuinely consider the relevant medical records in the formation of his opinions, those opinions are deficient on this basis alone and should be thrown out. Keep this fact in mind when discussing cases with insurance claims adjusters as well.

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