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Foveal spatio-temporal detection surfaces for gratings and gabor stimuli

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Purpose: To compare the contrast sensitivities obtained in the fovea with spatio-temporal gratings and Gabor stimuli.

Methods: Achromatic spatial gratings with frequencies 0.05, 2, 4 and 8 cycles per degree (cpd), with temporal sinusoidal modulation of frequencies 0.2, 6, 12 and 24 cycles per second (Hz) were spatially modulated with either a rectangle subtending 5°x5° or a bidimensional Gaussian function with its standard deviation subtending (5/6)°. These stimuli were generated by a CRS-VCG 2/5 graphics card and presented in a Mitsubishi CRT Display. Two observers carried out the measurements.

Results: The detection surfaces for both the gratings and Gabor stimuli have band-pass characteristics with spatial and temporal frequency, showing a maximum at 2 cpd and 6 Hz. The gratings/Gabor sensitivity ratio reaches a maximum value of approximately 8 when both spatial and temporal frequency are zero, and decreases when either spatial or temporal frequency increases. A two-way analysis of variance of the results was applied.

Conclusions: When all the frequency combinations are taken into account, the gratings/Gabor sensitivity ratio varies significantly only with spatial frequency. If 0 cpd is excluded, there is no significant difference for this ratio between frequency combinations, its average being approximately 1.7. If 0 Hz is excluded, a significant variation with spatial frequency appears again. If both 0 Hz and 2 Hz are excluded, the variations are significant when varying both spatial and temporal frequency.

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A comparison of glare and halo in contact lenses, emmetropes and spectacle wearers before and after lens cleaning

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Purpose: To compare glare and halos in a cohort of emmetropic subjects and ametropic subjects with various methods of refractive correction.

Methods: 98 eyes of healthy pre-presbyopes (emmetropes n=28, spectacles n=40, CI n=30) had glare and halo analyzed using computer-generated stimuli (GlareHalo®). The emmetropic and contact lens groups were tested once. The spectacle group subjects were tested twice. the lenses in their natural, end-of-day, dirty state, then tested again after cleaning with an alcohol based propriety lens cleaning solution, and a micro-fibre cloth.

Results: No significant difference in glare was found between any of the groups (p>0.05). Statistically significant differences in halo size were noted between emmetropes (no refractive correction) and both contact lens (p<0.001) and uncleaned spectacle groups (p<0.05) but not with cleaned spectacles. The reduction in halo size, post lens cleaning was significant. (p<0.0187).

Conclusions: Contact lenses and uncleaned spectacle-lens wearers both experience significantly larger halos than emmetropes and cleaned spectacles-lens wearers. Uncleaned spectacles and contact lenses will affect the accuracy of results in psychophysical and clinical testing.

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Clinical performance of Nidek ARK 700A autorefractor

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Purpose: The aim of this study was to estimate the agreement between an autorefractor (Nidek ARK 700A), and retinoscopy and subjective refraction.

Methods: Subjective refraction and retinoscopy were performed on 192 right eyes from 192 healthy young adults (mean age 24.5 ± 2.5), and compared with the measurements obtained with the ARK 700A. These measurements were performed without cycloplegia. The limits of agreement were used to determine the accuracy between the three methods.

Results: The refractive error of the sample, as represented by subjective refraction, ranged from -9.00 to +2.25 D mean spherical equivalent -0.29 ± 1.39 D (mean ± SD). The maximum amount of astigmatism was -2.50 D. The mean value of the refractive error obtained with each technique was Retinoscopy = -0.19 ± 0.26 x 170 Autorefractor = -0.03 ± 0.22 x 168Subjective refraction = -0.23 ± 0.12 x 165b considering the conditions, sphere and cylinder component within ±0.25D and cylinder axis within ±10 degrees, we may verify that in only 42 eyes (21.9%) the autorefractor agrees with subjective refraction compared with 96 eyes (50%) of the results of the retinoscopy.

Conclusions: The measurements obtained with the ARK 700A were slightly less positive or more negative than retinoscopy and subjective refraction, being these bias statistically significant. Retinoscopy continues to be the best method for obtaining an objective refraction value. The autorefractor can be used as a start point prior to subjective refraction, but never as its substitute.

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Absolute and incremental spectral sensitivities predicted by a new colour vision model

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Purpose: To predict absolute and incremental spectral sensitivities with a new colour vision model.

Methods: We have developed a neural colour vision model, ATTD, consisting of 1) a cone stage, with a Naka-Rushton type non-linearity and a multiplicative adaptation mechanism; 2) a first opponent stage at LGN level, computed from the cones, yielding an achromatic channel (A), two red-green channels with opposite polarities (TLM, TML), and a blue-yellow channel (D), all with Naka-Rushton non-linearities, and multiplicative and subtractive adaptation mechanisms; 3) a second opponent stage at cortical level, with a subtractive adaptation mechanism and 4) a third opponent stage, yielding the perceptual channels. The parameters of the model were adjusted to fit a large set of psychophysical and physiological data. Thresholds of a normal observer were obtained as the envelope of the action spectra of the excitatory components of the four LGN mechanisms.

Results: The predicted absolute spectral sensitivity, with a sensitivity peak around 540 nm, basically agrees with the experimental data except at low wavelengths, where our model overestimates the sensitivity of the blue-yellow mechanism. The predicted incremental sensitivity function shows the typical three peak shape, with maxima around 440, 520 and 610 nm and the Sloan notch around 570 nm.

Conclusions: The model predicts that the blue-yellow and the red-green cells with L- M polarity always detect at, respectively, the short and long-wavelength regions. Detection in the middle-wavelength range is mediated by achromatic and M-L cells in the absolute and incremental paradigms, respectively, although achromatic cells always detect around 570 nm. These results agree with the literature.