Laser Vision Correction in the US Military

An explanation of the scientific and clinical evidence that supported the armed forces' decision to perform PRK and LASIK on active service personnel.

BY DAVID J. TANZER, MD

The US Military has strict visual requirements for its service personnel. They must be able to perform their duties under extreme conditions, such as the flying and landing of high-performance aircraft, parachuting, and undersea diving. These activities often require the use of special optical devices (eg, night vision goggles, masks, targeting scopes, and biological protective gear) that usually are not compatible with eyeglasses. Contact lenses are allowed under certain conditions, but they are prohibited in troops serving in Iraq, Afghanistan, and Korea. Given these challenges, the US Military is constantly looking for ways to improve the functional vision of its personnel.

The US Military's decision to adopt laser vision correction—first PRK and then LASIK—to improve its troops' visual function was not taken lightly. It was based on the results of more than 45 clinical trials. This article describes some of the studies that led to this change in policy.

IDENTIFYING A NEED

Data on file at the Naval Ophthalmic Support and Training Activity (Yorktown, VA) estimate that approximately 30% of the US Military population depend on spectacles or contact lenses on a daily basis and that many of these troops could benefit from laser vision correction. Since 1993, the US Military has been evaluating the safety of refractive surgery for its active-duty personnel. With the support of the Department of Defense, my colleagues and I set out to independently

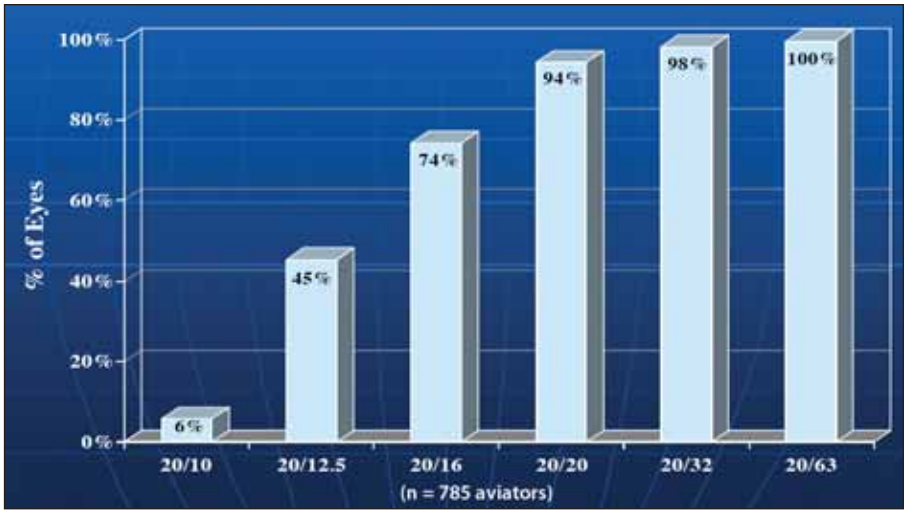

Figure 1. The UCVAs of Naval aviators 6 months after PRK.

evaluate the safety and efficacy of laser vision correction in US fighting forces. Our investigations focused on assessing quality of vision, the rate of visual recovery, and the effect of specific environments on the eyes of treated personnel. We also evaluated the parameters employed by industry to ensure the safety of the devices used to perform laser vision correction.

PRK IN NAVAL AVIATORS

In 2000, the first active-duty Naval aviators (n = 785) underwent PRK as part of the Retention in Naval Aviation Study. This trial was designed to treat aviators who had lost their qualification for flight status because of excessive refractive error.

By 6 months postoperatively, 94% of the aviators had achieved UCVAs of 20/20 or better, and 100% of them had successfully returned to full flight status[1] (Figure 1). During this postoperative period, the aviators logged more than 48,000 accumulated flight hours and performed over 19,500 landings (including 2,622 arrested landings on aircraft carriers). As a result of this landmark study, the Navy approved PRK for the correction of its pilots' refractive errors.

COMPARING DIFFERENT LASERS AND KERATOMES

In order to evaluate the latest-generation excimer lasers, Steven C. Schallhorn, MD, and I randomized 480 nonaviator military service personnel (960 eyes) to undergo LASIK with one of four different excimer lasers.[2] At 6 months postoperatively, approximately two thirds of the treated eyes had achieved UCVAs of 20/16. We did not note any significant differences among the lasers.

In another study, my colleagues and I evaluated the visual outcomes of LASIK in 600 eyes of 300 nonaviator service personnel randomized to flap formation with three different devices (two mechanical microkeratomes and one femtosecond laser). Approximately 75% of the patients achieved UCVAs of 20/16 or better at 1 month, and all of the tested devices for creating the flap were found to be safe and effective.[3] We did note, however, that the use of the femtosecond laser was associated with a quicker visual recovery and a higher quality of postoperative vision in this population.

ENSURING THE FLAP'S STABILITY

One of the concerns my colleagues and I shared about the safety of LASIK for aviators was whether the corneal flaps created during the procedure could withstand the G-forces exerted on the eye during flight and forced ejection from an aircraft.

