New contrast sensitivity chart defines visual function with greater precision

Kraig Bower MD

”Concerns over contrast sensitivity and degradation of night vision are things that come to the attention of people who are doing refractive surgery. And we’re looking for a good metric to use to assess the quality of vision”

Prospective study

Dr Bower described a prospective, non-randomised study of 50 people who underwent either photorefractive keratectomy (PRK) or laser-assisted in situ keratomileusis (LASIK). A total of 25 underwent PRK and 25 underwent LASIK (though two were lost to follow-up in the latter group). All subjects were treated at the Walter Reed Center for Refractive Surgery using the Alcon Ladarvision excimer laser system.

Patients underwent testing of high and low contrast visual acuity and small letter contrast sensitivity at normal and low luminance, with and without glare both before and after treatment.

Contrast acuity was measured under both photopic and mesopic conditions. Contrast sensitivity tests were performed using a back illuminated chart that was developed by Dr Rabin (20/50 letter size) at normal and at low photopic luminance levels, as well as in the presence of glare.

Follow-up evaluations were performed periodically for six months after treatment. At the one-week follow-up, contrast sensitivity (CS) in the PRK patients had a mean decrease of 0.35 log CS, compared to 0.32 log CS in the LASIK patients. Both were statistically significant changes, Dr Bower said. The decrease was even greater in PRK at low luminance and with glare.

Better recovery of contrast sensitivity with PRK

Refractive surgery tends to have some side effects early on that may resolve as time progresses – such as halos or optical scatter, he said. Evaluations at one month showed that contrast sensitivity was improved in both the PRK and LASIK patients, but remained below baseline levels.

Further evaluations showed that contrast sensitivity continued to improve in the PRK patients eventually reaching baseline levels. However, contrast sensitivity stabilised below baseline levels in those who underwent LASIK.

“I was a little surprised to find this and we’re trying to look at this a little more rigorously – that is why the LASIK patients didn’t ever make it back up to the baseline,” Dr Bower said.

There were similar findings in both groups for low contrast visual acuity.

“The results are consistent with a greater impact of higher order aberrations in LASIK verses PRK. The impact of this becomes evident with low contrast testing,” the researchers reported.

The contrast sensitivity test provides enhanced sensitivity for the detection of subtle decrements in vision that are not shown through high contrast visual acuity testing. Further analyses of the data from this study are being done to see if there are correlations with other factors such as pupil size, corneal curvature, contrast acuity and higher order aberrations.

Male v female eyes - is there a difference?

Another study presented at the conference looked at high order aberrations in men and women who underwent wavefront refractive surgery to determine if there were any differences. Here, researchers found what many ophthalmologists have suspected - that overall, there are no differences between the sexes.

However, there are some differences when it comes to individual high order aberration Zernike terms, according to Michael Blair, a medical student and lieutenant in the US Army.

Whether there might be a difference was questionable, as some studies in the medical literature had shown some variations between the sexes when it came to deep focus and horizontal astigmatisms.

Mr Blair presented findings from a study that evaluated 3,597 eyes of 1,874 patients (1,029 female and 2,568 male) who were about to undergo refractive surgery, using VISX wavefront measurements.

The wavefront analyses showed that overall there were no differences in high order aberrations between male and female eyes, and there were no differences between left and right eyes.

“We didn’t see that women had more high order aberrations than men, but we did see subtle variances between certain high order aberrations. It’s interesting,” he said.

However, individual Zernike Polynomials did reveal a significant difference between male and female eyes. Specifically, there were some differences in secondary trefoil, y, secondary spherical, tertiary astigmatism and hexafoil x aberrations. He believes this is the first study to show such a difference.

“As far as clinical significance goes, we haven’t elucidated what these differences mean,” he said.

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