4:00 PM 2 hours | Room 225 A-B
P-14 | **Papers: Binocular Vision/Pediatrics**
Moderators: Wendy L. Marsh-Tootle, OD, MS, FAAO, Erik Weissberg, OD, FAAO

4:00 PM. **OCULAR RESPONSES TO 3D VIDEO GAME PLAY** (120699)
Edward R. Nicholls, BS, Heather Anderson, OD, PhD, FAAO, University of Houston College of Optometry

RESULTS: 15 subjects preferred 2D and 28 preferred custom 3D. Subjects who preferred 2D reported significantly higher symptom scores during custom 3D play (mean score = 6 vs 2, $p<0.01$) with the most common symptoms being eyestrain, double vision, ocular fatigue, and blurred vision. Accommodative responses during 2D gameplay were significantly greater in the group preferring 2D (mean = 2.00D vs 1.65D, $p=0.03$) and did not significantly change during custom 3D play for either group ($p=0.2$). The change in vergence that occurred from 2D to custom 3D game play was smaller for the group preferring 2D, although the difference did not reach significance (mean = -0.55pd vs - 1.42, $p=0.17$). Base-in prism bar ranges at near were smaller on average for the group preferring 2D, although the difference was not significant (mean = 12pd vs 14, $p=0.14$).
PURPOSE: The increasing use of 3D media has raised awareness that visual symptoms are experienced by some individuals engaging in these tasks. This study objectively measured accommodative and vergence responses while subjects played 2D vs 3D versions of a video game and compared measurements between subjects who preferred 2D vs those who preferred 3D.
METHODS: Accommodative and vergence responses were measured with infrared photorefraction as subjects played the Nintendo 3DS (which utilizes uncrossed disparity) held at 40cm on 2D, full 3D, and customized 3D settings in randomized testing order (n = 43, age = 23-34 yrs). Subjects rated 8 potential visual symptoms on a scale from 0 to 5 after each testing condition (max total symptom score = 40). Upon completion of testing, subjects reported their game setting preference (2D, 3D or custom 3D). Clinical measures of acuity, phoria, vergence, and accommodation were also performed on each subject.
CONCLUSIONS: Subjects who experienced more symptoms during 3D gameplay had greater accommodative responses during both 2D and 3D gameplay. Greater accommodative responses may be disadvantageous when attempting gameplay on systems which utilize uncrossed disparities to create depth effects.
ADDITIONAL COMMENTS: NEI T35 EY007088

4:15 PM. **ENHANCING STEREOACUITY THROUGH PERCEPTUAL LEARNING IN NORMAL VISION: SPECIFICITY FOR SPATIAL FREQUENCY AND ORIENTATION** (120358)
Truyet Tran, Calvin Nguyen, Sandy Chat, Dennis M. Levi, OD, PhD, FAAO, University of California Berkeley, Tszwing Leung, The Hong Kong Polytechnic University School of Optometry

RESULTS: Our observers showed a substantial mean improvement of 64% in stereo thresholds after practicing with V5 stimuli in phase 1, and the improvement transferred substantially to the other two untrained stimulus configurations (H5: 46% and V10: 56%). Additional significant improvements obtained with subsequent direct-training in phases 2 (H5: 29%) and 3 (V10: 19%) indicate that the transfers observed in phase 1 were not complete.
PURPOSE: To investigate whether practicing a stereoscopic depth detection task enhances stereoacuity in adults with normal vision and whether the learning effects, if any, transfer across target spatial frequencies and carrier orientations.
METHODS: The visual stimulus consisted of two horizontally separated square blocks, one presented to each eye. Each block contained a Gabor target patch surrounded by four Gabor reference patches. A haploscope was used to enable binocular fusion. The visual task was to determine the stereoscopic depth of the Gabor target (in front / behind) relative to the four references. Ten adult observers with corrected-to-normal vision participated. The training protocol consisted of three training phases (each of 13 sessions). In Phase 1 observers were trained with targets with a vertical carrier of 5 cyc/deg (V5, vertical). In Phase 2 they continued to train with the same spatial frequency, but with an orthogonal carrier orientation (H5, horizontal). They were subsequently required to practice with targets with a vertical carrier at a higher spatial frequency (V10, 10 cyc/deg) in phase 3. Thresholds for each of the three stimulus configurations were measured before and after each training phase. Trial-by-trial feedback was provided.
CONCLUSIONS: Perceptual learning can induce functional plasticity for enhancing stereovision in the mature visual system. Our findings characterize the magnitude, time course and specificity of visual learning. This technique might have important applications in restoring impaired binocular vision in cortical visual disorders.
ADDITIONAL COMMENTS: NIH Grant R01EY01728

