AAPOS Abstracts

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**Introduction:** As pediatric ophthalmologists, we recognize pain points and limitations to optimal clinical practice with virtually every clinical encounter. These limitations inspire many of us to imagine innovative devices, programs, or protocols that might address one or more clinical challenges. But the path to commercialization of any novel idea travels through a haunted house of unexpected barriers, through a junkyard of failures, and through a seemingly endless string of heartbreak hills.

**Methods:** Review of the clinical innovation we call "retinal polarization scanning." The 30-year journey from initial innovation through scientific discovery, into clinical trials, and on to commercial development was evaluated. Clinical outcomes were tabulated, and barriers to success were reviewed.

**Results:** Retinal polarization scanning was initially proposed (as a fellowship research project) by David Guyton in 1991. The retina is illuminated with polarized light such that reflections, modulated by Henle nerve fibers emanating from the fovea and detected by the device, create a signature confirming true anatomic foveal fixation. The method has accuracy far greater than can be achieved by corneal light reflex methods. Commercialization of devices utilizing the concept has been limited by technical challenges, lack of venture funding for innovation in pediatrics, investor preference for therapeutics over screening, and difficulties overcoming intellectual complacency.

**Conclusions:** Retinal polarization scanning shows potential for solving a variety of clinical problems, including amblyopia detection, traumatic brain injury assessment, and objective evaluation of other diseases affecting visuomotor function. Barriers to commercial dissemination of any promising new idea, including this technology, are numerous and steep.

Infantile esotropia is not present at birth. The misalignment is acquired, usually showing up by 6 months of age. It is now well known that decorrelation of the two eyes' images reaching the brain impairs the development of horizontal connections between the ocular dominance columns in specific layers of area V1 of the visual cortex. Without these horizontal connections, there is persistence of pursuit asymmetry and deficient gaze holding, resulting in slow, involuntary adduction, usually depression, and intorsion of the fixing eye, leading to corrective saccades producing latent nystagmus, now called fusion maldevelopment nystagmus.

In 1966 Adelstein and Cüppers proposed what came to be called the nystagmus blockage syndrome, whereby convergence is used to damp or block nystagmus to improve vision, with the chronic convergence shortening the medial rectus muscles over time. This was an attractive explanation in cases where manifest infantile nystagmus clearly damped with convergence. But with the developing teaching that convergence does not damp or block latent nystagmus, and with many infantile esotropic infants showing no visible nystagmus with both eyes open, the nystagmus blockage syndrome fell out of favor in the United States.

Brodsky has recently proposed that simple monocular fixation may give rise to increased dissociated esotonus that gradually drives the two eyes inward by shortening the medial rectus muscles. But does simple esotonus shorten extraocular muscles over time?

Twenty years ago, my colleagues and I obtained bilateral scleral search coil recordings of 10 young adults with DVD, with 500 measurements each second of the horizontal, vertical, and torsional positions of both eyes simultaneously, under varying fixation conditions. We were able to examine the latent nystagmus present in every case, as well as to identify the multiple vergence, version, and refixation eye movements that make up the DVD response, each obeying Hering’s law. The vertical vergence damping of the cyclovertical component of the latent nystagmus was absolutely clear, and we were able to conclude that DVD is a learned, often anticipatory, nystagmus damping mechanism to improve vision in the fixing eye. Review of those recordings also shows the striking convergence (DHD) damping of the horizontal component of the latent nystagmus. We know that chronic convergence can shorten medial rectus muscles over time. So, we now propose, and provide supporting evidence, that it may well be the chronic dissociated convergence (DHD), that causes the progressive esotropia as an unfortunate side effect caused by this mechanism that is learned subconsciously because it improves vision in the fixing eye.
Amblyopia Treatment Outcomes from a Clinical Data Registry

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Introduction: To describe amblyopia treatment success using outcomes from a clinical registry

Methods: IRIS-50 is a clinical data registry outcome measure for amblyopia treatment developed by the IRIS® Registry (Intelligent Research in Sight). The measure specifications include unilateral amblyopia associated with strabismus, refractive error, or both. Multivariate analyses of success with treatment were performed using outcomes measured from 2013 to 2019.

Results: The IRIS Registry identified 18,841 children aged 3 to 7 eligible for IRIS-50, among which 77.3% were successful; and among 9,762 children aged 8 to 12 years, 55.5% were successful. Among the younger group, multivariate analyses found odds ratios for success were significantly lower for African American (0.71; 95% confidence interval (CI) = 0.62 to 0.83) children compared with White children. Medicaid insurance was also associated with lower success (OR= 0.65; 95%CI = 0.60-0.71). Among older children, African Americans had a lower OR for success (0.81; 95%CI = 0.68-0.96) compared with White children, while Hispanic children had an increased chance of success (OR=1.16; 95%CI = 1.03-1.31). Medicaid was associated with a decreased chance for success (OR=0.84; 95%CI=0.77-0.93).

Conclusion/Relevance: Based on outcomes from IRIS-50, we found significant rates of residual visual acuity impairment among all ages and races, especially among minorities and those on Medicaid. We cannot determine all the factors contributing to poor outcomes using these analyses, such as compliance with therapy. However, these findings emphasize the need to monitor and target activities to improve outcomes for groups performing especially poorly on IRIS-50.

**Randomized Clinical Trial of Streaming Binocular Contrast-Rebalanced Dichoptic Movies versus Patching for Treatment of Amblyopia in Children Aged 3 to 7 Years**

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**Introduction:** Contrast-rebalanced dichoptic movies that reveal binocular experience are effective in treating amblyopia in a laboratory setting.\(^1\)\(^2\) While these studies provided proof-of-principle, at-home therapy is a more practical approach. In a randomized clinical trial, we compared dichoptic movies, streamed at-home on a handheld 3D-enabled portable game console, versus patching as amblyopia treatment for children aged 3-7 years.

**Methods:** Sixty-five amblyopic children (3-7y; 20/32-20/125) were randomly assigned 2 weeks of patching (n=33, 2 hours/day, 7 days/week) or binocular treatment (n=32, 3 dichoptic feature-length animated movie with reduced fellow eye contrast per week displayed on a New Nintendo 3DS XL). After the 2-week primary outcome, all children had the option to complete 6 weeks of binocular treatment. Best corrected visual acuity (BCVA) and stereoacuity were measured at each visit.

**Results:** After 2 weeks of binocular treatment (5.7±0.1 movies, ~8.6 hours), BCVA improved 0.07±0.02 logMAR (p<0.0001). Similarly, with 2 weeks of patching treatment (30.0±2.0 hours), BCVA improved 0.06±0.01 logMAR (p<0.0001). At 2 weeks, stereoacuity improved in the binocular group but not in the patching group. Visual acuity continued to improve in both groups with up to 6 weeks of binocular treatment (0.15 and 0.18 logMAR improvement at 6 weeks, respectively).

**Conclusion/Relevance:** This novel, at-home, handheld binocular movie treatment significantly improved amblyopic eye BCVA after 2 weeks (similarly to patching) and up-to 6 weeks, and resulted in good compliance in young children with amblyopia. Repeated binocular visual experience with contrast-rebalanced binocular movies provides an additional therapy option for amblyopia.

**References:**
1. Li SL; Reynaud A; Hess RF; Wang YZ; Jost RM; Morale SE; De La Cruz A; Dao L; Stager D Jr; Birch EE. 'Dichoptic movie viewing treats childhood amblyopia.' J AAPOS. 19.5 (2015): 401-5.
2. Birch EE; Jost RM; De La Cruz A; Kelly KR; Beauchamp CL; Dao L; Stager D Jr; Leffler JN. 'Binocular amblyopia treatment with contrast re-balanced movies.' J AAPOS. 23.3 (2019): 160.e1-160.e5.
Long-Term Strabismus Outcomes after Unilateral Infantile Cataract Surgery in the Infant Aphakia Treatment Study

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Introduction: To characterize long-term strabismus outcomes in children in the Infant Aphakia Treatment Study (IATS).

Methods: Secondary data analysis of long-term ocular alignment characteristics of children aged 10.5 years who had previously been enrolled in a randomized clinical trial evaluating aphakic management after unilateral cataract surgery between 1 and 6 months of age.

Results: Through age 10.5 years, 96 of 109 (88%) children developed strabismus. Half of the 20 children who were orthophoric at distance through age 5 years maintained orthophoria at distance fixation at 10.5 years. Esotropia was the most common type of strabismus prior to age 5 years (56/112, 50%), while exotropia (49/109, 45%) was the most common type of strabismus at 10.5 years (esotropia 21%, hypertropia 17%). Strabismus surgery had been performed on 52 (48%) children (35% achieving microtropia <10 PD). Strabismus was equally prevalent in children randomized to contact lens care compared to those randomized to primary IOL implantation (45/54, 83%, versus 45/55, 82%, p=0.8349). Median visual acuity in the study eye was 0.56 logMAR (20/72) for children with orthotropia or microtropia <10 prism diopters (PD) versus 1.30 logMAR (20/400) for strabismus >10 PD (P = 0.0003).

Conclusion/Relevance: Strabismus, in particular exotropia, is common irrespective of aphakia management 10 years following infant monocular cataract surgery. The delayed emergence of exotropia with longer follow-up should lead to caution in managing early esotropia in these children. Children with better visual acuity at age 10 years are more likely to have better ocular alignment.

Automated Measurement of the Range of Eye Movement in Patients with Strabismus

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Introduction: To measure the range of eye movement using digital video cameras and computational image processing.

Methods: A cross-sectional study was performed on patients ≥7 years of age with comitant or paralytic strabismus. All participants had their range of eye movement evaluated in the 9 cardinal positions of gaze using clinical grading scales (0=normal, +1 to +4=hyperfunction, -1 to -4=hypofunction) and an automated system. The automated system used two digital video cameras and software that measured the degree of eye movement. The images of the 9 cardinal positions were obtained using parallel located cameras 50cm from each eye. The analyses were performed using Visual C++ software. The agreement was quantified as the intraclass correlation coefficient (ICC).

Results: The automated system was applied to 45 patients with strabismus and provided the range of eye movement with degrees and radar charts. There were significant correlations between the range of eye movement and the clinical grading scales (R = 0.6, P < .001). There was good agreement between the automated system and clinical examination (ICC, 0.84; 95% confidence interval [0.78, 0.89]). In secondary gaze positions, ICC was higher than in other gaze positions (0.95, 95% confidence interval [0.87, 0.98]). On the other hand, tertiary gaze positions showed lower ICC compared to other gaze positions (0.78, 95% confidence interval [0.70, 0.83]).

Conclusion/Relevance: The results of the automated system were highly correlated with clinical examination. The automated system measured the degree of eye movement accurately.


Can Machine Learning (ML) Distinguish Hypertropia (HT) in Sagging Eye Syndrome (SES) From Superior Oblique Palsy (SOP)?

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Introduction: SES has clinical similarities to SOP. We employed ML to determine if alignment measurements can distinguish unilateral SOP from cyclovertical strabismus caused by SES.

Methods: Orbital magnetic resonance imaging (MRI) identified 23 patients (average age 45±16 years, SD, 9 congenital) with unilateral SOP manifested by reduced maximal SO cross section, and 18 (age 60±11 years) having normal SO cross section but MRI findings of SES. Alignment was measured with prisms in all diagnostic positions, and Hess screen. Data were input to 5 methods of supervised ML.

Results: In SOP, central gaze HT averaged 13.6±8.6PD, increasing to 18.0±10.7PD in contralateral, and decreasing to 6.2±5.3PD in ipsilateral gaze. In SES, central gaze HT averaged 8.1±6.9PD, increasing to 11.2±10.2PD in contralateral, and decreasing to 6.1±5.6PD in ipsilateral gaze. In SES, 9 patients (50%) fulfilled the 3-step test with head tilt difference 5.1±4.8PD, compared with 13.1±7.5PD (P<0.013) in acquired and 22.2±13.7PD in congenital SOP (P=0.001). Deviations at several inferior Hess screen locations differed significantly between SES and SOP. Supervised ML of prism and Hess screen alignment distinguished the disorders with areas under receiver operating curves <0.93 and <0.87, respectively, representing good but imperfect discrimination.

Conclusion/Relevance: The 3-step test is frequently positive in SES, and although head tilt difference in HT averages more in SOP, SES alignment overlaps substantially with acquired SOP. Even when interpreted by optimized ML, clinical alignment features cannot always distinguish hypertropia in SES from unilateral SOP in older adults. Orbital imaging is necessary for certainty when the distinction is important.

Effect of Patch Testing on Strabismus Angular Deviation in Children

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Introduction: Diagnostic monocular occlusion (MO), or patch testing, prior to alternate prism cover test (APCT) is thought to determine the maximal angle of deviation prior to strabismus surgery. However, the exact degree to which MO increases angular deviation is understudied.

Methods: Medical records of pediatric patients (n=105) presenting between 01/2019 through 12/2020 who had an outpatient clinic measurement and a day-of-surgery APCT with 30 minutes of MO measurement were retrospectively reviewed.

Results: In patients with exotropia (64/105, 61%), MO showed mean increase of 3.8 PD (prism diopters) [95% CI 1.1 - 4.4, p = 0.0012] at distance and 5.9 PD [95% CI 3.5 - 8.3, p < 0.0001] at near. In esotropic patients (41/105, 39%), MO showed mean increase in deviation of 4.9 PD [95% CI 2.9 - 7.0, p < 0.001] at distance and 3.8 PD [95% CI 1.4 - 6.1, p = 0.0028] at near. There was no association between age (distance p = 0.633, near p = 0.4093) and the effect of MO. As baseline deviation increased, there was a diminishing increase in additional deviation elicited by MO in exotropic children at near [decrease of 3 PD per 10 PD baseline increase, p = 0.0173], but not at distance (p = 0.0580). No association was seen in esotropic children (distance p = 0.5687, near p = 0.1687).

Conclusion/Relevance: Monocular occlusion of 30 minutes increases angular deviation by about 5 PD in both exotropia and esotropia. In exotropic children, there is an inverse relation between baseline angular deviation and further increase elicited by MO.

Non-Surgical Consecutive Exotropia following Childhood Esotropia: A Multicentered Study

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Introduction: Spontaneous non-surgical consecutive exotropia (NCX) following childhood esotropia (ET) is rare. Studies often focus on accommodative factors and are small and inconclusive. We examined the clinical characteristics and response to management of NCX in a large retrospective multi-centered cohort.

Methods: Five centers contributed patients from 1980 to 2020. Inclusion criteria was confirmed diagnosis of esotropia by an ophthalmologist at minimum age of 6-months which spontaneously went to exotropia (XT) without surgery. Clinical findings, including visual acuity, cycloplegic refraction, glasses prescriptions, deviation and fusion/stereoacuity were collected. Outcomes were assessed for patients with accommodative versus non-accommodative esodeviations, as well as those who underwent refractive management of their exodeviations versus continued observation.

Results: Forty-nine children were identified at mean age of 3.5±1.6 and 8.4±3.6 years at time of ET and NCX, respectively. Accommodative esotropia occurred in 60% of patients. Mean cycloplegic refractive error was +4.40±2.13 and +4.05±2.74D at the time of ET and NCX, respectively. Mean near ET in glasses was 12.7±11.9 and 7.7±9.4PD at distance. All but one presented with their exotropia at distance fixation; mean deviation at presentation was XT 1.1±7.2PD at near and XT 8.1±5.9PD at distance. New glasses with decreased hyperopia of mean 1.55±0.48D were given to 36% in response to their XT. Eventually, 43% had surgery on their XT.

Conclusion/Relevance: NCX occurs in both accommodative and non-accommodative esotropia. Refractive manipulation for the XT gave modest results, with similar surgical incidence as the continued observation group. Non-refractive explanations of NCX, such as the role of the vergence system require further study.

Long-Term Visual Outcomes in Familial Exudative Vitreoretinopathy (FEVR)

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Introduction: Anatomical and visual outcomes in familial exudative vitreoretinopathy (FEVR) have historically been disappointing. The present study seeks to determine the anatomical and functional outcomes of patients diagnosed with FEVR and maximally treated with available vitreoretinal surgical techniques.

Methods: Ocular features of each FEVR case, including stage, associated conditions, genetic mutations, treatment type and number, primary outcomes (including macular reattachment, visual acuity, and late complications).

Results: 68 eyes from 34 patients qualified for inclusion in the study. Average age at presentation was 73 months (median 29.6 months). Asymptomatic parents of severely affected children were included. Age at final visit averaged 105 mos (median 76 months). 20/34 (59% of patients) were male. 11/34 (33%) were associated with positive family history of FEVR. Associated conditions were present in 15/34 (44%).

Macular attachment was preserved in 90% of eyes. Globe salvage was achieved in 92% of eyes. Cataract occurred in 12% of eyes, and late RD occurred in 8%. Reactivation of FEVR vessels was observed > 6 months out in 50% of eyes.

BCVA >/=20/40 was achieved in 30/68 (44%) of eyes. BCVA >/= 20/200 was achieved in 33/68 (49%) of eyes. Functional vision >/= 20/200 was achieved in 30/34 (88%) of all patients.

Conclusion/Relevance: Useful and functional vision is achievable in the vast majority of FEVR cases using available vitreoretinal surgical techniques. Underlying genetic causes should be identified. Aggressive treatment of retinal vascular abnormalities in FEVR has been utilized to stabilize the disease and achieve stabilization of vision.

Optic Disc Edema Index: Differentiating Pediatric Papilledema from Pseudopapilledema with Optical Coherence Tomography

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Introduction: The Optic Disc Edema Index (ODEI) is a number derived from a linear model of optical coherence tomography (OCT) measurements that differentiates pseudopapilledema from papilledema in adults. It was shown to have an area under the receiver operating characteristics curve (AUC) of 98.4% with sensitivity of 88.9% and specificity of 95.5%. We sought to validate this concept in the pediatric population.

Methods: Both eyes of pediatric patients were included for retrospective review and classified as papilledema or pseudopapilledema. The study was verified as IRB exempt. Inclusion, exclusion criteria and analysis were similar to the previously published adult study. The mean OCT retinal nerve fiber layer thickness and the absolute consecutive difference between adjacent clock hours were compared using mixed-effect models. The AUC and calibration curve were used to evaluate potential clinical usage.

Results: 42 eyes with papilledema and 38 with pseudopapilledema were identified. The papilledema group had a higher OCT magnitude (papilledema = 222 µm, pseudopapilledema = 126 µm, p < 0.01) and absolute consecutive difference between clock-hours (papilledema = 70.9 µm, pseudopapilledema = 45.1 µm, p < 0.01). Gender was also found to have a significant effect. When the linear combination of these variables was used to classify the groups, we achieved AUC of 89.5% (95% CI 78.7-97.2%) with optimized sensitivity of 84.2% and specificity of 81.0%.

Conclusion/Relevance: Pediatric patients with papilledema have higher variability and magnitude in OCT measurements than pseudopapilledema. The ODEI distinguishes papilledema from pseudopapilledema reliably in the pediatric population, similar to adults.

Peripapillary Hyperreflective Ovoid Mass-like Structures (PHOMS) in a Pediatric Population Referred for Suspected Papilledema

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Introduction: Peripapillary hyperreflective ovoid mass-like structures (PHOMS) are a new, benign entity identified in evaluation of the optic nerve, best described on enhanced depth imaging optical coherence tomography (EDI-OCT). PHOMS are now being considered the most common cause for pseudopapilledema in children. We chose to investigate pediatric patients with PHOMS referred for suspected papilledema.

Methods: We performed a retrospective chart review of patients ages 1-18 with confirmed PHOMS on OCT seen in a pediatric neuro-ophthalmology clinic between 2017-2021.

Results: We identified 43 patients (31 female/12 male), median age 14.2 (range 9-18). PHOMS were present bilaterally in all patients. 24 patients had optic nerve drusen. 16 patients had concomitant papilledema (37%). 33 patients underwent neuroimaging as part of a papilledema work-up, including 20 patients who had neuroimaging prior to being seen in our clinic. In 16 patients, neuroimaging was ordered prior to a formal ophthalmology evaluation. Of patients who had neuroimaging, 8 had positive neuroimaging signs concerning for elevated ICP, of which only 3 were felt to have true papilledema.

Conclusion/Relevance: Pediatric patients with PHOMS are referred because disc appearance can mimic papilledema. EDI-OCT is a good tool for detection and can readily identify PHOMS. PHOMS, when present, are seen bilaterally and can appear concomitantly with either drusen or disc edema. Prospective studies comparing all patients referred for papilledema with or without PHOMS are needed to better characterize PHOMS' incidence in the pediatric population and improve resource optimization for care.

International Classification of Retinopathy of Prematurity, 3rd Edition (ICROP3)

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Introduction: ICROP is a consensus statement that creates a standard nomenclature for ROP care. It was initially published in 1984, revisited in 2005, and now revised in 2021. This third edition is required because of advances in pediatric retinal imaging that are creating concerns about subjectivity in diagnosis, and new disease therapies (e.g., anti-VEGF agents) that are creating challenges related to post-treatment regression and reactivation. Every pediatric ophthalmologist should become familiar with ICROP3 because it affects routine ROP care.

Methods: An international committee (6 continents represented; 12 females, 22 male) of pediatric ophthalmologists (n=14) and retinal specialists (n=20) was assembled by the authors and facilitated by IPOSC. The group was initially broken into three subcommittees (acute phase, regression/reactivation, imaging). Iterative videoconferences and two in-person meetings were used to develop consensus on classification.

Results: ICROP3 retains definitions of zone, stage, and clock hour extent. Key updates are refined classification metrics (e.g., posterior zone II, 'notch' to describe disease incursion into a more posterior zone, sub-categorization of stage 5 into 5A/5B/5C, and recognition that a continuous spectrum of vascular abnormality exists from normal to plus disease). Updates also include definition of 'aggressive ROP' to replace 'aggressive-posterior ROP' because of increasing recognition that aggressive disease may occur beyond the posterior retina, particularly in regions of the world with limited resources. Nomenclature for regression and reactivation are defined in detail, with description of long-term sequelae.

Conclusion/Relevance: These principles may improve quality and standardization of ROP care worldwide, and provide a foundation to improve research and clinical care.

Outcomes for Spontaneously Regressed Retinopathy of Prematurity

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Introduction: The AAP recommends screening examinations for infants with spontaneously regressed ROP between 4-6 months of age. The rationale is these patients may have higher rates of other visual disorders (strabismus, high refractive error, amblyopia, cataract, or glaucoma) requiring the attention of a trained ophthalmologist. Our goal was to determine rates of these aforementioned problems at the initial follow-up examination to better inform the policy statement from the AAP, with respect to the optimal timing.

Methods: This study is a retrospective case series of 579 patients diagnosed with ROP at a single center between 2014-2020. The included patients had gradable ROP, documented gestational age, birth weight, single vs multiple birth status, reached completion with spontaneous regression of retinopathy of prematurity, and documented follow-up with the institution’s pediatric ophthalmologist after completion. The presence/type of visual disorder, the rates of their occurrence, and the need for intervention at the first and/or second follow-up visit were determined.

Results: Of the 304 spontaneously regressed ROP infants included in the analysis, 6.25% had an identifiable problem necessitating an intervention at their first visit after completion. Only 13 infants, 4.28%, presented with a condition, such as high refractive error or amblyopia, that necessitated glasses or occlusion therapy by a pediatric ophthalmologist.

Conclusion/Relevance: Our analysis found the rate of conditions requiring treatment from a pediatric ophthalmologist at 4–6 months after completion is very low. To reduce excessive, costly, and potentially burdensome subspecialist visits, we propose the infant’s follow-up after completion should be at the discretion of the pediatric ophthalmologist.


Two-year Ocular and Developmental Outcomes of a Phase 1 Dosing Study of Bevacizumab for Retinopathy of Prematurity

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Introduction: Previously, we reported intravitreous bevacizumab doses as low as 0.004 mg (< 1% of BEAT-ROP dose) were effective in treating type 1 ROP. We now report 2-year outcomes after low-dose and very low-dose bevacizumab.

Methods: One hundred twenty premature infants (mean birthweight = 687 g; mean gestational age = 24.8 weeks) with type 1 ROP were enrolled in a multi-center, dose de-escalation study. One eye per infant was given 0.25 mg, 0.125 mg, 0.063 mg, 0.031 mg, 0.016 mg, 0.008 mg, 0.004 mg, or 0.002 mg of intravitreous bevacizumab. Fellow eyes when treated received a dosage one level higher than the study eye. At 2 years corrected age, 70 children had ocular examinations and 49 were assessed using the Bayley developmental scales.

Results: Correlation coefficients for total dose of bevacizumab to Bayley subscales were -0.19 for cognitive (95% CI = -0.44, 0.11), -0.19 for motor (95% CI = -0.45, 0.11), and -0.14 for language (95% CI = -0.41, 0.16). Of 134 phakic eyes with a cycloplegic refraction, 21 (16%, 95% CI = 9%, 25%) had myopia of more than -5.00 D, and 12 infants (17%) had anisometropia >1.50 D. Optic nerve atrophy and/or cupping were reported in 14 eyes (10%); strabismus in 20 infants (29%), manifest nystagmus in 8 infants (11%), and amblyopia in 9 infants (13%).

Conclusion/Relevance: Total dose of intravitreous bevacizumab is not strongly correlated with neurodevelopment assessed by Bayley scores at age 2. Rates of high myopia and ocular abnormalities are similar to previous reports after higher doses.

References:
Semi-Automated Measures of Foveal Development by Handheld Swept-Source Optical Coherence Tomography May Paradoxically Correlate with Retinopathy of Prematurity Severity

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Introduction: Handheld swept-source optical coherence tomography (SS-OCT) is a non-contact technique to image retinal layers1, however correlation between foveal maturity and retinopathy of prematurity (ROP) severity is not well described2-3.

Methods: In this prospective observational study, awake premature infants were imaged with an investigational handheld SS-OCT at the time of routine ROP examinations. Full term infants were imaged within 72 hours after birth. A semi-automated program measured foveal angle, foveal/parafoveal (F/P) ratios of inner and outer retinal and choroidal thicknesses (parafovea=2.5mm from fovea), correlating with ROP severity. Intraclass coefficients (ICC) were calculated to assess intergrader reliability. A mixed model approach adjusted for multiple eyes and visits.

