# Quality of Vision in the Refractive Surgery Patient

Uncorrected visual acuity is the most important predictor not only of patients' satisfaction with the procedure but also of high-quality vision.

**BY STEVEN C. SCHALLHORN, MD**

Ophthalmologists understand that quality of vision after refractive surgery matters, but there is no clear consensus on how best to define or measure it. Surgeons appreciate, however, that it goes beyond simple Snellen acuity. Options for objectively measuring visual "quality" include higher-order aberrations, contrast sensitivity with and without a glare source, and functional vision tests such as night-driving simulation. Each has merit and pitfalls. Numerous studies have used these tests to assess outcomes and improve the procedures refractive surgeons offer.

The problem is that there is a wide range of "normal" for all of these metrics. In the US Navy, we found that, although aircraft carrier pilots as a group have better vision, fewer higher-order aberrations, and better contrast sensitivity than the general population, there is considerable variability. Moreover, none of the usual visual-quality metrics correlated strongly with task-based performance measures. We cannot say with any certainty that a given individual with relatively low contrast sensitivity, for example, will perform poorly on a visual task—even one as difficult as landing on an aircraft carrier at night.

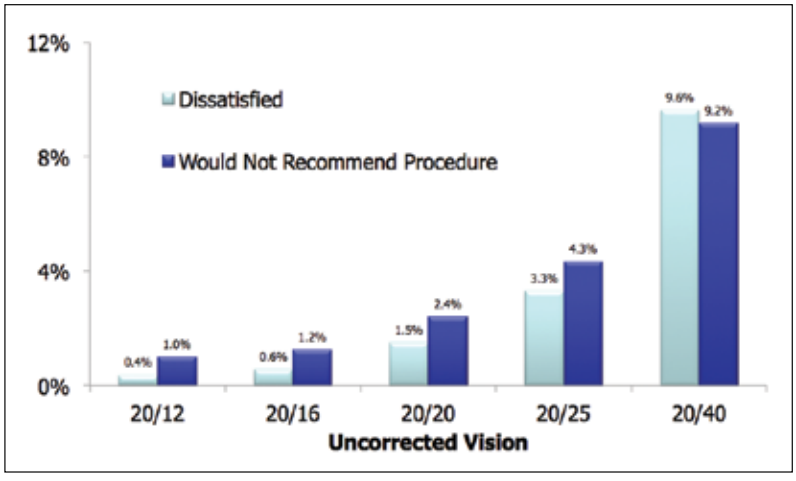


**Figure 1. Patients who had achieved 20/16 UCVA post-LASIK were half as likely as those with a UCVA of 20/20 to express dissatisfaction.**

Many refractive surgeons have observed this wide range of human ability and variability in their own practices. Two people with the same contrast sensitivity can have vastly different perceptions of their vision: one being "disabled" and the other with "perfect" vision. This points to other nonoptical issues that could affect perception, such as differences in neuroadaption, photoreceptor capacity, Stiles-Crawford effect, and cognitive sensitivity. With no ability to objectively measure and understand these complex issues, how can one better define quality of vision? Perhaps, like art, the answer is in the eye of the beholder: patients know high-quality vision when they see it.

## PATIENT-REPORTED OUTCOMES

At Optical Express, we are increasingly relying on patient-reported outcomes to further understand quality of vision. This simply means using patients to assess their satisfaction with the procedure's outcome as well as the quality of their vision.

We all assess how happy patients are with their procedure by simply talking to them. To formalize an assessment of satisfaction as well as elicit the quality of their vision and other visual and ocular symptoms, questionnaires are utilized. This provides a more structured and standardized approach and enables a more thorough analysis. All of our patients are asked to complete such a postoperative questionnaire. We analyzed patient-reported outcomes from 33,235 consecutive patients (64,952 eyes) undergoing laser vision correction. All were treated with the Visx Star S4 IR laser (Abbott Medical Optics Inc.), with a femtosecond laser-created flap (FS60 or iFS [both Abbott Medical Optics Inc.]) or a flap made with the EVO3 One Use Plus microkeratome (Moria Inc.). The mean manifest spherical equivalent was -2.33 D, but the corrections spanned a wide range from -12.50 D to +6.00 D.[1]

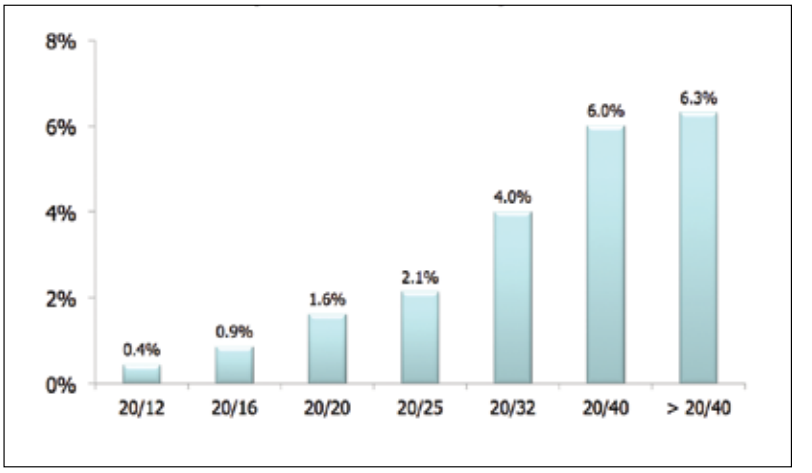


**Figure 2. The biggest determining factor for significant glare and halo disturbances was postoperative UCVA. At 1 month, the incidence of complaints about significant halos rose dramatically as UCVA worsened.**

