

# New contrast sensitivity tests let computers do the grading

**Dermot McGrath  
in Barcelona**

A NEW computer-based system provides a reliable, sensitive and valid means of testing contrast sensitivity (CS) at different luminance levels with and without glare, according to a German ophthalmologist.

Jens Bühren MD told delegates at the 8th Winter Refractive Meeting of the European Society of Cataract & Refractive Surgeons that the new system, known as the Frankfurt-Freiburg Contrast and Acuity Test System (FF-CATS), compared extremely well with other established CS tests in clinical trials.

"We all recognise the importance of testing optical quality after refractive surgery, and are aware that just testing for Snellen visual acuity may not necessarily give us a good indication of a patient's quality of vision. We wanted to set up a CS system that could test in different luminance conditions in a way that is observer-independent, reliable and reproducible," he said.

Dr Bühren explained that FF-CATS, implementing the FrACT (Freiburg Acuity and Contrast Test) originally developed by Dr Michael Bach at the University of Freiburg, has several theoretical advantages over existing CS systems.

"The computer determines contrast thresholds by an algorithm called 'best PEST' (Best Parameter Estimation by Sequential Testing, Lieberman & Pentland 1982). It has a low probability of guessing because of a forced-choice method that gives patients eight alternatives, and it is observer independent because the patient inputs his or her answers by keypad," he said.

Dr Bühren said that the system allowed the researchers to test visual acuity at different contrast levels as well as determine contrast thresholds at different spatial frequencies.

Patients were tested using Landolt ring optotypes displayed at different contrast settings on a high-resolution black-and-white monitor. For testing at scotopic luminance level (0.167 cd/m<sup>2</sup>), a neutral filter was used to reduce monitor luminance.

Forty eyes of 40 volunteers were examined with the FF-CATS and, for comparison, with the Functional Acuity Contrast Test (FACT) and the Pelli-Robson chart (PRC). There were two subgroups, one ranging in age from 21 to 47 years, the other ranging in age from 54 to 69 years. A control group of 20 eyes of patients with nuclear cataracts were also included in the study.

The Functional Acuity Contrast Test developed by Dr Arthur P. Ginsburg uses sine wave gratings, which measure specific visual channels. The Pelli-Robson chart determines the contrast required to read large letters of a fixed size.

Tests were performed with and without glare in a randomised order, and the test sequence was repeated at least one hour later. Tests were assessed concerning discrimination between group I and II, repeatability factor and also validity in terms of their correlation with higher order wavefront aberrations.

The results showed that the FF-CATS discriminated better between the two groups than FACT or the Pelli-Robson chart. Coefficients of repeatability [logCS] were 0.38 for the FF-CATS, 0.25 for the FACT and 0.21 for the Pelli-Robson chart.

The FF-CATS also showed the highest correlation with higher order aberration RMS values ( $r=-0.55$ ,  $p<0.001$ ), compared to FACT ( $r=-0.14$ ,  $p=0.46$ ) and Pelli-Robson ( $r=-0.45$ ,  $p<0.01$ ).

Dr Bühren concluded that the results thus far were encouraging and that the FF-CATS will be used in future clinical trials comparing standard and wavefront-guided algorithms, post-LASIK CS and phakic lenses in high myopia.

The growing need for an accurate and standardised means of measuring CS was further echoed by Miguel Angel Teus MD, who presented a separate study on contrast sensitivity with or without photo stress after LASIK to correct low to moderate myopia.

"Measurement of visual function after LASIK is quite problematic because we all have seen patients with good Snellen visual acuity who still have significant visual complaints such as glare, haloes, and night vision disturbances. At the present time we do not know which is the most sensitive or specific method to measure these particular aspects of the visual function," he said.

Dr Teus' prospective single-masked study included 31 eyes of 23 consecutive patients who underwent LASIK and 23 eyes of 23 patients with a UCVA 20/20 or better that served as the control group. Inclusion criteria were myopia lower than -8.75D, astigmatism lower than 3.0D and best-corrected visual acuity of 20/20 or better.

The mean age was 30 years for both groups (range 22-38 years), the average myopia corrected was -3.96D (range -0.5D to -8.75D), and the average cylinder corrected was -0.5D. The researchers used another computer-based system, the INDO CGT-1000 (INDO International), to assess

Contrast sensitivity, with or without photostress, was tested with the INDO CGT-1000, before LASIK and 3 months after surgery. Six spatial frequencies (0.7, 1.0, 1.6, 2.5, 4.0 and 6.3 cycles per degree) were tested. The pupil size measured in mesopic conditions with Colvard pupillometer was 5.5 mm or larger and the optical zone was 6.0 mm to 7.0 mm.

The statistical comparison of CS with photo stress showed a significant decrease in every frequency analysed at three months after surgery for the study group ( $p<0.05$ ), while there was no statistically significant difference for the CS study group without photostress.

**"We all recognise the importance of testing optical quality after refractive surgery," Jens Bühren MD**

"We found that after LASIK to correct low to moderate myopia, CS with photostress as measured with CGT-1000 was significantly decreased. This fact may explain some of the common complaints in visual quality after LASIK, in spite of good UCVA," he concluded.

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**"We all have seen patients with good Snellen visual acuity who still have significant visual complaints"**

**Miguel Angel Teus MD**

contrast sensitivity. A Technolas 217 excimer laser and the Hansatome microkeratome were used for all procedures and a single surgeon treated all patients.