Evaluation of accommodation changes to stereograms by dynamic infrared retinoscopy

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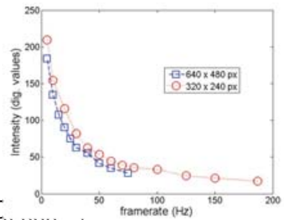
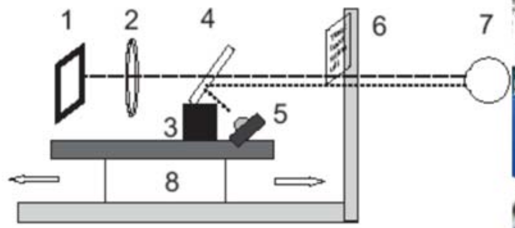
Modern life requires a great amount of near vision load, which negative influence on vision is necessary to reduce. To study the effect of the random dot stereoscopic images and office work on state of accommodation of the eye, we developed semiautomatic retinoscope for precise evaluation of accommodative load.

Optical system contains infrared power LED of 850 nm peak wavelength, semitransparent mirror, condensing objective and CCD matrix. Principles of functioning are transferred from classic manual retinoscope. Servo motor (3) is driven by microcontroller and mimics the ticker motion to provide the illumination motion over the retina of the eye. The moveable chassis of the system applies to enable the point of neutralization.

CCD matrix sensitivity to 850 nm IR light

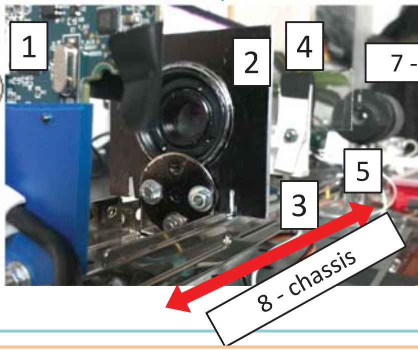


Schematics of the retinoscope

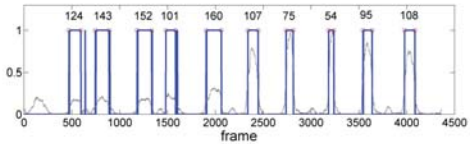


1- CCD matrix with electric circuit, 2- focusing optics, 3- servo motor, 4- semitransparent mirror, 5- IR LED, 6- accommodative stimuli, 7- subjects eye, 8- system stand with moveable chassis.

Real world example

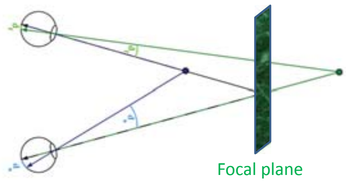


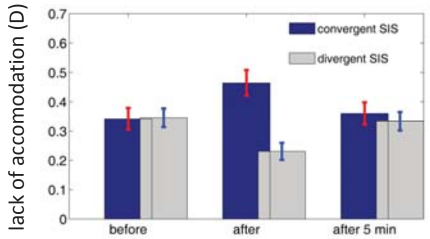
Halfwidth of reflex



Stereogramm effect

Seven subjects aged 20 to 25 years with binocular vision (>200 arc sec) participated in our research. For all subjects ametropy was corrected to visual acuity 1.0 dec units and accommodation positive and negative reserves identified as more than 2.0D. Accommodation response was measured with developed retinoscope before the exposition to the random dot stereograms, after 5 min viewing and after 30 min of relaxation.



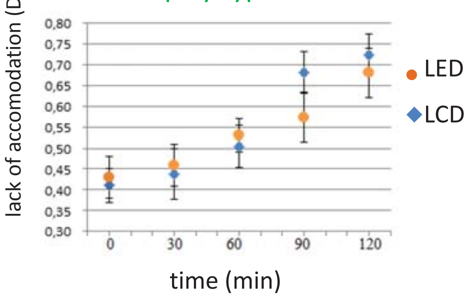


	After Convergent	5 min after Convergent	After Divergent	5 min after Divergent
Difference from initial (D)	0.122	0.018	-0.115	-0.012
Std.error	0.008	0.002	0.006	0.002

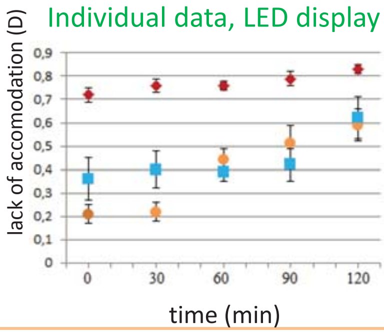
Our results indicate that short dynamic viewing of SIS produce unstable but significant changes of accomodative response. Immediately after the viewing of SIS significant chages in accommodation can be measured. After 5 min of relaxation accomodation returns to the initial state. It seems that while viewing divergent stereograms convergence point is behind the focal plane and reversion to normal state increases the accomodative response. Convergent stereograms produce relaxing effect on accomodative response. When the convergence point returns from point before the focal plane the accomodation response decreases.

Office work effect

Display type



Individual data, LED display



CONCLUSIONS

Short dynamic viewing of SIS produce unstable but significant changes of accomodative response.

Prolonged office work (>60 min) significantly changes the accomodation load. No statistical difference identified for display type.

Acknowledgement

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