Results: One-hundred ninety-four imaging sessions from 70 infants were included (48% female, 37.6±3.4 weeks postmenstrual age (PMA) at imaging, 26 preterms with birth weight 1058±325 and gestational age 29.1±3.4 weeks). Intergrader reliability was good (ICC>0.7 for all measures). Among preterms, higher inner retinal F/P ratio was associated with more severe ROP stage (p=0.03) and zone (p<0.001). Wider foveal angle (p<0.001) correlated with worse ROP zone. No correlations with plus disease status were seen. Both F/P ratio at the inner retina and foveal angle decreased with PMA at imaging (p<0.001 and p<0.001, respectively). Choroidal thickness at the fovea (p<0.001) and parafovea (p<0.001) increased with PMA at imaging, but was not associated with ROP stage or zone. No other significant associations were seen.

Conclusion/Relevance: Semi-automated analysis of foveal immaturity revealed associations with worse ROP zone and stage but not with plus disease status. No associations were seen between choroidal thickness and ROP severity.

References:
(Fish) Tales of Congenital Diseases: Molecularly Distinguishing Cranial Neural Crest Cell Populations

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Congenital diseases that affect the anterior segment are typically due to cranial neural crest defects. This transient embryonic stem cell population ultimately gives rise to the bone, cartilage, and connective tissue of the jaw and mid face, and within the eye contributes to the corneal, iris, ciliary body, aqueous outflow pathways, and sclera. Thus, due to their common origin, congenital eye anomalies are often associated with facial defects.

Zebrafish is an important developmental model for studying neural crest cells due to its genetic tractability and the ability to study cells in vivo and in real-time. Importantly, zebrafish craniofacial and ocular structures are similar to their mammalian counterparts, and there is evolutionary conservation and functional homology of genes.

Using zebrafish, we have shown molecular differences between craniofacial and ocular neural crest cells. Specifically, there are cellular differences in sensitivity to ethanol exposure, which explain in fetal alcohol syndrome the characteristic craniofacial findings yet the rare association with ocular anterior segment defects. Transcriptome analysis has further identified distinct expression profiles of genes associated with congenital eye diseases and critical signaling pathways in craniofacial vs. ocular neural crest cells.

These molecular differences are key to understanding the biology of the ocular neural crest and unlocking the pathogenesis of congenital eye anomalies. This will lead to breakthroughs in creating molecularly targeted therapies for these blinding diseases. Further, this work is critical for identifying ocular neural crest stem cells in post-natal tissues that will yield regenerative capacity for degenerative eye diseases.
Timing of Initial Frontalis Suspension for Congenital Ptosis

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Introduction: Children with congenital ptosis and poor levator function are commonly first treated with silastic-sling frontalis suspension. Silastic can be replaced with autogenous fascia lata (AFL) at age 4-years, when leg length is sufficient for harvesting fascia. We sought to determine if age at initial surgery affects silastic sling longevity, anecdotally hypothesizing that delaying surgery may increase likelihood of reaching AFL age.

Methods: Retrospective cohort study of 391 eyes of 280 children who underwent silastic frontalis-sling surgery (169 unilateral, 111 bilateral) for congenital ptosis prior to age 3-years. Exclusions included mechanical, traumatic, CFEOM, or myasthenia-related ptosis. Kaplan-Meier survival analysis with inter-eye correlation adjustment compared time to sling failure between early (<6 months, mean 2, 136 eyes) and delayed (6 to <36 months, mean 12, 255 eyes) surgery groups. Secondary analysis of very early surgery (<3 months, 48 eyes) was also performed.

Results: Three-year sling-survival estimates were 73% (95% CI 64%-81%) for early surgery and 79% (73%-85%) for delayed surgery (Cox-univariate hazard ratio 0.76 (0.44, 1.32) p=0.33). Among those with follow-up to 4 years (220 eyes), survival did not differ (63% early, 68% delayed, p=0.47). Neither did complication rates (15% early, 10% delayed, p=0.16), nor did survival rates following very early (74%) versus later (78%) surgery (p=0.88).

Conclusion/Relevance: Delaying congenital ptosis surgery beyond age 3 or 6 months does not provide a sling-survival benefit. Surgical timing for congenital ptosis requiring frontalis suspension should be guided by eyelid height, success of amblyopia management, severity of chin-up head position, and anesthesia considerations.

Screening Corneal Tomography as a Helpful Adjunct in the Diagnosis of Keratoconus in Children with Down Syndrome

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Introduction: Keratoconus (KCN) is a bilateral progressive corneal ectasia characterized by the presence of irregular astigmatism and corneal thinning with possible visual impairment if not diagnosed and treated (1). This disease can have an aggressive course in pediatric patients and patients with Down syndrome (DS) (2). We hypothesize that regardless of refractive error, we should screen children with DS using corneal tomography to detect keratoconus.

Methods: 145 patients with (n=48) and without DS (n= 97) were included if they had tomography performed to evaluate for keratoconus at a pediatric hospital from July 2018- January 2020. Refractive data was obtained from the visit. We compared refractive errors and interpretation of corneal tomography in patients with and without DS.

Results: In the group with DS, patients had lower astigmatism compared to the non-DS group (p value < 0.01). There was no statistically significant difference in astigmatism in the patients who were diagnosed with KCN or KCN suspect versus those who were not (p=0.74). Of the patients diagnosed with KCN or KCN suspect, lower values for astigmatism were observed in the DS group compared to the non-DS group (p<0.01).

Conclusion/Relevance: Children with DS diagnosed with keratoconus often have much lower amounts of astigmatism at the time of diagnosis. This supports our hypothesis that screening tomography is a helpful adjunct in diagnosing keratoconus in patients with DS, as relying on high astigmatism as an indicator for disease may not be enough. Earlier detection and treatment is crucial to increasing favorable visual outcomes in children with DS and KCN.

Baseline Biometry of Eyes with Pediatric Cataract Compared to Age-Matched Controls

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Introduction: Corneal curvature (K) stabilizes by 18-24 months of life, but axial length (AL) increase rapidly in the early years and stabilizes in the second decade of life. While the rate of refractive growth is variable, information regarding baseline biometry parameters in eyes with pediatric cataract in relation to normative data are lacking. An understanding of deviation from norms may be helpful to reduce long-term refractive surprises.

Methods: Biometry was performed in children <=10 years of age; 100 had pediatric cataract and 100 were age-matched controls. One eye was randomly selected from each patient. K and AL were compared as a function of age continuously and in discrete two-year bins. Variances were compared using Levene’s test and means using ANOVA. We report Pearson’s correlation coefficients.

Results: ALs were longer and Ks were steeper in cataractous eyes compared to age-matched controls in first 6 years of life. There was also greater variance in the biometry measurements of eyes with cataracts compared to normals. The trend towards greater AL, was most significant in the 2-4 year age group (p = 0.03). The trend towards greater variance was most significant in the 4-6 year age group (p = 0.004). There was greater correlation between AL and K in normal eyes (r = 0.58) compared to cataractous eyes (r = 0.31).

Conclusion/Relevance: We found high variability in the biometry measurements of eyes with cataract. Eyes that vary significantly from norms may need adjustment in post-operative refractive targets to reduce long-term refractive surprises.

Qualitative Comparison of Aphakic Contact Lenses in Children

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Introduction: The preferred contact lens for pediatric aphakia has historically been Silsoft, a silicone elastomer lens. Due to a supply chain disruption, aphakic children require an alternative contact lens. Our goal is to perform a qualitative comparison between Silsoft and alternative contact lenses.

Methods: Aphakic children wearing Silsoft lenses underwent refitting with an alternative silicone hydrogel lens (Flexlens Definitive, Biofinity XR, or Intelliwave). Surveys were completed comparing the patient/family experience with Silsoft at time of fitting and the alternative contact lens at 1-week, 1-month and 3-months of wear.

Results: Eighteen patients completed the Silsoft survey. Ten patients completed the 1-week follow up survey. Parents report slightly more comfort with handling Silsoft versus alternative lenses. In contrast, a higher percentage of parents report more difficult insertion, greater tendency for falling out/lost lenses, and increased irritation symptoms with Silsoft compared to the alternative lens. We anticipate at least 37 additional patients will be refit for aphakic contact lenses over the next 2 months. This data will be incorporated into our preliminary findings.

Conclusion/Relevance: After one week of wear, patients'/parents' comfort with handling an alternative contact lens was comparable to Silsoft with fewer lost lenses and decreased irritation. Alternative contact lens options should continue to be considered for aphakic pediatric patients.

Myopic Shift Over Five Years Following Pediatric Lensectomy with Primary IOL Implantation

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Introduction: Our purpose was to estimate 5-year myopic shift following pediatric lensectomy with primary IOL implantation, stratified by age.

Methods: 200 eyes of 164 children enrolled in a multicenter registry (61 sites) were included. All had undergone unilateral or bilateral lensectomy with primary IOL implantation and had refraction data immediately postoperatively and at 5 years. Eyes with traumatic cataract or glaucoma were excluded. Myopic shift was calculated as spherical equivalent (SE) refractive error postoperatively (within 45 days of surgery) minus SE refractive error at 5 (range 4-6) years and compared between younger age groups and the oldest age group. Age-adjusted mean myopic shift was compared in children aged 4 to <13 years with immediate postoperative myopia (SE) (n=27) versus those with emmetropia / hyperopia (n=82).

Results: Mean SE myopic shift (95% CI) was 6.03D(4.35-7.71) when surgery was performed at 0 to <1 year of age[n=13], 3.55D(2.39-4.72) at 1 to <2.5 years[n=28], 1.70D(1.04-2.37) at 2.5 to <4 years[n=38], 2.07D(1.54-2.60) at 4 to <7 years[n=63], and 0.49D(-0.14-1.12) at 7 to <13 years[n=58] (P≤0.02 for each comparison between age groups). Eyes of children ≥ age 4 that were myopic immediately postoperatively had an age-adjusted mean myopic shift of 0.64D(-0.05-1.33) compared with 1.75D(1.38-2.12) in emmetropic/hyperopic eyes (P=0.01). 44% of eyes were within 1.00D of emmetropia at 5 years, and 72% were within 2.00D.

Conclusion/Relevance: In pseudophakic eyes, myopic shift is greater with younger age at surgery. In children 4 years and older, immediate postoperative myopia was associated with less myopic shift.

References: None
Is Aphakia Associated with Endophthalmitis in Pediatric Cataract Surgery? A Report from a Nationwide Insurance Claims Database

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Introduction: To determine the cumulative incidence and factors associated with endophthalmitis after pediatric cataract surgery using a nationwide claims database.

Methods: Retrospective cohort study including patients ages 0-18 who underwent cataract surgery in the Marketscan database from 2004 – 2017. Outcomes included the rate of postoperative endophthalmitis within 90 days of surgery and associated risk factors.

Results: A total of 5304 eyes underwent cataract surgery, of whom 33 had ICD codes for endophthalmitis (0.62% with 95% confidence interval (CI) 0.43% - 0.87%) and 18 also had confirmatory CPT codes for vitrectomy or aspiration / injection within 7 days (0.34%, 95% CI 0.20% – 0.54%). No significant association was detected for age, intraoperative antibiotics, or concomitant vitrectomy. Aphakic patients had 2.86x increased odds of endophthalmitis compared to pseudophakic patients (CI 1.13 – 7.26, p = 0.027). There was a significant difference among patients older than one year, with aphakic patients having 5.71x increased odds compared to pseudophakic patients (CI 2.20 – 14.87, p < 0.001), while no such difference was found under one year. For this high-risk group, 75% were diagnosed within 10 days after surgery.

Conclusion/Relevance: Although the incidence proportion of endophthalmitis is consistent with other studies, these data also suggest an association with aphakia. The IRIS registry reported 0.37% in children but did not analyze factors specific to pediatric cases. A recent insurance claims review estimated 0.51% but was unable to detect associated risk factors among 4/789 cases. Although confirmatory studies are warranted, older patients in whom surgical complications preclude IOL placement may merit closer follow-up.


Risk of Developing Glaucoma-Related Adverse Event within Five Years Following Pediatric Cataract Surgery

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Introduction: Children aged 0 to <13 years undergoing lens removal were enrolled into a prospective registry. We report the incidence of glaucoma/glaucoma suspect (‘glaucoma-related adverse events'[1,2]) within 5 years of cataract surgery and associated risk factors.

Methods: Data were collected from medical records at enrollment (<=45 days after cataract surgery) and annually thereafter. We calculated the cumulative incidence of glaucoma-related adverse events and evaluated the strength of associations of baseline factors with risk of event in multivariable models.

Results: In 607 pseudophakic eyes (median age at surgery 5.5 years), the overall cumulative incidence of glaucoma-related adverse events was 7% (95% confidence interval (CI), 5% to 9%), whereas in 427 aphakic eyes (median age at surgery 11.3 months), it was 29% (95% CI, 25% to 34%). Among aphakic eyes, a higher risk for glaucoma-related adverse events was associated with younger age (<3 months) at surgery (P<0.001), bilateral lensectomy (P=0.009), anterior segment abnormalities noted at surgery (P<0.001), operative complications (P=0.007), and non-White race/ethnicity (P=0.008). Sex and concomitant surgeries at time of lensectomy were not associated with glaucoma-related adverse events. Among pseudophakic eyes, there were no associations between any of these risk factors and glaucoma-related adverse events.

Conclusion/Relevance: Glaucoma-related adverse events were common in aphakic eyes. Younger age at surgery, among other factors, was associated with elevated risk. Children with pseudophakia were older at surgery and less likely to develop a glaucoma-related adverse event within 5 years of lensectomy. Children undergoing lensectomy at any age need ongoing monitoring for the development of glaucoma.

Handheld Optical Coherence Tomography of the Irido-Corneal Angle before and after Goniotomy and Trabeculotomy in Primary Congenital Glaucoma

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Introduction: To evaluate morphological changes of the iridocorneal angle before and after angle surgery in primary congenital glaucoma (PCG) using hand-held anterior segment optical coherence tomography (HH AS-OCT) and to correlate preoperative findings with the surgical outcome.

Methods: This prospective, institutional study included 57 eyes of 32 infants who underwent goniotomy or trabeculotomy for PCG. Patients underwent HH AS-OCT preoperatively then postoperatively at 6 months or, in failed cases, once failure criteria were reached. Cases were classified as successful when the final intraocular pressure (IOP) was <18 mmHg and/or with >/=30% IOP reduction on the same or fewer medications.

Results: The severity of trabeculodysgenesis was consistent with the clinical severity of the disease as age at presentation was significantly higher in the mild group (p=<0.001), the cornea was significantly clearer in the mild group (p=0.003) and thicker in the severe group (p=<0.001). The success rate of trabeculotomy was significantly higher in eyes with mild trabeculodysgenesis (p=0.01). Postoperative findings included reduction of central corneal thickness (CCT), deepening of the iridocorneal angle, and interruption of the hyperreflective membrane occluding the angle. Reduction in CCT was significantly higher in the success group of both trabeculotomy and goniotomy (p=0.004,p= 0.003 respectively). A significant difference in preoperative and postoperative average iris thickness at the temporal and nasal angles was found between successful and failed trabeculotomy cases.

Conclusion/Relevance: AS-OCT grading of trabeculodysgenesis in PCG could help predict the outcome of angle surgery. A thinner iris may be a risk factor for failure of trabeculotomy.

Outcomes of Baerveldt Glaucoma Drainage Devices in Pediatric Eyes

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Methods: Retrospective case series of children who underwent Baerveldt implant placement (2012-2019 by single surgeon) with >1 year follow-up. Ocular examination and surgical details were collected. Failure defined as intraocular pressure (IOP) <5mmHg or > 21mmHg for 2 consecutive visits, need for IOP related surgery, or visually-significant complication.

Results: 106 eyes of 76 patients underwent 110 Baerveldt placement at median 6.4 years. Baerveldt placement was combined with additional procedures in 49%, with vitrectomy most common (30%). Success of 1st Baerveldt (per patient) was 64% at final follow-up (median 4.7 years). One-, 5-, and 8-year survival rates were 84%, 60%, and 32% respectively. There was no difference (p=0.97) in survival between 1st Baerveldt and all Baerveldt surgeries. Failure of 1st Baerveldt was not associated with gender, age, ethnicity, prior IOP-lowering surgery, concurrent intraocular surgery, or glaucoma type. Complications occurred in 14% and were associated with concurrent surgery. 26% required additional IOP-lowering surgery. At final follow-up, IOP and glaucoma medications were significantly decreased (p<0.0001). Eyes underwent an average of 3.8±2.3 ocular surgeries and 3.0±2.0 glaucoma surgeries.

Conclusion/Relevance: Baerveldt implants showed good success initially, but survival rates declined over time. No risk factors for failure of first implanted Baerveldt were identified. Concurrent surgery was associated with complications. Majority of eyes required multiple surgeries to achieve IOP control and preserve vision.


Introduction: The Ahmed glaucoma drainage device (GDD) is commonly employed in the treatment of childhood glaucoma, but large studies with long-term follow-up are lacking.1, 2 Purpose: to characterize long-term performance of this GDD in children with primary and secondary glaucoma.

Methods: IRB-approved, retrospective study of children with primary and secondary glaucoma3 s/p GDD implantation at XXX from 7/1/1994-12/31/2019 with >/=1 year follow-up. Primary outcome measure: duration of glaucoma control, defined as IOP >/=6/</=21mmHg on any #glaucoma medications without additional IOP-lowering surgery or devastating complication. Secondary outcomes included visual acuity(VA), change in IOP, and #glaucoma medications at last follow-up, postoperative complications, and risk factors for failure. Analyses included and Kaplan-Meier curves and bivariate logistic models.

Results: Included were 273 eyes (210 children), 46(23%) with primary and 158(77%) with secondary glaucoma. Primary (vs. secondary) glaucoma cases presented earlier (0.9±2.1 vs. 4.5±4.6 years), had higher #prior glaucoma surgeries (0.9±0.1 vs. 0.4±0.7), and lower presenting IOP (28.3±0.1 vs. 32.4±9.2mmHg, all p<0.01). Analysis of first operated eyes (n=204) showed mean±SD time to GDD failure of 8.89±0.43 years. Survival probability for first operated eyes at 1-, 3-, 5-, 7-, and 10- years was 88.4%, 77.5%, 73.1%, 66.2%, and 54.7%, respectively. Devastating complications occurred in 11 eyes (5.4%). Younger age at surgery and higher #glaucoma medications at baseline were associated with GDD failure (p=0.003, p=0.043, respectively), while type of glaucoma (primary vs. secondary) was not (p=0.19).

Conclusion/Relevance: The Ahmed GDD has good long-term survival and an acceptable safety profile in refractory childhood glaucoma, both primary and secondary.

References:
Outcomes of Inferonasal Glaucoma Drainage Device Surgery in the Management of Refractory Childhood Glaucoma

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Introduction: Glaucoma drainage devices (GDDs) are an important treatment for refractory childhood glaucoma. Circumstances such as conjunctival scarring, prior or future anticipated surgery sometimes require inferonasal GDD placement over the preferred superotemporal location. Purpose: to evaluate indications and postoperative outcomes of inferonasal Ahmed and Baerveldt GDDs in pediatric patients.

Methods: This retrospective study included sequential cases ≤18 years old at inferonasal GDD placement, from 6/2013-9/2021. Demographic information, indications, and outcomes were recorded. Surgical success was defined as intraocular pressure (IOP) ≥5 and ≤21 mmHg or 20% below pre-operative values, without additional IOP-lowering surgery (excluding clearing tube occlusion) or vision-threatening complications.

Results: Fifty-two patients (68 eyes) were included. Mean(±SD) age at surgery was 9.5±5.5 years. Most common diagnoses were primary congenital glaucoma (n=21 eyes), glaucoma following cataract surgery (n=10 eyes), and anterior segment dysgenesis (n=6 eyes). Plate trimming for short eyes occurred in 14 eyes (20.6%). Success rates by Kaplan-Meier survival analysis (95%CI) at 1-, 2-, and 3-years were 62.2% (49.3-72.7), 49.0% (36.3-60.6), and 36.8% (24.0-49.7), respectively. Surgical failure was associated with younger age (HR=0.91, p=0.013) and Ahmed (vs. Baerveldt) GDD (HR=3.4, p=0.0001) using a marginal clustered Cox model accounting for paired eyes. Complications included new/worsened strabismus (n=10, 14.7%), corneal issues (n=6, 8.8%), lens opacities not requiring surgery (n=5, 7.4%), tube exposure or blockage (n=4, 5.8%), retinal redetachment (n=1, 1.5%), delayed corneal-ulcer-related endophthalmitis (n=1, 1.5%) and other non-visually threatening events (n=8, 12.9%).

Conclusion/Relevance: Our results demonstrate a lower success rate of inferonasal GDDs compared to previous reports of superotemporal GDDs in children. Limited success and frequent complications bear further scrutiny to improve safety and outcomes.

References:
One Year Results of Gonioscopy-Assisted Transluminal Trabeculotomy in Pediatric Glaucoma

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Introduction: To assess the safety and efficacy of gonioscopy-assisted transluminal trabeculotomy (GATT) in the treatment of primary congenital glaucoma (PCG).

Methods: This prospective, interventional study included 43 eyes of 33 patients aged<14 years diagnosed with PCG. Patients underwent GATT using 5/0 prolene suture between November 2019 and September 2020. We excluded patients that had <270 degrees of the angle incised and those who did not complete 12 months' follow-up.

Results: The preoperative intraocular pressure (IOP) ranged from 16-40 mmHg (mean 23.6 ±5.87mmHg). The extent of Schlemm’s canal incision ranged from 270-360° (mean of 352° ± 25°). The mean intraocular pressure (IOP) decreased from 23.6 mmHg to 13.0, 12.95,13.74,13.95 and12.28 mmHg at 1,3,6,9 and 12 months postoperatively (p<0.001 at all postoperative follow-ups). The mean number of glaucoma medications decreased from 0.69 preoperatively to 0.14, 0.25, 0.16, 0.31 and 0.36 at 1,3,6,9 and 12 months. Four eyes (9.3%) required additional glaucoma surgeries during the first year. All other eyes had a final IOP<18 mmHg, with 31 eyes (72%) being controlled without medications. No major complications occurred, except for early transient postoperative hyphema in 15 eyes (34.8%), and mild corneal edema in 4 eyes (9.3%), both of which resolved spontaneously.

Conclusion/Relevance: GATT using a 5/0 prolene suture yields a high success rate in PCG patients. This minimally-invasive procedure is also safe and fast and has the added advantage of sparing the conjunctiva, which may be needed for subsequent procedures.

Association of Mood Disorders, Substance Abuse, and Anxiety Disorders in Children and Teens with Eye Disease

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Introduction: We sought to evaluate the association between 5 eye diseases (including glaucoma, cataract, congenital optic nerve disease, congenital retinal disease, and blindness/low vision) and mental illness in a pediatric population.

Methods: A cross-sectional study of a de-identified commercial insurance claims database, OptumLabs® Data Warehouse, between 1/1/2007 and 12/31/2018, was conducted. Children less than 19 years old at time of eye diagnosis were included. Demographics and mental illness claims were compared, looking at the association of mental illness and eye disease claims.

Results: 11,832,850 children and teens were included in this study with mean age of 8.04 +/- 5.94 years old at first claim. Of the patients with at least one of the 5 eye diseases (n=180,297), 30.5% had Glaucoma (n= 54,954), 9.5% had cataract (n= 17,214), 21.4% had congenital optic nerve disease (n= 38,555), 26.9% had congenital retinal disease (n= 48,562), and 25.9% had blindness or low vision (n= 46,778). There was a statistically significant association, after adjusting for confounding variables, between at least one of the 5 eye diseases and schizophrenia disorder (OR 1.54, 95% CI: 1.48-1.61, p<0.001), anxiety disorder (OR 1.45, 95% CI: 1.43-1.48, p<0.001), depressive disorder (OR 1.27, 95% CI: 1.21-1.31, p<0.001), and bipolar disorder (OR 1.27, 95% CI: 1.21-1.31, p<0.001), but a reversed association with substance use disorder (OR 0.88, 95% CI: 0.86-0.90, p<0.001).

Conclusion/Relevance: We found associations between eye disease in children and teens and mental illness. Understanding these relationships may improve mental illness screening and treatment in the pediatric population.


**Outcomes of Refractive Lens Exchange to Treat High Myopia in Special Needs Children & Adolescents**

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**Introduction:** Refractive lens exchange (RLE) is useful for treating high myopia in children who are unsuitable for excimer laser or phakic IOL correction. Here we analyze outcomes in special needs children treated by RLE.

**Methods:** Clinical outcome data were collated retrospectively in 57 myopic children (94 eyes) treated for isommetropic or anisometropic myopia by RLE. The mean age at surgery was 8.7 yrs (range 1.5 to 22); mean follow-up was 6.4 yrs (range 1-21 yrs). 83% of the children had strabismus and/or nystagmus; 68% retinopathy of prematurity; 54% amblyopia; and 26% cerebral palsy. IOL power was chosen to achieve a target refraction of 0 to +1 D.

**Results:** Myopic spherical equivalent averaged \(-15.6 \pm 4.4\) D (range \(-6.5\) to \(-27.5\)) and was corrected to \(-0.23 \pm 1.32\) D at 1-year follow-up and \(-1.15 \pm 1.2\) D at 5-yr follow-up. Corrected Distance Visual Acuity (CDVA) improved 0.32 logMAR; Uncorrected DVA improved 0.80 logMAR. 60% of children treated had a gain of at least one level of binocular fusion. 12 eyes (13%) required YAG laser capsulotomy and 8 eyes (9%) required IOL exchange or repositioning. One eye in 2 children (2%) incurred irreparable retinal detachment an average 9.1 yrs after RLE.