4:30 PM. **SYMPTOM LEVEL OF CHILDREN WITH ACCOMMODATIVE INSUFFICIENCY** (120422)
G. Lynn Mitchell, MAS, FAAO, Marjean T. Kulp, OD, MS, FAAO, The Ohio State University College of Optometry, Mitchell M. Scheiman, OD, FCOVD, FAAO, Pennsylvania College of Optometry at Salus University

RESULTS: Analyses were completed on 174 children ages 9 to 17 years (mean=11.3). AI was identified in 73 children of whom 17 had 0 signs, 14 had 1 sign, 29 had 2 signs and 13 had 3 signs of CI. The mean CISS score of children with AI (mean=27.6, std=12.8) was significantly higher than that of children with NBV (mean=9.4, std=7.4, $p<0.001$). Among the children with AI, there was no significant effect of # of signs of CI on symptom score ($p=0.80$). Children with no signs of CI reported a mean CISS of 10.5 while children with 3 signs of CI had a mean score of 10.9. Nearly 81% of children with AI scored ≥ 16 on the CISS.
PURPOSE: Children with accommodative insufficiency (AI) report many of the same near activity related symptoms as children with convergence insufficiency (CI). The Convergence Insufficiency Symptom Survey (CISS) was developed to assess the symptom level of children with CI. It has been shown to be a valid and repeatable

survey with a cut-point of 16 used to identify children with CI whose symptom level exceeds that of children with normal binocular vision (NBV). In fact, 96% of children with CI score 16 or higher while 88% of children with NBV score less than 16. Here we investigate the CISS scores of children with AI and compare them to scores from children with NBV.
METHODS: Children with AI were identified from a larger study on vision screening or through participation in a study of the effect of office-based vision therapy on accommodation. Monocular amplitude of accommodation was assessed using a single column of letters of 20/30 equivalent at 40cm. AI was defined as amplitude at least 2D less than minimum expected (Hofstetter). The children with NBV were subjects in two studies of the Convergence Insufficiency Treatment Trial. Analysis of variance was used to compare the mean CISS score of children with AI and children with NBV. Additional analyses were performed to assess the impact of signs of CI on CISS score of children with AI.
CONCLUSIONS: Children diagnosed with AI reported significantly higher symptom levels when compared to their peers with normal binocular vision.

4:45 PM. **VISUAL DISCOMFORT SYMPTOMOLOGY AND ITS CORRELATION WITH CLINICAL MEASURES OF ACCOMMODATIVE AND VERGENCE FUNCTION** (120299)

Chunming Liu, OD, PhD, MD, Christopher Chase, PhD, Stephanie Drew, PhD, Amy Escobar, Western University of Health Sciences College of Optometry, Eric Borsting, OD, MS, FAAO, Southern California College of Optometry

