

Low Speed Accidents

The plaintiff verbally moved in limine, to preclude the testimony of a biomedical engineer who was being proposed as an expert witness by the defendant before the commencement of the damages portion of a bifurcated trial. Upon listening to the defense attorney's proffer of the engineer's expected testimony and after reviewing the engineer's written report, this Court was skeptical about the reliability of such evidence and thereby decided to conduct a Frye¹ hearing to ascertain whether the evidence being proffered was "generally accepted" in the engineering community. In order to prepare for the hearing, this court temporarily excused the jury until the next day and directed the defense attorney to ensure that the proposed engineer immediately provide the plaintiff's counsel and this court the supporting data and literature which formed the basis of his opinion.

After hearing the testimony by the proposed engineer about his education, training and experience, and after reviewing his curriculum vitae, the court qualified him as an expert in the field of biomedical engineering. However, due to the unreliable methodology which he utilized to reach his conclusions, he was precluded from presenting his opinion to the jury on whether the physical forces exerted in this accident could have caused the plaintiff's herniated and bulging spinal disks. This is the written decision confirming that verbal decision.

Facts

The plaintiff, Deborah Clemente, was a 40 year old driver of a 1996 GMC Jimmy 4-door sport utility vehicle (SUV) that was hit in the rear by a 1989 Chevrolet Astro passenger van (van) driven by Ernest J. Blumenberg, who was 17 years old at the time of the accident. At the liability portion of the bifurcated trial, the jury returned a verdict which found the defendant 73 percent responsible for the accident and the plaintiff 27 percent responsible for the accident.

During the damage portion of the trial, the plaintiff presented her treating neurologist who testified that she had sustained a herniated disk in her lower lumbar spine at the L4-5 disk and a bulge at the L5-S1 disk. These findings were objectively disclosed in a magnetic resonance imaging (MRI) scan which was admitted into evidence. The plaintiff testified that she had pain in her lower back which radiated down her right hip and into her right leg and foot. Her neurologist testified that such pain was consistent with a herniated disk at L3-4, and a bulging disk at L5-S1.

The defense presented a board certified orthopedic surgeon as an expert witness. The orthopedist did not examine the plaintiff, nor did he ever see her MRI films. He did, however, examine her medical records from the hospital, x-rays and the records of her neurologist. The orthopedist opined that the plaintiff's injuries were not severe enough to cause her the pain of which she complained. Moreover, he claimed that the accident could not have caused her injuries. The defense also called a board certified radiologist in place of the previously scheduled radiologist who was not available. The radiologist had not previously reviewed either the MRI films or the MRI report. Nonetheless, for the first time, in the presence of the court and jury he read the MRI films from a shadow box and opined that the plaintiff did not have a herniated disk that impinged on her nerves to cause the pain of which she complains. He testified she suffered from degenerative disk disease due to aging.

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Lastly, the defendant offered an engineer, M. Kenneth Salzer, who has a Master of Science degree in Biomedical Engineering from Rensselaer Polytechnic Institute in 1994 and a Bachelor of Science degree in Mechanical Engineering from Clarkson University in 1991. The engineer stated that he has studied physiology as part of the curriculum for his graduate and undergraduate degrees. However, he acknowledges that he has not attended medical school or chiropractic school and that he has not studied orthopedics or neurology. Mr. Salzer is not a licensed professional engineer. He is instead a New York State engineer intern who is eligible, to sit for the professional engineer's licensing exam in mechanical engineering. Mr. Salzer claims there is no professional engineer license in either biomedical or biomechanical engineering. He notes that there is one for mechanical engineering, but he has not taken that certifying examination.

Mr. Salzer has a certification as a diplomat in biomechanics through the American Board of Forensic Examiners. He is currently the Director of the Biomechanical Engineering of the Eastern Division of CMR Forensic Consultants which overwhelmingly prepares reports for defendants in the insurance industry. In the past he claims that he has given expert testimony in arbitrations, depositions and trials and has testified in 21 states, including New York and that his testimony has been almost 100% for defendants.

