

**THE USE OF BIOMECHANICAL ENGINEERS**

**by**

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## **BIOMECHANICAL EXPERTS IN MIST<sup>1</sup> CASES**

### **THE NEW NORM.**

In recent years the use of biomechanical experts in minor impact soft tissue cases has become increasingly commonplace. The science behind the biomechanical analysis as applied to soft tissue claims has enjoyed greater acceptance and the Bar at large has become enlightened as to its benefits.

The problem still remains, however, that many practitioners feel the science is outside their grasp. Nevertheless, with the right expert and some preparation, even the most cautious practitioner can confidently use a biomechanical defense. It is because of the heightened scrutiny the science has received that you will likely find your expert more adept at explaining his methods to you and in turn to the Judge and jury. So take heart and take a minute to familiarize yourself with the concepts and you will find yourself armed with a new and useful tool.

### **UNDERSTANDING THE BIOMECHANICAL EXPERT**

Biomechanical engineering is the use of mechanical engineering as it applies to both the human body and its physiology. Therefore, a good biomechanical engineering expert will be an expert in both mechanical engineering and its use as applied to the human anatomy and physiology. In other words, he or she is an expert in physics and the effects of the motions and forces upon the human body.

However, a biomechanical expert does not need to be a medical doctor. The expert's goal is not to render a diagnosis or prognosis but rather to opine as to whether a particular accident produced sufficient forces to result in the injury claimed.

### **ACCIDENT RECONSTRUCTION VERSUS BIOMECHANICAL ANALYSIS**

A biomechanical expert will perform a partial accident reconstruction and biomechanical analysis. The word "partial" is key as this topic can be ripe for cross examination of your expert if there is any claim that a full accident reconstruction was performed.

For the purposes of the biomechanical expert, an accident reconstruction is performed to determine the change in speed and direction of each vehicle and as a result the change in speed and direction of the people inside the vehicle.<sup>2</sup>

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<sup>1</sup> Minor Impact Soft Tissue

<sup>2</sup> **PRACTICE TIP:** Typically a biomechanical expert works with much less material than an accident reconstructionist. A good adversary will make sure to point out, question by question, everything an accident reconstructionist would do in a significant injury case that was not done in your case. One should be prepared for this cross and have a plan in place to minimize its effect.

The accident reconstruction needed for a biomechanical analysis must determine the sudden changes in the speed and direction of the vehicle both in the forward/backward and sideways directions during a collision. In other words, the acceleration of the car in either a forward and backward direction or the side to side direction will cause the occupants inside the car to move in the opposite direction.

This is relevant to determining the forces on the plaintiff in a car accident. In general a sudden change in speed will be due to the gain or loss of energy when making contact with another vehicle. For example, in a rear end collision, suppose that two cars are travelling on a road, one after another, and the rear car is traveling faster than the car in front. At impact, the rear car transfers its extra energy to the car in front. When this happens, the car in front will accelerate in an amount determined by the amount of energy transferred; BUT the occupants will continue to travel at the slower initial speed. Accordingly, this will cause the occupants to move towards the rear of the vehicle. The same logic applies to the rear car, which will transfer its energy at the time of collision, causing it to decelerate. At the same time, the occupants of the rear car will continue traveling at their original faster speed. As a result, this will cause the occupants of the rear car to move towards the front of the vehicle.

Using these basic laws of physics the expert can determine the direction the plaintiff's body travelled as a result of the accident.

The next step in accident reconstruction is to determine the severity of the impact (i.e., how hard the vehicle was hit). This can be determined mathematically and it can also be determined using photographs of the damage to the vehicles. The mathematical calculation is done using pure physics, taking into account the testimony concerning the speed of the vehicles, the direction of the vehicles, and other known variables. For this analysis you will want to equip your expert with as much information as possible, such as the speed of the vehicles, distance traveled after contact, make, model, and accident history of the vehicles. To this end, your deposition of the plaintiff will be key.

The use of photographs and estimates to determine the severity of the impact is also a reliable tool. This is commonly referred to as a crush analysis. In short, the expert determines the depth of the crush (dents) or damage to each vehicle. The expert then plugs the numbers into formulas that take into account the resilience of the body of that particular vehicle and comes up with the amount of energy the body of the car can take before becoming deformed (dented). In a pinch, a crush analysis can be performed by reviewing photographs of only one car but this is not ideal.

After this analysis is conducted, the biomechanical analysis is performed to determine whether the resultant change in speed and direction of the persons in the vehicle was sufficient to create the forces and motions needed to create the injury alleged. Put another way - was the impact strong enough and the subsequent movement of the plaintiff the right kind of movement to create the injury? The human body is exposed to all kinds of forces on a daily basis.