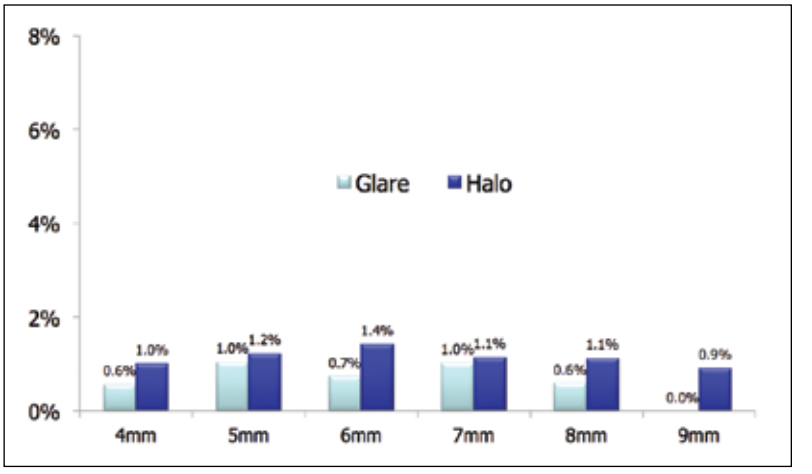


**Figure 3. Our data show that large low-light pupils were not associated with an increase in glare and halo disturbances 1 month after LASIK.**

### Satisfaction

When patients were asked how satisfied they were with the outcome of the procedure on a five-point scale (very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, and very dissatisfied), 96% indicated they were satisfied (78.9% very satisfied and 16.7% satisfied). Nearly all said they would recommend the procedure to family and friends (97.9%) and that the procedure had improved their lives (96.6%).

UCVA was by far the biggest driver of patients' satisfaction with their laser vision correction results. Those with a visual acuity worse than 20/20 were more likely to report dissatisfaction or to say they would not recommend the procedure. Conversely, for every line of UCVA better than 20/20, there were approximately half as many patients who were dissatisfied (Figure 1).

### Glare and Halos

Quality-of-vision symptoms can be relatively common in the early postoperative time period and gradually improve with time in the vast majority of patients. Proportional odds modeling in this same study population showed that worse postoperative UCVA, which covaries with residual sphere and cylinder, and higher preoperative sphere were significantly associated with symptoms after surgery.

The biggest determining factor for glare and halo phenomena was postoperative UCVA. At 1 month, the incidence of significant halo disturbances rose dramatically as UCVA worsened (Figure 2). Therefore, an important element to prevent or reduce halos is to achieve the best unaided vision

possible. Surgeons should not consider 20/20 UCVA to be the perfect outcome.

Patients with significant halos were more likely to be dissatisfied than those without them, but the majority of patients who reported halos were still satisfied with the outcome of their surgery. Also, 16% of those who reported significant halos at 1 month were dissatisfied with the procedure.

Many surgeons believe that pupillary size has a major impact on quality of vision, particularly halos. Our data show that very large pupils were not associated with significant glare and halo problems 1 month after surgery (Figure 3). The study population included many patients with large pupils in low light (more than 2,500 with either an 8- or 9-mm pupil). Those patients were no more likely to report quality-of-vision problems in their daily activities or night driving, and they were no more likely to be dissatisfied with their results than patients with smaller pupils.

## CONCLUSION

Residual sphere and cylinder cannot only increase patients' dissatisfaction, but they can also increase the chances that patients will be bothered by glare and halos or by problems with daily activities or night driving. Postoperative dry eye disease, although not measured in this study, can affect quality of vision and should be carefully considered in any patient who is dissatisfied with a refractive surgery outcome.

An important lesson from this analysis is that it is not adequate to measure visual acuity just down to the 20/20 line. Clinicians should push themselves and their staff to test patients to the limits of their vision. Our results demonstrate that patients with better than 20/20 visual acuity are more satisfied with laser vision correction and less likely to experience quality-of-vision problems. Patients with 20/12.5 visual acuity are much less likely to report quality-of-vision problems. In fact, based on our study, a patient with 20/12.5 UCVA is 10 times less likely to report significant halo disturbances as one who has 20/32 vision (0.4% vs 4.0%).

In short, the most important way to ensure excellent patient satisfaction and a high quality of vision is to achieve what patients typically desire after refractive surgery: the best possible visual acuity. ■

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1. Schallhorn S. Quality of vision and life following LASIK. Paper presented at: The American Academy of Ophthalmology Annual Meeting; November 11, 2012; Chicago, IL.