Injury Models

Quantitative Visualization of Human Cortical Bone Mechanical Response: Studies of the Anisotropic Compressive Response and Fracture Behavior as a Function of Loading Rate

Researchers at USARL, sponsored by AMC and RDECOM, studied the effect of loading rate and orientation on the compressive response of wet human femur cortical bone. Cortical bone compression specimens were extracted from three male donors (ages 36, 43, and 50) in the longitudinal and transverse directions, relative to the long axis of the femur. The compressive behavior of the cortical bone was studied at quasi-static, intermediate, and dynamic strain rates using a split-Hopkinson pressure bar to determine the strain rate dependency on the strength of bone. The failure strength of the human cortical bone in two directions was found to be positively correlated with strain rate. The cortical bone material was anisotropic and stronger in the longitudinal direction than the transverse direction, and was also rate dependent in both directions. This study will enable the design and evaluation of protection devices to mitigate bone deformation and injury during blast and impact loading.