**Conclusion/Relevance:** RLE is an effective means for improving visual function and quality of life in highly myopic children with spectacle aversion who are unable to be treated by PRK or phakic IOL implantation. Visual acuity and refractive error improved substantially from preoperative levels.


Web-based Pediatric Visual Acuity Testing At Home

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Introduction: Pediatric eye care access, particularly in rural areas, has been an ongoing concern. The COVID-19 pandemic has led to a growing appreciation and acceptance of a role for telemedicine in pediatric eye care. However, many at-home visual acuity (VA) charts and apps have poor test design or inaccurate optotype sizes, and may passively provide misinformation for clinical decision making.1-3 We evaluated the new M&S EyeSimplify At-Home Visual Acuity Tests, which include web-based versions of the ATS-HOTV and E-ETDRS tests commonly used in clinical trials.

Methods: Children with and without VA deficits were enrolled. In-office VA was tested with the M&S Smart System ATS-HOTV (ages 3-6; N=34; 68 eyes) or E-ETDRS (ages 7-12; N=31; 62 eyes) protocol. The child was registered on the EyeSimplify web-based portal and the parent was emailed a link to the at-home VA test. The portal notified us when at-home testing was completed and provided us on-line access to VA results. Equivalence of the two test settings was evaluated by mean difference and 95% limits of agreement (LOA) using Bland-Altman analysis.

Results: The mean difference between in-office and at-home was small for both ATS-HOTV (0.01+0.08 logMAR) and E-ETDRS 0.04+0.08 logMAR; 95% LOA=-0.15 to 0.17 and -0.11 to 0.19, respectively, comparable to test-retest agreement in an office setting.

Conclusion/Relevance: The M&S EyeSimplify At-Home Visual Acuity Tests provided VA equivalent to in-office testing. If the burden of travel is significant, at-home testing may provide the information needed to continue care via telemedicine consultation when it might otherwise be discontinued or delayed.

Parent-Performed Visual Acuity Testing Using Novel iPad Application

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Introduction: With the rise in teleophthalmology, the need for an accurate, validated, and easy to use application for testing visual acuity has become apparent. Recently, numerous at-home testing platforms have been created. Most have not been validated for clinical use, and parent confidence in their use has not been assessed. We present a pilot study of a novel, free access iPad application that directs parents through the visual acuity testing process. We assess parent confidence and accuracy of this method of visual acuity testing.

Methods: 50 patients (4 to 18 years old) at a single pediatric ophthalmology center were recruited. Visual acuity testing was performed by patient parents using the Home Vision Check app on a clinic iPad and then by regular clinic protocol. Parents were then surveyed on their confidence in their ability to accurately perform visual acuity testing using the app. Interclass correlations with 95% confidence intervals (CI) were computed to assess agreement between measurements of visual acuity.

Results: Parents reported high confidence in their ability to accurately perform visual acuity using the app (average 4.78/5). The mean differences and 95% CI between the parent derived visual acuity and clinic derived visual acuity was 0.022 logMAR (95% CI: -0.1751 to 0.1312, p=0.0087).

Conclusion/Relevance: Parents report a high degree of confidence in using this self-directed application. This novel visual acuity testing app showed modest agreement of visual acuity compared to technician performed visual acuity testing.


Strabismus Surgery in Orthotropic Patients: Rationale, Strategy, and Outcomes
Effectiveness of the Vision Screener using Updated Uniform 2021 AAPOS Guidelines

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Introduction: In 2021 the AAPOS Vision Screening Committee updated the Uniform Guidelines for Instrument-Based Pediatric Vision Screen Validation. We evaluate the Spot Vision Screener in detecting amblyopia risk factors and visually significant refractive errors according to these new guidelines.

Methods: As part of an IRB-approved ongoing prospective study, children are screened with the Spot prior to a complete ophthalmology exam. The updated guidelines include adjustment of hyperopia for all ages to +4.00, and myopia for age > 4 yr to >3.00 D and >/>=4 years to >2 D. Statistical analysis compares screener results with physician findings and includes Bland Altman and ROC curves. 1093 children (48% male, av age 5.5 yrs, range 6 mo- 13 years and 43% Cauc, 25% AA, 28% Hisp) are enrolled.

Results: Of those children in the initial statistical analysis group (826), sens/spec of the Spot to detect 2021 AAPOS Guidelines is 0.89/0.77. For children >4 years old, the sens/spec improve to 0.92/0.80. Results are stratified by age and by diagnoses (all criteria, myopia, hyperopia, astigmatism, anisometropia). The sens/spec for hyperopia is 0.37/0.99 and for myopia 0.52/0.99 (0.60/1.00 for age > 4 and 0.50/0.98 for age/>/>=4 ). Bland-Altman plots are provided. For Cylinder, 81.1% of subjects are within + 1 SD of the mean difference. ROC and evaluation curves for different thresholds by age enable maximization of Spot referral criteria.

Conclusion/Relevance: This study informs on performance characteristics of the popular Spot screener. We recommend specific device refractive referral criteria to maximize screening effectiveness using the updated AAPOS guidelines.


Targeting Amblyopia with Diverse Technologies: Birefringent Scan, Autostereoscopic Rivalry and Photorefraction

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Introduction: Novel devices target different risk factors associated with amblyopia; subnormal visual acuity, suppression, refractive error and asymmetric foveal fixation and corneal reflexes.

Methods: Children from a pediatric eye practice were consented to simultaneously validate three different vision screen devices: the Adaptica 2WIN photoscreener, the Rebion blinq and the PDI Check forced-choice game on Nintendo 3DS autostereoscopic screen. Results were compared with receiver operating characteristic (ROC) curves targeting the 2021 AAPOS amblyopia risk factor (ARF) Guidelines.

Results: 202 ethnically diverse patients aged 10.3 ± 3.6 (4.2 – 19.6) years, with 117 having 2021 AAPOS ARF and 63 treatment-näive, completed 3 screenings compared to confirmatory examinations. Spherical equivalent was +1.00 ± 3.3D (range -14 to 9D) with cylinder 1.3±3.4D (max 6.5D) cylinder with 2WIN -0.2±2.2D (range -9 to 4.5D) with cylinder 1.7±1.4D. Visual acuity distance logMAR was 0.1±0.2 (range -0.2 to 1.6) compared to near PDI Check 0.4±0.5 (range -0.1 to 1.6). For AAPOS 2021 <4y, sensitivity/specificity for blinq was 88%/32%, 2WIN 73%/88% and PDI Check 70%/59%. Targeting amblyopia and/or strabismus, blinq scored 94%/37%, 2WIN 56%/65% and PDI Check 79%/68%.

Conclusion/Relevance: From this high-prevalence, cooperative cohort of school-aged children, each device had strengths and weaknesses highlighted by different ARF targets. Each device revealed patients at risk for otherwise occult amblyopia, visually significant refractive error and strabismus.

Intermittent Exotropia: A Novel Surgical Algorithm Based on a Postocclusion Distance-Near Relationship

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Introduction: For the preoperative evaluation of patients with intermittent exotropia, prior studies have revealed that prism alternate cover testing at distance and at near should be performed after a period of monocular occlusion, and that the use of a reading add at near helps to exclude accommodative convergence. Using these evaluation techniques, a performance improvement project was undertaken to evaluate a dosage-modification algorithm created to improve outcomes with bilateral lateral rectus recession surgery.

Methods: The following postocclusion distant-near relationship was designated the clinical vergency index (CVX): CVX = N – D, where N is the near postocclusion measurement using a +2.50 add, and D is the distance postocclusion measurement. The algorithm is based on surgical undercorrections observed to be proportionally associated with positivity of CVX values, and overcorrections proportionately associated with negative values. Eighty-five consecutive dosage-modified lateral rectus recession procedures performed by one surgeon (AJC) were evaluated for a satisfactory outcome defined as: a phoria or intermittent tropia between 10PD of exodeviation and 5PD of esodeviation. All patients had stereopsis of 50 seconds or better at one exam.

Results: Six weeks after surgery using dosage modifications of -0.75 mm to +1.5 mm, surgical outcomes were satisfactory for 78/85 (90.5%) at distance, and 67/85 (78.8%) at near. After a mean of 4.8 (±3.6 years) of postsurgical adaptation, satisfactory outcomes were measured for 54/85 (63.5%) of patients at distance, and 53/85 (62.4%) at near.

Conclusion/Relevance: Satisfactory surgical outcomes using the clinical vergence index algorithm support its continued use by the author for the correction of intermittent exotropia.

Strabismus Surgery in Orthotropic Patients: Rationale, Strategy and Outcomes

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Introduction: Patients with orthotropia in primary gaze may nonetheless be symptomatic due to the presence of incomitance in eccentric gaze. We report surgical outcomes of patients undergoing rectus muscle surgery despite orthotropia in primary gaze.

Methods: Record search of all patients operated by a single surgeon over 11 years. Inclusion criteria either 1) Orthotropia in primary gaze with symptomatic vertical or horizontal incomitance or 2) Horizontal deviation <=4 PD in primary gaze with symptomatic deviation in right and left gaze. Patients treated with Faden suture alone were excluded.

Results: The search identified 8 patients with incomitant vertical or horizontal deviation and 4 with lateral gaze esotropia following bilateral lateral rectus recessions. Strategies to treat incomitance included 1) simultaneous ipsilateral recession of antagonist rectus muscles; 2) advancement of one rectus muscle with recession of its yoke muscle; 3) combined resection and recession of one muscle; 4) combined rectus muscle surgery with contralateral Faden procedure. For lateral gaze esotropia, both lateral rectus muscles were advanced despite anticipated exotropia in primary gaze. At the 2-month post-operative visit, no patient had new-onset diplopia in primary gaze. Comitance and range of binocular single vision (where measured) improved in 11 patients. No patient has required additional surgery with 12.3-month mean follow-up (range 2-83 months). Patient satisfaction and surgeon assessment of outcomes were generally high.

Conclusion/Relevance: Although the risk of operating on patients who are orthotropic in primary gaze may discourage surgeons from offering treatment, the use of specific strategies to address incomitance can preserve alignment in primary gaze while improving overall patient satisfaction.

Worldwide Outcomes of Nasal Transposition of the Split Lateral Rectus Muscle for Strabismus Associated with Bilateral 3rd-Nerve Palsy

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Introduction: To determine success rate and complications associated with nasal transposition of the split lateral rectus muscle (NTSLR) for treating bilateral 3rd-nerve palsy (B3NP).

Methods: Retrospective cohort study using an international registry of patients with B3NP treated with NTSLR. Primary outcome was post-operative horizontal alignment <=15 PD. Secondary outcomes included intra-operative technical difficulties and vision-threatening complications. Association of each outcome with patient demographics and surgical technique was analyzed using multivariable logistic regression.

Results: Thirty-four patients were included with median (IQR) age at surgery of 46 (25, 54) years. The most common etiology was ischemic (29%). Bilateral NTSLR was performed on 35% (pre-operative exotropia of 90 PD [82, 105]), and unilateral NTSLR accompanied by a different contralateral surgery on 65% (preoperative exotropia of 100 PD [80, 111]). Bilateral NTSLR reduced exotropia to 14 PD (5, 35) and unilateral NTSLR with a different contralateral surgery reduced exotropia to 18 PD (7, 35). A linear surgical dose response was demonstrated (R2=0.84). Success was achieved in 50%; however, greater misalignment was associated with decreased success in unilateral NTSLR cases (OR = 0.79; 95% CI 0.54-0.98). There was a trend towards success in eyes treated with concurrent superior oblique tenotomy (OR = 4.9; 95% CI 0.6-103). Technical difficulties were encountered in 18%, and vision-threatening complications in 21%.

Conclusion/Relevance: NTSLR performed bilaterally, or unilaterally with an alternative procedure on the contralateral eye, for B3NP is successful in 50% of cases with similar reductions in exotropia. Thus, bilateral NTSLR may not be needed for B3NP.

A Predictive Model for Amblyopia Risk Factor Diagnosis in Preschool Children After Photoscreening

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Introduction: Referral criteria for photoscreening instruments currently rely on cutoff values for each estimate of refractive error; tailoring them to adjust predictive values is challenging. We present a model that combines refractive estimates to provide a single outcome metric that is associated with the likelihood of a child having an amblyopia risk factor (ARF).

Methods: Chart review was used to retrospectively identify a cohort of patients younger than 60 months referred for ophthalmic evaluation following preschool photoscreening using the Plusoptix S12C (N = 335). Presence of ARFs was determined using the 2013 AAPOS Preschool Vision Screening guidelines.[1] Demographics and photoscreening results were assessed as predictors of ARF diagnosis using binary logistic regression with bootstrap validation.

Results: ARFs were identified in 125 patients (37.3%). Age, race, estimated astigmatism, estimated myopia, and estimated hyperopia were found to be independent predictors of ARF diagnosis in a combined logistic regression model. The model produces a single probability for each screened individual; a proposed referral criterion can be adjusted to meet the needs of a screening program. The bootstrap overfitting-corrected c-index (AUROC) was found to be 0.81 (0.95 CI 0.77-0.88) with a calibration slope of 0.86.

Conclusion/Relevance: The predictive model described in this study utilizes photoscreening data and known covariates to provide an estimate that a screened child will have an ARF detected. This innovative model has good discrimination and will allow a screening program to adjust referral thresholds quickly and easily based on a desired sensitivity, specificity, or predictive value.

Binocular Contrast Sensitivity Deficits and Fixation Eye Movement Abnormalities in Amblyopia

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Introduction: Visual function deficits are seen in amblyopic patients during fellow and binocular viewing. The purpose of the study was to examine the relationship between Fixation Eye Movement (FEM) abnormalities and binocular spatial contrast sensitivity deficits in amblyopia.

Methods: We recruited 8 controls and 22 amblyopes (anisometropic=7, strabismic/ mixed=15). We measured contrast sensitivity function using a staircase procedure. We computed the area under the log CSF (AULCSF) for each subject. Amblyopes were divided into low contrast group (LCG, AULCSF < controls) or high contrast group (HCG, AULCSF=controls). We recorded FEMs using high-resolution video-oculography and classified subjects as having no nystagmus(n=8) or nystagmus(n=14). We computed the amplitude and velocity of the fast and slow FEMs.

Results: Amblyopes had reduced AULCSF at SF 8,12, and 16 (p = 0.043, 0.30, 0.022; respectively, repeated-measures ANOVA) than controls. Amblyopes without nystagmus had greater reduction in AULCSF at low (1 cpd) and high (12,16 cpd) (p = 0.023, 0.045, 0.016; respectively, repeated measures ANOVA) than those with nystagmus. Amplitude was increased for LCG versus HCG amblyopic eye (p = 0.018, t-test) and fellow eye (p = 0.024 t-test). Variance of fellow eye was increased for LCG versus HCG (p = 0.01145, t-test).

Conclusion/Relevance: Our data show that contrast sensitivity deficits are more pronounced in patients without nystagmus than those with nystagmus. This may be as majority of patients with nystagmus had mixed/strabismic who are known to have better contrast sensitivity than anisometropic amblyopes. Evaluation of FEM abnormalities can help predict varying contrast sensitivity deficits seen in amblyopia.

Association of Initial Amblyopia Presentation with Neighborhood Quality

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Introduction: Racial and socioeconomic disparities in amblyopia have been previously reported (Repka, 2020); we sought to investigate this finding using the Child Opportunity Index (COI), a metric of neighborhood quality for child welfare (Acevedo-Garcia, 2014).

Methods: A cross-sectional study was conducted using data from the Boston Amblyopia Study, a registry of children with amblyopia diagnosed between 2010 and 2014 at a metropolitan pediatric hospital. We included children 2 - 12 years of age and determined nationally-normalized COI scores based on residential address. We analyzed the association of visual acuity at presentation with COI scores using linear mixed effect models adjusting for sex, race, ethnicity, and insurance status.

Results: 1,132 subjects met inclusion criteria of which 30% were non-white and 44% had public insurance. 13% of children lived in very low opportunity neighborhoods and 46% of children lived in very high opportunity neighborhoods. After adjusting for individual-level factors, there was a change in visual acuity of the better seeing eye (β = -0.0090, 95% CI: -0.0176 to -0.0003) and worse seeing eye (β = -0.0074, 95% CI: -0.0209 to 0.0062) per 20 unit increase in COI: approximately a two-letter decrease in visual acuity from highest opportunity neighborhoods to lowest.

Conclusion/Relevance: Amblyopic children residing in neighborhoods with lower opportunity tend to present with lower visual acuity after adjusting for individual-level socioeconomic factors. The disparate number of subjects in very high opportunity neighborhoods diminished the power to query socioeconomic disparities in amblyopia and underscores the need for diverse cohorts in the future.


Early Amblyopia Therapy in Pediatric Open Globe Trauma

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Introduction: Younger age is an independent risk factor for poor visual acuity after open globe injuries (1,2). Since ocular trauma represents an acute interruption in the development of a previously normal visual axis, amblyopia may be a factor contributing to worse outcomes. We hypothesized that preventative therapy with patching, atropine, or spectacle correction for amblyogenic refractive error early in the post-operative period may lead to improved visual outcomes after open globe injury by potentially preventing or reducing the onset of the physiologic and anatomic changes associated with amblyopia.

Methods: In this retrospective observational case series, medical records of 151 pediatric patients presenting to the emergency departments of two institutions for open globe injuries were reviewed. Subjects with at least 3 months of follow-up were included for analysis. Demographics, mechanism of injury, ocular findings to calculate a pediatric ocular trauma score, and initial and final visual acuities were recorded.

Results: Of 80 patients who met inclusion criteria, 53 were younger than 9 years old and 33 received amblyopia therapy. Children younger than 9 years old had significantly better BCVA if amblyopia therapy was initiated within the first three months after the injury than those in whom it was used later or not at all.

Conclusion/Relevance: Prophylactic therapy with patching, atropine, or spectacle correction in children at risk of amblyopia may allow for improved visual outcomes by preventing the onset of amblyopia in the setting of pathologic changes caused by open globe trauma.

**Reading Ability in Children with a Unilateral Congenital Cataract**

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**Introduction:** Amblyopia has been associated with reading skills, but this association has not been observed with deprivation amblyopia. We analyzed data from the Infant Aphakia treatment Study (IATS) to see if unilateral congenital cataract, or visual acuity (VA) in the treated eye, was associated with reading.

**Methods:** At age 10 ½ years, VA was measured in 109 of the 114 IATS participants using the E-ETDRS protocol. Data on silent reading were collected on 91 participants using the ReadAlyzer® system. A sample of 20 9- to 11-year old children with normal bilateral vision were recruited from the Emory Eye Clinic. Each child read two passages: one at a 3rd grade reading level and a second at their current grade level. Multiple regression was used to compare reading rate and saccades while adjusting for gender and current grade level.

**Results:** There was no evidence that IATS participants read more slowly than controls (156.4 ± 72.2 versus 130.1 ± 48.1 words per minute (wpm)) or that reading rate differed by VA in the affected eye. IATS participants had fewer forward saccades than controls (104.1 ± 42.5 versus 141.6 ± 87.9, p<0.01), but the number of forward saccades was similar in children with good VA (113.6 ± 7.4) and those with VA of 20/200 or worse (107.2 ± 44.1).

**Conclusion/Relevance:** Reading skills in IATS participants were similar to those in children good vision in both eyes, and did not differ by visual acuity in the affected eye. Deprivation amblyopia may not affect reading skills.

Association Between Motor Ability at 4½ years and Physical Activity at 10½ years in the Infant Aphakia Treatment Study

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Introduction: Children with amblyopia have impaired fine and gross motor skills which may lead to reduced physical activity, and increased risk of obesity and cardiovascular disease. The goal of this analysis was to see if motor delay was associated with reduced participation in physical activity in IATS participants.

Methods: Fine and gross motor skills at age 4½ years were assessed by a traveling tester using the Movement Assessment Battery for Children (MABC-3) in 113 of the 114 IATS participants. Parents of 109 of these children reported the frequency of participation in organized and recreational physical activities at age 10½ years. We used logistic regression to estimate the relative odds of infrequent physical activity between children with and without motor delay, defined as scoring at or below the 15th percentile on the MABC-3.

Results: After adjusting for potential confounders, children with poor motor skills at age 4½ years were slightly less likely to participate in structured physical activities (ORadj =0.69, 95% CI=0.29, 1.64) and substantially less likely to participate in recreational physical activities (ORadj = 0.13 95% CI = 0.02,1.05) at least once a month than children with better motor skills.

Conclusion/Relevance: Deprivation amblyopia impacts fine and gross motor skills which may impact children's participation in physical activity. This could have implications for long-term obesity and cardiovascular health. It may be important for clinicians treating children with deprivation amblyopia to encourage them to participate in physical activities while wearing safety goggles to minimize risk for ocular injury.

References:
Stereopsis in the Infant Aphakia Treatment Study: Comparison between ages 4½ and 10½

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Introduction: Infants born with a unilateral congenital cataract (UCC) are frequently unable to perceive depth based on binocular cues because of the patching regimen employed to ensure optimal vision in the treated eye, as well as the disparity in acuity between their eyes. At the 4½ year visual assessment approximately 25% of the IATS patients demonstrated some level of binocular functioning.1 We determined that re-testing stereopsis at age 10½ years would provide valuable information.

Methods: At age 10½ stereopsis was assessed by local clinical staff using the Randot Preschool Stereoacuity Test and recognition visual acuity was tested using the ATS E-ETDRS.

Results: Of the 110 patients who participated at age 10½ one did not have a reported measure of visual acuity. Of the remaining 109, 12 (11%) demonstrated some level of stereopsis, equally divided between the two treatment groups. Half of the patients demonstrating stereopsis ranging from 40 to 800 seconds of arc had visual acuity in the treated eye of 20/40 or better.

Comparing stereopsis measures between the two ages indicated that only three of the patients who had demonstrated stereopsis on the Randot Preschool stereo Test at age 4½ also showed stereopsis at the later age and all three of the individuals who had positive findings at both ages had E-ETDRS VA of 20/40 or better (Kappa = 0.473 (95% CI 0.12,0.83)).

Conclusion/Relevance: These findings demonstrate that, although rare, it is possible for patients with unilateral congenital cataracts to achieve some degree of binocularity.

**BRAF V600E Immunohistochemical Studies of Pediatric Conjunctival Lesions**

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**Introduction:** BRAF mutations have been documented in cutaneous nevi and correlate with clinical and histopathologic features that affect treatment and outcome. BRAF tissue positivity has previously been associated with conjunctival nevus presentation but failed to analyze for statistically significant differences in clinical presentation while isolating for BRAF tissue positivity. The purpose of this study was to analyze the prevalence of BRAF V600E immunoreactivity in pediatric conjunctival lesions and its relation to clinical and histopathologic features to determine their statistical relationship.

**Methods:** A retrospective case-control study of 13 pediatric patients evaluated for conjunctival lesions between January 2019 and August 2021 was performed. Demographic data, clinical info and histopathologic characteristics were noted. Continuous variables were compared with a Student's t-test and categorical variables were compared with a Fisher's Exact Test.

**Results:** All 13 patients underwent surgical excision with cryotherapy; one patient also received an amniotic graft. All conjunctival lesions were diagnosed pathologically as compound nevi. Immunohistochemistry for BRAF was positive in 6/13 nevi (46.1%). Age at diagnosis was not statistically significant (p > 0.1) with the mean age at diagnosis of 143.7 months for BRAF+ lesions, compared with 138.7 months for BRAF- lesions. There was no statistical significance (p > 0.1) between the mean largest basal diameter of 4.75 mm for BRAF+ and 6.00 mm for BRAF- groups.

**Conclusion/Relevance:** BRAF reactivity is present in many pediatric conjunctival nevi, but does not correlate significantly with unique clinical or histopathologic features.

Introduction: Vernal keratoconjunctivitis (VKC) is a rare allergic inflammatory ocular surface disorder (OSD) that primarily affects children and young adults. Diagnostic delays are common, and little is known of the patient experience in the time leading up to diagnosis.

Methods: This study used an interpretative phenomenological analysis approach to assess the lived experience of US children with VKC. Between March 8th and April 6th 2021, structured interviews were conducted with caregivers of children with VKC (n=7) and VKC healthcare providers (n=16) to identify key ‘pain points’, obstacles, and trends on the path to diagnosis.

Results: Like an earlier study conducted in the UK(1), this study found low awareness of the nature and severity of VKC among US caregivers and non-specialist providers, and a tendency among young patients and their caregivers to downplay initial symptoms. Medical intervention was delayed as caregivers treated symptoms with over-the-counter medications; 88% (14/16) of physicians reported frequent misdiagnosis and mistreatment by pediatricians and primary care providers (PCPs) who were initial points of care. Time to appropriate referral ranged from 1-2 weeks to 3 months, in part due to convoluted referral pathways that were universal points of frustration for caregivers and specialists.

Conclusion/Relevance: Limited awareness of VKC remains a barrier to timely identification and management of this rare but disruptive OSD. Caregivers underestimate symptom severity, pediatricians and PCPs misdiagnose VKC as allergy or infection, and referrals to appropriate specialists are delayed until symptoms are severe. Early identification of VKC is essential to improving the diagnostic journey.

Anterior Chamber Granuloma: Conservative Treatment versus Surgical Intervention

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Introduction: A distinct pattern of granulomatous anterior uveitis, with white anterior chamber (AC) granuloma, has been reported in certain endemic areas. We aim to compare the outcome of conservative treatment to surgical intervention for large AC granulomas presenting with moderate-severe anterior uveitis. The secondary outcome is ultrasound biomicroscopy (UBM) characterization of AC granulomas.

Methods: This is a prospective randomized interventional study including 41 eyes of 39 patients with active AC granuloma ≥ 3mm (flare & cells ≥ +2). Patients were randomly assigned either to conservative treatment in form of topical prednisolone and cycloplegic drops with transseptal injection of Triamcinolone acetonide (20 eyes) OR surgery in form of granuloma excision and AC wash (21 eyes). As a perioperative care, topical steroids and cycloplegic drops were given few days before surgery and tapered gradually over 6 weeks. Patients were followed-up at first day, 2 weeks, 1 and 3 months.