However, in this situation, we want to determine if the forces experienced by the plaintiff were beyond the ordinary tolerance of the human body.<sup>3</sup>

Once your expert has established how much force is necessary, he can liken this force and direction to the forces and directions experienced in everyday life such as plopping down in a chair, carrying a gallon of milk, jumping in the air, etc. This testimony is very powerful. It will drive home the crux of the defense and must be presented correctly. Make sure to highlight this testimony to allow its effect to sink in with the jury.<sup>4</sup>

If you have gotten this far, you have successfully presented your position. Everything beyond this point is icing on the cake. Next, you will have the expert offer his/her opinion regarding the specifics of your particular case.

The conscientious practitioner will want to have the expert testify that the forces in the direction experienced in this accident were insufficient to cause the injury claimed by THIS CLAIMANT IN THIS CASE. This is where many have experienced push back from the bench and the plaintiff's bar. So an important distinction must be made here. If your expert is not a practicing M.D., have him testify as to his opinion within a reasonable degree of biomechanical certainty (NOT biomedical or medical certainty).<sup>5</sup> The language makes little or no difference to the jury but will expose your expert to considerable, and unnecessary, cross-examination.

So how do you present your biomechanical expert? Your direct should look something like this:

- 1) Have the expert explain what biomechanics is and what it can tell us about how the accident happened. Do not overstate here, it is physics, it speaks for itself. Similarly, do not oversell the medical end. Have the expert explain what training he/she has in the understanding of the effects of forces on the human physiology. Steal the cross examiner's thunder, have the expert volunteer his limits as to medical testimony. You may not have Hippocrates but you have Sir Isaac Newton on your side. Acknowledge the

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<sup>3</sup> **PRACTICE TIP** Intellectually this is where many have trouble. What about the eggshell plaintiff, the 90 year old grandmother, the ticking time bomb hidden defect? This will likely come up during cross-examination and the defense attorney would do well to prepare for it with the expert in anticipation of the issue. Studies have been conducted to establish how much force must be applied before a human body part will fail. The expert may testify about the conclusions drawn from these studies.

<sup>4</sup> **PRACTICE TIP - Practitioner Beware:** You should not limit your analogy to the force alone. Whenever possible, make sure to have your expert address the issue of direction as well. For example, testimony that a given force is the same as standing while lifting two gallons of milk may address the amount of force on a person's shoulder. However, if plaintiff is claiming his arm was raised or behind him at the time of impact, it does not address direction. This is a common sense analysis. Therefore, if you do not address it, the jurors may feel you are trying to trick them. So make sure to talk to your expert to determine which is the most appropriate daily activity analysis.

<sup>5</sup> See, e.g., Gates v. Longden, 120 A.D.3d 980 (4<sup>th</sup> Dept. 2014) ("Defendants' biomechanical expert is an engineer, and is not a medical doctor, and thus the court properly determined that the expert did not possess 'the requisite skill, training, education, knowledge or experience from which it can be assumed that the information imparted or the opinion rendered [regarding injury causation] is reliable.'").

limitations quickly and then celebrate the strengths. Doing so may lead to decreased scrutiny from the Judge and will certainly cut a chunk out of the cross-examination.

- 2) The expert will recite the relevant facts he used to draw his conclusions and the reliability of same. Explain how the automobile industry has been using the same information in the same way to test and improve the safety of vehicles for years. Have him stress the reliability of the information gathered from the facts in the case as well. Stress any information relied upon that was taken from the plaintiff's testimony.
- 3) The expert will tell the jury he was able to determine the upper limits of the amount of force and its direction. It may not be an exact number but it is BETTER because this number is the worst case scenario. Thus the actual forces were likely less than the numbers used by the expert in his calculations. Have him explain the methods he used to get to that conclusion. **WARNING:** the subject matter can be very boring. However, you have an obligation to make it interesting so the jury will absorb it. Throw around Sir Isaac Newton's name if it will help.
- 4) The expert will explain how he can presume to apply these cold hard numbers to soft tissues of the body and the impossibility of injury under the circumstances. This is crucial to his credibility. Have him explain any test or studies that have been conducted, and subsequently accepted, that establish the human body's tolerance of force before injury or failure.
- 5) **The Important Part:**  
The expert will liken the force and direction to everyday activities. Do not rush this part of the presentation. Do it slowly. Be repetitive. Make sure every juror has heard this testimony.
- 6) **The Finale:**  
The expert will give his opinion within a reasonable degree of biomechanical certainty with respect to the case. It is best if he is repetitive here. Ask the question in different ways to get the information before the jury multiple times. In the end, the expert will explain that the plaintiff could not have incurred the injury alleged as a result of:
  - a) these forces;
  - b) these movements; and
  - c) this accident.