The flaps proved to be stable in an animal model in which the subjects were exposed to forces equivalent to those produced during ejection from a plane traveling at 400 knots.[4] It required the force of an approximately 700-knot ejection—which is not compatible with life—to detach corneal flaps from the eye in this study.

NIGHT VISION

Active military personnel often perform their duties at nighttime, so it is important that their vision is not impaired by glare. My colleagues and I evaluated the efficacy of customized LASIK with femtosecond flap formation by comparing the pre- and postoperative results of simulated night-driving tests in a myopic, nonaviator, military population (n = 21). Postoperatively, 18% and 28% of the patients reported a significant improvement in their ability to detect a target (with and without an additional source of glare, respectively). In contrast, very few patients (3% with glare, 0% without glare) had a significant reduction in their ability to perform this task after LASIK.[5]

Laser vision correction also positively influenced the patients' ability to identify a simulated target in night-driving tests, with 41% and 46% reporting improvement (with and without glare, respectively). Once again, LASIK

appeared to reduce the ability to identify a target in only 3% of patients (with and without additional glare).

LASIK IN NAVAL AVIATORS

The US Military's most recent assessment of laser vision correction is the ongoing LASIK in Naval Aviators trial. By 2 weeks postoperatively, 100% of the treated aviators (n = 30) had UCVAs of 20/20 or better. In addition, 94% saw 20/16 or better, and 57% saw 20/12 or better.[6]

When the participants were asked if they felt that LASIK had enhanced their effectiveness as aviators, 95% said yes. None of them thought that the procedure had injured his ability to perform his duties, and 100% of them stated that they would recommend LASIK to their fellow Naval aviators.

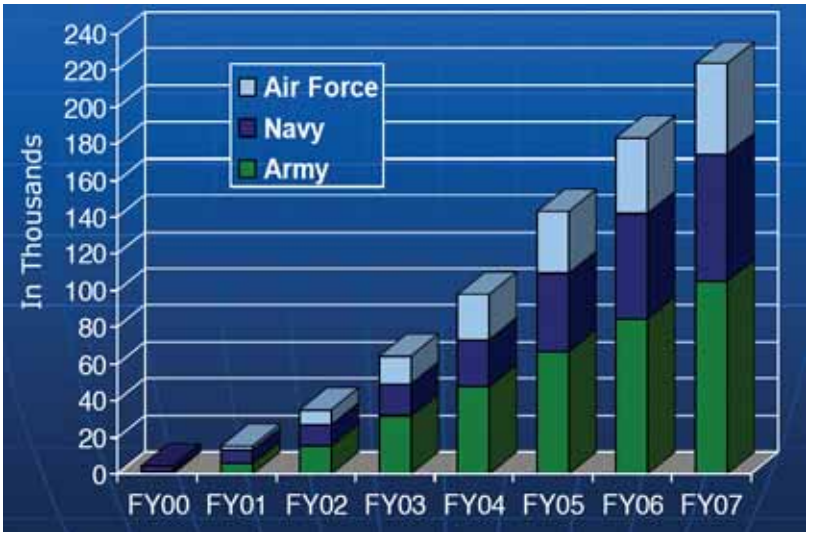

Figure 2. Cumulative total of laser vision correction procedures performed by the US Department of Defense as of fiscal year (FY) 2007.

THE WARFIGHTER REFRACTIVE SURGERY PROGRAM

To date, the US Army, Navy, and Air Force have performed more than 224,000 refractive surgery procedures at 20 centers participating in the Warfighter Refractive Surgery Program (Figure 2). Overall, laser vision correction has been shown to be safe and effective for individuals involved in all aspects of military service. Most recently, the National Aeronautics and Space Administration approved LASIK for astronauts. Furthermore, an unpublished meta-analysis showed that 98.2% of 1,200 military personnel were satisfied with their postoperative visual outcomes.

Military physicians fully acknowledge that refractive surgery is not without the risk of complications, however, and they inform all potential patients about the risks and benefits associated with the procedure. They also discuss alternative forms of visual correction. Although many military personnel elect to have refractive surgery, they are not required to do so.

Of all the military personnel treated with laser vision correction, only one person has been medically retired from the Department of Defense due to complications secondary to the procedure (one of 112,000 patients, 0.009%). Despite a postoperative UCVA of 20/20, the patient complained of poor quality of vision and therefore was not returned to active duty.

CONCLUSION

I recently had the opportunity to fly with the first Naval aviator to be treated with laser vision correction. As our F/A 18 Hornet approached our destination—an aircraft carrier—he told me that the treatment he had received at my hands made it easier for him to see the ship's deck and landing lights. I was proud that, by providing laser vision correction, I had permanently improved his ability to perform this visually demanding task.

Since this inaugural case, my colleagues and I have performed refractive surgery on more than 1,000 Naval aviators. If I did not believe that all military personnel could benefit from laser vision correction, I would never perform it on active-duty troops. ■

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