D29 Updating the Injury Reconstruction Methodology: An Exemplar Motor Vehicle Crash (MVC) Case Involving Restraint and Intrusion Issues

David J. Porta, PhD, Bellarmine University, Dept of Biology, 2001 Newburg Road, Louisville, KY 40205*

After attending this presentation, attendees will understand how the study of free, publicly available online databases of MVC data can assist with the reconstruction of injuries for research and/or forensic analysis. A sample crash case will illustrate this process.

This presentation will impact the forensic science community by informing attendees of an important update to the method of injury reconstruction, which is a less common subdivision of accident reconstruction.

In 1994, Nahum and Gomez published a Society of Automotive Engineers (SAE) technical paper describing the steps recommended for reconstruction of injuries, a parallel to accident reconstruction which focuses on occupant kinematics in addition to the vehicles and roadway.[1] The paper also included a nice overview of biomechanical research related to injury production. American Academy of Forensic Sciences (AAFS) attendees will understand how utilizing online federal crash databases serves as a modernization and enhancement of the methodology described in this seminal work. This will be demonstrated via examination of a forensic case involving the questions of if and how proper restraint utilization could have mitigated injuries to the unrestrained driver of a particular model pickup truck which struck the rear of a tractor trailer.

Approximately 15 states allow for the so-called "Seat-Belt Defense" in which it can be argued in court that a driver is partially responsible for his or her injuries when that person was not properly restrained — even when they are not at fault in the accident. The subject case involves such a defense. Crash severity can be described in terms of the information gleaned from the police report, the event data recorder (a.k.a. black box), and photos from the accident scene. In this case, the pickup was travelling 52mph one second before impact and brakes were applied 0.5 seconds before impact. The damage was severe as it suffered a 43mph change in longitudinal velocity. Although police indicated the 5′11″, 264-pound, 39-year-old male driver was restrained, the event data recorder and eventual inspection showed otherwise. He suffered fractures of the right femur and bilateral tibial plateaus, a T-1 wedge fracture, right foot fractures, and a mesenteric tear, in addition to numerous contusions and abrasions. What injuries could have been prevented had the driver elected to follow state law and properly restrain himself?

To answer this question, the facts were compared to the data and videos publicly available through the New Car Assessment Program (NCAP) frontal crash tests of this model vehicle (specifically NCAP tests 7121 and 7099) performed for the United States Department of Transportation National Highway Transportation Safety Administration (NHTSA). These tests involved 35mph crashes of the same model truck into a solid barrier. In each case, a restrained, instrumented 50-percentile male Anthropomorphic Test Dummy (ATD) was placed in the driver's seat and an instrumented 5th-percentile female ATD was restrained in the passenger seat. The NCAP tests indicated less than a 5% chance of femur fracture in these crashes with proper restraint use (three-point seat-belt and airbag). The online databases of the National Automotive Sampling System (NASS) were searched for investigations of real-world frontal crashes involving the same model vehicle with even higher changes in velocity. In NASS case 77301100, the pickup truck struck a square bridge support column and experienced a 51.6mph change in velocity. The 6′, 190-pound, restrained 30-year-old male driver only suffered bruised knees. While this data seemingly supports a seat-belt defense, the importance of an actual vehicle inspection will be demonstrated.

Online crash data can be extremely valuable, but issues such as underride, override, and intrusion may trump the crash data during injury reconstruction and exploration of the seat-belt defense. In this case, the pickup truck underrode the trailer and struck with such violence that displacement of the engine and transmission forced the firewall, dashboard, and steering wheel well into the occupant compartment negating the normal benefit of properly utilized three-point restraint.

Reference(s):

1. Nahum A.M., Gomez M.A. Injury reconstruction: The biomechanical analysis of accidental injury. *Society of Automotive Engineers*. 1994 Technical Paper 940568: 69-79.

Injury Reconstruction, Injury Biomechanics, Seatbelt