HYBRID Iii HEAD ACCELERATION SUBJECTED TO MULTI-DIRECTIONAL BLAST

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While a number of different mannequins and test rigs are currently being developed for the assessment of blast injuries, no such apparatus has yet been fully validated, with associated reliable injury criteria and biofidelity corridors. As such, the Hybrid III anthropomorphic mannequin is still widely used for the assessment of blast injuries, even though it was developed for automotive applications. Advantages of the Hybrid III mannequin include its correct mass and mass distribution, as well as the possibility to provide relevant instrumentation data from various sensors.

In particular, the potential for blast-induced traumatic brain injuries has been investigated through the use of the acceleration traces gathered from the tri-axial cluster of linear accelerometers located at the center of gravity of the Hybrid III mannequins' head. Most of these studies have focused so far on frontal threats, which is not surprising, as the Hybrid III has been designed for frontal impacts. Blast performance testing of Explosive Ordnance Disposal (EOD) personal protective equipment (PPE) has also focused on frontal threats, in line with standard operating procedures which recommend facing the blast, due to the protection being optimized in the front area of the EOD ensemble.

Due to a high incidence of blast-induced traumatic brain injuries (TBI) in soldier populations involved in the current Middle East conflicts, more recent investigations on blast-induced TBI have involved the effect of blast on soldiers being exposed to the explosion of terrorist devices. As the soldiers do not necessarily face the blast threat, it becomes relevant to investigate how the head will respond to blast exposure in various orientations with respect to the origin of the blast.

Recent such investigations, carried out within a test program aimed at developing a helmet-mounted blast dosimeter, have generated a significant amount of data on the effect of blast orientation on the head acceleration and associated injury predictions. In particular, the sensitivity of the Hybrid III head and neck to the directionality of the impact has been shown to be quite high. This paper will present these recent results, and will discuss their relevance, in view of the geometry and response of the Hybrid III as compared to actual human biomechanics.