Results: 37 patients were males and 2 were females (13.0 ± 3.5 years). Granuloma disappearance/healing was achieved in 20 eyes in surgical group versus 2 eyes in conservative group, after 2 weeks (p<0.0001). This effect was maintained throughout the follow-up, for the surgical group and reached up to 70 %, for the medical group. At every follow-up, BCVA was better in surgical group (statistically significant at 1 and 3 months). The granuloma appeared as a homogenous hyperreflective lesion in examined eyes (16 eyes of 15 patients).

Conclusion/Relevance: Surgical treatment of large granulomas leads to a more complete and rapid resolution of inflammation.

**Clinical Profile of Pediatric Traumatic Cataract in Tertiary Hospital**

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**Introduction:** Traumatic cataract is one of the leading causes of monocular visual disability and blindness in pediatric that surgically manageable. Our objective is to describe the characteristics of pediatric traumatic cataract in tertiary hospital.

**Methods:** A retrospective review of patient's medical records diagnosed with pediatric traumatic cataract from September 2018 to August 2021 was conducted. Data collected include sex, age, type and cause of injury, interval between injury and surgery, visual acuity at presentation until 1 month after surgery, structural damage, treatment and complication.

**Results:** A total of 39 children with traumatic cataract were included and predominantly boys (82.05%) with age range 6-11 years (48.72%). Open globe was the most common injury (56.41%) and wooden stick was the predominantly causes (20.51%). Most of traumatic cataract in closed globe injury underwent surgery after 6 months (17.95%). A full thickness corneal laceration was present in all patients with open globe injury (56.41%). Majority of patient (35.90%) were underwent lens aspiration with PPC and anterior vitrectomy surgery. Patient with initial visual acuity less than 3/60 was 79.49% and 25.64% patients had visual acuity over 6/12 in 1 month after cataract surgery. Corneal opacity (56.41%) and PCO (33.33%) was the most common complication.

**Conclusion/Relevance:** Majority of pediatric traumatic cataract patients was school aged boys. Late presentation and associated ocular injury could developed poor visual outcome. Children should be under supervision of adult during activities to prevent injury and parents should be informed to take the children to the nearest hospital in any ocular injury.

**References:**
Mydriasis in Paediatric Cataract Surgery using Intracameral Solution

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Introduction: To study the efficacy and stability of pupillary dilatation using commercially available intracameral combination of phenylephrine, lidocaine and tropicamide in pediatric cataract surgery

Methods: Children undergoing cataract surgery were dilated using commercially available combination of phenylephrine 0.31%, tropicamide 0.02% and lidocaine 1%. None of the patients received any preoperative dilating drops. Intracameral injection of 0.025 ml of this solution was given through a paracentesis and the pupil size was measured at different stages of surgery till the completion. Measurements were made from screenshot from recorded videos.

Results: Cataract surgery was performed in 45 eyes out of which 28 had congenital cataract, 6 had surgery for subluxated lenses, 4 eyes had complicated cataract with synechiae, 7 were associated with retinopathy of prematurity. A minimum of 6 mm dilatation was achieved in most with infants showing the most resistance. The stability of dilatation was maintained in 43/45 eyes till the end of surgery. There were no systemic side effects as these children were monitored under general anesthesia.

Conclusion/Relevance: Intracameral combination of mydriatic anaesthetic is a viable option in dilating the pupil in paediatric cataract surgery. It provides targeted delivery with miniscule dose and avoids the ill effects of drops

Quantitative Comparison of Aphakic Contact Lenses in Children

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Introduction: The preferred contact lens for pediatric aphakia has historically been a silicone elastomer lens (Silsoft). Due to supply chain disruption, aphakic children require an alternative contact lens. Our goal is to perform a quantitative comparison between Silsoft and alternate contact lenses in aphakic children.

Methods: Aphakic children wearing Silsoft lenses were refit into an alternative silicone hydrogel lens (Flexlens Definitive, Biofinity XR, and Intelliwave). Data collected includes contact lens parameters, exam findings and patient demographics.

Results: Eighteen patients presented to be refit from Silsoft to an alternative lens. The finalized contact lens distribution was 61.1% Flexlens, 16.7% Biofinity, 11.1% Intelliwave and 11.1% remained in Silsoft. Among patients 0-24 months, 75% were fit in Flexlens and 25% remained in Silsoft. Among 2-5 years old, 75% were fit in Flexlens and 25% in Biofinity. Among those 6 years and older, 33.3% were fit in Flexlens, 33.3% in Biofinity and 33.3% in Intelliwave. The median base curve for Silsoft was 7.5mm and 7.2mm for Flexlens. The median diameter was 11.3mm for Silsoft and 11.5mm for Flexlens. An additional 37 patients are anticipated to be refit for aphakic contact lenses over the next two months. This data will be incorporated into our preliminary findings.

Conclusion/Relevance: Flexlens Definitive serves as an adequate alternative to Silsoft in young aphakic children. However, the lens parameters must be steepened for an appropriate fit. Older aphakic children are often successfully fit into commercially available soft contact lenses.

References:


Long-Term Visual and Anatomic Outcomes Following Late Surgery for Unilateral Persistent Fetal Vasculature: A Single-Center, 22-Year Review

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Introduction: Persistent fetal vasculature (PFV) is a congenital anomaly caused by complete or partial failure of the ocular fetal vasculature to regress. We report the visual and anatomic outcomes in a cohort of patients who underwent late surgery for PFV.

Methods: A retrospective review of patients who underwent lensectomy and anterior or core vitrectomy for unilateral PFV, with or without intraocular lens implantation, was performed. Inclusion criteria were those operated on after 7 months of age with at least 12 months of follow-up. Patients with severe posterior segment involvement were excluded. The primary outcome was the final visual acuity (VA) using age-appropriate tests converted to logMAR. Secondary outcomes included the rate of adverse events and the number of subsequent intraocular procedures.

Results: Twenty patients met the inclusion criteria. Mean age at surgery was 19.3 ± 10.5 months with a mean follow-up of 73.7 ± 46.7 months. Sixteen patients had delayed surgery due to late presentation, whereas the remaining four were managed initially with refractive correction and occlusion. Eight patients achieved a final VA better than 1.0 logMAR. Of the remaining 12, one achieved perception of light and one no perception of light. Four eyes developed adverse events including one event of retinal detachment. None developed glaucoma. Four eyes underwent subsequent procedures.

Conclusion/Relevance: In our study cohort, late surgery for unilateral PFV achieved functional visual acuity in over a third of patients. This is comparable to the results achieved with early surgery but with less adverse events. [1]

Incidence and Predisposing Factors of Intraocular Lenses Tilt after Secondary IOL Implantation in the Ciliary Sulcus in Children: An Ultrasound Biomicroscopy Study

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Introduction: To evaluate incidence and cause of IOL tilt and changes in anterior chamber angle after 2ry IOL sulcus implantation in children.

Methods: A retrospective observational study was done on children who underwent secondary IOL implantation in the ciliary sulcus after pediatric cataract removal during 2017-2020 in Cairo University Hospitals. Children were examined clinically and ultrasound biomicroscopy (UBM) was performed in eyes with clinically detected tilt. Main outcome measures included IOL tilt, anterior chamber depth (ACD), IOP, and gonioscopic changes in anterior chamber angle (ACA).

Results: IOL was implanted in ciliary sulcus in 102 eyes (57 children). IOL tilt was detected clinically in 16 eyes of 14 children (15.69%). The mean angle of tilt measured by UBM was 11 ± 4.4 degrees. The mean ACD was 2.4 ±0.5 mm. Postoperative IOP elevation > 18 mmHg occurred in 12.5% in presence of IOL malposition compared to 15% in cases with clinically stable IOLs however, this difference was statistically insignificant. ACA narrowing occurred in 54% of patients after IOL sulcus fixation. Soemmering’s ring was found in 37.5 % of eyes (6 /16). Retro-IOL proliferations and obliterated sulcus were detected in all eyes with IOL tilt. Axial length, corneal diameter, and presence of PHPV did not affect IOL position.

Conclusion/Relevance: IOL tilt was detected in 15.69% of eyes that underwent 2ry IOL implantation. Presence of residual lens matter (Soemmering’s ring) and obliterated ciliary sulcus could be associated with a higher incidence of IOL malposition following ciliary sulcus fixation.

Outcomes For Combined Pediatric Cataract and Strabismus Surgery

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Introduction: In the pediatric patient population, both cataracts and strabismus have amblyogenic potential and often occur concurrently (1). This study seeks to provide one of the largest retrospective chart reviews revealing the benefits and pitfalls of addressing both within a single surgery.

Methods: Our study includes a meticulous retrospective chart review of 80 combined intraocular lens and strabismus procedures performed by a single surgeon at a large tertiary referral center.

Results: 91.25% of procedures resulted in improved alignment. 79.5% of patients with quantifiable vision noted improvement post-operatively with 35% of all eyes included achieving a visual acuity better than or equal to 20/80. One patient experienced a transient intraocular pressure spike on postoperative day 1 to 44 mmHg that responded to typical medical therapies. The combined nature of procedures did not directly contribute to this complication as it is potentially inherent with cataract extraction alone.

Conclusion/Relevance: Where appropriate a combined intraocular lens procedure with a strabismus procedure is a safe and effective method for maximal improvement in vision with minimal surgeries.

Is YouTube a Useful Tool for Trainees in Pediatric Cataract Surgery?

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Introduction: With the widespread public use of video sharing platforms such as YouTube, medical students, residents, and fellows now have access to vast amounts of free and easily accessible, but unvetted surgical content. To determine the utility of surgical videos published on YouTube as resources for trainee education in pediatric ophthalmology, we assessed the surgical proficiency, patient care, and video quality displayed in the available YouTube content.

Methods: The ten most highly viewed pediatric and congenital cataract procedural videos published within the last ten years were independently reviewed by three separate board certified, practicing pediatric ophthalmologists. Videos were assessed for surgical competency on a 5-point Likert scale in six key areas as outlined in the American Academy of Ophthalmology's congenital cataract surgery guidelines. The teaching quality of the videos were also subjectively assessed on several measures.

Results: The mean overall grading was 3.93 (SD: 0.94, Range: 2.67-4.67). One video failed to receive an overall grading of greater than three, indicating incompetent overall surgical performance. No other video failed to reach a mean competent score for any single individual technique. One video demonstrated potential patient safety concerns. Eighty percent of videos had adequate or better picture quality.

Conclusion/Relevance: Of the ten most popular pediatric cataract surgical videos published on YouTube, all but one displayed competent overall surgical technique. While viewers must be wary as unvetted and potentially harmful videos may be published on the platform at any time, if used correctly, surgical content on YouTube can be a helpful tool for ophthalmologic trainees.

Will my Child with Albinism Lose Vision over Time? Age-Related Vision Loss in Adults with Albinism

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Introduction: Albinism is associated with congenital nystagmus, foveal hypoplasia, iris transillumination and optic nerve anomalies. Because it is a panocular developmental disorder, we sought to study other common ocular disorders in adults with albinism.

Methods: Retrospective chart review of albinism patients in one practice examined at least twice after 18 years old. Prevalence of ocular conditions was compared to United States population norms using Binomial test and Wald test (with p= 0.05).

Results: 75 charts fit inclusion criteria, 40 male. Average age was 46 years (range 18-107). Average time between first and last examination was 17.6 years. Average visual acuity was 20/87 Snellen (range 20/20-light perception). Nystagmus (p=6.16E-217) and strabismus (p=4.00E-48) were overrepresented in the ophthalmology clinic albinism population, as expected. Cataracts, glaucoma, and age-related macular degeneration (AMD) (p=0.000145,0.017,0.025 respectively) were more common than in the general population. Age at documentation averaged 55 years for cataract (childhood-74), 58 years glaucoma (29-76), 75 years AMD (57-95). Patients first ascertained between 11-29 years and followed an average 18.6 years (10-45) had no worsening of vision over time (logMAR change -0.16).

Conclusion/Relevance: Albinism is more than a pigment deficiency; it is a developmental ocular disorder that affects the entire eye. People with albinism should be followed throughout life as they may have higher prevalence of cataracts, AMD and glaucoma, if confirmed by larger population studies. Visual acuity averaged 20/87 for adults and did not decrease, on average, over the lifespan. Of note, age related macular degeneration occurred, despite the absence of an anatomic macula.

Will My Child Drive? What to Tell Parents of Children with Albinism

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Introduction: Visual acuity in patients with albinism ranges from normal to legally blind. Parents of newly diagnosed children wonder whether vision will be adequate to drive, work, and learn, but the wide range makes prognosis challenging. We surveyed adults with albinism about driving, ocular conditions, and psychosocial responses to albinism.

Methods: People with albinism 18 years and older were invited by letter and on albinism organization websites to complete an IRB approved 120 question Qualtrics survey online. Descriptive statistics were used to summarize the data sets. Binomial tests were used to compare prevalence of ocular conditions to the general population.

Results: 117 surveys were completed. Visual acuity ranged from better than 20/40 to worse than 20/400. Visual acuity was worse than 20/100 in 59%; 33% reported driving. Cataracts were more prevalent in our survey population than the general population at 40-49 years (p=0.0265) and 50-54 years (p=0.0040). Three patients reported cataract onset before age 40. Psychosocial questions revealed good self-esteem (Rosenberg 23.6+/-2.8) and resilience (BRS 3.5; normal 3-4.3), but moderate fear of negative appraisal based on physical appearance (FNAES 13.7 +/- 5.9).

Conclusion/Relevance: A majority of respondents may qualify for at least daytime driving, yet only 33% drive. Requirements vary by state, so pediatric ophthalmologists should be familiar with their state’s requirements and educate patients and parents, as well as refer for low vision driving evaluations. Pediatric ophthalmologists should recommend continued eyecare throughout life, since cataracts may develop earlier than the general population. Support for concerns about physical appearance should be offered.

Diagnostic Yield of Two Gene Panel Assays for Nonacquired Childhood Anterior Segment Diseases

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Introduction: Congenital cataracts and early-onset glaucoma are potentially sight-threatening diseases with high heritability. Next generation sequencing is a cost-effective alternative to individual gene screening. Currently, the diagnostic yield of gene panel assays for these anomalies remains uncertain. Our purpose is to ascertain the diagnostic yield of two such panel assays, and to identified patient characteristics associated with higher diagnostic yield.

Methods: The medical records of consecutive patients who had undergone next generation sequencing using the Early Onset Glaucoma (EOG) gene panel (37 targeted genes), the Congenital Cataract (CC) gene panel (39 targeted genes), or both, at a dedicated biomolecular genetic diagnostic laboratory were analyzed retrospectively. Variants were classified according to guidelines of the American College of Medical Genetics and Genomics.

Results: 105 patients were included. 76 patients underwent the EOG gene panel, 11 (14.5%) had pathogenic or likely pathogenic variants identified. Among 28 glaucoma patients with onset < 3 years of age, 9 (32%) had such variants identified. In contrast, among 48 patients with later onset, 2 (4.2%) had said variants identified (P=0.0015). Having a positive family history of glaucoma did not increase the likelihood of identifying pathogenic variants. The CC gene panel was applied to 22 patients, and 2 (9.1%) patients had pathogenic variants identified.

Conclusion/Relevance: In childhood glaucoma, earlier age of onset is correlated with higher likelihood of having an identified pathogenic variant. The large proportion of unsolved cases with gene panel assays suggest a robust opportunity for gene discovery among both early-onset glaucoma and congenital cataract patients.

**Introduction:** Both primary congenital glaucoma (PCG) and congenital nasolacrimal duct obstruction (CNLDO) present as tearing infants, challenging primary care providers to discriminate accurately between these two diagnoses. The tearing characteristics of PCG and the prevalence of CNLDO in a large cohort of childhood glaucoma patients are reviewed. Pubmed literature review revealed no similar data.

**Methods:** Retrospective review of 18,084 pediatric patients at a major US academic practice over 10 years with 11 providers.

**Results:** 208 (1.15%) patients had a childhood glaucoma diagnosis. 7 of these had a diagnosis of CNLDO or congenital nasolacrimal stenosis (CNLDS). 4 were false artifacts of inaccurate coding. In all 3 remaining cases, mattering began after glaucoma had already been diagnosed, prompting the subsequent diagnosis of CNLDO. The rate of CNLDO in our population of patients with childhood glaucomas was 3/208 (1.4%). In contrast, 28/208 (13.5%) patients were diagnosed with PCG during infancy and presented with: 0 (0%) mattering, 20 (71%) clear tearing, 23 (82%) photophobia, 27 (96%) corneal haze.

**Conclusion/Relevance:** The rate of CNLDO in 208 patients with a childhood glaucoma diagnosis (1.4%) was significantly less than typically cited incidences of 6-20% in the general population (p = 0.0087). 0 cases of PCG presented with mattering while 71% presented with clear tearing. In no cases did mattering mask an underlying diagnosis of glaucoma. Primary care providers should be counseled to consider more urgent referrals to ophthalmology for clear tearing without mattering, especially if associated with photophobia or corneal haze.

**References:**
Elevated Intraocular Pressure and Microvascular Retinal Injury Identified by Overhead Mounted Optical Coherence Tomography (OCT) in Two Infants with Glaucoma

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Introduction: OCT imaging (tabletop and handheld/overhead-mounted methodology) aids in evaluating the optic nerve and retina in children. (1) Glaucomatous optic nerve damage can be described on OCT as an isolated loss of ganglion cells in the macula. (2) Using supine imaging with overhead-mounted OCT, we examined the macula in children with glaucoma, hoping to characterize the pattern of glaucomatous nerve damage.

Methods: Ongoing prospective study of childhood glaucoma patients imaged under anesthesia with overhead mounted HRA+OCT SPECTRALIS with Flex module (FLEX-OCT, Heidelberg, Germany) from 2019-2021.

Results: Two out of 59 children imaged to date had unexpected retinal findings. Case 1: 7-month-old girl with CYP1B1-associated primary congenital glaucoma (PCG) with persistently elevated IOP (~40mmHg) OU despite medical management and prior 360-degree trabeculotomy OS and glaucoma drainage device (GDD) OU. FLEX-OCT demonstrated similar severe atrophic changes in the inner>outer retina of the temporal maculae OS>OD that remained stable on follow-up. Case 2: 20-month-old girl with glaucoma following cataract surgery OD and persistently elevated IOP (40s mmHg) despite medical management and prior trabeculotomy-trabeculectomy, had OCT imaging before GDD surgery. FLEX-OCT demonstrated severe thinning/loss of the inner layers of the temporal macular retina, remaining stable on follow-up.

Conclusion/Relevance: Two young infants with refractory glaucoma of different etiologies and initially highly elevated IOPs demonstrated similar findings on FLEX-OCT consistent with microvascular injury to the macula and possible Paracentral Acute Middle Maculopathy (PAMM). PAMM has been reported in one adolescent with PCG. (3) Retinal pathology identified on FLEX-OCT imaging in infant-onset glucomas may improve our understanding and ultimately treatment of these diseases.

**Introduction:** Children with uveitis are at increased risk for developing glaucoma secondary to the effects of inflammation and corticosteroid use. They require frequent follow-up to monitor intraocular pressure (IOP). The COVID-19 pandemic forced remote monitoring and telemedicine to reduce in-clinic patient volumes and disease transmission. This study investigates the impact of home tonometry on frequency of patient visits and management decisions.

**Methods:** Children (< 18 years) with uveitis were prospectively recruited for remote monitoring of IOP using the home iCareTM tonometer if they had a diagnosis of glaucoma suspect, glaucoma, or were on high frequency topical corticosteroids. Parents or children were trained to measure IOPs twice daily and continued until IOP had stabilized or topical corticosteroids had been tapered. Clinical data included patients’ demographics, uveitis diagnosis, indications for home-monitoring, and local and/or systemic treatment. We analyzed clinical management decisions, impact on visit frequency, and travel mileage.

**Results:** Nine patients (12.3±3.6 years) with uveitis were included and monitored an average of 13.1±7.8 weeks. Average patient visit frequency were 7.1±5.3 (0.55 visits/week), and an average of 3.1±2.6 visits/person were deferred. 101.7±87.3 miles of travel was avoided. Glaucoma medications were changed in 3/9 in clinic, and in 6/9 patients remotely. An urgent visit was needed for one patient. Local and systemic IMT was changed based on remote monitoring in 2 patients. Medical management changed in 6/9 patients.

**Conclusion/Relevance:** In patients with uveitis and suspicion or risk of glaucoma and ocular hypertension, home tonometry can be used to aid in management decisions and to defer in-person appointments.

**References:** Mali et al., Home tonometry in childhood glaucoma: clinical indications and physician and parental attitudes. JAAPOS 2018, 22, 4, p 319-321.
Introduction: To assess current practice patterns of topical hypotensive medication usage in childhood glaucoma.

Methods: Clinical records of pediatric patients with glaucoma and ocular hypertension treated between 2008 and 2019 at University of Illinois at Chicago were retrospectively reviewed. Data collected included age at the time of presentation, gender, type of glaucoma, and glaucoma treatment modalities employed. Types of hypotensive medications prescribed and frequency of drop instillation per day were recorded for each patient. Univariate analysis and cross-tabulations were used to describe current medication practice patterns.

Results: 174 eyes of 102 patients (58M/44F) were included in the study. The mean age at the time of initial presentation was 5.5±4.3 years and the mean follow-up interval was 4.2±2.6 years. The three most common glaucoma diagnoses were glaucoma following cataract surgery (20.1%), primary congenital glaucoma (19.5%), and glaucoma associated with non-acquired ocular anomalies (19.5%). The majority (n=122; 70.1%) of eyes were on ≥1 medication for chronic glaucoma treatment; beta-blockers (109 [62.6%] eyes), prostaglandin analogues (100 [57.5%] eyes) and carbonic anhydrase inhibitors (102 [58.6%] eyes) were the three most preferred hypotensive glaucoma medications for long-term management of pediatric glaucoma. Overall, 62.3% patients required ≥ instillations of glaucoma drops/day.

Conclusion/Relevance: Beta-blockers and prostaglandin analogues are currently the most frequently prescribed medications for pediatric glaucoma. The majority of pediatric glaucoma patients still require polytherapy for long-term care. Penetration of new medications into this population is limited.

References:
An Analysis of the Socioeconomic Factors Impacting the Provision of Care to the Pediatric Glaucoma Population at a Single Center

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Introduction: Recent studies have shown that socioeconomic factors (SES) can determine care provision for several conditions. Large disparities in the receipt of glaucoma testing related to the health insurance carrier in adults has been shown (Elam et al 2017). There is limited research of the disparities of the receipt of care in Pediatric Ophthalmology, namely for pediatric glaucoma. Prior work has suggested follow-up following strabismus surgery is impacted by SES (Daly 2021). In this study, we aim to identify any disparities in pediatric glaucoma care related to SES.

Methods: Single center retrospective longitudinal cohort study, deemed exempt by Institutional Review Board. Inclusion criteria was all pediatric patients with ICD 9/10 coded diagnosis related to pediatric glaucoma. Frequency of appointments, drop and glasses compliance, and completion of ancillary tests were recorded, as well as demographic information. Data was compiled using the institution wide electronic health record.

Results: 43 patients were identified with a diagnosis of pediatric glaucoma on initial dataset of patients seen within the preceding 3 months. Age of diagnosis ranged from 10 days to 14 years. 51% of this cohort had a diagnosis of secondary glaucoma. High levels of appointment no shows were related to insurance carrier, race, and medical co-morbidities. There was not a direct correlation between ancillary testing, examination under anesthesia and SES.

Conclusion/Relevance: Appointment no shows are related to socioeconomic factors, unlike ancillary testing, on this initial analysis. We anticipate further data acquisition to provide a more comprehensive picture of the impact of SES on glaucoma care in pediatric patients.

**Childhood Glaucoma Profile in a Tertiary Centre in Egypt According to the Childhood Glaucoma Research Network Classification**

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**Introduction:** To describe the prevalence and clinical characteristics of a large cohort of childhood glaucoma patients that presented to a tertiary Egyptian children’s hospital using the childhood glaucoma research network (CGRN) classification.

**Methods:** A retrospective review of the medical records of all patients \(\leq 14\) years with a diagnosis of childhood glaucoma or glaucoma suspects who presented to Cairo University Children’s Hospital between January 2014 to December 2019 was conducted. Data collected included age at time of diagnosis, gender, laterality, prenatal history, parental history, including consanguinity, intraocular pressure, horizontal corneal diameter, and cup to disc ratio.

**Results:** A total of 1113 eyes of 652 patients with diagnosis of either childhood glaucoma or glaucoma suspects were included in the study. Six hundred and sixteen patients (94%) were born full term. A history of positive parental consanguinity was identified in 334 patients (51.2%). Almost 60% of patients were males. Primary congenital glaucoma (PCG) was the most prevalent diagnosis (68.2%), followed by glaucoma suspects (10.4%) and glaucoma following cataract surgery (GFCS) (8.4%). Juvenile open angle glaucoma was the least prevalent category (0.3%). Other categories including glaucoma associated with non-acquired systemic disease, glaucoma associated with non-acquired ocular disease and glaucoma associated with acquired conditions represented 5.8%, 4.7% and 1.9%, respectively.

**Conclusion/Relevance:** PCG is the most common form of glaucoma in Egypt and is mostly bilateral and male predominant. More than half of the pediatric glaucoma patients had a positive history of parents’ consanguinity.

**References:**
Astigmatism and Strabismus Following Glaucoma Surgery in Children

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Introduction: This study evaluated the prevalence of strabismus and astigmatism following glaucoma surgery in a pediatric population.

Methods: We reviewed records of children who underwent glaucoma surgery at Carmel Medical Center, Haifa, Israel (2004-2021). Included were patients <18 years of age at the time of surgery and with >6 months follow-up. Eyes were divided into two groups according to the surgical interventions they had: Ahmed Glaucoma Valve (AGV) implantation as a primary or late procedure (group A) and other surgical interventions such as trabeculotomy or trabeculectomy (group B). Main outcome measures were: prevalence of >1.5D astigmatism, strabismus and best corrected visual acuity (BCVA).

