EFFECT OF YELLOW FILTER ON CONTRAST THRESHOLD WITH AND WITHOUT GLARE IN MYOPIA CORRECTED BY LASER IN SITU KERATOMILEUSIS (LASIK)

PÉREZ MJ1, SÁNCHEZ C1, PUELL C1, LANGA A1  
Dept. Optics. Optic and Optometry School. UCM (Spain)  
E-mail: mjpc@opt.ucm.es  
ARVO 2003

INTRODUCTION
As refractive surgery, laser in situ keratomileusis (LASIK) is gaining popularity as the procedure of choice to correct myopia. Compared with PRK, LASIK is associated with the development of less haze and earlier stabilisation of visual acuity. Nevertheless, many patients who had LASIK with a good visual outcome complain of reduced night vision, increased glare, or decreased contrast, due to the increased optical aberrations (Mico) associated with the larger pupil sizes.

Nowadays, yellow filters are used because of the apparent improvement on brightness perception (Chung et al., 1999; Kelly, 1999) as well as on the contrast sensitivity under photopic and mesopic illumination conditions (Pérez, Yap, 1984; Rabin et al., 1996; Wolffsohn et al., 2000), and also on several ocular pathologies (Rosenblum et al., 2000; Limklin et al., 1992; Kinney et al., 1983).

The purpose of this research was to determine the effect of the yellow filter X-482, with coated treatment, on contrast threshold with and without glare under mesopic conditions in eyes having uncomplicated eximer laser in situ keratomileusis (LASIK) for myopia.

METHOD
The study included two groups of subjects: Control and lasik groups. The control group consisted of 30 adult subjects (mean age 35.2 ± 4.7 years), 23 women and 7 men; they were all emmetropic (± 0.25 D) with at least 6/6 Snellen visual acuity and absence of ocular pathologies and pharmacological treatments. Lasik group included 35 baseline myopic adult subjects (mean age 36.9 ± 7.4 years), 23 women and 12 men, who had undergone refractive surgery LASIK, 12 months before in different ophthalmological clinic of Madrid. Their mean preoperative refractive error was -5.12 ± 2.44 D (range, -1.25 to -12.2 D), and their preoperative best spectacle corrected high contrast visual acuity and contrast sensitivity function were normal with absence of ocular pathologies and pharmacological treatments. The postoperative mean uncorrected Snellen visual acuity was 0.89 ± 0.14.

The selected protocol to carry out the psychophysical measures in the lasik group, with and without the interference of the yellow filter, was the following: Mesopic contrast sensitivity with and without glare was measured binocularly in a darkened room. Subjects were adapted to mesopic level for 5 minutes before testing. Control group subjects were realised the same measures with equal procedure but without the interference of the yellow filter. The protocol was completed in a single visit to the Optometry School Clinic (Complutense University, Madrid) by each subject.

The cut-off filter selected was the Essilor X-482 (yellow residual colour), with a transmittance of 60.930 for 482 nm, with a luminous transmittance of 0.71. The filter was subject to a multilayer coated treatment with a residual reflection of 0.4%. Figure 1 shows the X-482 spectral transmittance curve obtained with the UV-VIS Sensing Spectrophotometer UV-2401 PC of Shimadzu Corporation Company of Japan.

Figure 1. Transmittance curve of the filter X-482.

The mesopic contrast sensitivity, with and without glare, was measured using the Mesostet II or Mesoptometor II (Oculus, Germany) (Figure 2). The Mesostet is a compact instrument that avoids instrument myopia and measurements are carried out under natural conditions. The viewing screen of the test panel is seen through an optical system at a distance of 5 metres from the eye. The complete elimination of light from other sources ensures correct examinations even when room conditions are only moderately dark.

The test is performed with Landslits of decimal visual acuity of 0.1 (20/200). These can be presented in six different ring positions for four contrast levels (Table 1). The subject must identify at least 1 out of 5 positions (60% criterion). The contrast in each level decreases by a factor of 0.10 log contrast sensitivity units. The most important setting was the 1.5 contrast level, which is the critical level for driving a car at night according to the German Ophthalmic Society (DOG).

Table 1. Contrast levels of the optotypes.

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Log Contrast Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:23</td>
<td>0.05</td>
</tr>
<tr>
<td>1:5</td>
<td>0.10</td>
</tr>
<tr>
<td>1:2:7</td>
<td>0.20</td>
</tr>
<tr>
<td>1:2</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Table 2. Mesopic Contrast Weber %

With the yellow filter, the contrast threshold mean improved with glare (p = 0.0479) and without glare (p = 0.00012) respect the lasik group without filter. Moreover, contrast threshold differences among control and lasik group were statistically significant, obtaining the control group the best contrast thresholds with glare (p = 0.01) and without glare (p = 0.01).

Figure 3. Frequency doubling of the stimulus.

Figure 4. Mesopic contrast threshold mean without and with glare in control, Lasik and Lasik with filter types. Vertical line indicate the standard deviation.

CONCLUSION
The effect of yellow filter without residual reflections had a positive influence on the mesopic contrast perception of eyes having uncomplicated eximer laser in situ keratomileusis (LASIK) for myopia.

ACKNOWLEDGMENT
The yellow filters used were kindly supplied by Essilor España, S.A.

REFERENCES

RESULTS.

Figure 2. Mesopmic Weber Contrast in conditions of glare and without glare for each studied group, expressed as the percentage of subjects who discriminated each Weber Contrast category. Lasik group didn’t discriminate the lowest contrast threshold with glare, however a 73.33% of control group reached it. When the yellow filter was interposed in the lasik group the proportion of subjects who discriminated the lowest contrast threshold increased by 20%. With glare, 11.43% of lasik group’s subjects reached the lowest contrast threshold increasing by 14.29% with the yellow filter, and being of 46.67% in the control group.