SIMULATED HEAD AND BRAIN RESPONSE RESULTING FROM REFLECTED BLAST LOADING

M. Cheng[1], D. Singh[2], J. Levine[1], J.-P. Dionne[1], A. Makris[1], D. Cronin[2]

[1]Med-Eng, 2400 St. Laurent Blvd., Ottawa, Ontario, K1G 6C4, Canada;
[2]Department of Mechanical and Mechatronics Engineering, University of Waterloo, 200 University Ave W, Waterloo, Ontario, N2L 3G1, Canada

ABSTRACT

Blast-induced Traumatic Brain Injury is considered as the signature injury in recent military conflicts. Significant efforts are devoted to determine how these injuries could be assessed. Previous studies have investigated the link between blast characteristics (e.g. explosive size, standoff) and global head kinematics and tissue-level responses, either through explosive blast experiments or numerical simulations. Earlier studies focused on free-field blast (absence of obstacles or reflecting surfaces in the near field). Conclusions and corresponding injury assessment methods derived from such studies are not well validated for complex blast loading scenarios that are different from the free-field blast. In this study, a FEA model was used to investigate the global head kinematics of a Hybrid III mannequin subjected to explosive blast, with a reflecting wall located behind the mannequin. The head of the mannequin was first struck by the incident blast wave and then by a reflected wave travelling in the opposite direction. In addition, detailed sagittal and transverse models of the human head have been applied to a similar reflecting wall scenario to investigate whether the reflective surface introduces similar effects on head responses at the tissue-level. The results from the current study emphasize the need to consider blast confinement and the surrounding environment in the development of blast injury criteria for the head and brain.