

New system uses time-based aberrometry approach for wavefront scanning

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in Anaheim



Arturo Chayet

THE Nidek NAVEX custom ablation system provides excellent tools for the measurement and treatment of highly aberrated eyes, reported Arturo Chayet MD at a symposium held during the annual meeting of the American Academy of Ophthalmology. Dr Chayet

presented data on 360 eyes in a series ending in July 2002. Patients had up to -6.0 D and up to 4 D of astigmatism. Among 80 consecutive eyes in which he has at least three months follow up data, 94% had UCVA of 20/20 or better and 97% of the patients were within 0.5 D of the intended refraction.

He reported that only 6% of the patients lost one line of BCVA. More than 90% achieved UCVA that was superior to their preoperative BCVA. Some 95% retained or improved their contrast sensitivity.

Dr Chayet noted that the patients of today are more sophisticated and aware of the limitations of LASIK than in the past.

"Patients are not the risk-takers who we were seeing in previous years. They want good vision without glasses, without the complications and risks. To do this we need a treatment that produces a large, smooth ablation zone, with accurate algorithms to produce this effect," he commented.

Chayet is very impressed with the results he has achieved with the new algorithms. "We've gotten such good results with the Optimized Aspherical Transition Zone (CATz), that I'm not sure we're going to get much better results by treating the higher-order irregularities," said Dr Chayet.

Nonetheless, he has some data on the next iteration of the NAVEX algorithms, the Custom Aspheric Transition Zone (CATz) algorithm.

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Using CATz, Dr Chayet again managed to get 97% of eyes to within 0.5D of target refraction, indicating that the algorithms are extremely accurate, he said. Some 84% have maintained or improved their contrast sensitivity.

At the core of the NAVEX is NIDEK's OPD-Scan system, which performs simultaneous topography, autorefractometry and wavefront aberrometry, combining all three functions into a single machine. The wavefront sensing in particular uses an approach quite different from most systems on the market. The OPD-Scan is done by dynamic skiascopy, using a principle of time-based aberrometry rather than the position-based approach used by other systems. The OPD-Scan projects 1440 rays of infrared light (wavelength: 880 nm) into the eye and measures the time it takes each of these rays to traverse the entire optical system. Other systems use Hartmann-Shack or Tscherning aberrometers, which measure the spatial displacement of light rays as they pass through the eye.

Proponents claim that because so many more points are used in the OPD-Scan, there is much less extrapolation and data smoothing in the system. Positional crossover in the Hartmann-Shack approach also reduces the accuracy of those systems.

The OPD-Scan also directly incorporates corneal topography, using placido disk technology resulting in both axial and instantaneous topography. Because all the measurements are taken simultaneously by the same machine, the chance of alignment error is minimized.

The combined NAVEX system (using the OPD-Scan with the NIDEK EC5000CXII

excimer laser) has incorporated software algorithms called FinalFit™ that converts the data into customised ablation parameters that take advantage of the data collection powers of the OPD-Scan.

The first of these approaches is called the Optimized Aspherical Transition Zone (CATz), and was developed by Paolo Vinciguerra MD. It attempts to reduce night vision complaints after LASIK by minimising induced spherical aberration and increasing the effective optical zone. It does this by creating a gentler gradient between the optical zone, the transition zone, and the untreated peripheral cornea, preventing large power discrepancies between the corrected and uncorrected areas of the eye. This removes edge effects, which contribute to postoperative night vision problems. The machine comes with five profiles to create different taper zones at the edge, even with the same basic treatment.

Paul Dougherty MD uses the OPD-Scan in his practice and has found he could replace a separate autorefractor, topographer, and aberrometer with just the one machine. It also saves time, getting all three scans in a single pass with one machine.

He also recommends the OPD-Scan for clinical evaluation of highly aberrated post-refractive surgery eyes. Dougherty specifically referred to the case of a 38-year-old woman who was referred to him with poor vision in her right eye after LASIK due to a decentred ablation. When the woman was referred, he was unable to pick up the problem using other wavefront scans, but got it right away using the OPD-Scan.

Howard Gimbel MD in Calgary, Alberta, Canada has been using the Nidek laser since

September 1994. He began using the Navex system in July 2003. He cites the integration of wavefront sensing and corneal topography in one exam as a key feature of the system. He also cited the use of small (1.0 mm) spot for treating irregularity components combined with scanning slit for treatment of spherical and cylindrical components of the eyes aberrations, which shortens the total ablation time.

"The scanning slit mode allows one to use trans-epithelial PTK and regular PTK for treating ridges over RK incisions and raised scars and PRK haze that scanning spot lasers cannot because of the inability to watch the blue pseudo-fluorescence from epithelium and masking fluids. This is important because PTK is often used preliminary to "fine tuning" with Wavefront treatments," he told EuroTimes.