Mr. Salzer testified that biomedical engineering and biomechanical engineering are essentially the same and that these disciplines apply the principles of mechanics to the specific facts of an accident and provide information about the forces generated in the accident. Biomedical engineers also examine how the body moves in response to the forces exerted in an impact. Lastly, Mr. Salzer claimed that biomedical engineers offer opinions on the types of injuries that can result from the forces of an impact.

Mr. Salzer has never met Mrs. Clemente, nor did he physically examine her. Nonetheless, based on his education, Mr. Salzer was qualified as an expert in the field of biomechanical engineering. However, the admissibility of his opinion needed further scrutiny.

The Methodology

Mr. Salzer was advised that the plaintiff, Ms. Clemente, was wearing a seatbelt when she drove a 1996 GMC Jimmy four-door sport utility vehicle (SUV) that was struck in the rear by the defendant's 1989 Chevrolet Astro passenger van (van). The engineer explained that neck and back injuries from an automobile accident are usually from a combination of one or more factors: axial compression, tension, shear, bending or rotation which is dependent upon the location and direction of the contact force.² He stated that the method of analyzing the extent of injuries to a person involved in an automobile accident is to measure the g forces³ on the human spine from exterior forces. The amount of g force is calculated by measuring the change in velocity (speed) of the "target vehicle" (the plaintiff's SUV) which was struck in the rear by the "bullet vehicle" (the defendant's van).

The method the engineer used to compute the change in velocity of the vehicles at impact was to review color photographs of the damaged portion of the two vehicles along with the repair bills for the vehicles and to compare the cost of repair of the plaintiff's 1996 GMC Jimmy SUV with a chart entitled "Bumper Performance Repair Costs, 5 mph Crash Tests." In the chart the engineer found a GMC Jimmy SUV listed amongst 13 other SUV models from 1995 to 1997 vintage and then found a column listed "Rear into flat barrier" and found the number "\$882" which represents the average cost of repair.

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Since the plaintiff's repair bill for her 1996 GMC Jimmy was \$860.40, the engineer reasoned that it was close enough to the \$882 average cost of repair for a 1995 to 1997 GMC Jimmy SUV when its rear is driven into a flat barrier at 5 mph. The engineer concluded that since the repair bill was almost identical to the chart (within 2.5%), therefore the change in velocity from the plaintiff's SUV, after being struck in the rear by the defendant's van, was 5 mph.

After using this questionable method of calculating change in velocity at impact, the engineer continued his collision analysis using the 5 mph change in velocity (Delta V) which he classified as a low velocity. He stated that a relevant causation variable was the fact that "the vehicular damage correlates with an impact involving a low velocity." The report bases its conclusion on Newton's first law of motion which specifies that "a body will remain in a state of rest unless an unbalanced external force acts on it." Therefore, the report concludes that the impact would have induced the Jimmy forward, while Ms. Clemente would have moved backward relative to the Jimmy's interior. The engineer concludes that this "mishap reasonably would not have injured Ms. Clemente's low back."⁴

Without specifically citing to any particular study, the report then discusses "the scientific literature" which contains numerous studies which are "analogous to the occupant kinematics of this accident."⁵ The report then applied these "analogous studies" to the plaintiff and concludes:

"Accordingly, because the lumbosacral region of her spine would not have been exposed to significant stresses or strains, there essentially was no potential for a low back injury or associated lower extremity radicular symptoms from the September 17, 1996 mishap."

The report next addressed the likelihood of a cervical injury which is "proportional to the difference between the acceleration of a person's head and the acceleration of his or her torso." After assuming that Ms. Clemente's head could have undergone an average inertial acceleration of 4.2g, which he claims is a fairly common occurrence, the report then refers to the appendix of the report where it discloses that jumping off an eight inch step has an equal amount of inertial head acceleration (4.2g) as being hit in the rear by a van at 5 mph. He concludes:

"In summary, from an objective biomedical perspective, the accident on September 17, 1996 was not consistent with significantly injuring Ms. Clemente. At most, she may have briefly experienced some minor upper spinal discomfort."

