

## Forensic Biomechanics, Accident Reconstruction Using Technology

Andrés J. Calderón, Ph.D.

### 1. (1 min) Introduction and Expertise

### 2. (3 min) Biomechanics Definition:

- a. **What is Biomechanics?:** Biomechanical engineering is a relatively new branch of engineering that studies the human body as a mechanical system and uses engineering mechanics to model the human body as such. Mechanics is a branch of physics concerned with the motion and deformation of bodies that are acted on by mechanical forces. In turn, applied mechanics or engineering mechanics is the science of applying the principle mechanics.
- b. **Branches of Biomechanics:** There are three main branches in applied mechanics, rigid body mechanics, deformable body mechanics, and fluid mechanics. The human body is a complicated and interconnected body in which all of these branches of applied mechanics can be utilized. Biomechanics combines the field of engineering mechanics with the fields of biology, anatomy and physiology. In biomechanics, the principles of mechanics are applied to the conception, design, development, and analysis of equipment and systems in biology and medicine.
- c. **Biomechanics Purpose:** Biomechanics studies the normal and pathological situations of human physiology, mechanics of neuromuscular control, mechanics of blood flow in the circulation, mechanics of airflow in the lungs, and mechanics of growth and form. Biomechanics is also used for the development of medical diagnostic and treatment procedures. Understanding how external and internal forces and stresses interact with human physiology provides the knowledge and means to design and manufacture medical instruments and devices, understand pathologies (diseases and conditions) as well as human motion from an engineering perspective.

### 3. Forensic Biomechanics

- a. **(6 min) Occupant Biomechanics:** Forensic biomechanical experts utilize the different components of applied mechanics to evaluate and reconstruct accidents. Forensic biomechanics focuses on the interaction of humans with their environment and how human physiology is affected by external forces and stresses. The mechanics of the human body are analyzed to understand how an injured person was positioned or moving at the time of an accident, what caused the injury, and if the injury is consistent with the accident description.
  - i. **How can we use technology to describe occupant motion?**
  - ii. **Injury presentation using technology.**

- b. **(6 min) Use of Event Data Recorder for Accident Reconstruction:** In motor vehicle accidents, biomechanical engineers work alongside accident reconstruction experts to determine the occupant dynamics and how injuries occur within a vehicle; to evaluate restraint systems and protective devices; and to determine if injuries are consistent with the information available from the EDR.
  - i. **How Biomechanical Engineers use EDR information?**
  - ii. **What are some short comings of the EDR information?**
- c. **(5 min) Case 1: High Speed Rear End Collision: Who was driving?**
- d. **(5 min) Case 2: Pedestrian Impact from a Passenger Bus**
- e. **(3 min) Summary**

**Consulting Engineers & Scientists, Inc.**  
**Andrés J. Calderón, Ph.D.**  
**Biomechanical/Biomedical Engineer**  
**acalderon@ces-experts.com**  
**610-296-2250**