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BIOMECHANICS & THE RISK MANAGER: DEFENDING FLEETS, PREMISES, PRODUCTS & WC CLAIMS

By Tom Jennings

Do the alleged injuries fit the dynamics of the accident? Was there an injury mechanism present in this incident that could have caused this injury? Risk managers and safety, claims and loss prevention professionals deal with bodily injury claims every day resulting from vehicle collisions, slips and falls, product use and industrial accidents. In some cases, the description of loss does not account for the claimed injuries. You may ask yourself, "How could those injuries result from the described accident?"

By conducting a biomechanical analysis of the events and injuries, biomechanical engineers explore whether an injury mechanism was present in the event that could have caused the claimed injuries.

Biomechanics

"The study of the mechanics of a living body, especially of the forces exerted by muscles and gravity on the skeletal structure."[1] By education, a mechanical engineer (usually) with advanced degree(s) in human anatomy, physiology, tolerance of biological tissue, neuroscience, kinematics and dynamics to name a few.

Mechanism of Injury

Forces applied to the human body in a specific direction and magnitude required to cause injury.

[1]The American Heritage® Stedman's Medical Dictionary Copyright © 2002, 2001, 1995 by Houghton Mifflin Company. Published by Houghton Mifflin Company.

Medical Doctor

Diagnose and treat the injury.

Biomechanical Engineer

Causation—was there an injury mechanism that could have caused the claimed injuries?

Slips, Trips & Falls: Which One Was It?

It matters because it can determine whether there was an injury mechanism for this particular injury. A slip causes different injury mechanisms than a trip. Slips might result in lower back, wrist and head injuries. Trips could involve rotator cuff, wrist, knee injuries, etc. Analyzing and comparing the injuries to the description of the loss event and other available factors enables the biomechanic to reconstruct the event and to reasonably determine whether the claimed accident matches the claimed injuries. If it does not, then it is likely that these injuries occurred elsewhere.

Slips

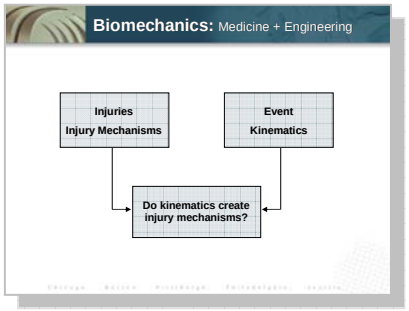
Possible
- Sprains & Strains
- Meniscal
- Fractures
- Disc Herniation

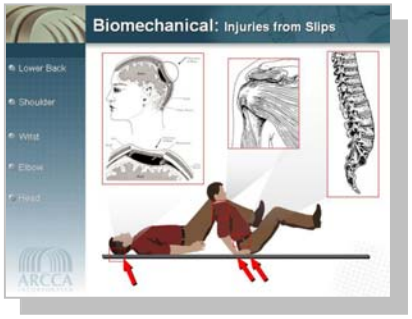
Unlikely
- TMJ
- Degenerative Joint Disease
- Osteophytes
- Disc Herniation (circumstances dictate)
- Carpal Tunnel Syndrome

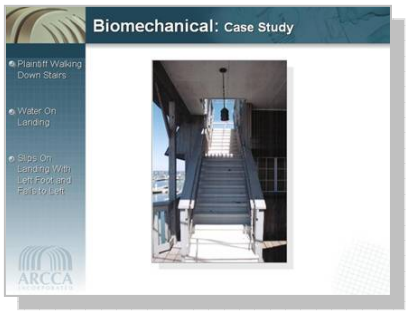
Trips

Possible
- Fractures
- Sprains & Strains
- Rotator Cuffs

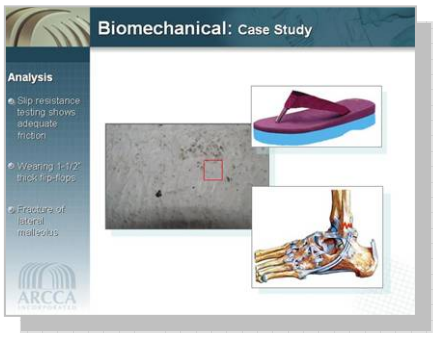
Unlikely
- Carpal Tunnel Syndrome
- Osteophytes
- Disc Herniation
- Degenerative Joint Disease
- TMJ







Case Study: Slip, Trip or Fall
Claimant descending stairs at a marina, slips, falls to her left on the landing and suffers a serious fracture of the lateral ankle (lateral malleolus). She alleges unsafe, slippery, wet surface causing her to "slip." Adjuster's investigation reveals claimant was wearing very thick flip-flops**.** The biomechanical analysis indicates that this type of injury would be caused by the ankle "rolling-over" to the side (i.e., falling off her flip-flop) causing the lateral malleolus bone to fracture. Surface analysis (using the Brungraber Mark-II to measure slip resistance) conclusively showed that, even wet, the surface coating was well within acceptable safety parameters.



