

Wavefront-guided LASIK offers benefits over wavefront-guided PRK

U.S. Navy study finds equivalent safety and effectiveness outcomes at 12 months, but faster healing time with laser-cut LASIK flaps.

After 1 year, patients had equivalent quality of vision with minimal negative outcomes whether they had their vision corrected with wavefront-guided LASIK or wavefront-guided PRK, a study in U.S. Naval personnel found.

However, patients treated with the LASIK protocol had a more rapid recovery and were able to return to full active duty status quicker than patients treated with PRK. The study spurred a second trial that employed wavefront-guided LASIK using laser to cut the flap in naval aviators.

In the second trial, pilots were returned to full flight status 2 weeks after surgery. Typically, according to Capt. David J. Tanzer, MD, pilots are grounded for a minimum of 3 months after PRK.

"That represents a six times faster return to duty status than with prior procedures," Dr. Tanzer said.

Comparison of wavefront techniques

Under an investigational device exemption (IDE) protocol, Steven C. Schallhorn, MD, and Dr. Tanzer compared clinical outcomes and quality of vision resulting from wavefront vision correction techniques.

"The point of the IDE study was to compare a [U.S. Food and Drug Administration]-approved procedure, which is wavefront-guided LASIK, to one that is not yet FDA approved, and that is PRK," Dr. Tanzer said. "We have a long and proven track record with surface ablation, and we wanted to ensure that both procedures were safe and effective. ... We were comparing the best PRK had to offer with the best LASIK had to offer."

Immediately after surgery and at all time points up to 1 year after surgery, wavefront LASIK had superior outcomes, but at 1 year, the results equalized and no significant difference was noted. In terms of uncorrected visual acuity, 98% in the LASIK group and 81% in the PRK group achieved 20/20 vision at 1 month, and 87% in the LASIK group and 58% in the PRK group were 20/16 or better. At 1 year, 97% in the LASIK group and 96% in the PRK group were 20/20 or better, and 88% in both groups were 20/16 or better.

That trend continued in all analyses: 94% of LASIK and 89% of PRK patients were within 0.5 D of mean spherical equivalent at 1 month, and 76% of

LASIK and 65% of PRK patients were within 0.25 D. At 12 months, 98% of LASIK and 94% of PRK were within 0.5 D, and 87% of LASIK and 83% of PRK were within 0.25 D.

Change in best corrected visual acuity and change in mesopic BCVA also followed a similar pattern, with a healing advantage seen among patients in the LASIK group. At 1 month, patients treated with LASIK had a 0.06- μ m increase in higher-order aberrations compared with 0.07 μ m among PRK patients;

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at 12 months, change in higher-order aberrations were essentially the same in both groups (+0.05 μ m induction for LASIK vs. +0.07 μ m induction for PRK). Changes in aberrations between groups were statistically insignificant.

Pilot study

The equivalent safety profile of the two procedures led Dr. Tanzer, under the direction of U.S. Navy protocols, to investigate the use of wavefront-guided LASIK in naval pilots, with the thought that the procedure could return them to flight status quicker than PRK while still delivering high-quality results.

"[Pilots] have very specific qualifications they need to maintain in order to fly, and every day they are out of the cockpit, they run the risk of losing those qualifications that take time, money and effort to maintain," Dr. Tanzer said. "So we want the refractive procedure that is the safest and most effective as possible, but ideally returns them to duty status as quickly as possible."

The protocol for the study includes the use of Fourier-based algorithms to guide the ablation, as well as a femtosecond keratome to cut the flap. Both wavefront technology and laser-cut flaps offer distinct advantages to the procedure, especially so in this unique patient population, according to Dr. Tanzer.

Aside from the ability to measure and treat both lower- and higher-order aberrations, "using the Fourier-based algorithm to control the wavefront-guided

ablation allows us to treat higher fidelity down to 1/100th of a diopter, which was not previously possible," he said.


Several studies have documented that femtosecond lasers are more accurate at cutting a LASIK flap with less variance in the desired thickness. These studies have noted that a more accurate flap allows the surgeon to more precisely predict the thickness of the residual stromal bed, which may be important in patients with thinner corneas.

The femtosecond laser-cut flap also allows the surgeon to cut a planar flap, Dr. Tanzer said, meaning that it is of equal thickness at the center and the periphery. Older, metal keratomes cut a meniscus flap, which was essentially

irregular and more prone to inducing aberration in the visual field.

Compared with PRK, LASIK, in general, obviates the risk of corneal haze. Although LASIK has the inherent risk of flap dislocation, the planar flap, because of its side cut architecture, may offer advantages for healing that minimize that same risk, Dr. Tanzer said.

The study in naval aviators is ongoing. So far, 100% of patients are 20/20, 94% have achieved 20/16 or better uncorrected vision at 2 weeks, and a majority had a stable refractive result at 1 week with an improvement in low contrast acuity of more than 50%. More importantly for this patient population, pilots are grounded for 2 weeks after wavefront-guided LASIK with laser-cut flaps, on convalescent leave for only 1 day and are deployable after 1 month. Previously, naval pilots who received PRK had to wait a minimum of 3 months before they could be returned to flight status and deployed.

"We now have the best technology available to treat all of our military personnel, including naval aviators, with a procedure that gives us the highest quality of vision, and the beauty of LASIK is that it gets these people back to full-duty status very quickly," Dr. Tanzer said. — by Bryan Bechtel 

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