RESULTS: Three measures were significantly correlated with total Conlon scores: accommodative facility (AcF) OS (r= -0.26, p=0.03); AcF OU (r=-0.25, p=0.04); and amplitude-scaled facility (AsF) OU (r =-0.27, p=0.03) in CS group. For the GS group, only AsF showed statistically significant correlation (r=-0.36, p=0.015). We used AcF OU and AsF OU, the most predictive tests for overall visual discomfort, as dependent factors and examined their correlation with the 5 symptom subtypes as independent factors. Within the CS group, total score for HA was the strongest predictive test for AcF, accounting for 11.5% of the variance (p=0.005). For AsF, Glare was the only predictive measure (9%, p=0.01). For GS group, again HA was the only predictive measure for AcF (16.3%, p=0.004). Text movement predicted 8% of the variance for AsF (p=0.047).
PURPOSE: Visual discomfort symptoms associated with near work are prevalent in a young adult population with high academic demand. Symptomology has previously been studied in cohorts of college (CS) and graduate students (GS) using Conlon Visual Discomfort Survey. The purpose of this study was to explore which clinical measures of accommodation (A) and vergence (V) function would be the most sensitive for predicting near-induced visual discomfort. In addition, we examined which types of symptoms are most strongly associated with accommodative dysfunction.
METHODS: Clinical assessment of A/V function was made in subjects from two groups (GS, n=50; CS, n=69) representing a wide range of Conlon scores. The

correlation between the clinical tests and total Conlon score, as well as 5 subtypes of visual discomfort symptom (Headache/Soreness HA; Blur/Diplopia; Text movement/Fading, Reading and Glare), were analyzed using a stepwise regression analysis.
CONCLUSIONS: Among standard clinical measures of A/V function, facility tests appear to be most strongly associated with visual discomfort symptoms. Headache symptoms among young adults were the most predictive symptom for accommodative dysfunction.

5:00 PM. **THE BRÜCKNER TEST: DETECTION OF STRABISMUS & AMBLYOPIA IN INFANTS & YOUNG CHILDREN** (120023)
Kristine Huang, OD, MPH, FAAO, Susan A. Cotter, OD, MS, FAAO, Southern California College of Optometry, Kristina Tarczy-Hornoch, MD, Ge Wen, MSc, Mark Borchert, MD, University of Southern California

RESULTS: The sensitivity and specificity of the Brückner test in detecting constant strabismus at near (n=48) was 47.9% and 97.5%, respectively. The sensitivity increased with increasing magnitudes of strabismus, with a sensitivity of 66.7% for detecting strabismus >30Î”. In detecting anisometropia (spherical equivalent or cylindrical), sensitivity and specificity were 13.5% and 98.0%, respectively, for anisometropia â‰¥1D (n=624), and 44.0% and 97.5% for anisometropia â‰¥2D (n=75). The PPV for detecting constant strabismus at near was 10.0% and for anisometropia â‰¥2D was 13.6%. Conversely, due to the low prevalence of these conditions, the NPV was â‰¥99.5% both for detecting strabismus and for anisometropia â‰¥2D.
PURPOSE: To investigate the diagnostic accuracy of the Brückner test in identifying strabismus and anisometropia in a population-based sample of infants and young children.
METHODS: Using standardized protocols, eye care providers administered the Brückner test followed by a comprehensive eye examination in 8601 children 6-72 months of age without spectacle correction who were enrolled into the Multi-Ethnic Pediatric Eye Disease Study (MEPEDS). We determined the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the Brückner test for identifying constant strabismus at near and anisometropia.
CONCLUSIONS: Our findings suggest that the Brückner test is not sufficiently sensitive to use as a screening test for strabismus and anisometropia in children 6 to 72 months of age. The sensitivity of this test is low, leaving the majority of children with these potentially amblyogenic conditions undiagnosed.

5:15 PM. **VALIDATION OF A NEW TECHNIQUE FOR MEASURING INFANT VISUAL ACUITY WITH GAZE TRACKING** (120109)
Amithavikram Rugvedi Hathibelagal, BSOptom, Susan J. Leat, PhD, FCOptom, FAAO, University of Waterloo School of Optometry and Vision Science, Moshe Eizenman, PhD, University of Toronto, Krithika Nandakumar, BOptom, University of Waterloo, Centre for Contact Lens Research

