A STUDY OF SHOCK INTERACTIONS INSIDE A HELMET UNDER BLAST LOADING

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Recent studies have indicated that a dramatic increase in blast traumatic brain injuries (TBI) due to blast waves generated from explosives. The TBI is mainly due to the peaking of pressures at some points on the head inside the helmet where the blast wave travels through the narrow gap between the head and the helmet, and focusses. A recent computational study [1] reveals that there is a pressure peaking just on the parietal bone when the blast wave hits the head in a direction in which the blast induced flow is normal to the head. The reasons of this focusing are not detailed as this needs a 2-D visualization of the blast wave. In this paper, the wave-head-helmet interaction patterns due to the impact of blast wave in two different orientations are investigated. Blast wave patterns between head and helmet are captured using time resolved schlieren technique. Preliminary schlieren images show focused reflections of shockwave at a point on the parietal bone right at the top center of the skull as shown in Figure 1. The point of interaction of the shockwaves when shockwave hit the head in normal direction is on the frontal bone right above the forehead. A radial wave is also seen along the curvature of the head as Figure 1. Further experiments and numerical simulations will be carried out to capture the pressure profile on the head for various blast strengths and the heads in different orientations.

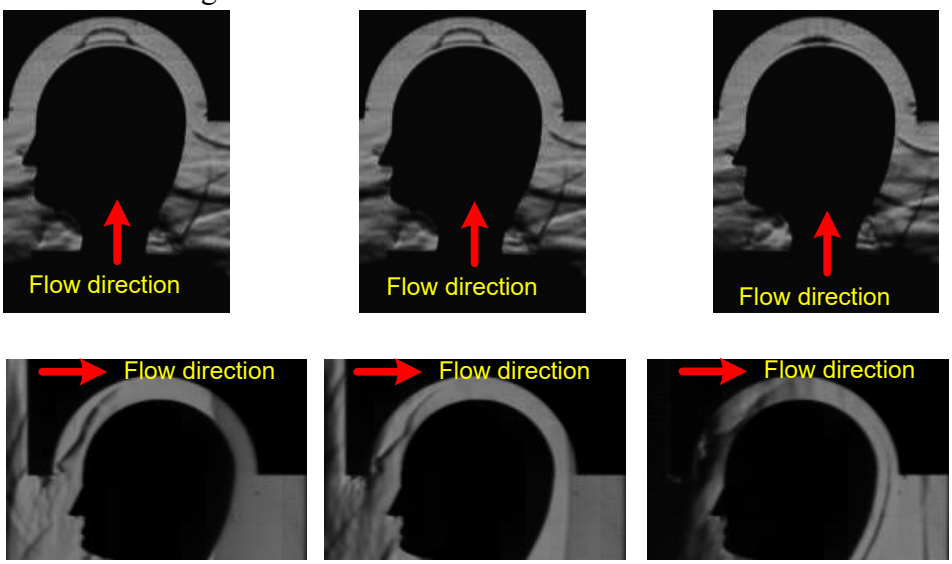

Figure 1. Shock structures inside the helmet and the head for differnet orientations

Reference:
1. S. Ganpulea, L. Gub, A. Alaia and N. Chandraa, "*Role of helmet in the mechanics of shock wave propagation under blast loading conditions,"* Computational Methods in Biomechanics and Biomedical Engineering, 1-12, 2011