Optical Quality, Threshold Target Identification, and Military Target Task Performance after Advanced Keratorefractive Surgery

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PUBLIC ABSTRACT

Field deployment is an unfriendly environment for the use of contacts and/or eyeglasses. Contact lenses pose a risk as decreased hygiene and long continuous wear can result in infection, corneal ulceration, and even permanent vision loss. However, the need for ballistics goggles and the use of night vision goggles hinders the use of glasses. Both contacts and glasses may be difficult to replace if lost or broken, depending on the situation the soldier is in. For this reason the Army instituted the Warfighter Refractive Eye Surgery Program (WRESP) to provide refractive surgery to deploying soldiers.

Photorefractive Keratectomy (PRK) is the preferred refractive surgery technique used in the Army as it has an exceptional safety profile. Laser-assisted in situ keratomileusis (LASIK) is the most popular refractive surgery technique in the civilian community due to is quick recovery time. Both techniques are highly successful in improving daytime vision, though glare, halos, and a decreased ability to distinguish contrast have also been shown to affect patients. The impact on contrast is more readily apparent at night, and is of particular significance to soldiers as many military operations occur in nighttime conditions. Rapid evaluation to correctly assess visual information such as "Is that shadow on that man's jacket consistent with a bomb belt? An AK-47? Or perhaps, a loaf of bread?" relies on a soldier's ability to discriminate differences in contrast.

Advances in refractive surgery using wavefront technology have improved nighttime vision, though this has not been assessed in a military environment. In addition, use of a femtosecond laser to create the corneal flap in LASIK surgeries offers greater safety and efficacy. In the protocol we propose, we intend to evaluate different refractive surgery techniques to determine their impact on nighttime military tasks. Subjects will receive one of four treatments: Wavefront guided PRK, wavefront guided LASIK, wavefront optimized PRK, or wavefront optimized LASIK. In collaboration with the U.S. Army Night Vision and Electronic Sensors Directorate (NVESD), nighttime military performance will be evaluated before and after surgery. These tasks include night vision sensor testing and night vision firing range performance.

The projected time for the study is 2 years as patients will be followed up to a year after surgery. The design is mainly intended for active-duty soldiers, though the data collected will advance the scientific knowledge of military and civilian surgeons alike. Evaluating nighttime battlefield simulations and measuring visual performance will contribute not only to the operational readiness of U.S. Army combat units, but will also help the scientific community at large. Night vision difficulties are also a concern in the civilian population, especially when related to nighttime driving conditions. This study will provide a greater understanding of which surgical treatment and technique will result in optimum vision in both daylight and nighttime conditions.

Another important reason for this study is economic. The money devoted to refractive surgery is fixed. Wavefront guided treatments cost 50 percent more per procedure. Adding in the costs of the IntraLase femtosecond laser increases the costs even more. Therefore, an important question to have answered is: Is a soldier's visual function improved so significantly with wavefront guided

ablations and the IntraLase femtosecond laser that it might warrant a decrease in the total number of treatments so that the total cost of refractive surgery to the U.S. Army Medical Command remains constant?

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