Results: The study included 235 eyes (150 children) of which 45.9% were in group A. 136 children had information regarding eye alignment of which 30.6% had strabismus. Severe visual loss was found to be a significant risk factor for strabismus (p=0.03) however, AGV implantation (p=0.29) and number of surgeries (p=0.09) were not. Only 4 children had restrictive strabismus following AGV implantation. Mean astigmatism was -2.21±0.51D in group A and -2.2±0.18D in group B (p=0.53). There was no difference in the prevalence of >1.5D astigmatism between the groups (p=0.43). Data on visual acuity was available for 154 eyes, mean BCVA for was 0.6 ±0.43LogMar.

Conclusion/Relevance: Pediatric glaucoma patients who undergo glaucoma surgeries are at an increased risk for strabismus and astigmatism. Severe visual loss is the main risk factor for strabismus in these patients.

Epidemiology of Extraocular Muscle Palsies and Internal Ophthalmoplegia after Herpes Zoster Ophthalmicus

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Introduction: Herpes Zoster Ophthalmicus (HZO) is more frequently seen in older and immunocompromised patients. Uncommon associated manifestations include external and internal ophthalmoplegia which are rarely symptomatic.

Purpose: To analyze the presentation and course of patients with acute onset symptomatic ophthalmoplegia secondary to HZO

Methods: A retrospective study including all consecutive patients diagnosed with acutely acquired ophthalmoplegia associated to a HZO infection. All patients underwent a complete ophthalmological, systemic and neuroradiology examination.

Results: Ten patients with a mean age of 68 +/- 16.5 years were included. Six patients had 6th nerve palsy, 2 had 3rd nerve palsy, 1 presented with a 4th nerve palsy and one patient had complete ophthalmoplegia. All patients had unilateral involvement. Five patients had sluggish dilated pupils. No patient was immunocompromised. All patients were treated with antivirals and prednisone. Complete motility recovery was seen in 9/10 patients within the next 3 to 12 months, but pupillary defects persisted in all patients.

Conclusion/Relevance: Herpes zoster associated ophthalmoplegia can affected all oculomotor nerves with a preference for cranial nerve 6th. Unilateral involvement appear to be more common. Half of patients present with pupillary abnormalities. This complication does not seem associated to immunosuppression. Motility disorders associated with HZO have good prognosis with complete recovery, but it can take several months. Persistent pupillary abnormalities is common. This may indicate a different sensitivity to damage between motor nerves and the ciliary ganglion.

References:
Radiological Findings in Patients with Isolated Acute-Onset Ocular Motility Disorders (AOMD)

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Introduction: To image or not to image is a critical question in the management of patients with isolated acute-onset ocular motility disorders (AOMD), without any neurological symptoms. Imaging may help in diagnosis; but is associated with risks and costs.

Methods: A retrospective review of patient charts with isolated AOMD (<3 months onset), who were examined by an Ophthalmologist and referred for imaging at a tertiary-care centre between December 2019-May 2021, was conducted. Ophthalmology exam and diagnostic imaging findings were recorded. Radiological findings were classified as 'clinically relevant', 'non-relevant', and 'normal/no positive' findings.

Results: 50 patients met inclusion criteria (3-91 years, 28M and 22F). Symptoms commonly reported were diplopia (41/50, 82%), noticeable eye drift (4/50, 8%), oscillopsia (2/50, 4%). 19 were clinically classified as nerve palsy (1 third, 10 fourth, and 8 sixth nerve), 5 acute-onset exotropia, 14 acute-onset esotropia, 7 vertical strabismus inconsistent with nerve palsy, 2 acute-onset nystagmus, and 3 limitation of elevation/suspected dorsal midbrain syndrome. We found 9/50 (18%) with clinically relevant imaging findings [1/8 (13%) of sixth nerve palsy (mass), 3/3 (100%) of suspected dorsal midbrain syndrome (mass/aneurysm/infarct), 2/14 (14%) of acute-onset esotropia (Chiari malformation/ischemia), and 3/7 (43%) of the acute-onset vertical strabismus (signs of thyroid ophthalmopathy)].

Conclusion/Relevance: Positive neuro-imaging findings may be seen even in patients with apparently isolated ocular symptoms/signs. Certain diagnostic entities are more likely to be associated with positive imaging. This data may help clinicians and institutions with decision-making and policy formulation with respect to ordering of imaging for patients with isolated AOMD.

Long-Term Visual Outcomes in Spasmus Nutans

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Introduction: Long-term visual outcomes data for patients with spasmus nutans are varied, and the etiology is poorly understood. How deprivation from the oscillatory movements of the eye, refractive error, and/or strabismus contribute to visual prognosis needs clarification. The purpose of the study is to characterize visual outcomes and highlight underlying etiologies which may impact visual function in these patients.

Methods: We retrospectively reviewed the charts of the 32 patients diagnosed with spasmus nutans between 2000-2020. Nine patients with only one examination were excluded from statistical analysis. Demographic information, ophthalmic characteristics, and neuroimaging results were compared.

Results: Mean follow-up period was 66 +/- 62 months. Mean age of diagnosis and resolution were 17 +/- 13 months and 48 +/- 29 months respectively. Nine patients were female, and six patients had Down syndrome. All 23 patients had nystagmus, 22 had head bobbing and 13 patients had ocular torticollis. At the baseline exam, 6/23 (26%) had an amblyogenic refractive error, compared to 17/20 (85%) of patients at the final exam. Best-corrected visual acuity in the better seeing eye was 0.77 (range 0.18-1.4) LogMAR at baseline and 0.48 (range 0 to 1.7) LogMAR at the final exam. At the final exam, 12 patients had measurable stereopsis and 8 had strabismus with 3 undergoing strabismus surgery. Eight patients developed amblyopia.

Conclusion/Relevance: Patients with spasmus nutans may have a higher prevalence of amblyogenic refractive error, strabismus and amblyopia as previously thought and thus may benefit from ophthalmic follow-up throughout childhood.

Demographic and Clinical Characteristics of 600 Children With Nystagmus

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Introduction: We report on the characteristics of a large, international cohort of childhood patients with nystagmus.

Methods: This is a prospective analysis of demographic and clinical characteristics in 600 patients with nystagmus in childhood. Data included: 1) demography, 2) nystagmus type, 3) clinical characteristics, 4) associated ophthalmic and 5) non-ophthalmic conditions, 6) special testing findings and 7) treatments.

Results: Between 2010-20, 1,774 patients from 35 states and 26 countries with nystagmus were evaluated. 600 children's data were collected prospectively as part of an IRB approved registry. Age < 18 yrs (mean 15.2 yrs), 58% female, 35% were other than Caucasian, 75% had infantile nystagmus syndrome, 18% had acquired nystagmus, 6% had fusion maldevelopment nystagmus syndrome, 81% had strabismus, 52% had an anomalous head posture, 92% had a significant refractive error, 74% had associated ophthalmic abnormalities (excluding ammetropia), 63% had systemic condition (most commonly albinism in 35%). Special testing showed abnormalities of electrophysiological testing and/or imaging (other than eye movement recordings (EMR) in 67%. EMR's clearly differentiated infantile from acquired forms and characterized (a)periodicity and gaze, monocular and vergence changes. Optical, medical or surgical treatments were performed in 95% of patients.

Conclusion/Relevance: The prevalence of nystagmus in is estimated to be 14-24/10,000. Although nystagmus can result from a variety of conditions, EMR's can provide a path towards accurate diagnosis and classification. There is a high prevalence of underlying ocular and/or systemic conditions requiring special testing. Clinical treatments are available and of benefit to a majority of patients.


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Introduction: Atypical anatomy of the visual pathway and cerebral visual impairment (CVI) may be visually devastating, but there are a few reports of remarkable visual acuity despite significant cerebral abnormalities on MRI. 1,2 Visual evoked potentials (VEPs) have been proposed as a method of predicting visual outcome.3

Methods: Patients were identified via the ICD10 code of CVI, cases presented at institutional neuroradiology conferences, and clinical encounters at two academic pediatric ophthalmology offices. A retrospective chart review was performed to identify two samples: Sample A: patients with 20/200 or better VA despite abnormal visual pathways on MRI, Sample B: patients with both flash VEP and preferential looking acuity measurements. Those with pathology anterior to the chiasm that would be expected to affect VA (such as optic nerve hypoplasia or atrophy) were removed from the analysis.

Results: Eight patients were included in Sample A (mean VA = 20/55). Etiology included congenital malformation or hydrocephalus (4), intracranial infarction (3), and infectious encephalitis (1). Ocular co-morbidities included refractive error over ±3 D (2 patients), strabismus (6), and nystagmus (3). Among 23 eyes identified for Sample B, a linear regression showed eyes with normal latency had a 0.314 lower logMAR (p=0.092). A one standard-deviation increase in latency was associated with an increase in logMAR of 0.27.

Conclusion/Relevance: In rare cases, patients may have surprisingly preserved visual acuity despite significant anatomical abnormalities. While this is a small sample, normal latency on VEP was associated with better VA. Multicenter research is needed to examine this potential relationship and can utilize these results for power calculations.

Impact of Strabismus on Vision-Specific Quality of Life in Children with Cortical Visual Impairment

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Introduction: Cortical visual impairment (CVI) is a leading cause of pediatric visual impairment. In CVI, vision is decreased due to damage to post-geniculate visual pathways in the brain. Little is known about vision-specific quality of life (VS-QOL) in children with CVI.

Methods: We prospectively recruited 24 children with CVI between 12 months and 12 years of age. Parents completed the Children's Visual Function Questionnaire (CVFQ) as a proxy measure of VS-QOL. A complete pediatric neuro-ophthalmologic examination was performed, including assessment of visual acuity using a 6-level scale of visual behavior and measurement of strabismus. Participants also underwent an eye tracking session during which grating acuity was measured using preferential looking. Statistical analyses were used to assess the relationships between CVFQ scores and visual acuity (Spearman's correlation coefficient) and CVFQ scores and strabismus (Mann-Whitney test).

Results: The median overall CVFQ score was 0.63 (scores range from 0 to 1, with 0 representing worst QOL). There was no significant correlation between CVFQ scores and visual acuity by clinical assessment (r=0.05, p=0.82) or eye tracking (r=0.13, p=0.56). Strabismus was associated with worse CVFQ scores on Competence (0.42 vs. 0.59, p=0.03) and Family Impact (0.56 vs. 0.79, p=0.0037) subscales. Among patients with a history of strabismus, there was no difference in CVFQ scores among those who had undergone surgery and those who had not.

Conclusion/Relevance: In children with CVI, strabismus had a greater impact on VS-QOL than visual acuity. Longitudinal data are necessary to determine whether VS-QOL improves with treatment of strabismus.

**Functional Goals and Intervention Planning in Children with Cerebral Visual Impairment**  
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**Introduction:** Cerebral Visual Impairment (CVI) is the leading cause of visual impairment in developed countries and is caused by damage to the posterior visual pathways. CVI negatively impacts learning and independence with functional skills. Individuals with CVI benefit from interventions to address functional deficits. However, the nature and severity of deficits varies greatly, making uniform therapeutic intervention guidelines difficult to construct. Additionally, there is a paucity of evidence-based interventions to guide clinicians. Therefore, the aim of this study was to examine functional goals set for children with CVI and their caregivers to inform intervention planning.

**Methods:** This study retrospectively reviewed parent identified occupational and physical therapy goals and therapist planned interventions from the electronic medical records of 56 children with CVI between September 2016 and September 2021.

**Results:** Goals were distributed equally among three categories including, body functions and structures, activities, and participation of the International Classification of Functioning, Disability, and Health (ICF) model. As expected, occupational therapy goals, were more focused on activities and participation including environmental modifications. Physical therapy goals tended to address body structure and function. Overall, children demonstrated progression toward goal achievement within 1 - 2 episodes (6 - 8 sessions per episode) of care.

**Conclusion/Relevance:** Identifying individualized goals and targeted interventions is critical for success in acquisition of new skills, increasing independence, and access to education for children with CVI. This study identifies common goals identified by parents and can help to develop measurable intervention outcomes for this population of children.

The Use of Selumetinib as an Effective Non-Surgical Treatment Option for Pediatric Orbital Plexiform Neurofibroma

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Introduction: Orbital plexiform neurofibromas that occur in patients with neurofibromatosis Type I (NF1) can cause clinically significant proptosis and facial disfigurement that may not always be amenable to surgical intervention. Selumetinib (Koselugo, AstraZeneca) is a mitogen-activated protein kinase (MAPK) kinase (MEK) inhibitor that was recently approved by the FDA for treatment of plexiform neurofibromas in children 2 years of age and older. We report a case of clinically significant orbital plexiform neurofibroma that responded favorably to treatment with selumetinib.

Methods: A 4-year-old male with left orbital plexiform neurofibroma causing significant left-sided proptosis and hypoglobus was no longer tolerating glasses wear for amblyogenic anisometropia due to difficulty keeping the glasses on the face from asymmetric facial morphology. Given the diffusely infiltrative nature of the neurofibroma on neuro-imaging, he was not deemed a suitable candidate for complete surgical removal and started a treatment trial with selumetinib.

Results: The patient was started on 20 mg BID of selumetinib. He tolerated the medication well without side effects for eight months and was noted to have marked clinical improvement of proptosis and hypoglobus before developing a maculopapular rash that prompted dose reduction to 30 mg daily. He subsequently started wearing his glasses again, and now more than 1 year since starting treatment, the patient has best-corrected visual acuities of 20/25-OU. Serial orbital imaging has confirmed decreased bulk of the lesion.

Conclusion/Relevance: This case report corroborates selumetinib as an effective non-surgical treatment for orbital plexiform neurofibromas causing proptosis and facial disfigurement. The treatment was well-tolerated with minimal side effects.

References:


Orbital and Eyelid Characteristics and Strabismus Severity in Children with Apert Syndrome Treated by Early Endoscopic Strip Cranietectomy versus Fronto-Orbital Advancement

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Introduction: Apert syndrome is characterized by craniofacial and orbital abnormalities and associated with V-pattern strabismus.\textsuperscript{1,2} We compare orbital and eyelid characteristics and strabismus severity in Apert patients treated by endoscopic strip cranietomy (ESC) versus fronto-orbital advancement (FOA).

Methods: 26 Apert-syndrome patients presenting to Boston Children's Hospital met inclusion criteria for retrospective cohort study (n = 14 ESC; n = 12 FOA). External photographs taken pre-operatively and post-operatively at ages 1, 3, and 5 years were analyzed using ImageJ (Bethesda, MD). Patients were placed in one of three strabismus severity groups based on change in misalignment from downgaze to upgaze.\textsuperscript{2}

Results: FOA-treated patients had a significantly larger angle of palpebral fissure downslanting in right and left eyes as compared to ESC-treated patients at ages 3 (OD: 9° vs. 3.5°, p = 0.02; OS: 8.2° vs. 3.6°, p = 0.044) and 5 years (OD: 11.5° vs. 3.9°, p = 0.011; OS: 7.8° vs. 5°, p = 0.049). Angle of downslanting correlated with severity of V-pattern strabismus (OD: p = 0.043; OS: p = 0.032). Treatment by FOA versus ESC, was not, however, an independent risk factor of strabismus severity (p = 0.774).

Conclusion/Relevance: Apert patients with greater downslanting of the eyelids are more likely to have severe V-pattern strabismus. It has been previously demonstrated that severe V-pattern in Apert patients correlates with extreme excyclorotation of rectus muscle origins near the orbital apex from bony dysmorphology.\textsuperscript{2} Downslanting of the eyelids may be the anterior correlate. Type of craniofacial repair may not alter this anatomical cause.

References:

Introduction: We sought to determine the prevalence and types of pathogens found in children with orbital cellulitis to inform empiric antibiotic choice.

Methods: Retrospective cohort study of children with imaging-confirmed orbital cellulitis admitted to a children's hospital over 8 years. Primary outcomes included prevalence and types of organisms grown. Secondary outcomes included polymicrobial infection, mixed aerobic-anaerobic infection, and effect of patient age.

Results: Two-hundred-thirty-seven children with orbital cellulitis were studied. One-hundred-twenty-four (52%) had cultures, of whom 55 (44%) had surgical intervention. The remainder (113, 48%) were managed without any cultures. Culture sources included 67 (54%) blood, 63 (51%) sinus/nose, 48 (39%) orbital, 11 (9%) ocular surface, 10 (8%) brain, and 5 (4%) eyelid/skin abscess, with some children having multiple sources. Seventy-two children (58%) had positive cultures, 53 (42%) had no growth. Forty-one (34%) cultures grew streptococcus, 18 (15%) staphylococci sensitive to methicillin (MSSA), 8 (6%) methicillin-resistant Staphylococcus aureus (MRSA), 6 (5%) other aerobic species, 16 (13%) other anaerobic species, 3 (2%) fungal species, and 29 (24%) normal respiratory/skin flora. Thirty (24%) cultures showed polymicrobial infection and 41 (33%) monomicrobial infection. Polymicrobial status and rates of positive anaerobic cultures did not differ significantly with age 1 to 14 years, ranging 41% to 57% and 20% to 30% respectively.

Conclusion/Relevance: A variety of organisms may be cultured from children with orbital cellulitis, but streptococcus and MSSA are most common. MRSA is uncommon, so initial empiric coverage for MRSA is not necessary.

Reduced Carbon Footprint of Virtual 2021 Annual Meeting of AAPOS

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Introduction: Carbon dioxide emissions are the primary driver of climate change, and international medical conferences contribute substantially to greenhouse gas emissions. The reduced carbon footprint of the virtual 2021 Annual Meeting of the American Association for Pediatric Ophthalmology & Strabismus (AAPOS) was calculated.

Methods: The cities and countries of origin for deidentified attendees of the virtual 2021 AAPOS Annual Meeting (scheduled for the Westin Boston Seaport District, Boston, MA, USA) were obtained from AAPOS, and the likely transportation mode was identified from the attendee’s registration. Attendees from New England (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island) were assumed to drive, and driving emissions from the city of origin were calculated using US Environmental Protection Agency’s guidelines on passenger vehicles. For attendees outside New England, flight emissions from the airport closest to the city of origin to Boston Logan Airport were calculated using Flight Emissions Calculator (Offsetters, Vancouver BC, Canada). Emissions were tallied in metric tonnes of CO2 emissions, tonnes CO2e.

Results: 1212 persons attended virtually, saving 1282 metric tonnes of CO2e (1.06 tonnes/attendee), equivalent to the emissions from 264 passenger vehicles driven for one year, or the carbon sequestered by 1485 acres of US forests in one year.

Conclusion/Relevance: The 2021 virtual Annual Meeting saved 1282 tonnes CO2e. AAPOS could consider entirely virtual or hybrid future meetings, both reducing its environmental footprint, and increasing opportunity for both national and international participation and education.

References:
The Ineffectiveness of Referral/Authorizations in Pediatric Ophthalmology Private Practice

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Introduction: For pediatric ophthalmology, triage, staffing, examinations and treatment are greatly influenced by diagnosis. HMO and 'gatekeepers' rely on authorizations/ referrals to schedule the patients. This is under the auspices of not only providing a cost saving mechanism but allowing a more appropriate triage of care. Previous studies have shown difficulties with triage\textsuperscript{1}. This study investigated if authorization/referral diagnosis are acceptable for triage and care.

Methods: Retrospectively analysis of 200 consecutive new visits in a private practice setting. Referring and final diagnosis, additional tests/services, and findings of the comprehensive dilated exam were noted.

Results: 48.5\% (97/200) of referral diagnoses did not match with the final diagnosis. Referral inaccuracy were found to be 43\% (29/67) of strabismus referrals, 62.5\% (5/8) of refractive/amblyopia, 20\% (1/5) of glaucoma referrals, 21.1\% (4/19) of chalazion/hordeolum referrals, and 60.4\% (61/101) of other diagnosis. 22.2\% (44/200) had significant/amblyogenic refractive errors not evident by the referral. 12\% (24/200) had significant strabismus with non-strabismus referrals. 14.5\% (29/200) had no or vague referral diagnosis. 51.5\% (103/200) needed additional tests/procedures, surgery, or intervention not anticipated by the referral, or part of an E/M or exam code. 54\% (108/200) had significant findings warranting a comprehensive/dilated exam.

Conclusion/Relevance: Due to high disparity in referral diagnosis, unexpected significant findings, and frequent need for additional tests/services, authorization/referrals are NOT an accurate way to successfully triage patients. This study strongly supports all new exams to have a comprehensive/dilated exam by a well-trained pediatric eye care provider (pediatric ophthalmologist/optometrist). Open authorizations for comprehensive services would optimize care and minimize disruptions in office flow and financial reimbursement.

An Analysis of Medicaid Reimbursement Trends in Pediatric Ophthalmology in Arizona: Years 2015 to 2021

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Introduction: A paucity of data exists regarding reimbursement trends in pediatric ophthalmology, especially regarding the consequences of national policy enacted to minimize the COVID-19 pandemic's effect on access to healthcare. The purpose of this study was to evaluate monetary trends for common pediatric ophthalmology procedures among the Arizona Medicaid population, compared to Medicare data.

Methods: Publicly available Arizona Medicaid and Medicare Physician Fee Schedules from 2015-2021 were utilized. Collected data included reimbursement for common procedural and non-procedural (examination, imaging) billing codes used in pediatric ophthalmology. Data was adjusted for inflation to 2021 dollars.

Results: From 2015-2020, the inflation-adjusted average Arizona Medicaid and Medicare reimbursement for all procedures decreased by 9% from 2015-2020 (-2% per year) and 12% (-2% per year), respectively. From 2020-2021, average procedural Medicaid reimbursement increased by 11%, while Medicare decreased by 6%. From 2015-2020, average non-procedural Medicaid and Medicare reimbursement decreased by 16% (-3% per year) and 18% (-4% per year), respectively. Average non-procedural Medicaid reimbursement increased by 8% from 2020-2021, while Medicare decreased by 2%. No significant difference was observed between Arizona and national Medicare trends (p>0.05).

Conclusion/Relevance: Arizona Medicaid and Medicare reimbursement steadily decreased from 2015-2020, but Medicaid reimbursement markedly increased from 2020-2021. This reflects a 6.2% increase in federal Medicaid funding to states enacted by Congress in 2020, which will end after the public health emergency.(1) In light of recent decreases in outpatient utilization due to the COVID-19 pandemic, increased awareness of these trends is needed to maintain adequate access to pediatric ophthalmologic care, particularly among Medicaid enrollees.(2,3)

References:
Evaluation of a Combined School-Based Vision Screening and Mobile Clinic Program

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Introduction: Uncorrected refractive error can lead to lowered academic performance.1 Many children depend on state-mandated school vision screening programs. Effective screening programs require follow-up with eye care providers, but studies demonstrate poor follow-up rates after failed screenings.2 Programs have attempted to mediate this issue by providing free examinations and glasses after failed screenings.3 This study presents data from a mobile clinic program that provides instrument-based vision screening, eye examinations, and free glasses directly to children at school.

Methods: Between 2018-2021, a nonprofit organization provided in-school instrument-based screening and non-cycloplegic exams and refractions in elementary, middle, and high schools. Deidentified screening and clinic data were reviewed retrospectively. Information about each school regarding total student enrollment, enrollment based on race, and number of economically disadvantaged students was obtained from the Virginia Department of Education.

Results: From 2018-2021, 132,118 students from 498 schools were screened and 40,413 (30.6%) were referred. The percentage of economically disadvantaged students was positively correlated to referral rate between 2019-2020 (R^2=0.406). Between 2019-2020, the mobile clinic examined 3,149 students from 60 schools. Of these, 72.9% were prescribed glasses and 16.3% were referred for a more comprehensive eye examination and treatment. Students were also diagnosed with cataracts, nystagmus, amblyopia, and strabismus.

Conclusion/Relevance: A combined screening program and mobile clinic traveling directly to schools can provide a pipeline for providing eye care to vulnerable populations.

Non-Cycloplegic Compared with Cycloplegic Refraction in a Chicago School-aged Population

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Introduction: Both cycloplegic and non-cycloplegic refraction are used in school-based vision programs (SBVP). While non-cycloplegic refraction is logistically simpler, questions remain regarding its accuracy for prescription. We evaluated differences between autorefraction measurements with and without cycloplegia.

Methods: In this retrospective analysis, individuals 3 to 22 years evaluated at Illinois College of Optometry's SBVP from September 2016 through June 2019 were included. Autorefraction was performed before and after cycloplegia. Myopia was defined as at least -0.50 diopters (D) spherical equivalent (SE), hyperopia as at least +0.50D SE, and astigmatism as at least 1.00D cylinder. Factors associated with at least 1.00D more hyperopic SE or at least 0.75D cylindrical difference after cycloplegia were assessed using logistic regression models.

Results: Mean age was 10.8±4.0 years for 11119 individuals; 52.4% were females. Mean SE refraction was -0.87±2.11D for non-cycloplegic and -0.23±2.31D for cycloplegic refraction. After adjusting for demographics and refractive error, individuals with hyperopic SE refraction ≥ 1.00D after cycloplegia (25.9%) were more likely <5 years (odds ratio [OR]=1.45, 95% confidence interval [CI]: 1.18 to 1.79) and 5 to <10 years (OR=1.32, 95% CI: 1.18 to 1.48) compared with 10 to <15 years. They were more likely to be Hispanic and hyperopic. Individuals with ≥ 0.75D cylindrical difference (5.1%) were more likely to be <5 years, male, and have mild or greater myopia, or moderate or greater hyperopia.

Conclusion/Relevance: Three quarters of school-aged individuals had less than 1D hyperopic SE difference in refractive error after cycloplegia. Non-cycloplegic refraction in SBVP could be cautiously considered with measures to prevent over-minusing.

Demographic and Clinical Data from a High School-Based Eye Clinic in Southeastern Michigan

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Introduction: There are socioeconomic and racial disparities in access to pediatric eye care. School-based clinics may improve access, but there are few reports of high school-based eye clinics. A pediatric optometrist holds a biweekly clinic at a local high school in a community with high rates of poverty. We performed a retrospective analysis of clinical and demographic data to design interventions to improve care.

