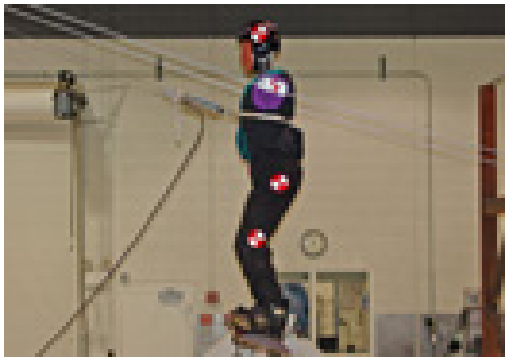
Exponent®
Engineering and Scientific Consulting

Product Design, Usage & Injury Analysis

Overview

Exponent has expertise in injury biomechanics, including the analysis of human kinematics and injury mechanisms. Our biomechanical engineers apply this expertise to understand how traumatic injuries occur. We can assess the role of various design features in a specific event and evaluate the biomechanical implications associated with changes in product design, including alternative products, and use.



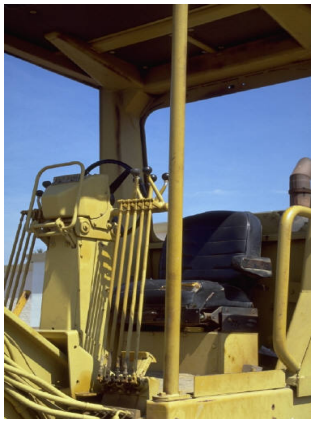
We analyze traumatic injuries occurring during product use to determine body position, movement, and contacts prior to and at the time of injury, and determine the mechanism of injury. Information about the product and the surrounding environment is used in conjunction with medical records, including imaging studies, to perform biomechanical injury reconstructions. The results of the reconstructions can also answer questions about misuse or non-use of product components, including safety features.

The biomechanical implications of design factors, such as changes in usage or design, or an alternative product, are assessed to evaluate injury mechanisms and injury risk. Because many products are used in multiple ways, this evaluation may consider not only the scenario associated with the specific injury or injuries in question, but also alternative scenarios that a user may encounter during normal use, misuse, and accidents. Additionally, field data from various databases, and information from the scientific, biomechanical, and medical literature are used to answer questions regarding injury severity and injury risk during the subject incident, and during alternative scenarios.

Consumer Products

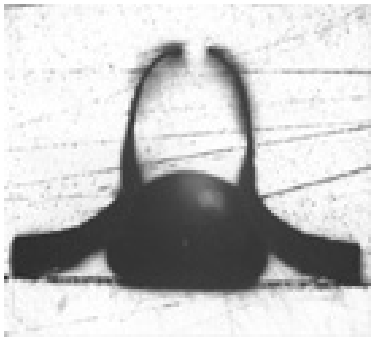
Exponent scientists and engineers reconstruct events involving a wide variety of consumer products, such as motor vehicles, sporting equipment, toys, children's products, safety equipment (helmet, protective clothing), footwear, amusement-park rides, and tools. Our biomechanical analysis can be used to reconstruct events leading up to and during an injury-producing event. The results are used to answer questions related to the user's position and actions at the time of the event and address issues related to product use. We use our expertise in pediatric biomechanics and developmental functional capabilities and anthropometry to evaluate injuries to children and to address biomechanical questions pertaining to use, misuse, and age appropriateness. We have performed analyses of field data, including data from the Consumer Product Safety Commission (CPSC) and the National Electronic Injury Surveillance System (NEISS), and developed and performed testing using anthropomorphic test devices (ATDs) and human volunteers. Exponent's engineers are active in several consumer product-related research projects, including those involving falls to children, effects of footwear on gait, and acceleration during amusement rides and daily activities.

Industrial Equipment



Exponent engineers perform biomechanical reconstructions involving many kinds of industrial equipment, including stand-up and sit-down forklifts, material handling systems, elevators, construction equipment, ladders, lifts, power tools, and manufacturing equipment, and evaluate questions pertaining to the use and non-use of safety equipment, such as protective headgear (hard hats) and fall arrest systems. We develop novel approaches to evaluate injury mechanisms, including analysis of field data from the Occupational Health and Safety Administration (OSHA) and NEISS, develop and perform specialized testing, and use three-dimensional computer-generated (CG) graphics to depict and analyze injury events. Exponent's biomechanical engineers have evaluated the accelerations experienced by lift-truck operators and related those accelerations to those causing a loss of balance..

Medical Devices



Exponent engineers have expertise in assessing various aspects of medical devices, including orthopedic, spine, vascular, and tissue implants. We perform detailed analyses and evaluations of medical devices using validated computational models and experimental testing, performed in-house in our lab facilities, to address biomechanical issues associated with device design, use, and interaction with biological tissues. We use biomechanical, statistical, and epidemiological studies from the published literature, clinical trials, and databases to address questions related to implant functionality, performance, and health economics. Our staff performs cutting edge research and is extensively published in several related areas, including implant retrieval, spinal implants, biomaterials, wear testing, and health care economics.