## **THE FRYE HEARING – A PRACTICAL GUIDE TO GETTING YOUR EXPERT “IN.”**

Unlike the federal system, New York state courts utilize the Frye test for admitting expert testimony.<sup>6</sup> At the outset, it should be noted that Frye hearings have become increasingly uncommon with respect to biomechanical experts.<sup>7</sup> However, as the proponent of a biomechanical engineering expert, you are entitled to a Frye Hearing. Below is a practical guide to what the practitioner can do to increase his or her chances of getting the expert's testimony “IN”.

### **1) Educational Background:**

The expert must give a detailed description of his educational background -- this is no time to be humble. Also instruct the expert to include any experience in accident reconstruction and any previous “qualifications” as an expert in that field in a prior legal proceeding. Accident reconstruction is more generally accepted than biomechanics. Thus, emphasis of the similarities between the two fields adds to the expert's credibility.

### **2) Generally explain the science of Biomechanical Engineering:**

Next, your expert should describe how the science of biomechanics is used to determine the forces of motion of the relevant body parts, and how this is generally useful for making cars safer and designing safety features of vehicles (such as air bags). A detailed explanation of how the science is used outside of litigation will lend credibility.

### **3) Explain the Scientific Concepts:**

Start with Delta V (i.e., change in velocity of the vehicle) and impact crush analysis. The expert should be prepared with studies supporting how impact crush analysis is done, how Delta V is determined, and the significance of the results. He/she must stress the reliability of these conclusions. (This is not a place for the thin-skinned; make sure your expert is prepared to be grilled about the validity of his/her findings). Also emphasize that the studies are subject to PEER REVIEW, capable of REPLICATION and are GENERALLY ACCEPTED in the field of both biomechanics and accident reconstruction. You should be prepared with studies to support your claim. A good expert will be able to provide you with the necessary peer reviews, etc., in advance.

Never forget that judges are people too. Work with your expert to make him personable, and have him relate the scientific principles being explained to everyday experiences. This will better aid the Judge (and later the jury) in understanding the principles being described. Additionally, never allow your expert to become defensive when being questioned about the validity of the science. It is your job to prepare him for scrutiny, and perhaps even skepticism.

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<sup>6</sup> See Zito v. Zabarsky, 28 A.D.3d 42 (2d Dept. 2006) (“New York has not adopted the *Daubert* standard, but rather continues to adhere to the *Frye* test for determining the admissibility of novel scientific evidence.”).

<sup>7</sup> See Parker v. Crown Equip. Corp., 39 A.D.3d 347 (1<sup>st</sup> Dept. 2007) (when expert testimony does not involve anything “novel or experimental,” no preliminary Frye hearing is warranted).



He should view himself as the most patient of teachers, seeking only to help the pupil truly understand.

The expert should describe occupant kinematics – the study of how people move within a vehicle during an accident. Again, you must emphasize that the literature supporting this science has been the subject of PEER REVIEW, is capable of REPLICATION and GENERALLY is ACCEPTED in the field of biomechanics.

Then the expert should also explain occupant dynamics – the analysis of forces applied to motor vehicle occupants. Again, you must emphasize that the literature supporting this science has been the subject of PEER REVIEW, is capable of REPLICATION and is GENERALLY ACCEPTED in the field of biomechanics. (Are you seeing the pattern here?!)

Photogrammetry – have your expert explain how photographs are used to extract three dimensional models, motion and/or crush. Again, be prepared to demonstrate how this science has been the topic of numerous studies, subject to PEER REVIEW, capable of REPLICATION and is GENERALLY ACCEPTED by the accident reconstruction and biomechanical engineering communities. (But you had figured that out by now.)

Basic Orthopedic Biomechanics – this is an analysis of forces and motions and the damage done to different body parts as a result of those forces. This is a very powerful persuasive tool. Once the expert determines the forces exerted upon the plaintiff by the subject accident, he can compare them to the forces experienced during every day activities, such as rolling over in bed, climbing stairs, etc. As with all other aspects of Biomechanics, be prepared to demonstrate PEER REVIEW, REPLICATION and GENERAL ACCEPTANCE.

#### **4) Your Case:**

If the Court requires you to go into the specifics of your case, be prepared to do so.

