significantly differed at all time points analyzed but became more apparent with advancing post-menstrual age (PMA). At 36-38 weeks PMA, mean score for treatment-requiring disease was 5.2 compared to 1.2 in untreated eyes ($P < 0.01$). 47 eyes received laser (n = 39) or anti-VEGF therapy (n = 8). The mean severity score 2 weeks pre-treatment (4.2) and post-treatment (4.0) significantly differed from treatment time (7.4, $P < 0.0001$ for each).

Discussion: The ROP severity score correlates with clinical progression and response to treatment. The score was an independent predictor of progression to treatment-requiring disease. The score at time of treatment was an independent predictor of disease recurrence.

Conclusions: Automated computer-based image analysis may be considered as a means to monitor disease progression and treatment response in infants undergoing screening for ROP.

023 Treating central-peripheral rivalry (CPR)-type diplopia. Jonathan M. Holmes, Sarah R. Hatt, David A. Leske, Raymond Iezzi

Introduction: Epiretinal membranes (ERM), and other maculopathies associated with abnormalities of the photoreceptor mosaic, may cause central-peripheral rivalry (CPR)-type diplopia (aka dragged-fovea diplopia, binocular retinal diplopia). CPR-type diplopia is notoriously difficult to treat. We evaluated the success of various treatments.

Methods: Fifty patients (44 with ERM) undergoing treatment for CPR-type diplopia (101 treatment episodes) were included. We only included patients with 'sometimes' or worse diplopia for distance or reading, using the Diplopia Questionnaire. We evaluated: prism, Bangerter filter/tape, iseikonic treatment, and ERM peeling. We defined success as improvement in diplopia to 'never' or 'rarely' for distance and reading, at a 6-month follow-up examination. Failure was assigned if diplopia was 'sometimes' or more at follow-up or if in-office treatment failed (persistent diplopia or not tolerated). Each treatment episode was assigned an outcome (not all patients tried every treatment) and success rates calculated with 95% confidence intervals (CIs).

Results: Success was achieved in 4/7 (57%; 95% CI, 18%-90%) using Fresnel prism and 4/28 (14%; 4%-33%) using Bangerter/tape. 8/18 (44%; 22%-69%) had successful resolution of diplopia following ERM peeling (with or without prism). There was one success with iseikonic treatment (1/23; 5%, 0%-22%) but none using loose or ground prism (0/25; 0%, 0%-14%).

Discussion: Fresnel prism treatment was somewhat more successful than expected (presumably by blur) and Bangerter/tape treatment less successful. Unexpectedly, ERM peeling improved CPR-type diplopia in many patients.

Conclusions: CPR-type diplopia may be amenable to treatment by ERM peel, Fresnel prism, or blur and each should be considered for such patients.

024 Machine learning for prediction of pediatric ophthalmology examination lengths and scheduling optimization. Michelle R. Hribar, Wei-Chun Lin, Isaac H. Goldstein, Michael F. Chiang

Introduction: Pediatric ophthalmologists are under pressure to see more patients in less time. This study investigates a machine learning model for predicting exam length in pediatric ophthalmology, based on existing electronic health record (EHR) data.

Methods: Data from 3049 office visits (2015-2018) from five pediatric ophthalmologists were used in a random forest machine learning classification model with 12 features (including prior average exam time, ICD-10 diagnosis code, age, dilation of eyes, patient's language, clinic volume, hour of the office visit). The exam time was predicted to be: short (shortest 20% of exam lengths), medium (middle 60%), or long (longest 20%). Ophthalmologists predicted exam lengths before scheduling each patient based on clinical and social factors. Accuracy was determined by comparing predictions to the actual exam lengths.

Results: The classification model had 65% accuracy for predicting exam length (short vs medium vs long) while the providers' accuracy was 41%. In the machine learning model, the top five predictors of exam length based on mean decrease accuracy (MDA) were prior average exam length, dilation, ICD-10 code, ophthalmologist, and patient age.

Discussion: This study demonstrates that existing EHR data may be used in machine learning algorithms to predict patient exam lengths. We have previously shown using computer-based simulations that scheduling patients according to their exam lengths (shortest exams first) reduced patient wait times. Taken together, this has potential to improve clinical efficiency for pediatric ophthalmologists.

Conclusions: Machine learning methods can predict patient exam lengths with comparable or better accuracy than physicians.