Methods: Students received comprehensive eye exams. We collected demographic and ocular data from 429 initial visits 2/2015-7/2019. Follow ups were excluded. Statistical analysis was performed using SAS 9.4.

Results: Average student age was 14.2±2.7 years. 55.7% were female and 59.7% were Black. 61.6% had Medicaid. 70.2% had a previous eye exam. There was no relationship between insurance or race and prior exam. Medical eye concerns included 8.7% with amblyopia and one student with a cataract. 56.0% had myopia; 31.9% had hyperopia. 61.3% wore glasses previously; 24.1% still wore glasses. 56.9% of former glasses wearers reported lost or broken glasses. There was no difference in prior glasses by insurance or race. 21.9% had presenting visual acuity (PVA) worse than 20/40 in both eyes. Black students had significantly worse PVA in the better seeing eye than White students (logMAR PVA 0.22 vs 0.13, P=0.0004), but there was no difference in PVA based on insurance status. 74.0% received glasses following the exam. 58.7% had visual acuity improvement of 2 or more lines; 62.7% of Black patients had 2 or more line improvement compared to 42.9% of White patients (P=0.01). 21 students required referral to ophthalmologists; 61.9% attended the appointment, 14.3% scheduled but no-showed, and 23.8% never scheduled.

Conclusion/Relevance: The high school-based clinic identified important pathology including high rates of uncorrected refractive error, highlighting the benefit of a high school-based eye clinic in a population with high rates of poverty. There were concerning racial disparities in PVA. Loss to follow up must be addressed.

Caregiver Perceptions of the Early COVID-19 Pandemic Rescheduling Process at One Academic Pediatric Ophthalmology Practice

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Introduction: The American Academy of Ophthalmology’s recommendation to provide only urgent/emergent care during the COVID-19 pandemic¹ resulted in high-volume appointment cancellations. We aim to evaluate how the rescheduling process at one academic medical center’s pediatric ophthalmology clinic was perceived by caregivers and to identify factors contributing to caregiver satisfaction, attitudes toward alternative appointments, and perception of patient harm.

Methods: Caregivers of children whose pediatric ophthalmology appointment was cancelled during the early pandemic, 3/18-5/18/2020, were recruited via telephone consent to complete an 18-question, 10-point Likert scale, anonymous online survey.

Results: 110/484(23%) of respondents completed the survey. Most were rescheduled <7months from the original date (25%-%4wks, 23%-5wks-3mos, 36%-4-6mos, 16%-7mos, p=0.003). Of the ocular diagnoses rescheduled, 41% were low acuity, 50% moderate, and 9% high, which correlated to the length of time to reschedule (57% high acuity-%4wks, 74% low acuity-%4mos, p=0.006). There was no difference in willingness to accept alternative appointments between new (n=95) versus established (n=15) patients, (phone call: p=0.555, audio-visual telemedicine: p=0.403). Overall frustration with rescheduling was low (mean: 2.61+/-2.91) and was higher in those with a longer interval to reschedule (%4wks %7mos p=0.0419, 5wks-3mos vs. %7mos p=0.019). Perception of harm caused by delay in care was most associated with length of time to reschedule (p=0.006).

Conclusion: Overall caregiver frustration towards the rescheduling process was low at one academic medical center’s pediatric ophthalmology clinic during the early COVID-19 pandemic. Survey results suggest that more interpersonal methods of patient examination/communication such as audio-visual telemedicine or transfer to another provider were preferred over audio-only telemedicine.

References:
The Incidence and Characteristics of Pediatric Traumatic Hyphema Presenting during the COVID-19 Pandemic

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Introduction: To analyze the clinical and epidemiologic trends of pediatric traumatic hyphema presenting during the COVID-19 pandemic era.

Methods: A single-center retrospective cohort study of all pediatric patients aged 21 or under diagnosed with traumatic hyphema. The incidence of traumatic hyphema presenting during the COVID-19 pandemic time periods of heavy restrictions (group 1) and loosened restrictions (group 2) were compared with similar control time periods pre-pandemic (group 3 and 4, respectively). Patient’s demographics, BCVA, IOP, need for IOP-lowering therapy, hyphema characteristics, and complications were subsequently analyzed.

Results: A total of 23 cases were identified in the aforementioned time-period, with 5 patients in group 1, 6 in group 2, 11 in group 3, and 1 in group 4. The overall incidence of traumatic hyphema was 0.63 cases-per-month. For groups 1-4 the incidence was 0.35, 1.55, 0.77, and 0.26 respectively. During the COVID-19 pandemic, the incidence rate ratio (IRR) was 4.44 (95% CI: 1.35, 14.54, p = <0.01 when the loosened (group 2) and the heavy (group 1) restrictions time-period were compared. Group 1 vs. group 3 IRR was 0.45 (95% CI: 0.16, 1.31, p = 0.13). Group 2 vs. group 4 IRR was 6.00 (95% CI: 0.72, 49.84, p = 0.06).

Conclusion/Relevance: There was an increased incidence of traumatic hyphemas following loosened COVID-19 restrictions. While the cause for this is unknown, prevention is possible through education on proper supervision, age-appropriate toys, and use of safety glasses. The public should be made aware of the importance of these measures.

Synchronous Patient-to-Provider Virtual Visits in Pediatric Ophthalmology During the Early COVID-19 Pandemic

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Introduction: COVID-19 catalyzed an unprecedented volume of US telemedicine in 2020. Synchronous patient-to-provider virtual visits (SPPVV) were deployed in our practice.

Methods: Retrospective review of 1,466 clinic encounters (April - May 2019) and 336 SPPVVs (April - May 2020 during the initial wave of the pandemic) at an academic pediatric ophthalmology practice. Characteristics were summarized using counts and rates or means and standard deviations, and compared between cohorts using the chi-square test for association or the two-sample t-test. Data are noted as '2019 clinic data; 2020 SPPVV data; p-value'.

Results: There was no difference in patient gender (female: 51.6%; 51.2%; p=0.88). Significant demographic differences included race (White: 60.3%; 67.3%; p=0.021), ethnicity (not Hispanic/Latinx: 76.1%; 83%; p=0.004), language (English: 82.1%; 89.9%; p=0.002), and provider (ophthalmologist, optometrist, orthoptist, respectively: 67%, 21.6%, 11.3%; 92.3%, 7.7%, 0%; p<0.001). Of 20 exam elements, mean (SD) number obtained varied (16.11 (4.16); 8.24 (2.55); p<0.001) including visual acuity (98%; 92%; p<0.001), primary gaze alignment at distance (77.8%; 6.2%; p<0.001) and eccentric gaze (34.2-37.9%; 1.2-3.3%; p<0.001). Alignment at near was equally documented (85.8%; 86%; p=1). Motility documentation frequency varied (92.8%; 87.7%; p=0.004). SPPVVs never included CVF, IOP, or fundoscopy. CPT coding (E&M: 31.2%; 100%; p<0.001) and ancillary testing frequency (2.8-55%; 0%; p<0.001) varied.

Conclusion/Relevance: Access to SPPVVs favored White, non-Hispanic/Latinx, and English-speaking patients. Lack of orthoptist-only SPPVVs reflects telemedicine policy. Incomplete examination and ancillary testing reflect technology limitations. Inclusive policies, payment models, and point-of-care technologies may improve quality and decrease cost. Further research on patient outcomes and care inequities is forthcoming.


Integrating Telemedicine into the Post-Operative Experience for Children and Adults

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Introduction: Telemedicine offers significant convenience for patients, but has been traditionally challenging to offer for ophthalmologists. This study describes our experience in utilizing telemedicine for strabismus post-operative visits.

Methods: This is a retrospective chart review of 153 patients undergoing strabismus surgery between 3/17/2020-12/9/21 by a single surgeon. (Data collection is ongoing). Prior to surgery, patients/caregivers were given the option to complete their first post-operative visit via telemedicine or in-person. For televisits, synchronous exams were performed using Doximity Dialer Video. If video calling was unavailable, asynchronous exams were performed via secure email and phone. A questionnaire was provided to the patient/caregiver at their next in-person exam to determine overall satisfaction, ease, and interest in future televisits. Patients/caregivers were invited to include additional comments.

Results: Of 153 subjects (77 <18yo; 76 >/=18yo at time of surgery), 39 (25%) opted for a televisit (25 <18yo; 14 >/=18yo); 21 evaluated synchronously and 18 evaluated asynchronously. 100% of patients/caregivers reported satisfaction with their visit. All reported it was easy to complete, and all reported interest in participating in additional telemedicine visits.

Conclusion/Relevance: Discussion: Patients/caregivers were uniformly satisfied by their telemedicine post-operative exams. Patient/caregiver comments highlight the convenience and improved access to care for those with difficulty traveling to exams or with health risk-factors.
Conclusion: First post-operative visits following strabismus surgery can be performed via telemedicine. Patients and families reported high satisfaction with televisits, and there is patient/caregiver interest in expanding options for telemedicine.

References:
Evaluation of Video Glasses for Real-Time Hardware-to-Software Telemedicine Strabismus Consultations Across Multiple Graders

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Introduction: While Pivothead® glasses have been shown to be an effective tool for real-time pediatric strabismus telemedicine consultations, high cost of the Polycom hardware-to-hardware conferencing system and bandwidth limitations may present barriers to accessibility and widespread adoption. This study evaluates the use of Pivothead® glasses with a more affordable Polycom hardware-to-software system for real-time strabismus consultations across multiple graders.

Methods: A pediatric ophthalmologist (Grader 1) wearing Pivothead® Smart Series glasses simultaneously performed and recorded strabismus examinations in primary gaze, with and without correction, both at distance and near. Recorded parameters included strabismus category, angle measurements, and ocular motility. Three years later, four pediatric ophthalmologists (Graders 1-4) reviewed and graded streamed video feed transmitted at 1 Mbps from a Polycom codec to software. Agreement between streamed and gold standard in-person findings was determined by weighted kappa (κ) for categorical variables, intraclass coefficient (ICC) for continuous variables, and percent agreement.

Results: Eighteen patients aged 4-11 years (median, 7 years) were included. Agreement between in-person and streamed examinations was perfect for both horizontal and vertical deviations (κ=1.0). Almost perfect agreement was found for degree manifest (tropia vs intermittent tropia vs phoria) across graders (κ=0.91, range 0.86-0.97). Agreement for angle measurements was excellent across graders (ICC=0.97, range 0.97-0.98). Extraocular motility agreement was 90% for all graders combined, with Grader 1 having 100% agreement between her in-person and streamed examinations.

Conclusion/Relevance: Video feed from Pivothead® glasses streamed through a Polycom hardware-to-software system at 1 Mbps is a reliable tool for real-time pediatric strabismus telemedicine evaluations.

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Ultra-Wide-Field Oral Fluorescein Angiography in Children

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Introduction: Ultra-wide-field fluorescein angiography (UWFA) has been used with intravenous fluorescein, largely in adults. We describe our experience using an oral UWFA protocol in our pediatric population.

Methods: A retrospective chart review of patients undergoing oral UWFA using a dedicated evidence based protocol between November 1st 2018 until October 31st 2021 was undertaken. The following details were gleaned from the patient charts: age at time of oral UWFA, indication for oral UWFA, adverse side effects, need to stop the test, adherence to protocol, effect of deviation from protocol, and quality of images for clinical decision making.

Results: A total of 47 patients with 70 examinations were found to have had oral UWFA. The mean age at the time of examination was 12 years (range 3-21). 49% were female. There was a wide range of indications for UWFA including uveitis, sickle cell disease, optic nerve pathology, retinal dystrophy and vitreoretinopathy. One child developed an urticarial rash 4 hours post FA but was able to have subsequent FA with a regimen of antihistamine prior to examination. Three children had mild transient nausea or dizziness which did not require cessation of the exam. Deviation from fasting time (less than that required by protocol) prior to oral UWFA in one case resulted in poor images.

Conclusion/Relevance: Ultra-wide-field oral fluorescein angiography is safe and negates the need for IV access. The quality of images was adequate in aiding clinical decision making when the protocol was adhered to.

Evidence-Based Screening to Optimize the Yield of Positive Ophthalmologic Examinations in Children Evaluated for Non-accidental Trauma

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Introduction: Non-accidental trauma (NAT) examinations in children are not entirely benign and preclude neurological examination. The majority of ophthalmic exams routinely ordered for patients suspected of NAT are negative. Our study elucidates clinical and imaging factors that correlate to retinal findings to increase the yield of positive exams and decrease the burden of potentially unnecessary exams, validating previous studies and introducing new screening variables.

Methods: Retrospective chart review from May 2014 - August 2021 at a level-1 trauma center. 274 patients met inclusion criteria: 1) Children <= 36-months-old 2) Concern for NAT 3) Ophthalmology consult placed. Through univariate and multivariate logistic regression, our study produces a screening algorithm for ophthalmic workup in NAT.

Results: Due to a strong association of “abnormal neuroimaging” and retinal hemorrhage (RH) (OR of 170 (95% CI (10.245, >999.999)), multivariate logistic regression controlling for “abnormal neuroimaging” was performed to analyze all variables associated with RH. 1 or more abnormal neuroimaging findings had a statistically significant association with retinal hemorrhages and produced the strongest association with a univariate OR of 170. The multivariate model (p-value<0.0001 with a c-statistic of 0.980) proposes using the following variables for predicting retinal hemorrhage on exam: Abnormal neuroimaging, Glasgow coma score (GSC) < 15, altered mental status on examination, seizure activity, vomiting, burising, scalp hematoma/swelling, and skull fractures.

Conclusion/Relevance: If neuroimaging is obtained in the evaluation of suspected NAT, the yield of positive ophthalmologic findings would increase if certain non-ocular findings are present. If absent, ophthalmologic exams may not be necessary.

Distinguishing Traumatic Optical Coherence Tomography Findings in Young Children

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Introduction: We sought to compare optical coherence tomography (OCT) findings associated with medical, ocular, and traumatic causes in infants and young children to identify findings that suggest head trauma.

Methods: OCT images were obtained from 205 children under age 3 years as part of their clinical care and read by pediatric, retinal, and neuro ophthalmologists with expertise in OCT interpretation. Each child was categorized based on their underlying disease process, and OCT findings were compared across groups to identify distinguishing signs.

Results: Among 205 children, 93 had retinal disease, 30 systemic syndrome, 29 nystagmus, 22 optic nerve abnormality or glaucoma, 10 increased intracranial pressure, 2 hypoxia, and 17 head trauma diagnosable based on non-ocular findings. Distinguishing OCT and retinal examination findings were identified for each category. OCT findings associated with head trauma included vitreomacular traction, vitreous separation, and inner-retinal hyper-reflective areas, all of which were not seen in other conditions; as well as retinoschisis and retinal hemorrhage. Retinoschisis was observed in retinal degenerations and X-linked retinoschisis, but these conditions were distinguishable from trauma by other diagnostic retinal examination findings and the absence of intracranial hemorrhage, which was present in head trauma.

Conclusion/Relevance: OCT findings that distinguish head trauma from medial and non-traumatic ocular diseases were identified and may be considered alongside other physical examination and imaging findings in child abuse evaluations. Future study is needed to better understand the specificity of OCT findings for the type and magnitude of biomechanical forces involved in head trauma in infants and young children.

OCT Fixation Shift in Children with Foveal Hypoplasia

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Introduction: We have reported the utility of optical coherence tomography (OCT) in the quantification of eccentric fixation in amblyopic children. (Jin et al, 2020) This study reported OCT-defined eccentric fixation characteristics in a larger cohort of children with foveal hypoplasia.

Methods: Three groups of children (4-17YR) were enrolled. 1) Full-term foveal hypoplasia (FH) Group (N=56), with or without diseases associated, 2) Preterm foveal hypoplasia (PH) Group, (gestational age<31 Weeks, N=57), 3) Control Group (N=54) were age-matched full-term born children without foveal hypoplasia. A spectral-domain OCT volume scan was obtained with the participant focusing on an internal target. Using cross-sectional OCT images, fixation shift, the distance between the fovea and the fixation point, was measured and converted into the visual degree. The OCT fixation shift of the right eye of three groups was compared using the ANOVA test.

Results: The mean fixation shift was 1.06±1.46deg in the FH group, 0.84±1.77deg in the PH group, 0.21±0.31deg in the Control Group (F=5.8, P<0.01). There is no significant difference between the FH and the PH groups (P=0.66). Fixation shift in the FH group significantly correlated with the best-corrected visual acuity (R=0.70, P<0.001); fixation shift in the PH group significantly correlated with the best-corrected visual acuity (R=0.44, P<0.001).

Conclusion/Relevance: OCT fixation shifts in both hypoplasia groups are significantly larger than in the control group; it is associated with visual acuity deficit. OCT fixation shift is useful in the quantification of eccentric fixation in patients with foveal hypoplasia.

Comparison of Sickle Cell Retinopathy Progression using Funduscopy and SD-OCT

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Introduction: Sickle retinopathy often begins during childhood, and its occurrence increases with age. We monitored retinal changes over time in children with sickle cell disease (SCD) using funduscopy and OCT.

Methods: Between September 2015 – August 2021, 87 patients (48 females, age 5.2 to 19.6 years) with SCD (58 SS, 23 SC, 3 Sß+, 3 Sß0) underwent more than one eye examination, including dilated funduscopy and macular OCT. Average interval between examinations 1.60 ± 0.88 years (0.51 – 4.81). Results were compared.

Results: Initial examinations in patients aged 11.5 ± 3.9 years, revealed retinopathy by funduscopy in 10 patients (11.5%) and OCT in 51 patients (58.6%), (Chi-squared = 42.1, p<0.001). Nine of 10 patients with abnormal funduscopy on initial exam also had initial abnormal OCT. At follow-up, 7 patients (8%), had new funduscopy findings and 16 (18%) exhibited worsening retinal OCT (Chi-square = 4.06, p = 0.04). Five of 7 patients with new funduscopy findings had abnormal OCT 1.1 - 3.4 years earlier, 2 patients showed new changes on both funduscopy and OCT at the same follow-up visit. Of 16 patients with progressive retinopathy by OCT, 5 had normal bilateral OCT and funduscopy initially, 2 progressed from unilateral to bilateral disease, and 9 demonstrated enlarged areas of inner retinal thinning. Nine of 17 patients had abnormal initial/follow-up funduscopy had subsequent normal examination.

Conclusion/Relevance: SCD fundoscopic changes may be transient. OCT detects irreversible retinal damage due to ischemia. In comparison to fundoscopy, OCT detects SCD retinal change earlier. Findings are consistent between exams and allow quantification of damage.

Visual Outcomes and Retinal Characteristics in Children with Myelinated Retinal Nerve Fibers, Myopia and Amblyopia

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Introduction: Myelinated retinal nerve fibers are a rare congenital developmental anomaly, which may be associated with high myopia and resulting severe amblyopia in unilateral cases. Early detection, refractive correction, and amblyopia treatment can result in improvement of visual function in cases without optic nerve hypoplasia. Limited data regarding macular thickness and lamination are available in such children.

Methods: Case Series. Data of five children were included in the retrospective chart review with a follow-up period between 2 months and 10 years.

Results: Age at first diagnoses varied between 8 months and 4 years. Best corrected visual acuity (BCVA) ranged from no fixation to objects to 0.1 at near at first visit. Myopia in the eye with myelinated retinal nerve fibers was documented between 4.6 and 13.0 dpt spherical equivalent (SE) resulting in an anisometropia of 6.1 to 11.5 dpt SE. Refractive correction and consequent patching therapy resulted in a significant improvement of BCVA: 0.16 to 0.4 at near, 0.3 to 0.6 at distance. Retinal structure analysis using OCT in two patients imaged revealed normal retinal lamination of the macula and slightly thicker central retinal thickness in the affected eye. Both children showed a favorable visual outcome from no central fixation and 0.05 to 0.4 at near after strict patching regime.

Conclusion/Relevance: Persistent amblyopia treatment result in favorable visual development in children diagnosed early with unilateral myelinated retinal nerve fibers, myopia, and amblyopia. Macular structure does not appear to be a limiting factor in visual development in affected children.

Laser Prophylaxis in Patients with Stickler Syndrome

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Introduction: Stickler syndrome (SS) is an inherited, progressive collagenopathy that is the leading cause of pediatric retinal tears and detachments (RD). The purpose of this study is to compare the visual acuity (VA) and odds of RD among patients with SS who received prophylactic laser to those who did not.

Methods: A retrospective chart review included patients with SS at Retina Consultants Ltd between 1/1/2006 and 10/6/2020. Our pattern of laser has been to treat from the ora serrata to the equator 360, which we term EVBL. Eyes that had undergone laser prophylaxis, but which did not follow this pattern, were termed non-protocol laser (NPL). Eyes with RD on presentation were included in the study. Statistical significance was defined as P-value < 0.05.

Results: 230 eyes of 115 patients were included in this study. 59 patients were female (51%). The median age at laser prophylaxis was 9.5 years old (6-13), and the median age of patients with RD was 11 years old (7-18). 92 of those eyes did not undergo any laser, 9 received NPL, and 129 received EVBL. Of the 129 eyes who underwent EVBL, 4 (3%) had an RD, compared to the 74 eyes (73%) which had an RD that did not receive laser treatment or had NPL (P<0.001). Eyes with EVBL had about 8 lines better vision, on average, compared to those without laser or NPL (-0.86 logMAR, 95% CI -1.1 - -0.64, P< 0.001).

Conclusion/Relevance: EVBL may prevent RD and is associated with better VA in patients with SS.

Early DMARD Therapy in Idiopathic Paediatric Uveitis

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Introduction: Scottish 2010 guidelines for JIA-associated and idiopathic paediatric uveitis recommended disease-modifying anti-rheumatic drugs (DMARD) if there was initial posterior involvement or lack of uveitis control at 4 month review. We sought to examine which patients went on to require DMARDs and whether this was associated with posterior disease at presentation.

Methods: Retrospective audit of all idiopathic paediatric uveitis cases managed in the joint rheumatology/ophthalmology uveitis clinic between 2003-2021. Paediatric uveitides with other coinciding inflammatory or infective disease (including JIA) were excluded. We compared the treatment pathway of our cohort with the Scottish guidelines by evaluating treatment at 4 and 12 months.

Results: 39 patients were included (mean age 10 years old). Of the 9 patients presenting prior to guideline publication, 3 (33%) had posterior involvement at presentation. 8 did not start DMARD after 4 month review and of these only 1 had control of their uveitis. Of the 30 patients presenting from 2011 onwards, 21 (70%) had vitritis or macula oedema at presentation. All patients had either DMARD therapy initiated or quiescent uveitis at 4 month review. In total, 94% of all patients went on to require DMARD therapy by 12 months.

Conclusion/Relevance: Early escalation of treatment to DMARDs is especially important in cases with initial posterior involvement. Almost all of our patients, whether or not they had posterior involvement, have required biologic therapy to become steroid independent. We suggest that DMARD therapy should be initiated on presentation for all cases of idiopathic uveitis, once underlying secondary causes have been reasonably excluded.

Outcomes in Retinal Detachment Repair and Laser Prophylaxis for Optically Empty Syndromes

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Introduction: Assessment of surgical outcomes and techniques for repair of RDs in patients with optically empty syndromes as well as evaluation the efficacy of laser prophylaxis in RD prevention for this group.

Methods: This study is a retrospective cross-sectional study of a single surgeon's patients that evaluates variables affecting visual and anatomical outcomes of surgical repair of RDs in optically empty syndromes (56 eyes). The study also explores laser prophylaxis for RD and retinal breaks in this population (60 eyes).

Results: Age of RD presentation, procedure type, PVR at presentation, Macula status (on/off) were all significantly correlated with final BCVA (p-value <0.5)
- Number of procedures, Procedure Type, and PVR at presentation were all significant for pseudo anatomical failure (retina on, but requiring oil) (p-value <.1)
- Of the laser prophylactic eyes that did have an RD, Final VA was better when compared to the outcomes of non-prophylaxed eyes (p-value = 0.03)
- No correlation was present between age of prophylaxis and final BCVA or Development of Tear/Detachment (p-values 0.21 and 0.23 respectively)

Conclusion/Relevance: Patients with optically empty syndromes undergoing RD repair had better anatomical and visual outcomes when receiving a SB opposed to PPV or SB/PPV even if the initial SB failed. Younger ages of presentation, PVR at presentation, macula off, GRT present, and absence of hyaloid elevation during the procedure all results in worse anatomical and visual outcomes for patients. Age did not affect anatomical or visual outcomes and rates of failure in eyes receiving laser prophylaxis. When an eye that received laser prophylaxis did detach, final VA was better than eyes that did not receive prophylaxis

Association of Health Insurance Status with Severity and Treatment among Infants with Retinopathy of Prematurity

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Introduction: To compare treatment for infants with retinopathy of prematurity (ROP) by Medicaid versus commercial insurance.

Methods: Retrospective cohort study by ICD and CPT codes in claims databases from 2010-2014 (Medicaid) and 2010-2015 (MarketScan).

Results: In the Medicaid database, 109,240 infants had ICD codes for ROP and 6093 (5.6%) also had CPT codes for treatment. By comparison, in the MarketScan database, 22,802 infants had ROP and 883 (3.9%) underwent treatment (p < 0.001). At baseline, 53% of treated Medicaid beneficiaries and 41% of commercially insured patients had bronchopulmonary dysplasia (BPD), p < 0.001. There were no significant differences in rates of necrotizing enterocolitis or intraventricular hemorrhage. Comparing treatment of Medicaid beneficiaries to commercially insured infants: 2203 (36%) versus 165 (19%) received antiVEGF injections, 3666 (60%) versus 710 (80%) received laser photocoagulation, and 224 (4%) versus < 11 (< 1%) received both injections and laser (p < 0.001).

Conclusion/Relevance: Overall, Medicaid beneficiaries were more likely to have treatment-requiring ROP compared to commercially insured infants, and the treatment was more likely to be antiVEGF than laser. Although limited claims-based data on ROP treatment exist (1), the proportion of treated infants in these databases is consistent with previously published data (2). Differential treatment practices by insurance type have been reported in other specialties like oncology (3). However, other neonatal comorbidities such as BPD likely represent potential confounders that may predispose providers to prefer injections, and lack of information on zone of ROP at treatment is a limitation of claims data.