RESULTS: The mean age of participants was 28.47 (+/- 7.93) years and their mean uncorrected logMAR acuity was 0.9 (+/- 0.2). There was no significant difference among the 6 objective protocols, the subjective protocol and the TACs (repeated-measures ANOVA p>0.05). Agreement between the objective and the subjective gaze tracker protocol was as follows; 93% were within 0.5 octave and 100% were within 1 octave. The objective gaze tracker VA agreed with TACs as follows; 87% were within 0.5 octave and 100% were within 1 octave. There was a significant correlation between refractive error and objective gaze tracker VA ($r = 0.87$, $p < 0.001$). As expected, the objective gaze tracker correlated with, but over-estimated, ETDRS VA. With gaze tracking, visual acuity within the normal range for age was demonstrated in 3 infants of 4 months, 8 months and 12 months.
PURPOSE: Remote gaze-tracking, which utilizes the relative fixation time on a target, has potential for measuring visual acuity (VA) in infants. Our purpose was to validate objective grating acuity measured with gaze tracking in adults, against current clinical VA tests and to demonstrate its use with infants.
METHODS: The uncorrected VA of 15 adult myopes was measured using computer-generated gratings of spatial frequency ranging from 2.3 cycles per degree (cpd) to 37 cpd presented randomly in one of 4 positions on the screen. Six objective protocols (in which VA was judged by fixations) were compared with (a) one subjective protocol, assumed to be the most accurate; (b) Teller Acuity Cards (TACs) and (c) ETDRS log MAR letter acuity, all tested at the same viewing distance.
CONCLUSIONS: The gaze tracker gave VA thresholds which were equivalent to the TACs and were not significantly different from the optimum subjectively determined grating VAs. These results demonstrate the validity of the instrument and its promise for use with infants.
ADDITIONAL COMMENTS: Supported by Collaborative Health Research Projects, NSERC, Canada.

5:30 PM. **THE BOSTON CHILD SELF-REFRACTION STUDY - THE EFFECT OF ASTIGMATISM ON VISUAL ACUITY** (120086)
Bruce D. Moore, OD, FAAO, Catherine A. Johnson, OD, FAAO, Nicole B. Quinn, OD, FAAO, Stacy A. Lyons, OD, FAAO, Paulette Tattersall, DipPharm, MSc, New England College of Optometry

RESULTS: In 728 myopic eyes undergoing self-refraction, 98.76% obtained VA ≥6/9.5 (9 eyes did not) and 91.89% obtained VA ≥6/7.5 (59 eyes did not) through their Adspec correction. 669 eyes had ≤1.25D of astigmatism as measured by cycloplegic subjective refraction, and 9 of those subjects had VA ≤6/12. 59 eyes had astigmatism ≥1.50D, but none of those eyes had VA ≤6/12.
PURPOSE: Uncorrected refractive error is a major cause of visual impairment in the developing world. One approach to mitigate this problem is the utilization of a self-adjustable, spherical, variable focus fluid-filled spectacle, called Adspecs. The purpose of this study is to determine the effect of moderate degrees of astigmatism on visual acuity measurement in adolescent myopes refracted by the technique of self-refraction.
METHODS: 364 children (728 eyes) 12-17 years of age met the inclusion criteria of

unaided visual acuity (VA)≤6/12 in one or both eyes, myopia of -0.75 to -7.00D in one or both eyes, and corrected VA ≥6/7.5 in both eyes with subjective refraction. Exclusion criteria were any ocular pathology, anisometropia ≥1.50D, or amblyopia. Subjects performed self-refraction through Adspecs. VA was measured through the Adspecs, and the power of the Adspecs was measured by lensometry. Subjects then had cycloplegic subjective refraction and autorefraction with ocular health assessment. VA was measured again through the sphero-cylindrical subjective RX. **CONCLUSIONS:** VA through self-refraction resulted in excellent vision for most subjects. All of the subjects that had reduced VA (≤6/12) had little or no astigmatism, while those with moderate degrees of astigmatism (≥1.50D) exhibited no adverse effect on their visual acuity measurement. Thus, spherical refractive correction through Adspecs resulted in good visual acuity in spite of moderate degrees of uncorrected astigmatism. Variable focus fluid-filled spectacles may be a useful means of providing correction to individuals with myopia with up to moderate degrees of astigmatism when other sources of refractive care are unavailable.