Conclusion
The injury was caused by a misstep from rolling off the flip-flop, not the client/insured's surface condition.

Verdict: Favorable to defense.

Vehicular Low-Speed Impact (LSI): Frontal, Rear-End & Side-Swipe
Vehicle damage? Does the force of the crash equate to the probability of injury? The vehicle helps you determine the force of the crash and the likelihood of injury in many ways.

Every fleet, safety and risk manager has been exposed to claims involving questionable injuries from low speed impacts with their commercial vehicles. Oftentimes, these "nuisance claims" are settled by insurers, self-insurers and third-party administrators (TPAs) because they have no viable alternative to refute the claimed injuries. However, the science of the events is often overlooked or simply not explored because adjusters, safety experts and risk managers may be unaware of available legal defenses.

The "damage" vehicles

Low-Speed Impact: Generally considered to be less than 5-8 MPH.

Employing the laws of physics and human tolerance, biomechanics analyze the forces of the impact and whether a mechanism of injury existed during the impact.

Biomechanics may not necessarily question the presence of the injury. However, they will evaluate whether forces and an "injury mechanism" were present in this collision sufficient to produce the alleged injury.

Biomechanical analysis can often reveal many claimed injuries to be quite unlikely given the forces involved in the subject incident. Some low-speed claims may involve claimants with real back, shoulder, wrist and knee injuries, but the vehicle contact forces in this incident did not approach the level required to 1) produce an injury consistent with the claimed injuries and 2) produce forces high enough to receive any injury at all. In other words, using a biomechanical-oriented Accident Reconstruction and Injury Mechanism Analysis can often produce a strong defense against these claimed injuries. By examining accident reports, medical files, damage appraisals and photos, an ARCCA Biomechanic will formulate an opinion/report as to whether the magnitude and direction of force existed to produce an injury.

Elements of a LSI Analysis
Photographs: Ideally, of all vehicles to show the areas of contact. Take both digital and 35 mm photos**.** If possible, "walk the clock." While circling the vehicle, take photographs from all sides, not just the impact area**.** Photograph the bumper shock isolators, if so equipped. Photograph the interior, airbags, the dashboard and steering wheel. Several years later at trial, there may be claims of secondary impacts. Take the photos now to refute such future claims.
Medical Reports: Claimant's (and other occupants if possible)
Damage/Repair Appraisals: For each vehicle involved.
Depositions: Make sure the right questions are included.
Police Reports: If any
Witness Accounts: If any
Occupants: Other Occupants? Injuries? Seating Location(s)
Supplemental Restraint (Airbag) Diagnostic Module Data (Black Box): If available.

What Can We Hope to Achieve?
Determine the range of speed at impact. Calculate the "g" or acceleration forces imparted to the vehicle and occupants. Compare the alleged injuries to the forces (based on the laws of physics) present in this

collision. Scientifically determine whether there was sufficient force to cause the alleged injuries.

Typical Information to be Analyzed

Incident Description: What happened?

- Typical Reports Reviewed: (when available)
- Police accident report
- Insurer's investigation report
- Medical records
- Deposition transcripts
- Plaintiff's answers to defendant's interrogatories
- Color photographs of incident scene, including both vehicles
- Auto body shop repair estimates
- Auto repair report
- Insurance invoices

Data

- Expert AutoStats and VINDeCoder data sheets for involved vehicles
- Insurance Institute for Highway Safety, Damage Repair Costs in Low-Speed Crash Tests at 5 MPH

Typically Claimed Injuries

- Carpal Tunnel
- Herniated discs
- Cervical spine strain and sprain
- Compression fractures
- Thoracic spine strain and sprain
- Lumbar spine strain and sprain
- TMJ
- Rotator cuff
- ACL tear
- Whiplash
- Headaches
- Spasms
- Tingling
- Vision and hearing loss
- Migraines
- Loss of balance and orientation

Vehicle Damage & Crash Severity

The vehicle photographs are relevant in the consideration and analysis of the physical forces in the subject incident. Examining photographs of the plaintiff's vehicle often reveals only minor cosmetic damage and no structural damage. Inspection of the bumper shock isolators can reveal impact forces.