025 Diagnosis of congenital special forms of strabismus based on high-throughput sequencing and high-resolution MRI. Yonghong Jiao, Hongyan Jia, Yi Liang, Yulan Liang, Qinglin Chang, Hui Wang

Introduction: Congenital special forms of strabismus (CSS) are a group of clinically and genetically heterogeneous diseases, which are considered to be neuropathic or myopathic. We aim to establish an effective diagnosis workflow for CSS by utilizing and combining exonic sequencing and MRI.

Methods: 61 families with CSS were enrolled in the study. 22 were familial and 39 were sporadic. All patients underwent comprehensive ophthalmic examinations and MRI. 115 candidate genes have been captured and sequenced, which may be associated with congenital cranial dysinnervation disorder (CCDDs), congenital ptosis, ophthalmoplegia, congenital myopathy and congenital muscular dystrophies (CMD). After excluding mutations in the 115 candidate genes in 22 probands, we conducted whole-exome sequencing (WES).

Results: MRI examinations of 61 patients showed marked hypoplasia cranial nerve and/or extraocular muscles. 9 mutations in 5 genes (*KIF21A*, 45.9%; *TUBB3*, 13.2%; *POMGNT1*, 1.6%; *RYR1*, 1.6%; *CHN1*, 1.6%) from 39 patients (63.9%) were identified. Out of 39 patients, 27 were diagnosed with congenital fibrosis of extraocular muscles (CFEOM), 2 patients were diagnosed with muscle-eye-brain disease (MEB), 2 patients diagnosed with familial Duane syndrome and 1 patient diagnosed with CMD. 4 patients with potentially pathogenic variants were identified with WES.

Discussion: Since CSS usually have overlapping clinical features, accurate diagnosis of CSS-related diseases is challenging. Combining MRI with exonic sequencing, the diagnosis rate could increase effectively.

Conclusions: We established a high sensitivity and specificity diagnosis workflow for CSS, based on MRI and targeted exonic sequencing, which could be a rapid, cost-efficient diagnostic option for clinicians to utilize.

026 What causes slow binocular reading in amblyopic children? Krista R. Kelly, Reed M. Jost, Bryan De La Cruz, Jeffrey S. Hunter, Lori Dao, Cynthia L. Beauchamp, Joel N. Leffler, Becky Luu, Eileen E. Birch

Introduction: Amblyopic children read slowly and make more forward saccades during binocular reading compared with nonamblyopic strabismic and control children (Kelly et al, 2015). Binocular inhibition - better performance during fellow eye viewing than binocular viewing - is related to slow reading in age-related macular degeneration and to contrast sensitivity loss in amblyopia. Here, we investigated whether binocular inihibition slows reading in amblyopia (ie, slower reading for binocular vs fellow eye viewing).
Methods: 41 children age 7-12 years treated for strabismus, anisometropia, or both (24 amblyopic [0.2-1.2 logMAR], 17 nonamblyopic) were enrolled. Children silently read grade-appropriate paragraphs during binocular (BV) and fellow eye viewing (FEV) while fitted with the ReadAlyzer. Reading rate (words/min) and number of forward saccades (per 100 words) were recorded. Visual acuity (VA) and stereoacuity were obtained.
Results: Consistent with our previous study, amblyopic children read more slowly and made more forward saccades than nonamblyopic children during BV (Ps < 0.05). Nonetheless, no differences were found between BV and FEV for amblyopic children (reading rate: BV, mean $\pm$ SD $= 160 \pm 57$ vs FEV, 154 ± 63 words/min, $P = 0.50$; Saccades: 107 ± 35 vs. 109 ± 46 per 100 words, $P = 0.75$). Reading rate was not related to etiology, amblyopic eye VA, or stereoacuity.
Discussion: Binocular reading did not differ from fellow eye reading in amblyopic children; binocular inhibition is unlikely to play a role in their slow reading.
Conclusions: Slow reading in amblyopic children is not due to inhibition of the fellow eye by the amblyopic eye. We are currently exploring other potential factors contributing to slow binocular reading, including fixation instability and abnormal saccadic eye movements.