The Literature

The studies upon which the engineer used to form his opinion were first supplied to the court and the plaintiff as the Frye hearing was about to commence. At that time the court stated that the studies may be reliable. However, on reflection and with more time to examine these studies, this court is of the opinion that the literature upon which the expert relies was not independent nor reliable.

A review of the studies reveals that five to ten human volunteers participated in the studies who are either associated with the authors or their sponsors. By knowing the hypothesis and purpose of the testing, the responses of the participants may have biased the results. Moreover, the size of the sample is too small to create a statistically significant inference to

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make a general conclusion about the entire automobile riding population which is involved in rear-end collisions.

Lastly, the attempts by the various authors to boot-strap the data from other studies supporting their hypothesis which utilized similar, but different, control variables and different methodology, is a stretch in an attempt to overcome the obviously inadequate number of participants used in one study.⁶

Scientific or Technical Evidence Hearings

Frye hearings are rarely conducted in New York State courts unless the evidence being presented is novel. Judges usually permit professionals to testify as experts and allow the adversary process of cross-examination and opposing experts with different opinions to balance the playing field so that jurors can weigh all the opinions and render a finding based upon what they believe is true. However, when the proffered evidence purports to be scientific or technical the court with or without an objection from the opponent must review the evidence, especially when it is new or uncommon, to ascertain whether it is scientifically or technically reliable and "generally acceptable" in the scientific community to which it belongs.

In 1923, in *Frye v. US*. (293 F. 1013, 1014 [D.C. Circ., 1923]) (hereinafter "Frye") the U.S. Circuit Court for the District of Columbia stated that:

"Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs."

The Frye decision distinguished the difference between the expert's education from his or her expertise of a specific subject matter. The body of knowledge upon which experts rely for their opinions must be separately evaluated from their professional education and training. If the underlying body of knowledge is not generally accepted by the professional community of that particular field, the testimony regardless of the brilliance of the expert is inadmissible.⁷ The Frye "general acceptance" test was the most common standard across the nation in both federal and state [courts] until 1993.

Daubert, Joiner and Kumho Tire

In 1993, the Supreme Court decided *Daubert v. Merrell Dow Pharmaceuticals* (509 U.S. 579 [1993]) (hereinafter "Daubert"). In *Daubert*, Justice Harry Blackmun, writing for the majority of the court, asserted that the Federal Rules of Evidence (FRE) enacted in 1975, supersede the common law of evidence which, by implication, included the 1923 Frye decision. The FRE provided the standard for admitting expert scientific testimony in federal trials (*Daubert* at 588). The Supreme Court noted that while the common law may serve as an aid in interpreting the FRE, nothing in the drafting history of Rule 702,⁸ which governs expert testimony, gives any indication that "general acceptance" is the only prerequisite for the admission of scientific evidence. Rule 703 further outlines the basis of the opinion testimony

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by experts⁹ and Rule 705 compels the expert to disclose the facts or data underlying the expert opinion.¹⁰

However, Rule 702 does place limits on the admissibility of purported scientific technical or other specialized knowledge as evidence. It requires that the trial judge first ensure that the expert's testimony rests on both a reliable foundation and that it is relevant to the particular case before the court. Moreover, the expert's testimony must be based on scientific, technical or other specialized knowledge which implies that scientific methods and procedures were employed. "[K]nowledge connotes more than subjective belief or unsupported speculation. The term applies to any body of known facts or to any body of ideas inferred from such facts or accepted as truths on good grounds."¹¹

The relevancy test of Rule 402 states that "all relevant evidence is admissible ... and evidence which is not relevant is not admissible." Moreover, the relevancy test of Rule 702 requires that expert testimony "assist the trier of fact to understand the evidence or to determine a fact in issue." Therefore, if the testimony is not scientifically reliable, then it is inadmissible.