Figure 1: Subject Vehicle

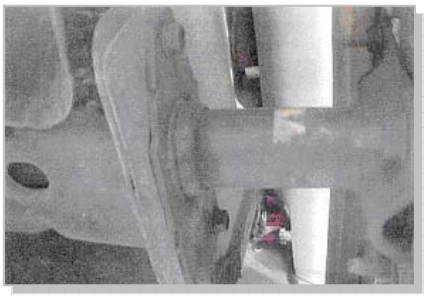


Figure 2: Bumper shock isolator of subject vehicle

Kinematic Analysis

Using the claimant's age, height, weight, seat belt usage and the laws of physics, the biomechanical engineer determines relative motion of the claimant and the vehicle at the time of impact.

According to the laws of physics, when a vehicle is contacted in the rear, it will move forward, if there is enough energy. If forward motion of the vehicle occurs, the occupants will tend to move rearward into the seatback, relative to the interior of the vehicle. This would cause all occupants' bodies to load into the seats and seatback structures, thus coupling their motion to the now accelerating vehicle. Occupants are not thrown forward within the vehicle. The low accelerations resulting from these impacts would cause little or no rebound of occupants' bodies forward from the seatback. Any minimal rebound energy is well within the range of protection of the available seat belt.

With the above facts in hand, the biomechanic will review the claimed injuries one by one to address whether or not sufficient forces were present in this event, which could have produced an injury mechanism to have caused each of the alleged injuries.

Conclusions

The biomechanic's final opinions are based on an objective scientific analysis of the subject incident. Accepted scientific principles are used to determine the crash severity and occupant kinematics, thus enabling an evaluation of injury mechanisms, if any. Subjective findings, such as verbal medical history, may be useful in injury diagnosis, but they cannot be solely relied upon in causally relating a reported injury to a specific event. This is the biomechanic's job.

Every case and every injury is different. However, the laws of physics are constant and apply identically to every collision. With a sufficient amount of the information outlined above, an accident reconstruction can be completed, and an objective biomechanical analysis can determine whether an injury mechanism was present to cause the claimed injuries and to support those findings in a court of law.

Workers' Compensation (WC)

Keeping in mind the same principles and methodology outlined above, biomechanics can analyze the injuries sustained in an alleged WC accident to determine whether there was an injury mechanism present to have caused the alleged injuries. We recognize the difficulties in overcoming the inherent obstacles in refuting WC claims. However, biomechanics can be used to mitigate the severity.

Case Study

This claim involves a WC subrogation/plaintiff defense but demonstrates the possibilities in using biomechanics to ascertain the cause of injury. Two construction workers were lifting a large section of pipe at a construction site when one worker experienced a sharp pain in his lower back. At that time, he left the area to rest and medicate.

Feeling better later that day, he returned to the site where he was working on an elevated scaffold outside a window opening. While stepping through the window opening, he alleges that the scaffold shifted, causing him to trip and fall forward onto his knees and hands.

The Injury: Herniated disc.

The Claim

As an employee, the claimant was entitled to a WC claim for a herniated disc. However, he claimed that the injury was sustained from the trip through the window opening, thereby involving our client, the scaffold contractor, as a third-party litigant. Therefore, apart from the WC claim, suit was filed against our client for $1 million.

A biomechanical analysis confirmed that the claimant had a herniated disc caused by compressive force and bending. Lifting the pipe would create an injury mechanism for such injury—tripping and falling forward would not.

A biomechanical analysis concluded that the injury was sustained when the worker lifted the pipe. No injury mechanism for the back injury was present in the subsequent trip and fall event.

Settlement

Case settled for a small fraction of the claimed amount. Client stated that the biomechanic's report was the key factor in obtaining a favorable settlement.

In summary, biomechanics can determine whether there was sufficient force in an accident/event to create the injury mechanism necessary to cause the alleged injuries. These examples offer a glimpse of what biomechanics can hope to achieve when working with risk managers, their adjusters and attorneys to rebut or at least mitigate some of these alleged injuries/claims.

Tom Jennings is Vice President of ARCCA, Inc. in Boston, MA. ARCCA is a national forensic engineering, insurance/reinsurance and litigation consulting firm that specializes in the analysis and communication of complex issues.

ARCCA Biomechanics and Engineers will conduct 2 presentations at the ASSE 2007 PDC in Orlando: # 644 "Biomechanics For Risk Managers—Slip, Trip and Fall Injuries" and #519 "When Driver Safety Fails—Then What? Vehicular Accident Analysis: The Big Picture."

Visit ARCCA at Booth # 517.

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