Determining Injury Causation: Sorting the Chaff from the Wheat

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Contentious bodily injury claims often involve soft tissue injuries alleged to have resulted from minor impacts. Whether the impact involved a low speed vehicular incident, a workers' compensation (WC) incident or a slip, trip or fall, the key question to be answered is "Was there an injury mechanism with sufficient force present in this incident to have caused these injuries?" Answering this question is the task of the biomedical/biomechanical engineer.

Biomedical engineering integrates traditional engineering principles with fundamental knowledge of the anatomy and physiology of the human body. As a scientific subdiscipline of biomedical engineering, biomechanical engineering applies the laws of physics and the tools and approaches of mechanical engineering to the joints and tissues of the human body. More specifically, biomechanical engineers investigate the response of the human body to the application of mechanical forces in order to determine the potential for failure or injury to the human body.

Medical Doctor or Biomechanical Engineer?

Determination of a causal relationship between claimed injuries and a specific event requires thorough analysis of the subject incident, an understanding of the unique tolerance level of the individual in question and a biomechanical analysis of the associated injury mechanisms and force magnitudes. Unfortunately, this task is often incorrectly given to a treating physician whose education and training is directed towards the diagnosis and treatment of injury—not determining the cause.

Trained in both mechanical engineering and the physical sciences, the biomechanical engineer applies these concepts and methods to determine the likelihood of a causal relationship between the claimed joint/tissue injuries and the claimed occurrence. Typical biomechanical injury analyses can include (but are not limited to) intervertebral disc bulges/herniations within the cervical, thoracic or lumbar spine, rotator cuff and labrum tears, carpal tunnel syndrome, meniscus and ligament tears within the knee joint, temporomandibular joint injuries or closed head injuries.

Biomechanical Injury Causation Analysis

The method used to conduct a biomechanical injury causation analysis is well defined and accepted in the biomechanical engineering community and is an established approach to assessing injury causation. This is well documented in the technical literature. Within the context of a specific incident, a proper analysis approach consists of the following steps:

1. Identify the claimant's diagnosed injuries alleged to have been caused by the incident.
2. Define the mechanisms/loads that cause such injuries.
3. If vehicular:
   A. Quantify the nature of the incident in terms of forces, accelerations and/or changes in velocity of the vehicle occupied by the claimant.
   B. Define the kinematics (movement) of the claimant's body within the vehicle as a result of the

incident and any interaction between his or her body and the interior components of the vehicle.
C. Determine whether the interaction between the claimant and the vehicle during the incident created any of the mechanisms/loads known to cause the injuries he or she attributes to the claimed incident.

4. If WC or slip, trip or fall:
   A. Identify the body movement/fall mechanism (slip or trip) and body kinematics (movement) through either the claimant's deposition or statement.
   B. Assess whether the body movement/fall mechanism is consistent with the described body kinematics (*i.e.,* a slip results in a rearward fall and trip results in a forward fall) and the claimed defective condition.
   C. Determine whether the claimant's described kinematics and/or fall mechanism created the mechanisms and loads known to cause the injuries that he or she attributes to the claimed incident.

Personal Tolerance Levels and Preexisting Conditions

Injury mechanisms and associated failure loads of the joints and tissues of the human body have been extensively studied and published in peer-reviewed scientific literature and learned treatises. However, a properly trained biomechanical engineer does not simply extrapolate the results of these scientific studies to a specific incident or individual. To provide an opinion regarding the causation (or lack thereof) of an alleged minor impact soft tissue (MIST) injury, the biomechanical engineer's evaluation of a causal relationship between an alleged injury and a specific incident uses thorough analyses of the forces and accelerations during the incident, an understanding of the unique tolerance level of the claimant's body, and a biomechanical analysis of the associated injury mechanisms and force magnitudes.

Testimony and Admissibility

Challenges to biomechanical engineering testimony and admissibility can come from a variety of directions based upon the facts of the case, the scientific methodologies utilized (or lack thereof), venue, improper or inaccurate assumptions made by others and judicial bias, to name a few. However, the testimony of a properly trained and qualified biomechanical engineer has been shown to be an effective tool in mitigating or refuting MIST claims. Nevertheless, court decisions precluding the testimony of biomechanical engineers exist and it is important to understand the details of those cases and how a properly conducted biomechanical injury causation analysis addresses those rulings. Further information and legal case citations are available from **Tom Jennings**, VP, ARCCA, Inc.(617 835 7151) TJennings@ARCCA.com.

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