In Daubert, the U.S. Supreme Court asserted that judges, when faced with an offer of expert testimony, must make a preliminary assessment of whether the expert testimony reflects scientific knowledge and that there is a connection or "fit" between the testimony and the issues of the case.¹² The testimony's underlying reasoning or methodology must be scientifically valid and thereby reliable as evidence to be applied to the facts at issue. Some of the factors the Supreme Court suggested be considered are: (1) whether the theory or technique in question can be tested (and has been) tested; (2) whether it has been subjected to peer review and publication; (3) whether its potential rate of error is known and is it statistically significant and acceptable; and (4) that general acceptance can yet have a bearing on the inquiry.¹³

The fourth factor of general or widespread acceptance within the relevant scientific community reaffirms the Frye test of admitting known techniques into evidence. However, the Supreme Court also invites trial judges to view such known techniques (and theories) with skepticism if they are only minimally supported by the relevant scientific community.¹⁴

The High Court stated that the inquiry is a flexible one, and its focus must be solely based on principles and methodology, not on the conclusions that they generate.¹⁵ The judge should also consider the presentation of contrary evidence and should instruct the jury on who has the burden of proof. Daubert highlights a trial judge's inherent role in a "gatekeeping function" to determine whether evidence is scientifically valid and whether the reasoning or methodology can be applied to the facts of the case.¹⁶

The U.S. Supreme Court remanded Daubert to the Ninth U.S. Circuit Court of Appeals, where Judge Kozinski added a fifth factor to consider: "[W]as the expert's opinion the product of independent research or was it developed solely for the purposes of testifying."¹⁷

Chief Justice William Rehnquist expressed some concern in his concurring and dissenting opinion in Daubert that trial judges might become amateur scientists. However, he did acknowledge that Rule 702 imposes some gatekeeping responsibility in deciding questions of admissibility of proffered expert testimony. Indeed, in *Joiner v. General Electric Co.*, 522 U.S. 136, 118 S.Ct. 512 [1997] Chief Justice Rehnquist, then writing for the majority, not only

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reaffirmed the Daubert standard, but reinforced the role of trial court as the gatekeeper of scientific evidence. The Supreme Court asserted that while different judges at the appellate level may disagree with the validity of the evidence proffered, it was not the role of the appellate courts to second guess the trial judge. The standard on appeal is whether trial judges abused their discretion. Thus, it is the trial judge who must initially rule on whether to admit such scientific evidence into court.

On March 23, 1999, the Supreme Court clarified in *Kumho Tire Co., Ltd. v. Carmichael* (526 U.S. 119 S. Ct. 1167 [1999]) that, in addition to scientific knowledge, "technical" or other "specialized knowledge" - such as engineering - offered as evidence is also subject to the Daubert factors of testing, peer review, error rates and "acceptability" in the relevant community where "some or all of which might prove helpful in determining the reliability of a particular scientific theory or technique." Justice Steven Breyer in writing *Kumho* went even further in embellishing the judge's role as a gatekeeper to include a review of all technical or other specialized knowledge, as well as scientific theories or techniques to determine the validity of the principles and methodology underlying the opinion. A trial judge should review the evidence to ascertain whether it is legally relevant and reliable and helpful to the jury. This process need not be belabored on theories previously found to be generally acceptable which are admissible by judicial notice.

In *Kumho*, the plaintiffs sued the manufacturer of a five year old tire from their minivan which had at least two punctures which had been inadequately repaired.¹⁸ Despite the tire's age and travel history, a mechanical engineer testifying as an expert witness for the plaintiff concluded that a defect in its manufacturer or design caused the blowout.¹⁹

The methodology employed by the mechanical engineer in analyzing the data obtained was merely a visual inspection of the tire. No other testing was done. There were no comparisons to establish a rate of error of this technique or any peer review generally accepting this technique was ever published. Accordingly, the trial judge precluded the expert opinion of the mechanical engineer. While U.S. Court of Appeals for the Eleventh Circuit reviewed the case *de novo* and determined that the trial court erred in applying Daubert standards to non-scientific matters,²⁰ the U.S. Supreme Court reversed the U.S. Court of Appeals and affirmed the trial court's exclusion of the engineer's opinion.