Dr Gimbel mentioned that anyone considering using the Nidek NAVEX system should expect a learning curve, particularly regarding the nomogram and software adjustments.

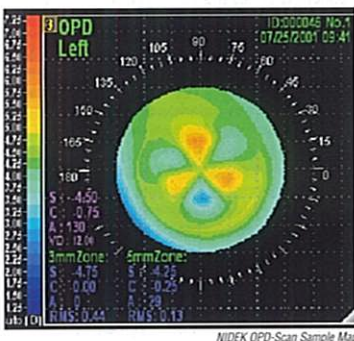
He suggested that interested surgeon talk to users of NAVEX system and observe it in use.

Once a system has been purchased, he advised starting cautiously and monitoring outcomes so that nomograms and treatment protocols could be adjusted before doing a large volume of cases.

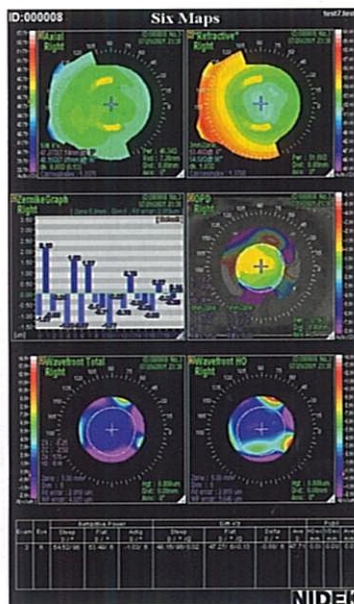
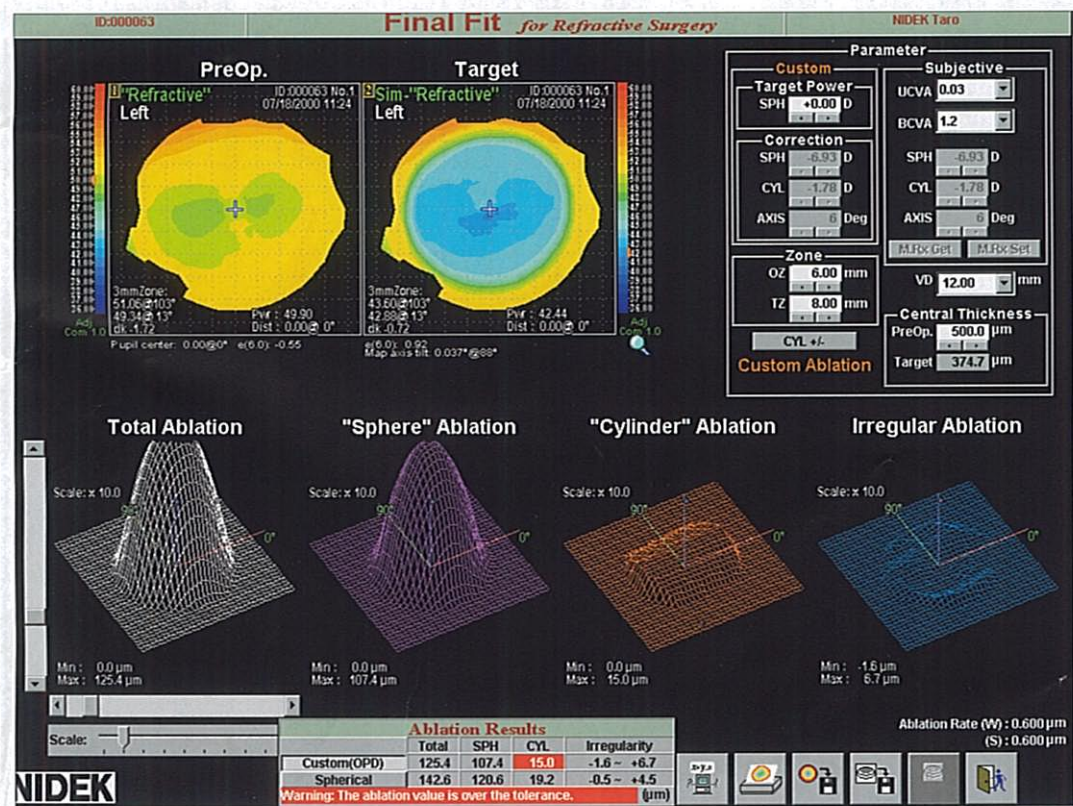
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NIDEK OPD-Scan Sample Map



Courtesy Arturo Chayet MD