Travel Burden in Treatment of Retinopathy of Prematurity

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Introduction: Approximately 10% of infants screened for ROP require treatment. Current treatment options include Panretinal Laser Photocoagulation or Intravitreal antiVEGF. Our institution provides treatment of ROP for a very large geographic region, making the travel burden for some patients a large barrier to care access. Our aim is to compare the follow-up and travel burden between patients with ROP treated with laser and those treated with intravitreal antiVEGF at our institution.

Methods: We use an institutional retrospective chart review to compare the number of outpatient visits and driving distance from our Eye Institute to patients' residences for patients screened for ROP, treated with PRP, and treated with antiVEGF between January 2016 and January 2021.

Results: 601 patients were seen for ROP. 551 patients were seen for screening only, 21 patients treated with PRP, and 29 patients treated with antiVEGF. The average number of visits for ROP follow-up overall was 2.46. The average number of visits was 4.95 for those treated with PRP and 11.7 for antiVEGF. The average total combined driving miles for ROP visits for a single patient was 257.8 for screening-only, 873.9 for PRP, and 1777.6 for antiVEGF.

Conclusion/Relevance: At our institution, follow-up for patients treated with PRP was significantly less compared to antiVEGF. For an institution serving a large geographic area, travel burden on families can be a large barrier to care access and therefore should be a consideration when discussing treatment options for ROP.

ROP Severity and Treatment Rate during COVID-19 in UK

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Introduction: The (COVID-19) pandemic and lockdown restrictions have significantly affected delivery of healthcare amongst UK hospitals. Some centres had reduced screening rates of pre mature babies, while others documented higher rates. The purpose of this study is to explore the effect of first UK lockdown restrictions on ROP prevalence and treatment.

Methods: Participants were pre-mature babies born during UK first Lockdown between 23 March 2020 to 20th October 2020 at Royal London Hospital. They were identified using the national neonatal database (BadgerNet). Severity of ROP, birthweight, gestational age, treatment and total number were compared to same data in corresponding dates in 2019. Independent T test was used to compare the demographics and a chi-squared test was used to compare the prevalence of various stages of ROP between the two groups.

Results: 107 babies were included,(2020 n=51, 2019 n=56). Although the mean birth wight in 2020 (991grams) was less than that in 2019 (1021grams), this was not significant (P=0.6). More babies were born below 1000 grams in 2020 (60%) compared to 2019 (53%) (P=0.1). The mean gestational age (27 weeks) was equal in the two years (P=0.7). 62.7% of babies in 2020 had grade 2 or more of ROP compared to 50% in 2019. Treatment rate was 14% in 2020 compared to 5 % in 2019 (P=0.1).

Conclusion/Relevance: Our pilot study showed no statistical significance in the prevalence of babies with ROP between 2019 and 2020, However we have subjectively noted younger and smaller babies during the lockdown, hence the higher treatment rate.

Evaluation of Risk Factors, Treatment, and Outcome of Patients with Retinopathy of Prematurity at Tertiary Hospital

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Introduction: Retinopathy of prematurity (ROP) is a proliferative vitreoretinopathy affecting premature infants which a leading cause of childhood blindness worldwide. Screening is scheduled according to gestational age and birth weight to detect ROP development and to determine the appropriate timing of treatment. Screening also identified any risk factors for ROP development. Aim of this study is to evaluate risk factors, choice of treatment and outcome based on severity of ROP.

Methods: An observational analytic study, all data were taken from medical records all ROP patients between January 2020 - July 2021.

Results: From 61 cases (116 eyes), most cases were found at stage 3 (47 eyes; 40.5%) with a mean gestational age of 29.47 weeks, post conceptual age 31.66 weeks, and chronological age 61.12 weeks. Mechanical ventilator appears to be significant with the incidence of high risk ROP (p=0.034, OR 5.164 95% CI 1.131 - 23.538). Outcome impacted with more severe ROP stage (0.871) and chronological age (0.536), post conceptual age (0.578), and birth weight (0.324) correlated with more severe ROP. Regression rate of all ROP cases is 55.9% and regression rate of cases that underwent surgical treatment is 81%.

Conclusion/Relevance: The use of a mechanical ventilator increases the risk of developing advanced ROP. Identification of risk factors and early detection play an important role in ROP cases. Awareness of early detection and treatment needs to be improved for a better outcome.

References:
Unilateral or Sequential Treatment of Eyes with Bevacizumab for Retinopathy of Prematurity

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Introduction: While usually bilateral, the severity and tempo of retinopathy of prematurity (ROP) can be asymmetric.1,2 We review the outcomes of patients receiving unilateral or sequential (six days or more between treatments) intravitreal bevacizumab (IVB).

Methods: We reviewed the medical records of consecutive patients who were treated with IVB for ROP between 1-1-2011 to 9-1-2021. Patients who received unilateral or bilateral sequential treatment were included.

Results: Of 103 patients receiving IVB for ROP, 22 (21.3%) initially received unilateral treatment. 20 patients received initial treatment for type 1 ROP and two for less than type 1 ROP. 11 patients (50%) required contralateral IVB injection a mean of 12±6.7 days later. Of the unilaterally treated group, six patients received no additional treatment, two received panretinal photocoagulation (PRP) for persistent avascular retina (PAR) (one bilateral and one in treated eye only), one was lost to follow up and two are still under surveillance. Of the sequentially treated group, seven received no additional treatment, two received PRP for PAR OU, one received repeat IVB for recurrent ROP in one eye and is still under surveillance, and one was lost to follow up.

Conclusion/Relevance: Since general anesthesia is not required, IVB allows for unilateral or sequential treatment when ROP is asymmetric, which can reduce systemic absorption and other risks of IVB injection. The high percentage of infants requiring sequential treatment suggests a limited effect of IVB on the contralateral eye. Future research examining long term outcomes after unilateral /sequential IVB treatment is needed.

Comparing Recurrence and Retreatment of Three Doses of Bevacizumab in Treating Severe Retinopathy of Prematurity

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Introduction: To determine timing and rates of recurrence and retreatment of severe retinopathy of prematurity (ROP) after treatment with either 0.500 mg, 0.250 mg, or 0.125 mg of intravitreal bevacizumab (IVB).

Methods: In this retrospective chart review, data was examined for babies with severe ROP and treated with IVB from 2014 to 2021. Data collected included demographic information, past medical history, and ROP characteristics.

Results: One eye was analyzed for each baby. Out of 85 subjects, 78 were included in the study. 26 subjects were treated with 0.125 mg bevacizumab, 37 with 0.250 mg, and 16 with 0.500 mg. 60 eyes (76.9%) received retreatment with laser for late recurrence or persistent avascular retina, including 23 (88.5%) for the 0.125 mg dose, 29 (78.4%) for the 0.250 mg dose, and 8 (53.3%) for the 0.500 mg dose (p=0.050). Most retreatments were due to recurrence of ROP rather than prophylaxis (19 (82.6%) for the 0.125 mg dose, 18 (62.1%) for the 0.250 mg dose, and 7 (87.5%) for the 0.500 mg dose (p=0.188)). On average, subjects treated with 0.125 mg were retreated with laser 5.0 weeks sooner after initial treatment than the 0.500 mg dose groups (p=0.154), with retreatment for recurrence occurring 6.2 weeks sooner (p=0.003).

Conclusion/Relevance: The time to recurrence of ROP after IVB was found to be sooner in the lower dosage groups. A relationship between the lower dose of IVB and the need for retreatment was found, however, no relationship between lower dosages and incidence of recurrence was found.

Postnatal Growth and Neurodevelopment of Infants Treated with Bevacizumab for Retinopathy of Prematurity

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Introduction: Uncertainty persists regarding systemic effects of anti-vascular endothelial growth factor agents in the treatment of retinopathy of prematurity (ROP)[1]. We performed a retrospective study to investigate systemic outcomes in ROP infants treated with intravitreal bevacizumab (IVB).

Methods: All patients who developed ROP at one tertiary hospital system from 2008-2019 were identified. 262 infants were included and divided among three study groups: 22 treated with IVB, 55 treated with laser, and 185 with ROP that resolved without treatment. Infants with nonviable course or hydrocephalus, a source of non-physiologic weight gain, were excluded. Neurodevelopment was assessed with Bayley III scores, if available. Weekly weight, length, and head circumference from birth through 50 weeks postmenstrual age (PMA) were plotted on the Fenton preterm growth chart to examine growth trends over time.

Results: Comparison of growth curves showed percentile deterioration in weight, length, and head circumference from birth through 50 weeks PMA, regardless of sex or treatment status. One-way ANOVA comparing weekly changes in growth measures showed no significant differences in growth rate between groups by 50 weeks PMA. Logistic regression using Bayley III scores also trended to be not statistically significant after adjusting for covariates.

Conclusion/Relevance: To our knowledge, this is the first large retrospective study to examine longitudinal growth in infants treated with IVB compared to controls. There were no significant differences in postnatal growth or neurodevelopment between groups, which supports safety of bevacizumab treatment for ROP. Our observation of growth percentile deterioration further confirms growth rate as a risk factor of developing ROP[2].

**Refractive Outcomes after Primary Bevacizumab followed by Laser versus Primary Laser Alone for Retinopathy of Prematurity**

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**Introduction:** Children with severe retinopathy of prematurity (ROP) commonly develop myopia or high myopia. One proposed benefit of intravitreal bevacizumab (IVB) over laser is decreased myopia; however, many IVB eyes are later treated with laser. We sought to compare incidence of myopia and high myopia after primary IVB followed by laser photocoagulation (VEGF/LASER) to primary laser (LASER).

**Methods:** Retrospective cohort of infants who had VEGF/LASER or LASER for Type 1 ROP and cycloplegic refraction at age 6-30 months (mean 19). Primary outcomes were incidence of myopic (minimum -1D) and highly myopic (minimum -5D) spherical equivalent refractive error by eye.

**Results:** 28 eyes (15 infants) had VEGF/LASER at mean PMA weeks 33.8/45.2. 297 eyes (151 infants) had LASER at mean PMA 37.7. Incidence of myopia (46.4% VEGF/LASER, 43.8% LASER, p=0.23) and high myopia (14.3% VEGF/LASER, 16.2% LASER, p=0.29) did not differ between groups. Subgroup analysis for zone I at first treatment (14 eyes VEGF/LASER, 56 eyes LASER) also showed no difference (myopia 64.3% VEGF/LASER, 67.9% LASER, p=0.73; high myopia 14.3% VEGF/LASER, 37.5% LASER, p=0.22). Among all eyes, total laser spots were associated with myopia (aOR 1.07 per 100 spot increase, 95% CI 1.03-1.12) and high myopia (aOR 1.06, 95% CI 1.01-1.12), but spots did not differ among treatment groups (mean 2044 VEGF/LASER, 1857 LASER, p=0.60).

**Conclusion/Relevance:** The prevalence of myopia and high myopia did not differ between VEGF/LASER and LASER. Though more laser spots were associated with higher risk of myopia, spot counts were not lower when laser followed primary IVB.

**References:**


Refractive Outcomes of Patients Treated for Retinopathy of Prematurity

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Introduction: Two effective treatments for Retinopathy of Prematurity (ROP) include laser photocoagulation therapy and intravitreal bevacizumab (IVB). Laser therapy has been linked to causing high myopia in children post-treatment. We hypothesize that patients treated with IVB alone or in combination with laser will have less myopia development than patients treated with laser therapy alone.

Methods: Patient demographics, treatment details, refractive data at 6-9 months and 3-4 years, the occurrence of strabismus at 3 years, and the most recent vision data were collected from 133 ROP patients. Quantitative analysis was used to compare the refractive error, strabismus, and vision outcomes between the three treatment groups. A linear regression model was used to analyze the relationship between the number of laser spots applied and refractive error.

Results: Refractive outcomes, occurrence of strabismus, and vision outcomes were statistically similar between the three treatment groups. However, the laser group had the most occurrences of high myopia. We also observed a 0.002 unit decrease in refractive error, reported at 6-9-months, with each laser spot applied (p<0.001). This may be due to the influence of outliers because no significant relationship was seen at the 3-4 year exam.

Conclusion/Relevance: There was no difference in outcomes among patients treated with IVB, laser, or a combination of both, with the exception of more myopic outliers in the laser-only group. We can therefore assume that ROP patients who have received one of these three treatments had developed differences in myopia independent of treatment modality.

Long-Term Outcomes of Type 1 Retinopathy of Prematurity (ROP) after Treatment with Bevacizumab Monotherapy: A Canadian Experience

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Introduction: We report long-term structural, visual, and refractive outcomes after monotherapy with 0.625 mg intravitreal bevacizumab injection (IVB).

Methods: A retrospective chart review of infants treated for type 1 ROP. Inclusion criteria was single injection of 0.625 mg IVB and minimum follow up of three years ± 6 months. Primary outcome was retinal structure. Secondary outcomes were refractive error in spherical equivalent (SE) and monocular visual acuity (VA) at last follow up.

Fifty-six infants (101 eyes) met inclusion criteria.

Results: Twenty-four eyes were in zone I (24%) and 77 in zone II (76%). Mean post-menstrual age at treatment was 36.9 ±2.1 (range 32.8-42.0) weeks. At mean age of 5.4±1.6 years, (range 2.7-8.4), all eyes had favorable structural outcome. None developed recurrence that would require treatment.

Mean monocular VA was 0.29±0.27 logMAR (range 0.0 to 1.3); n=89/101 eyes (88%). Mean SE was -1.98±4.91 D, (range -16.63 to +5.38 D). Prevalence of emmetropia (>1.0 to =1 D) was 43.6% (44/101 eyes), low myopia (=1.0 to <5 D) was 17.8% (18/101eyes), high myopia (=5 to <8 D) was 8.9 % (9/101 eyes), and very high myopia (= 8.0 D) 12.9% (13/101 eyes). Twelve children (23%) had amblyopia and 17 (32%) developed strabismus.

Conclusion/Relevance: In this cohort, all patients demonstrated favourable structural outcome with a single IVB injection without need for additional laser. Consequently, we suggest careful monitoring following regression of acute ROP as an alternative to universal, preplanned delayed prophylactic laser treatment. Future studies to evaluate other aspects of visual function are needed.

Outcomes of Intravitreal Ranibizumab Followed by Laser Photocoagulation for Type 1 Retinopathy of Prematurity

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Introduction: Retinopathy of prematurity (ROP) is treated with both anti-vascular endothelial growth factor (anti-VEGF) agents and laser photocoagulation, though some have advocated for combination treatment, employing both modalities.

Methods: Retrospective case series of 70 eyes of 35 neonates with a minimum of 6 months follow-up. Patients were treated for type 1 ROP with intravitreal ranibizumab followed by laser photocoagulation between 2015 and 2020. Structural and refractive outcomes were extracted.

Results: Median gestational age was 24 weeks, median birthweight was 640 grams. Patients aged 0.9 to 5.4 years at last follow-up were included and mean±SD follow up interval was 2.78±1.10 years. There was no progression to stage 4 or 5. Eight patients required a repeat injection due to recurrence, which was not associated with a significant change in spherical equivalent (P=0.81). At 2-year follow-up (n=40 eyes; mean age 2.38±0.23 years), median spherical power was -0.75 D [range -15.50 to 4.00], cylinder power was 1.25 D [range 0 to 2.50], and spherical equivalent was 0.00 D [range -14.8 to 4.75]. At most recent exam (n=70 eyes; mean age 2.77±1.10 years), 7% had high myopia, 33% low myopia, 39% emmetropia, 13% low hyperopia, and 9% high hyperopia. Other common findings included strabismus (69%), optic atrophy (23%), amblyopia (20%), nystagmus (11%).

Conclusion/Relevance: Treatment of type 1 ROP with anti-VEGF agents spares destruction of the peripheral retina, but risks ROP recurrence and retinal detachment years after treatment. Consequent laser ablation could reduce this risk and we report favorable 2-year refractive and structural outcomes for patients treated with this regimen.

Risk Factor Analysis for Additional Treatment After Intravitreal Bevacizumab Monotherapy in Patients with Retinopathy of Prematurity

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Introduction: Anti-VEGF agents are now preferred over ablation therapy for type 1 ROP. However, recurrence of neovascularization has been documented after treatment with these agents. The goal of this study was to investigate the risk factors associated to the need for re-treatment after intravitreal bevacizumab (IVB) in patients with ROP.

Methods: 78 eyes of 39 patients who were treated with IVB were studied retrospectively. The eye with more severe ROP was selected for subsequent analysis. A group comparison between patients who required additional treatment after IVB (Group 1) versus those who did not (Group 2), was performed to determine the risk factors associated to re-treatment.

Results: 19 eyes (49%) required re-treatment after IVB. The indications for re-treatment were lack of response (26%), recurrence (58%), and incomplete vascularization of the retina (16%). It was mostly seen in African-American patients (p=0.010). The average PMA (weeks) at diagnosis of ROP between Group 1 and Group 2 were 35 vs 38 (p<0.001). A difference in birth weight (566 gr vs. 681 gr; p=0.015), and weight at the time of diagnosis (1520 gr vs 2268 gr; p<0.001), was observed between these groups, as well as a difference in the time from initial diagnosis of ROP to treatable disease (weeks) (1.8 vs 4.8; p<0.001).

Conclusion/Relevance: High-Risk factors associated to the need for re-treatment identified in this study include African American race, low weight at birth and time of diagnosis, early diagnosis of ROP (PMA), and rapid progression of ROP from initial exam to type 1 ROP.

Increased Association of Mood Disorders, Schizophrenia, and Anxiety Disorders in Children with Strabismus

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Introduction: Children with strabismus have poorer functional vision, more problems with self-image, and decreased quality of life. The purpose of this study was to evaluate the association between strabismus and mental illness in children.

Methods: Claims from the OptumLabs® Data Warehouse, a longitudinal de-identified commercial insurance claims database, were analyzed. Eligibility criteria included age <19 years at the time of strabismus diagnosis, enrollment in the health plan between 2007-2018, and having at least 1 strabismus claim based on ICD9/10 diagnostic codes. Controls were children from the same database with no eye disease other than refractive error. Demographics and mental illness claims were compared.

Results: Adjusted odds ratios (OR) for mental illnesses with strabismus were 2.01 (95% CI: 1.99-2.04), 1.83 (95% CI: 1.76-1.90), 1.64 (95% CI: 1.59-1.70), 1.61 (95% CI: 1.59-1.63), and 0.99 (0.97-1.02) for anxiety disorder, schizophrenia, bipolar disorder, depressive disorder, and substance-use disorder, respectively. There was a substantial association between each strabismus type (esotropia, exotropia, hypertropia) and anxiety disorder, schizophrenia, bipolar disorder, and depressive disorder.

Conclusion/Relevance: There was a strong association between strabismus and anxiety disorder, schizophrenia, bipolar disorder, and depressive disorder but not substance-use disorder. Recognizing these relationships should prompt mental illness screening and treatment for children and adolescents with strabismus.

Pediatric Strabismus is Associated with Increased Severe Functional Impairment

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Introduction: Previous studies found children with strabismus have increased risk of physical injuries and reduced overall quality of life.(1,2) However, the impact of strabismus on interpersonal relationships and engagement in daily activities is not well understood. The purpose of this study was to determine the association of strabismus with severe functional impairment and identify domains disrupted by strabismus.

Methods: This study analyzed 213 children (ages 5-17 years) with strabismus enrolled in the 1996-2015 Medical Expenditure Panel Surveys, annual representative surveys of the US population. Functional impairment was evaluated by the Columbia Impairment Scale (CIS), a validated measure of behavioral and psychosocial functioning.(3) CIS score >/=16 defined severe functional impairment.(3) Multivariable regression models adjusted for age, sex, race/ethnicity, household income, geographic location, and insurance type were constructed to examine the association of strabismus diagnosis with severe impairment and individual domains of function.

Results: Children with strabismus had higher rates of severe functional impairment, compared to children without strabismus (14.6% vs 9.1%, adjusted OR [95% CI]: 1.84 [1.13-3.00]). Moreover, strabismus diagnosis was associated with increased rates of problems with getting along with mother (1.71 [1.23-2.39]) and father (1.66 [1.18-2.34]), getting along with other kids (1.70 [1.18-2.44]), behavior at home (2.02 [1.44-2.83]), staying out of trouble (1.54 [1.06-2.22]), nervousness (1.56 [1.11-2.19]), and getting involved with sports and hobbies (1.70 [1.18-2.44]).

Conclusion/Relevance: Childhood strabismus is associated with 1.8-times increased odds of severe functional impairment, with greater dysfunction in specific relationship and behavioral domains. Functional burden may be an important consideration in management decisions.

References:
Impaired Hand Kinematics During Visually-Guided Reaching in Children Age 4 - 6 Years with Impaired Binocularity

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Introduction: Coordination between eye and hand movements is essential for children interacting with their environment. We previously reported slow reaching in children aged 7-12 years with impaired binocularity, specifically in the final approach (i.e., deceleration phase (1,2). It is unclear when this deficit emerges, so we investigated hand kinematics during visually-guided reaching in younger children with impaired binocularity.

Methods: Fourteen children aged 4-6 years with impaired binocularity (reduced/nil stereoacuity) associated with strabismus or anisometropia were compared to 17 age-similar controls. Hand movements were recorded using the LEAP motion controller. Viewing binocularly, children reached out and touched a small dot that appeared in one of four positions (±5° and ±10). Kinematic measures were time-to-reach onset, total reach duration, acceleration duration, and deceleration duration.

Results: Children with impaired binocularity were slower than controls on time-to-reach onset (499±97 vs 439±67 ms, p=0.050), total reach duration (526±49 vs 459±56 ms, p=0.002), acceleration duration (220±27 vs 195±24 ms, p=0.011), and deceleration duration (306±44 vs 266±47 ms, p=0.022).

Conclusion/Relevance: Children aged 4-6 years with impaired binocularity were slower on all aspects of the reach. This is unlike older children age 7-12 years who are slow in the deceleration phase only, indicating a compensatory change in strategy that develops with age. Impaired binocularity impacts the development of eye-hand coordination, which may hinder academic and social success in children. Longer time-to-reach onset and acceleration in the initial approach may indicate impaired movement planning; longer deceleration in the final approach may indicate impaired use of visual feedback.

References:
**Impaired Saccade Kinematics during Visually-Guided Reaching in Children Aged 7 - 12 Years with a History of Strabismus**

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**Introduction:** Coordination between eye and hand movements is essential for children interacting with their environment. We previously reported slow reaching in children with strabismus, specifically in the final approach (1,2). Here, we investigate saccades during visually-guided reaching to determine the contribution of eye movements to deficits observed in children with strabismus.

**Methods:** Ten children with a history of strabismus (7-12 years) were compared to 10 age-similar controls. Hand movements (Leap Motion Controller) and eye movements (EyeLink 1000) were recorded simultaneously. Viewing binocularly, children reached out and touched a small dot that appeared in one of four positions (±5° and ±10°). Outcome measures were saccade onset latency, amplitude (i.e. accuracy), and peak velocity, temporal eye-hand coordination (i.e., time between saccade initiation and reach initiation), and frequency of corrective saccades.

**Results:** During binocular viewing, children with strabismus had longer saccade onset latency than controls (199±34 vs 166±21 msec, p=0.015). Saccade amplitude, peak velocity, temporal eye-hand coordination, and frequency of corrective saccades did not differ between groups (all ps =0.18).

**Conclusion/Relevance:** While children with strabismus had longer saccade latency during visually-guided reaching, saccades did not differ from controls once the eyes started moving. This is unlike strabismic adults who show normal saccade latency but more reach-related corrective saccades (3), suggesting a compensatory change in strategy that develops with age. Slower saccade latency may indicate suboptimal sensorimotor transformation (i.e., mapping visual input to a motor command), which may also impact control of the reach in the final approach. Impaired eye-hand coordination may hinder academic and social success in children.

**References:**
The Ocular Rotational Axis Is More Medial than Normal in Esotropia

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Introduction: In normal people, the eye translates as it rotates about an axis eccentric to globe center. We used magnetic resonance imaging (MRI) to determine the location of the rotational axis in esotropic patients.

Methods: Fourteen orthophoric and 11 esotropic adults underwent high-resolution axial MRI in target-controlled large adduction and abduction. Axial lengths (ALs) were measured in axial planes containing maximum globe cross-sections. Area centroids were calculated to determine globe centers. Rotational axes in orbital coordinates were calculated from displacements of lens centers and globe-optic nerve attachments during duction.

Results: Esotropic adults were older (47±18 yrs vs 24±2 yrs, std dev, p<0.0001) and had longer ALs (27.0±1.0mm vs 25.7±1.6mm, p=0.025) than controls. Both groups achieved similar rotation from large adduction to large abduction (61.7±5.9° vs 60.8±6.2°, p=0.63). The rotational axis, however, was significantly more medial in esotropia, 1.3±1.7mm medial to globe center vs 0.4±1.1mm for normals (p=0.035). The rotational axis also tended to be more anterior to globe center in esotropia, 1.0±2.6mm vs -0.1±2.0mm, but greater variability rendered this difference statistically insignificant (p=0.10).

Conclusion/Relevance: In esotropia, the eye's rotational axis is eccentric because it is closer to the medial rectus (MR) insertion and farther from the lateral rectus (LR) insertion. This location should create more rotational effect per mm of MR surgical insertional repositioning than LR insertional repositioning. The eccentric rotational axis may explain why, in surgical tables, smaller doses are recommended for the MR compared with the LR to correct esotropia.

**AS-OCT for Preoperative Visualization of EOMs in Adult Strabismus Patients.**

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**Introduction:** To evaluate the accuracy of AS-OCT in measuring the extraocular muscle insertion distances as compared with intraoperative measurement using caliper.