The New York Experience

New York has not formally adopted the Federal Rules of Evidence (FRE)²¹ to include Rule 702 which governs the "testimony by experts." However, New York common law and the New York Civil Practice Law and Rules (CPLR) contain many of the same principles of evidence contained in the FRE. Indeed, Rule 703, which discusses the "basis of opinion testimony by experts," and Rule 705 which discusses "disclosure of facts or data underlying, expert opinion," are similar to CPLR §451.5 which states:

"Unless the Court orders otherwise, questions calling for the opinion of an expert witness need not be hypothetical in form, and the witness may state his opinion and reasons without first specifying the data upon which it is based. Upon cross-examination, he may be required to specify the data and other criteria supporting the opinion."

The New York Court of Appeals has not embraced the Daubert standard of scientific reliability, but has retained the Frye general acceptance test.²² The Frye test of "general

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acceptance" is one measured by the scientists of the relevant scientific community to which it belongs. However, the accelerated pace at which science travels today is far faster than the speed at which it traveled in 1923 when Frye was written. Breakthroughs in science which are valid may be relevant to a case before the courts. Waiting for the scientific community to "generally accept" a novel theory which is otherwise valid and reliable as evidence may deny a litigant justice before the court.

A trial judge's role as a gatekeeper of evidence is not a role created by Daubert and rejected by the Court of Appeals; it is an inherent power of all trial court judges to keep unreliable evidence ("junk science") away from the trier of fact regardless of the qualifications of the expert. A well-credentialed expert does not make invalid science valid merely by espousing an opinion.

In the case before this court, Mr. Salzer claims he has testified in several courts and tribunals of this state. However, there are no reported court decisions on the use of biomechanical or biomedical engineers in New York courts.

Biomechanical engineers have been proffered in other jurisdictions. In *Smelser v. Norfolk Southern Railway Co.*, 105 F3d 299 [USCA 6th Cir. 1996 cert. denied 118 S. Ct. 67 (1997)], a federal appellate court held that the trial court erred allowing an expert to offer his opinion that a defective shoulder belt and not a rear-end collision caused the plaintiff's back injuries. The U.S. Court of Appeals for the Sixth Circuit held that the court did not "adequately assess the reliability of the methodology underlying [the expert's] opinions both as to the defect and causation and also failed to recognize that [the expert's] opinion went beyond his expertise in biomechanics."

The expert in *Smelser* admitted that biomechanical engineers can opine as to how a hypothetical person's body will respond to forces, but they are not qualified to render medical opinions regarding the precise cause of a specific injury. While *Smelser* was under the federal Daubert standard, the rationale is similar to this court's holding.

Two Arizona Superior Court judges in separate opinions have also refused to admit the opinion of a biomechanic that the plaintiffs could not have sustained the injuries which they have documented and complained of from low impact automobile accidents.

In the first of these cases, *Yorston v. Bailey* (CV 95-17659, Ariz. Super. Ct., Maricopa Cty., July 31, 1997) Judge Steven Sheldon, while recognizing that a Frye test was required in order to admit novel scientific evidence, concluded that the proffered evidence of the application of mathematics, physics and the laws of motion were not novel. He also recognized that the Arizona Rules of Evidence would allow a witness to opine about the ultimate issue of whether the plaintiff's injuries were caused by the forces exerted upon the vehicle (and consequently the plaintiff) by another vehicle.

However, Judge Sheldon also recognized that an expert should possess a specialized knowledge which is beyond the understanding of the average jury and that the opinion should be able to assist the jurors in determining the ultimate issue. The trial judge concluded that low impact automobile accidents were not so specialized that jurors would be unfamiliar with them and, accordingly, the biomechanical expert should not tell the jury how they should decide the case. Thus, the opinion of the biomechanical expert was precluded.

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The other case is Pinsker v. Cohen (CV 95-12419, Ariz. Super. Ct., Maricopa Cty., Sept. 22, 1997) decided by Judge William T. Maroney who sat in the same court as Judge Sheldon. In Pinsker, Judge Maroney ruled that Dr. McNish, a biomechanical expert who was a graduate engineer and a physician could not testify before the jury. Dr. McNish relied upon his knowledge of physics and mechanics and on National Safety Board data for the strength of the relevant impacting vehicle parts and concluded that the insignificant forces to the neck of the plaintiff could not have caused his herniated disk. The doctor also relied oil studies performed by him and his co-worker to assess the forces from a staged low-impact collision to conclude that the plaintiff could not have sustained the injury he claims.