027 Novel digital therapeutic improves visual acuity and encourages high adherence in amblyopic children. Aaron M. Miller, Lisa I. Bohra, Christie L. Morse, Louis C. Blumenfeld, Noha S. Ekdawi, Ann U. Stout, Scott Xiao, David G. Hunter, Eric Gaier, Malcolm L. Mazow
Introduction: Current amblyopia treatments can be limited in effectiveness due to low adherence over long treatment periods (33-54%)[1] and monocular viewing conditions. We tested the clinical effectiveness and adherence of Luminopia One—a virtual reality system that applies binocular therapeutic modifications to television shows or movies chosen by the patient.
Methods: This single-arm, multi-center study enrolled children aged 4-12 with anisometropic, strabismic, or mixed amblyopia at 10 centers to use Luminopia One at-home for 1 hour/day, 6 days/week for 12 weeks. Best-corrected visual acuity (BCVA) and stereoacuity (Randot) were assessed at each visit. A group of participants (n $=$ 20) was excluded from this analysis due to improper software calibration.
Results: Of the 55 enrolled participants (mean age 7.1 ± 2.3 years), 53 had stable BCVA at enrollment and 46 had prior treatment beyond glasses (eg, patching, atropine). Thirty-one participants have completed 12 weeks of treatment with mean adherence 84% of prescribed dose. Mean amblyopic eye BCVA improved 0.20 logMAR (2 lines; 95% CI 0.14-0.25, $P < 0.0001$) after 12 weeks from baseline of 0.47 logMAR. Mean stereoacuity improved 0.30 log arcsec (1 octave step; 95% CI, 0.00-0.59, $P = 0.047$). Infrequent mild blurry vision (n $=$ 3), headache (n $=$ 3), and double vision (n $=$ 1) were reported and resolved without additional treatment.
Discussion: Patients demonstrated clinically and statistically significant improvements in visual acuity and stereoacuity, maintaining high adherence over 12 weeks.
Conclusions: Luminopia One shows promise as an engaging and potentially effective at-home amblyopia treatment.

028 Reliability of telemedicine for real-time pediatric ophthalmology consultations. Sudha Nallasamy, Josephine Coffey-Sandoval, Carly Stewart, Mark W. Reid, Thomas C. Lee
Introduction: Geographic and socioeconomic disparities in access to care impede timely diagnosis and treatment of pediatric ophthalmic conditions. Telemedicine may address these disparities, but its technological and diagnostic reliability are uncertain.
Methods: This prospective, noninferiority study included 349 examinations of 210 patients aged 0-17 years (median, 6 years). Examinations were conducted by an optometrist using Pivothead glasses, a digital slit lamp, and a digital indirect ophthalmoscope, and streamed via Polycom codec to an ophthalmologist, who recorded diagnoses, measurements, and management plans. Following each telemedicine examination, the ophthalmologist verified the results in-person.
Results: Sixty-two percent of patients were primarily diagnosed with strabismus (n $= 130$); other common primary diagnoses included nasolacrimal duct obstruction (n $= 8$) and glaucoma (n $= 7$). No primary diagnoses were changed (although two nonprimary diagnoses were), and no management plans (including surgical plans) were changed following in-person examination. In strabismus patients, almost perfect agreement was observed for angle measurements (ICCs $= 0.97$-1.00) and disease categorization ($\kappa = 0.94$-1.00). Almost all patients who consented for surgery (54/55) did so during the telemedicine examination, masked to receiving an in-person exam. Most families felt comfortable with the quality of the telemedicine examination (99%), and indicated they would participate in another one in the future (97%).
Discussion: The ophthalmologist was able to make accurate diagnoses, plans, and measurements via telemedicine, in contrast to previous studies with older technology.
Conclusions: Pediatric ophthalmic conditions can be reliably diagnosed and monitored by ophthalmologists via telemedicine. Care delivery for underserved populations can be improved by collaboration between optometrists and ophthalmologists using video-conferencing technology.

029 A prospective outcomes study of pediatric optic neuritis. Stacy L. Pineles, Michael X. Repka, Elizabeth L. Lazar, Grant T. Liu, Amy T. Waldman, Mark S. Borchert, Sangeeta Khanna, Gena Heidary, Jennifer S. Graves, Veeral S. Shah, Mark J. Kupersmith, Raymond T. Kraker, David K. Wallace
Introduction: We are aware of no prospective data on visual outcomes in children with optic neuritis (ON).
Methods: In a nonrandomized observational study, we prospectively enrolled 3- to <16-year-olds with a clinical diagnosis of acute ON (onset within 2 weeks) and at least one of the following: visual acuity (VA) deficit $\geq$0.2 logMAR below age-based norms in the affected eye, diminished color vision, abnormal visual field, or optic disk swelling. The primary outcome was percentage of study eyes within age-normal VA range after 6 months.
Results: Fifty-four eyes of 44 participants age 3-15 years were enrolled; 41% were female. Regarding type of ON and central nervous system associations: 14 participants had unilateral isolated ON, 10 had bilateral isolated ON, 8 had acute disseminated