Triage and Treatment of Laser Eye Injury on the Modern Battlefield

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TECHNICAL ABSTRACT

Background: Corneal eye injuries produced by lasers on the battlefield currently have no scientifically proven methodology for identification, characterization, triage, or hospital medical management. The potential exists to produce laser injuries that have rarely been encountered by military medical personnel. Further, funding for laser tissue interaction research is focused on defining threshold endpoints and not on triage or treatment should a catastrophic injury occur.

Objective/Hypothesis: (1) Determine how laser energy is deposited in tissue, how that energy affects the site of deposition, and how energy deposition leads to injury. We will begin monitoring and examining the development of tissue damage to the cornea in terms of the threshold to damage, while monitoring the progression from damage onset to recovery. (2) Develop techniques for performing triage on corneal injuries. (3) Develop battlefield treatments utilizing medications and materials currently carried by medics. (4) Determine the medications and treatments carried by a medic that are contraindicated.

Specific Aims: Our aim is to report on the outcomes discussed above and publish the techniques necessary for triage and treatment of laser battlefield injuries to the cornea. The rationale for this is that successful completion of the research will allow battlefield injuries to be properly recognized, evaluated, and treated as rapidly as possible. The major aim is to return the warrior to the fight.

Study Design: In vivo ocular exposures will be made at the threshold to cause injury and the threshold for non-linear phenomena to occur. In vitro cornea models will be utilized in conjunction with in vivo exposures to determine specific biomarkers associated with corneal wound healing and explore the mechanism of laser-corneal tissue interaction. In addition, in vitro studies using human organotypic corneal models will be conducted to explore issues of extrapolation of experimental results in rabbits to potential human battlefield experience.

The information gained from biomarker analysis, histomorphometric evaluation, and gross observations will be used to determine the best treatment modalities to evaluate. Treatments based on pharmaceuticals available to a medic will be evaluated in vivo and in vitro. Those techniques that result in the most favorable outcomes will be optimized for battlefield application. Those techniques determined to be detrimental to corneal wound healing will be documented.

Relevance: Training, treatment, and knowledge gained from our program of research will aid field commanders, battlefield management personnel, hospital personnel, and military medical readiness in general. Our research will result in the proper recognition of the severity of the injury and the correct battlefield treatment using materials already carried by medics, rather than having to always medevac any eye injury without any, or worse, improper, treatment.