The court ruled that such study was not professionally challenged and therefore, did not meet the Frye test as being generally recognized in the scientific community. Moreover, the court found that such a test commissioned by the defense was so biased that it should not be presented to the jury.

Lastly, the court concluded that Frye requires that the "question involved ... not lie within the range of common experience or common knowledge." The trial judge also recognized the Daubert standard and attempted to apply the proffered evidence to that test which it also failed. Therefore, the opinion of the biomechanical expert was precluded.

There may be more than one valid scientific or technical opinion on a particular point which may be generally accepted by the relevant scientific community. The opinions presented need not be the majority opinion. There may be valid minority opinions which are scientifically valid which may rightfully be presented to the trier of fact.

But, when the minority opinion has no valid scientific testing or has not been critically reviewed or assessed in relevant scientific or technical journals by scientists in the same field, then it is the judge's role to keep such untested, unreliable evidence out of court proceedings. Courts are not laboratories in which to try out new theories to ascertain whether jurors will believe them or not. Theories do not gain general acceptance in the relevant scientific community merely because some jurors accepted a theory as plausible. It is the role of the judge to spend time screening a novel theory before having it presented to the jury.

Discussion

Using repair costs and photographs as a method for calculating the change in velocity at impact is not a generally accepted method for computing speed or change in velocity between two vehicles after a rear end collision in any relevant field of engineering or under the laws of physics. Hence, under the Frye test of general acceptance, the opinion upon which it relies is inadmissible. Applying the Daubert/Kumho factors also found this methodology to be invalid. The engineer acknowledged that this was a method that he developed. Indeed, the engineer when questioned by this court whether there was any literature supporting this method of calculating velocity claimed there was none.

Moreover, the engineer disregarded the actual facts of this case in forming his conclusion that the change in velocity was 5 mph. The testimony of the plaintiff was that she was slowing down when she was hit and that caused her vehicle to move a few feet forward. The defendant stated that the plaintiff's vehicle was at a stop when he hit her and that he was traveling at about 25 miles an hour when his vehicle hit the plaintiff's SUV. The defendant

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further stated that both vehicles did not move and remained in the same place after the impact.

In view of either version of the facts the defendant's statement that the vehicles did not move after the impact is contrary to the Newtonian theory of physics testified to by the defendant's expert engineer. Accordingly, the court finds the defendant's testimony that the plaintiff's vehicle did not move after impact to be incredible. Indeed, all the testimony at this trial was at odds with the methodology and assumption used by the biomedical engineer to reach his conclusion. Utilizing Mr. Salzer's formula, if the speed of the defendant's bullet vehicle were traveling at 25 mph or 15 mph when it struck the plaintiff's target vehicle at 5 mph or less, then the change in velocity would be approximately double the basic assumption of the engineer and the literature upon which he relies, that the change in velocity was 5 mph.

Conclusion

Accordingly, this court finds that the proffered biomedical engineer is qualified as an expert in biomedical engineering based upon his professional training and may render a general opinion as to the general formula of forces upon objects.

However he may not render an opinion based upon his report and testimony at the Frye hearing because the source of data and the methodology employed by him in reaching his conclusion is not generally accepted in the relevant scientific or technical community to which it belongs. Moreover, applying the Daubert/Kumho factors to the proposed opinion, this court finds that the data and the methodology employed by the biomechanical engineer is not scientifically or technically valid. Therefore, such testimony is not reliable and may not be presented to the jury. Moreover, a biomechanical engineer lacks the training and experience to testify that the plaintiff did not sustain "serious injuries" as a result of this accident. Hence, the expert opinion is precluded from presentation to the jury.

NOTES

(1) Frye v. U.S., 293 F. 1013 (D.C. Cir. 1923).