At the outset, the expert must explain what materials were used in his analysis. Have him explain how Delta V was established and explain that there are upper and lower ranges of the potential Delta V. Also have him describe the residual crush. Then using the parties' deposition transcripts to establish the position of the plaintiff in the vehicle as well as his/her height and weight, the expert can testify as to the application of force based upon the Delta V and determine the pounds of force generated by the accident. He will then be able to opine whether the forces at play in this accident could have had damaging effects on the plaintiff's body.

#### **5) Do not be Afraid:**

Counsel is not expected to be a biomechanical expert. Your job is to help portray your expert in the best light possible. As counsel, it is helpful for you to understand the basic principles behind biomechanical engineering, but you do not need to be a professional. Some of the biomechanical literature may not be directly on point with your set of facts. In that case, work with your expert and be prepared to explain how the principles apply nonetheless.

Finally, should the Court refuse to allow your expert to testify as to the ultimate question - whether the forces generated by this accident were sufficient to cause the alleged injury - you can still make a great impact on the jury if you have the expert testify that the forces sustained in this accident were similar or less than those experienced by everyday activities.

### **CONCLUSION**

Expert testimony in the field of biomechanics, whether ruled as admissible or inadmissible, can be a crucial factor in any given case. Defense counsel should always, at the very least, consider use of such an expert. Furthermore, defendants should analyze whether the facts, combined with questionable causation, call for the use or consultation with a biomechanical engineer.

If a decision to retain a biomechanical engineer is made, then counsel, either for plaintiffs or defendants, must take care and present specific evidence regarding the expert's methodology and testing. Counsel should do his or her homework regarding the admissibility steps outlined above.

We truly hope you found these materials informative. Good luck. Make sure to call and tell us how it went.

## **TABLE OF RELEVANT CASES**

- Martell v. K&K Auto & Towing Corp., 2013 N.Y. Misc. LEXIS 3699, 2013 NY Slip Op 31950(U) (Sup. Ct. Queens Cty. 2013): In an action to recover damages based on a “serious injury” sustained in an automobile accident, plaintiffs’ motion to preclude defendants’ expert biomechanical engineer from testifying at trial with respect to the cause of plaintiff’s alleged injuries was denied. The court held that “biomechanical engineering has been found generally accepted as reliable in the scientific community and New York courts have specifically held that a biomechanical engineer is qualified to give an opinion testimony regarding injury causation.”
- Neat v. Pfeffer, 2013 N.Y. Misc. LEXIS 4185, 2013 NY Slip Op 32207(U) (Sup. Ct. New York Cty. 2013): Plaintiff allegedly sustained several injuries when defendant rear-ended her. The court held a Frye hearing to determine whether defendant’s expert, a biomechanical engineer, should be allowed to testify. The court held that the expert could testify as to the forces involved in the accident, because the field of accident reconstruction, the methods of calculating the forces involved in the accident, and how much force was applied to bodies inside the taxi are generally accepted in the scientific community. However, the court held that the expert could not testify as to whether those forces could have caused the plaintiff’s injuries, as the expert did not show significant peer-reviewed literature validating the methods he used to come to his conclusions.
- White v. Grocery Haulers, Inc., 2014 N.Y. Misc LEXIS 738, 2014 N.Y. Slip Op. 30412(U) (Sup. Ct. N.Y. Cty. 2014): Plaintiffs alleged various injuries due to a motor vehicle accident with a tractor-trailer. The court held a Frye hearing to determine whether defendant’s expert, a biomechanical engineer, should be allowed to testify. The court held that the expert could testify as to the forces involved in the accident but could not testify as to whether those forces could have caused plaintiffs’ injuries.
- Gaona-Garcia v. Gould, 31 Misc. 3d 1237(A) (Sup. Ct. Bronx Cty. 2011): The plaintiff made a motion in limine to preclude the testimony of defendant’s biomechanical engineering expert. The court held that the testimony of the defendant’s biomechanical expert will be admitted at trial for the jury’s consideration, as the weight to be accorded to his testimony is a matter to be determined by the trier of fact. The court found that it did not matter that the expert was not licensed to practice medicine in the United States because he was licensed in England, and this fact would go to the weight of the evidence to be accorded to his testimony rather than its admissibility. The expert was able to refer to peer-reviewed articles to support his findings, and he showed that he was previously qualified as an expert on biomechanics and injury causation in prior trials at which his testimony was not precluded.
- Vargas v. Sabri, 115 A.D.3d 505 (1st Dep’t 2014): The court held that “[t]he fact that [the biomechanical expert] lacked medical training did not render him unqualified to render an opinion as an expert that the force of the subject motor vehicle accident could

not have caused the injuries allegedly sustained.” The expert’s education, background, experience, and areas of specialty rendered him able to testify as to the mechanics of injury. The court stated that the expert’s qualifications, as well as his conflicting testimony with another defendant expert, would go to the weight rather than the admissibility of his testimony.

