Protective Equipment

Primary Blast Wave and Protective Eyewear Studies

Deployed Service Members are at particular risk of a spectrum of ocular injuries caused by blast. The spectrum includes penetrating and closed globe eye injuries, retinal detachment, eye rupture, intraocular hemorrhage, corneal lacerations, and optic nerve damage, among others. To help protect Service Members from these injuries, the Authorized Protective Eyewear List was adopted in 2006 and incorporated acquisition guidelines for ballistic protection. However, there is growing laboratory evidence that the primary blast wave may cause significant ocular as well as higher visual system injuries. Researchers from USAARL evaluated the protection provided by current protective eyewear by evaluating pressure wave dynamics at the cornea in an instrumented headform. Eyewear protection coefficients were calculated using peak and integrated pressure readings. In general, goggles provided the greatest protection and eyeglasses were only slightly effective for frontal blasts. For oblique blast angles, eyeglasses actually potentiated the blast wave by creating higher pressures at the cornea. Oscillations in the time pressure recordings provided evidence of increased turbulence caused by some eyewear and this could lead to increased shear forces on ocular tissue. Computational modeling efforts led by BHSAI are confirming USAARL's findings. The USAARL team's findings suggest that current eye protection, designed to reduce secondary and tertiary blast injuries, may provide insufficient protection against primary blast wave. Showing that foam inserts can reduce the energy impact on the eye may lead to optimized eye protection in the future.