**Project Title:** Sub Lethal Ocular Trauma  
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**Background:** A large gap exists in the understanding of physical mechanisms and progression of blast induced ocular trauma. This gap hampers the ability to design effective protective devices, and may contribute to ineffective treatment and rehabilitation due to inadequate awareness of potentially vision-threatening injury. Significant internal trauma can occur at very low levels of insult energy.  
**Objective:** The objective is to address the knowledge gap by experimentally identifying injury mechanisms and their progression with increasing blast energy and impulse. This approach is a fully integrated experimental and computational study. Experiments will be conducted using the Army Institute for Surgical Research shock tube. This shock tube is capable of generating the range of peak pressures and pulse durations of interest to the proposed study. Although most previous studies have used globe rupture as the injury criteria, researchers will identify and characterize a full range of potential non-lethal (i.e. sub-globe rupture) trauma, from mild angle recession up to globe rupture, allowing for a comprehensive understanding of blast-induced ocular trauma. Experiments will increase in complexity, from ex vivo porcine eyes, to anesthetized rabbit eyes, to ex vivo human eyes. Use of the *in vivo* rabbit model will allow for biochemical marker monitoring and characterization. Although physical trauma will be our primary focus, the chemical biomarker assessment will allow correlation of observed physical trauma with more subtle chemical indicators.  
**Hypothesis:** Physical mechanisms and progression of blast induced ocular trauma hampers the ability to design effective protective devices and may contribute to ineffective treatment and rehabilitation.  
**Specific Aims:** 1) Conduct sub globe rupture shock tube experiments on approximately 102 ex *vivo* porcine eye specimens, characterize the blast-induced trauma, and establish trauma thresholds for a range of sub-rupture trauma phenomena; 2) conduct sub-globe rupture shock tube experiments on approximately 18 *in vivo* rabbit specimens, characterize the blast-induced trauma, and establish trauma thresholds for a range of sub-rupture trauma phenomena; and 3) develop an ocular trauma predictive model using the experimental data.  
**Study Design:** The study design starts with ex *vivo* porcine eye studies to establish trauma thresholds for a range of sub-rupture trauma phenomena. This will be followed by *in vivo* rabbit and ex *vivo* human eye testing that will lead to an ocular trauma predictive model. The study design is in line with the primary objective by identifying physical mechanisms of acute injury and their progression with increasing blast energy and impulses.  
**Relevance:** The shock tube testing results will have substantial impact in improving knowledge and establishing standardized blast thresholds. The development of a computational model will provide further knowledge and may play a role in the development of protective devices. The data and the models will inform the design of more effective eye protection and will improve treatment by increasing the knowledge of potential trauma phenomena for military ophthalmologists.