- Garner v. Baird, 27 Misc. 3d 1231(A), 910 N.Y.S.2d 762, 2010 N.Y. Misc. LEXIS 1542, 2010 NY Slip Op 51004(U), 243 N.Y.L.J. 113 (Civ. Ct. Queens Cty. 2010): Defendants’ biomechanical expert did not support his conclusory statements that the methodologies he used are generally accepted and have been used for decades with evidence, such as peer review reports or other scientific studies. Further, defendants’ expert was not a medical doctor and failed to cite any studies to support his conclusion that the subject accident did not cause or contribute to plaintiff’s injuries. Therefore, defendants’ expert’s testimony was precluded at a Frye hearing.
- Santos v. Nicolos, 24 Misc. 3d 999, 1000–02, 879 N.Y.S.2d 701, 703–04, 2009 N.Y. Misc. LEXIS 1252, 2-5, 2009 NY Slip Op 29224, 1-2, 241 N.Y.L.J. 106 (Sup. Ct. Bronx Cty. 2009): In order for scientific expert testimony to be admitted at trial, the procedure and results must be “generally accepted as reliable in the scientific community.” Styles v. General Motors Corp., 20 A.D.3d 338, 341, 799 N.Y.S.2d 38 (1st Dep’t 2005); Frye v. U.S., 293 F 1013 (D.C. Cir. 1923). The most common ways an expert may establish that his methodology has been generally accepted is by citing to peer-reviewed literature in the field, by showing that independent studies have been done using this methodology and that the results have been duplicated and by establishing that the studies were done on a statistically significant number of subjects. *See* Styles, 20 A.D.3d 338, 799 N.Y.S.2d 38 (2005); Fraser v. 301-52 Townhouse Corp., 57 A.D.3d 416, 418–19, 870 N.Y.S.2d 266 (1st Dep’t 2008); Lara v. New York City Health & Hosps. Corp., 305 A.D.2d 106, 757 N.Y.S.2d 740 (1st Dep’t 2003); Saulpaugh v. Krafte, 5 A.D.3d 934, 774 N.Y.S.2d 194 (3rd Dep’t 2004). The question for the court at a Frye hearing is “whether the proffered expert opinion properly relates existing data, studies or literature to the plaintiff’s situation, or whether, instead, it is ‘connected to existing data only by the ipse dixit of the expert.’” Marsh v. Smyth, 12 A.D.3d 307, 312, 785 N.Y.S.2d 440 (1st Dep’t 2004) (Saxe, J., concurring). Moreover, when the expert cites no scientific literature at all, the court must preclude the expert’s testimony. *See* Marsh, 12 A.D.3d at 313 (Saxe, J., concurring). For example, in Lara, the First Department held that where the plaintiff’s expert could not cite a single reported medical case or formal study to support his theory, his testimony must be precluded. *See* 305 A.D.2d 106, 757 N.Y.S.2d 740; *see also* Selig v. Pfizer, Inc., 290 A.D.2d 319, 735 N.Y.S.2d 549 (1st Dep’t 2002); Clemente v. Blumenberg, 183 Misc. 2d 923, 705 N.Y.S.2d 792 (Sup. Ct. Richmond Cty. 1999). Similarly, the Second Department has affirmed the preclusion of the testimony of plaintiff’s expert where he could point to no scientific data or studies or provide even anecdotal evidence that supported his conclusion. *See* Cumberbatch v. Blanchette, 35 A.D.3d 341, 825 N.Y.S.2d 744 (2d Dep’t 2006). Although the Second and Fourth Departments have held that a biomechanical engineer may testify as to whether the forces experienced by a plaintiff in a motor vehicle accident could cause the complained-of injuries, those cases do not describe the basis for their holdings. *See* Plate v. Palisade

Film Delivery Corp., 39 A.D.3d 835, 835 N.Y.S.2d 324 (2d Dep't 2007); Cardin v. Christie, 283 A.D.2d 978, 723 N.Y.S.2d 912 (4th Dep't 2001). Neither the Second Department in Plate nor the Fourth Department in Cardin states whether the proposed expert cited any scientific literature to prove that his theory was "generally accepted."