Project Title: Programmable Micro Wafer Drug Delivery for Ocular Trauma  
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Background: War fighters are often exposed to burn injuries that affect the eyes resulting in loss of vision, which translates to total disability that carries a great cost to patient, military, and society. New treatment strategies for ocular injuries are necessary.  
Objective: Test whether nanotechnology based nanofabrication methods can be integrated with controlled release drug delivery technology for the development of a dissolvable micro wafer for long-term drug delivery to the eye.  
Hypothesis: Current nanotechnology based nanofabrication methods can be integrated with controlled release drug delivery technology to develop a dissolvable micro wafer for long term drug delivery to the eye.  
Specific Aims: 1) Fabrication of drug-eluting micro wafer by hydrogel template strategy;  
2) Evaluation of micro wafer for in vitro drug release and in vivo pharmacokinetics;  
3) Evaluation of the efficacy of micro wafer in preventing corneal perforation in animal model of alkali burn and dry eye.  
Study Design: The micro wafer will be prepared from nanofabricated silicon wafers using FDA approved biomaterials. The micro wafer contains wells of 200 and 500nm that can be filled with a drug. It will be examined for total drug content and the in vitro drug release kinetics by HPLC analysis. The in vivo drug release kinetics post implantation will be studied by analysis of tear washings by spectrophotometry. The drug-loaded micro wafer will be placed on the ocular surface of mice and early (perforation) and late parameters (corneal healing; corneal smoothness), and the expression of matrix metalloproteinase and inflammatory cytokines will be evaluated.  
Relevance: This new micro wafer technology provides sustained drug delivery for three to seven days, thus allowing better compliance, increased local drug delivery, and avoidance of peak/trough drug concentrations achieved with conventional eye drops. Chemical eye injuries continue to cause severe morbidity, and this proposal takes a highly innovative approach to develop a new technology for the delivery of ocular medications on the battle field. The technology, if successful, will have wide applicability.