(2) Bending loads are almost always present, while the degree of axial, shear, or rotational forces is dependent upon the location and direction of the contact force. The potential for a spinal injury is proportional to the difference between the relative motions of each section of the neck and spine. When the individual body components move at different rates, the connecting ligaments and musculature must compensate for the inertial loading differences.

(3) A g force is an acceleration or deceleration force that acts on a body due to a change in velocity. Variables such as direction, magnitude, duration, rate of onset, and manner of application influence the effect that g forces have upon a vehicle and its occupants. The area over which the forces act and the physical characteristics of the involved tissues are also important in the analysis of motion and injury.

(4) The report states that approximately 60 msec. after the impact, her body would have had increased contact with her seat back, a structure which provides excellent protection to the spinal column and reduces the potential for injury to the entire back. This contact would have continued to increase for about 260 msec., subsequently, Ms. Clemente may have experienced some minimal forward rebound away from the compressed seat back. Although

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it is extremely unlikely that significant forward motion would have been produced by the initial rearward acceleration of 2.1g, any such movement would have been arrested by her safety belts.

(5) The report discloses experimental rear-end crashes at 10 mph with restrained human test subjects which produced average resultant rearward and subsequent average forward shoulder excursions of 135 mm (5.31 inches) and 56 mm (2.19 inches), respectively. In some cases, the subjects' shoulders did not move forward past their initial pre-impact positions. A subsequent study of a similar nature produced average shoulder excursions of only 3 mm (0.1 inches) beyond the shoulder's pre-impact positioning.

(6) See, Thomas J. Szabo and Judson B. Welcher, et al, Human Subject Kinematics and Electromyographic Activity During Low Speed Rear Impacts, Society of Automotive Engineers, Inc. (1996); Whitman E. McConnell and Richard P. Howard, et al, Human Head and Neck Kinematics Velocity Rear-End Impacts - Understanding "Whiplash," Society of Automotive Engineers, Inc. (1995); Whitman E. McConnell and Richard M. Howard, et al, Analysis of Human Test Subject Kinematic Responses to Low Velocity Rear End Impacts, SAE; The Engineering Society for Advancing Mobility, Land, Sea, Air and Space International (1993); Thomas J. Szabo and Judson B. Welcher, et al., Human Occupant Kinematic Response to Low Speed Rear-End Impacts, SAE; The Engineering Society for Advancing Mobility, Land, Sea, Air and Space International (1994).

(7) See, David L. Faigman, et al., Modern Scientific Evidence: The Law and Science of Expert Testimony, Vol. I at 6 (1997).

(8) Rule 702: Testimony by Experts. If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

(9) Rule 703: Bases of Opinion Testimony by Experts. The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to the expert at or before the hearing. If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.

(10) Rule 705: Disclosure of Facts or Data Underlying Expert Opinion. The expert may testify in terms of opinion or inference and give reasons therefor without first testifying to the underlying facts or data, unless the court requires otherwise. The expert may in any event be required to disclose the underlying fact or data on cross-examination.

(11) Danbert, 509 U.S. at 590, quoting Webster's Third New International Dictionary, 1252 (1986).

(12) Id. at 590-591.

(13) Id. at 593-594.

(14) Id. at 594.

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(15) Id.

(16) Id. at 597.

(17) Daubert v. Merrell Dow Pharmaceuticals, Inc., 43 F.3d. 1311, 1317 (9th Cir 1995).

(18) Kumho, 119 S.Ct at 1172.

(19) Id. at 1172-73.

(20) Carmichael v. Samyang Tire Inc., 131 F3d 1433 (11 Cir. 1997).

(21) In 1991, a proposed Code of New York Evidence was presented by the Governor to the state legislature which tracked the Federal Rules of Evidence. Despite the encouragement of most of the leading evidence professors and others, the legislature failed to act upon the proposed state evidence code. Thus, the law of evidence in New York State Courts continues to rely upon the common law and piecemeal rules of evidence contained in Article 45 of the Civil Practice Law and Rules. Other rules of evidence are found in Article 60 and 670 of the Criminal Procedure Law and in Section 342.1 to 344.4 of the Family Court Act.

(22) People v. Wesley, 83 N.Y.2d 417 (1994).

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