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ORAL PRESENTATION

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RESEARCH-LED THEME

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12:40-12:50

A new 3D virtual reality system to assess visual function with convergence and accommodation control

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Key words: *Visual function, virtual reality, convergence, accommodation*

PURPOSE:

To show the capabilities of a new stereoscopic virtual reality (VR) system for optometric test.

METHODS:

A 3D VR system that allows either to match accommodation and convergence planes or to control each one independently has been developed (Eye and Vision Analyzer, EVA, Davalor, Spain). The system generates 3D images using two displays (monocular field of view 26º). Vergence is induced through image disparity (accuracy (acc)0.87') and accommodation (acc.0.125D) is stimulated using a varifocal system. EVA also incorporates an aberrometer that allows monocular and binocular measurements of refraction from 0 D to 10 D of accommodation stimulation (acc.0.25D) and an eye-tracker that registers ocular movements (acc.0.8º) and allows to monitor patient collaboration and to measure pupil diameter (acc.0.1mm). The system allows to control any dissociation between accommodation and convergence planes in amplitude and speed and a dynamic control of the stimulus in terms of size, shape, color, texture, luminance, spatial frequency, position and velocity. EVA can correct sphere (-18D to +10D) and cylinder (-5D) errors. A subjective refraction methodology, accommodation tests (i.e., amplitude of accommodation and accommodative facility) and binocular tests (i.e., cover test, fusional vergence, near point of convergence and vergence facility) were implemented in this system. In this study we investigated the agreement between EVA and conventional clinical procedures.

RESULTS:

98 healthy subjects were included in the study, with a mean age ± SD of 39.3 ± 14.8 years. Subjects were measured with EVA and using conventional clinical procedures. Limits of agreement, a dependent t-test and a Pearson correlation coefficient were computed for each parameter. None of the

mean differences were significantly different ($p>0.05$). Pearson r-value were: Subjective refraction M ($r=0.98$); J0 ($r=0.79$); J45 ($r=0.78$); Near Point of Accommodation ($r= 0.84$); Accommodation Facility (monocular $r=0.82$; binocular $r=0.80$); Cover Test ($r=0.68$); Near Point of Convergence ($r= 0.65$); Vergence Facility ($r= 0.93$); Fusional Vergence (Positive $r=0.57$; Negative $r=0.60$).

CONCLUSIONS:

Our results suggest that there is a linear relationship and no systematic bias between the new VR system and conventional clinical procedures. EVA system allows objective measurements and shows a flexible new way of controlling optometric parameters.