**Methods:** It was a Cross sectional observational study including 35 patients imaged using AS-OCT and were operated for strabismus. We enrolled Patients with non-paralytic esotropia or exotropia not operated before. Determination of EOM site insertion by SD-OCT, The patients were operated, intraoperative EOM insertion distance was measured with Castroviejo caliper.

**Results:** There was no statistically significant difference between AS-OCT preoperative measurement and intraoperative caliper measurement, in case of MR muscle measurement, however there was a statistically significant difference in LR muscle image mostly, due to the machine length beam being only 8 mm which is so close to the distance of LR insertion from limbus, about 7 mm.

**Conclusion/Relevance:** AS-OCT is a non-contact, highly accurate tool for imaging MR muscle. However, its accuracy is limited in LR muscle by the beam length. AS-OCT is not effective in poor fixating and uncooperative patients.

**References:**
Medial Rectus Insertion Site in Surgical Candidate Children with Esotropia

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Introduction: To study the site of medial rectus (MR) insertion in surgical candidate children with esotropia and its relation to the angle of deviation.

Methods: A prospective study that had been done on 110 children scheduled for surgical management of esotropia. We divided them, according to age, into 3 groups, below 2 years, from 2 to 6 and from 6 to 12. We documented the angle of deviation. During surgery we measured the distance between MR insertion and limbus using the caliber viewing by microscope. We created similar control age groups of non-strabismus 98 children. They were admitted to operating theatre for other reasons. After written permission we measured MR insertion site.

Results: The mean insertion site in control group 1 (age below 2) was 4.33±0.39. While it was significantly less in patient group 1 (P<0.001), 3.81±0.48 and 3.78±0.56 for right and left eyes. For group 2, it was 4.63±0.48 in control group. While it was significantly less in esotropia (P<0.001), 3.99±0.38 and 3.98±0.40 for right and left eye. For group 3 (6 to 12 years), it was 5.27±0.24 in control and 4.91±0.46 and 4.26±0.47 in esotropia (P<0.001). There was significant negative correlation between angle of deviation and MR insertion site (P<0.001) in all age group patients.

Conclusion/Relevance: From this study we can conclude that medial rectus is significantly closer to limbus in children with esotropia than non-strabismus. Also, there is negative correlation between MR insertion site and severity of esotropia.

References: The accuracy of anterior segment optical coherence tomography (AS-OCT) in localizing extraocular rectus muscles insertions
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Monofixation in Adult-Onset Divergence Insufficiency Type Esotropia

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Introduction: We hypothesized that subnormal preoperative sensory status (sensory monofixation) was associated with poor postoperative motor outcomes in adult-onset divergence insufficiency (DI) type esotropia.

Methods: We retrospectively reviewed 30 adults with esotropia at distance greater than near, VA 20/40 or better in each eye, and distance diplopia rated as always, often or sometimes, who underwent bilateral medial rectus recessions. Stereoacuity was measured, preoperatively and 6-weeks postoperatively, using Randot Preschool tests. Sensory monofixation was defined as stereoacuity of 200 seconds of arc (arcsec) or worse, bifoveal as 40 or 60 arcsec, and indeterminate as 100 arcsec. Motor undercorrection was defined as >4pd esodeviation (by prism and alternate cover test at distance or near), overcorrection as >10pd exodeviation at distance or near, and success as 4pd esodeviation to 10pd exodeviation.

Results: Preoperatively, 19 (63%) had sensory monofixation (95% confidence interval [CI] 44-80%), 4 (13%) were bifoveal, and 7 (23%) were indeterminate. At 6-weeks postoperatively, 2 patients (7%, 95% CI 0%-22%) were motor undercorrections and 1 (3%, 95% CI 0%-17%) was overcorrected, none of whom demonstrated preoperative monofixation. 27 (90%, 95% CI 73%-98%) were motor successes. Postoperatively, 13/19 (68%, 95% CI 43%-87%) of preoperative monofixators continued to demonstrate monofixation despite excellent alignment.

Conclusion/Relevance: Sensory monofixation is surprisingly common in DI-type esotropia, confirmed postoperatively in the majority of patients. Excellent motor outcomes are common in DI-type ET despite frequent coexistence of monofixation. Whether sensory monofixation is a risk factor for DI-type ET or develops secondarily is a topic that deserves further study.

Refractive Error in Unilateral Duane Syndrome

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Introduction: Research on the effect of strabismus surgery on refraction suggests that tension exerted on the globe by extraocular muscles influences refractive error. We studied differences in refractive error between Duane and fellow eyes in patients with unilateral Duane syndrome. We hypothesized that chronic co-contraction of the medial and lateral rectus muscles leads to higher astigmatism in Duane versus fellow eyes.

Methods: A database of 4103 patients of Dr. Art Jampolsky was queried for diagnosis of Duane syndrome. Inclusion criteria were unilateral Duane syndrome and complete data set, including refraction.

Results: Eighty-four patients with unilateral Duane syndrome were identified: 51 females (61%) and 33 males (39%). The spherical equivalent of Duane eyes (M=0.4, SD=2.3) and fellow eyes (M=0.2, SD=2.4) was similar (P = 0.14). Astigmatism ranged from 0 to 4.75 D in Duane eyes and from 0 to 2.5 D in fellow eyes. Mean cylinder power was higher in Duane eyes (M=0.7, SD=0.8) compared to fellow eyes (M=0.4, SD=0.6; P = 0.00015). Among the Duane eyes with astigmatism, 20 had with-the-rule (WTR), 20 had against-the-rule (ATR), and 20 had oblique astigmatism. Among fellow eyes, 22 had WTR, 12 had ATR, and 6 had oblique.

Conclusion/Relevance: Duane eyes compared to fellow eyes had higher astigmatism that was more likely to be oblique. Our study lends further support to the literature that extraocular muscles influence refractive error. It also informs the ophthalmologist of the importance of carefully refracting patients with Duane syndrome.


The Pre-Equatorial Nasal Superior Oblique Tendon Syndrome

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Introduction: Abnormal superior oblique (SO) tendons have been characterized in both congenital and acquired palsies. The nasal insertion variant (class II) is rare but usually associated with a loose tendon in congenital cases. Iatrogenic anteriorization and nasal displacement of the SO can also occur following ocular surgery.

Purpose: Evaluate the clinical characteristics and management of patients with nasal pre-equatorial SO insertion syndrome.

Methods: Case series of 6 patients in whom the SO was found inserted pre-equatorial and nasal to the superior rectus muscle insertion.

Results: Two patients were diagnosed with congenital SO palsy, one patient with an acquired SO palsy, and 3 patients presented following ocular surgery. Congenital and acquired SO palsy patients demonstrated a large incomitant vertical deviation with limited depression, worse in adduction. Two patients who underwent previous SO disinsertion presented with hypertropia, limited depression and globe retraction on attempted downgaze. One patient had a scleral buckle surgery with a restrictive hypertropia worse in downgaze and abduction. Repositioning of the SO improved alignment and downward rotations in all cases.

Conclusion/Relevance: Nasal pre-equatorial SO insertion syndrome is uncommon. In SO palsy, large vertical deviations with limited depression worse in adduction and lateral incomitance may be predictive of this anomaly. In post-surgical cases, additional findings may include a V-pattern esotropia and enophthalmos in downgaze. Nasal pre-equatorial SO insertion is associated with hypertropia greater in downgaze as a result of an anti-depressor effect. Surgical repositioning of the normal path of the SO is recommended.

References:
3D Printing Surgical Applications in Pediatric Ophthalmology: A Case Series

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Introduction: 3D-printing has rapidly grown in use in clinical practice of many medical disciplines, but its application has been rare in pediatric ophthalmology. Studies have been previously described utilizing the technology for strabismus training models (1), and imaging model based custom eyeglasses for atypical head shapes (2). There is however, a paucity of literature on the application of 3D printing for surgical planning.

Methods: Two cases of restrictive strabismus are described, one of an 11 month old with a complex congenital fibrous band in the medial orbit, and another case of a 3 year old with an accessory extraocular muscle. In both cases, the orbital MRI data was used to create a virtual 3D model with segmentation of the abnormal anatomy in Materialise Mimics Innovation Suite. The 3D models were then produced on a Connex500 3D printer for 1:1 ratio physical replication.

Results: The 3D models were successfully printed in both cases and used as rehearsal for surgical planning. For the case of the accessory extraocular muscle, surgical findings matched those of the 3-D model. The case of the congenital fibrous intraorbital band is upcoming.

Conclusion/Relevance: Congenital orbital anomalies are difficult to visualize with 2D cuts of imaging. 3D modeling and printing can be utilized to effectively visualize the complex pathology and allow rehearsal with instrumentation prior to the surgery. This allows for improved contingency planning and safer surgery. Future applications include the development of custom surgical instruments and implants.

References: -
Could Rare Earth Magnets be Used to Treat a 'Lost' Medial Rectus Muscle?

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Introduction: To demonstrate that implanted rare-earth magnets might be used to replicate the forces generated by the medial rectus muscle during normal globe rotations.

Methods: We assume a single magnet under the insertion of the medial rectus muscle, and one or more magnets implanted along the medial orbital wall. A target function was established based on the published force-generation curve for the medial rectus (1). The precise location and strength of each magnet were optimized using a genetic algorithm to maximize agreement between the force-generation curve of our model and the target function while minimizing radial force on the globe. A dipole approximation was used throughout the calculations. Parameter values were constrained based on the dimensions of a hypothetical adult orbit and globe and the strength of N52 rare-earth magnets.

Results: Our optimized magnet configuration approximated the desired medial rectus forces within a range of (+/-) 30 degrees of primary gaze. The tangential forces (abduction/adduction) on the globe remained within 10g of the target force-generation function. The radial force (away from the center of the globe) was less than 20g throughout this range.

Conclusion/Relevance: Transposition procedures provide a constant force against which an unopposed antagonist muscle can operate but do not replicate the varying forces generated the medial rectus muscle during normal rotations, limiting the potential field of single binocular vision. Our model suggests rare-earth magnets might be used to replicate those forces, potentially allowing for an expanded field of SBV. These findings may be relevant to other forms of ‘paralytic’ strabismus.

Sensorimotor Outcomes in the Surgical Management of High-Accommodative Convergence/Accommodation Ratio Esotropia

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Introduction: There is uncertainty regarding the optimal surgical approach for correcting high-accommodative convergence/accommodation ratio (AC/A) esotropia(1).

Methods: The medical records of 39 consecutive patients who underwent bilateral medial rectus muscle recession for high-AC/A esotropia from June 2010 - March 2017 were retrospectively reviewed. Deviations in primary gaze at distance and near fixation, stereopsis, and bifocal use were noted preoperatively and postoperatively at 1 week, 6 months, 1 year, and final recorded. Surgical groups were categorized based on target of 'Distance' deviation, 'Near' deviation, or 'Hybrid' between the two.

Results: The Distance group demonstrated significantly improved stereopsis at the final visit compared to the Near and Hybrid groups(Fisher’s p=0.029). The Near group had significantly improved near alignment(p=0.029) and decreased bifocal need(p=0.039) at 6 months, but this was not maintained at the final visit compared to the Distance(p=0.332) and Hybrid(p=0.102) groups. There were no significant differences in distance alignment outcomes(p=0.846) or reoperation rates(p=0.454) among the groups.

Conclusion/Relevance: Surgical targeting for high-AC/A esotropia appears to have comparable results with regard to motor alignment, use of bifocals, and need for reoperation. While there was an initial trend towards improvement in near deviation and bifocal usage with surgeries aimed at near, this trend was not observed past the 6-month point. However, our data demonstrated an improvement in stereopsis for patients undergoing surgeries aimed at the distance deviation compared to the near or hybrid targets. Our research is limited by number of patients and its retrospective nature. Further study is needed to identify the optimal surgical approach to high-AC/A.

Effect of Bimedial Recession on Near Distance Disparity in Esotropia

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Introduction: Bilateral medial rectus recession (BMR) and unilateral recession-resection (RR) are well-established surgical techniques for esotropia.¹ There is no consensus on which is preferable although convention suggests a greater effect of BMR on near deviation. We present a series of patients who underwent BMR for esotropia and the effect on the near and distance angles.

Methods: Retrospective analysis of 69 BMR cases in a large teaching hospital between November 2011 and July 2021. The surgical dose aiming for within 10 prism diptres (PD) of orthophoria was based on the largest angle at any fixation.

Results: 35 patients were included; 19 were female. The average age was 18. Diagnoses included infantile (11), non-accommodative (10), partially-accommodative (9), myopic (3) and convergence excess (2) esotropia. Average follow-up time was 21.5 months. The average pre-operative deviation was 39 PD for near and 34 PD for distance. The average post-operative deviation was 12 PD for near and 10 PD for distance. The average difference between the pre and post-operative deviations was 26 PD for near (P<0.001) and 23 PD for distance (P<0.001). The PD gain per mm was 2.5 for near and 2.2 for distance (P=0.145). 13 patients had a near-distance disparity (NDD) of greater than 10 PD. The average pre-operative NDD was 13PD and post-operative was 6 PD (P= 0.010).

Conclusion/Relevance: BMR has a greater effect on near deviation but is also effective for distance and can improve NDD. It is an effective option for all sub-types of esotropia with the benefit of limited tissue loss compared to RR.


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Introduction: Purpose: To compare the success rate of strabismus surgery versus botulinum toxin injection (BTX) in the management of esotropia (ET) in individuals with Down Syndrome (DS).

Methods: We designed a multicenter retrospective cohort study. We included all consecutive DS patients with ET between 2014 and 2021 in King Khaled Eye Specialist Hospital, King Abdullah Specialist Children Hospital, and King Abdullah International Medical Research Center in Riyadh. We divided the patients into two groups according to the type of intervention. Success was defined as the angle of deviation within 10 Prism Dipters (PD) in the last visit.

Results: Fifty-three patients met our inclusion criteria. Twenty-three patients were in the surgical group and 30 in the BTX group. There was no difference between age, sex, diagnosis, spherical equivalent, and preoperative angle of deviation. Before the intervention, the mean angle of deviation was 37.39 ± 15.06 PD in the surgical group and 38.33 ± 12.20 PD in the BTX group, respectively (P=0.802). The mean postoperative angle of deviation was 9.17 ± 12.62 and 19.77 ± 13.72 PD in the surgical and BTX groups, respectively (p-value = 0.006). Success rate in surgical and BTX groups was 65% and 30%, respectively (p-value = 0.011). Two patients developed dissociated vertical deviation in the surgical group. One had consecutive exotropia and inferior oblique overaction in the BTX group.

Conclusion/Relevance: BTX injection could be considered to correct ocular alignment for ET in individuals with DS. However, the success rate is higher with the conventional surgical intervention.

References: 0
Description of a New Surgical Technique for the Correction of Highly Myopic Esotropia

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Introduction: Highly myopic esotropia is usually a bilateral progressive condition that results from ocular elongation, nasal displacement of the superior rectus (SR), inferior displacement of the lateral rectus (LR), and globe superotemporal herniation. The aim is to describe a novel surgical procedure for esotropia correction in highly myopic patients, using interlacing of the LR and SR.

Methods: Interventional case report.

Results: 58-year-old female with high myopia (26 diopters on both eyes (OU), with 2 unknown previous surgery OU, uncorrected visual acuity (VA) of counting fingers OU, and fixus convergent strabismus of over 100 PD. For the interlacing procedure in OU, first the SR was divided but not disinserted. Then LR was divided longitudinally in half to 15 mm from the muscle's insertion, the upper half of the muscle was secured by a double-armed suture and disinserted from the sclera, passed through the halves of the SR (interlaced), and then reinserted in its original insertion (Figure 1). On the left eye (OS) an additional LR resection was performed to eliminate tendon flaccidity and irregularity, and the medial rectus (MR) was re-recessed to 15 mm from the limbus due to positive forced duction for abduction after the interlacing.

At the 3-month postoperative visit, the patient was satisfied, with no diplopia. Her corrected VA was 20/40 and 20/60, residual right esotropia of 20 PD, and improved abduction to -2 OD and -3 OS.

Conclusion/Relevance: A new technique for the correction of highly myopic esotropia of easy execution and with good postoperative results.

Conjunctival Resection and Caruncular Fixation for Complete Adduction Palsy

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Introduction: Correcting a large-angle exotropia (XT) secondary to a third cranial nerve (CNIII) palsy can be difficult. Supramaximal ipsilateral lateral rectus recession and medial rectus resection are often insufficient, and periosteal fixation procedures can be challenging. The purpose of this work is to describe the novel surgical technique of a large nasal conjunctival resection with caruncular fixation, as an adjunct procedure to extraocular muscle surgery for the treatment of a large-angle XT secondary to CNIII palsy.

Methods: This is an IRB approved retrospective case series of consecutive patients who underwent conjunctival resection and caruncular fixation, in addition to extra-ocular muscle surgery, for the treatment of XT due to unilateral or bilateral CNIII palsy.

Results: Included were 5 patients (6 eyes), mean age 49.2 years (range 32, 58), with follow-up time of 2 to 11 months (mean 5.6 months). Three eyes had prior strabismus surgery and mean pre-operative XT was 55 prism diopters (PD). Conjunctival resection with caruncular fixation was combined with lateral rectus recession (2 eyes), botox to lateral rectus (1 eye), lateral rectus splitting with nasal transposition (1 eye), medial rectus resection or plication (2 eyes), traction sutures (1 eye) and lateral conjunctival recession (1 eye). Three of 5 patients had postoperative alignment within 15 PD of orthotropia and 5 of 6 eyes maintained some degree of abduction.

Conclusion/Relevance: This well-tolerated and technically simple procedure should be considered, in addition to rectus muscle surgery, for patients with large exodeviations due to CN III palsy.

Surgical Dosing of Partial Sixth Nerve Palsy with Novel Incomitance Protocol for Improvement of Area of Single Binocular Vision

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Introduction: Cranial nerve (CN) VI palsy can result in paralytic strabismus that may necessitate surgical correction. There is little data on the optimal method of surgical correction to maximize area of single binocular vision (ASBV).

Methods: A case series of ten patients with symptomatic partial CN VI palsy of >6-month duration was analyzed by retrospective chart review. The degree of ipsilateral-eye lateral rectus recession (LRR) was determined by esotropia in ipsilateral gaze and ipsilateral-eye medial rectus recession (MRR) by contralateral gaze. The preoperative and postoperative heterotropia in primary and horizontal gaze positions at 1 month postoperatively were recorded in prism diopters (PD) as well as subjective diplopia.

Results: Mean age of patients was 70. Mean preoperative esotropia (ET) was 16PD in primary gaze at distance (range 6-40PD), 21PD in ipsilateral gaze (range 10-30PD) and 11PD in contralateral gaze (range 0-30PD). The mean LRR was 6mm (range 4-9mm); mean MRR was 2mm (range 0-5.5mm). Mean postoperative measurements were ortho in primary gaze (range ET6PD-XT4PD), ET1PD in ipsilateral gaze (range ortho-ET8PD) and ET1PD in contralateral gaze (range ET6PD-XT5PD) with eight patients (80%) reporting complete resolution of diplopia in all gazes. One patient reported diplopia in ipsilateral gaze and another occasionally at distance.

Conclusion/Relevance: This case series demonstrates that adjusting surgical dose for incomitance in the respective field of action of each muscle significantly improves ASBV in partial CN VI palsy. Future studies are needed to validate these results and compare them to traditional strabismus techniques.

Surgical Techniques for Sagging Eye Syndrome: Avoiding Lateral Rectus Surgery

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Introduction: Sagging Eye Syndrome (SAS) is a common cause of diplopia in older adults, caused by weakening of the superior rectus-lateral rectus band, leading to inferior displacement of the lateral rectus, with resultant esotropia, hypotropia, and excyclotorsion. A review of surgical results of adults with diplopia due to SAS over a four-year period was performed.

Methods: The charts of adults over age 50 were reviewed over a four-year period. Of the 290 charts reviewed, 35 had strabismus consistent with Sagging Eye Syndrome who underwent strabismus surgery. Lateral rectus surgery was not performed. The surgical techniques employed were:

1- Medial rectus recession of 4 mm or more for esotropia
2- Vertical rectus surgery for comitant hypertropia
3- Inferior oblique recession for incomitant hypertropia with excyclotorsion

All surgery was performed under general anesthesia.

Results: Chart analysis showed a success rate of 92%. One patient required prism glasses following surgery (surgical failure). One patient required a second strabismus procedure.

Conclusion/Relevance: Although the primary pathology of Sagging Eye Syndrome involves stretching of the SR-LR band with inferior displacement of the lateral rectus, surgery on the lateral rectus is not required for successful surgical treatment of this common disorder.

One-Step Triple Surgery for Large Esotropia in Chinese Patients with Chronic Six Nerve Palsy

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Introduction: The aim of this study is to evaluate the effect of a one-step triple surgery comprising inferior rectus belly transposition, augmented superior rectus transposition and medial rectus recession (IRBT-aSRT-MRc), in the management of large-angle esotropia in Chinese patients with chronic six nerve palsy.

Methods: This is a prospective interventional study. Consecutive patients with large-angle esotropia were enrolled. IRBT-aSRT-MRc or modified vertical rectus belly transposition plus medial rectus recession (mVRBT-MRc) were performed on these patients. Main outcomes included pre-and postoperative deviation in primary position, abduction limitation and complications.

Results: A total of 28 patients were included: 13 undergoing IRBT-aSRT-MRc (ISM group) and 15 undergoing mVRBT-MRc (VM group). Both groups had similar amounts of MRc (t=1.78, P=0.09). After surgery, statistically significant changes of abduction limitation and esotropia were observed (both P<.05). At the last follow-up, ISM group demonstrated greater improvement of abduction limitation than VM group in both abduction grading (t=-5.36, P<0.05) and abduction quantitation (t=4.19, P<0.05). More esodeviation was corrected in ISM group than in VM group (t=3.81, P<0.05). However, 8 cases (4 ISM and 4 VM) had an induced adduction limitation ≥1. 8 cases (5 ISM and 3 VM) developed vertical deviation and 7 cases (2 ISM and 5 VM) developed torsional deviation. Keratitis was observed in 4 cases (2 ISM and 2 VM).

Conclusion/Relevance: The one-step triple surgery, IRBT-aSRT-MRc, demonstrated effective in the management of large-angle esotropia in Chinese patients with chronic six nerve palsy. However, attention should be paid to the potential complications.

Impact of Adding Augmented Superior Rectus Transpositions to Medial Rectus Muscle Recessions When Treating Esotropic Möbius Syndrome

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Introduction: Effective management of the esotropia characterizing Möbius syndrome (MBS) remains a clinical challenge. The purpose of this study was to compare the pre- and post-operative characteristics of patients with MBS esotropia treated by adjustable bilateral medial rectus recessions (BMR) versus those treated by adjustable BMR plus augmented superior rectus transpositions (BMR+SRT).

Methods: For this retrospective case series, billing records identified patients treated at Boston Children's Hospital between 2003 and 2019 meeting 2014 diagnostic criteria for MBS. Visual acuity, sensorimotor evaluations and strabismus procedures were recorded. Surgical outcomes for patients treated with strabismus surgery (excluding those with prior surgery elsewhere) were evaluated. Primary outcome measure was post-operative alignment comparing treatment by BMR versus BMR+SRT.

Results: Twenty patients had MBS, 60% male, and all had bilateral abduction deficit. Eight of 20 met inclusion criteria for primary strabismus surgery outcome. Five had undergone BMR (4.5-6.5 mm per eye) and three BMR+SRT (medial rectus recessions all 4 mm). Mean pre-operative esotropia before treatment by BMR was 39.5 PD (+/- 15 PD) with mean post-operative esotropia 9 PD (+/-7.9 PD) at six months. Mean pre-operative esotropia before treatment by BMR+SRT was 70.8 PD (+/-5.9 PD) with mean post-operative esotropia 2.5 PD (+/-3.5 PD) at six months.

Conclusion/Relevance: Significantly greater reduction in esotropia resulted from BMR+SRT than BMR (P=0.036). BMR proved sufficient to treat esotropia < 50 PD and BMR+SRT for greater esotropia in patients with MBS associated abduction limitation. We believe this study offers useful guidelines for the strabismus surgeon treating MBS patients.


Rate of Vision Screening at Well Child Checks for Ages 3-5: Optotype Versus Instrument Based

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Introduction: Pediatric vision screening during well child checks is an integral part of determining a child's amblyopia risk. The screens are time consuming and technically difficult to perform, particularly for children ages 3-5, which can lead to a high rate of children who fail to receive a timely screen. We aim to compare the rate of successful vision screens performed with the SPOT instrument-based vision screener to traditional optotype-based visual acuity assessment. The rate of ophthalmology referral will also be evaluated.

Methods: Two primary care pediatric clinic sites were selected to compare the number of completed vision screens during well child checks for children ages 3-5 from May to September of 2019 and 2021. An optotype-based critical line test visual acuity assessment was performed in 2019 and the SPOT was used in 2021. A query search was used to pull numerical data for the two clinic sites.

Results: The rate of successful vision screens increased when the SPOT was used. During 2019 there were 305 vision screens for 849 well child checks (36%). During 2021 there were 724 vision screens for 818 well child checks (89%). During 2019 there were 6 referrals to ophthalmology (2%). During 2021 there were 177 referrals (24%).

Conclusion/Relevance: Using the SPOT increased the number of vision screens as well as the percentage of ophthalmology referrals. The use of this technology can help to more easily identify a greater number of children at risk for amblyopia, resulting in timely referral for those who need further evaluation.

Age at Presentation of Vision-Threatening Ocular Disease in the First 10 Years of Life: A Population-Based Study

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Introduction: The purpose of this study is to provide a population-based assessment of the age at diagnosis and referral source of potentially treatable vision-threatening pediatric ocular disorders.

Methods: The medical records of all children < 11 years of age diagnosed with any ocular condition (excluding conjunctivitis, NLDU, and trauma-associated disorders) who were born in a single county from January 1, 2005, through December 31, 2009, were retrospectively reviewed.

Results: Among the 5-year birth cohort of 10,056 children, 1467(14.6%) were diagnosed with an ocular disorder at a mean age of 4.4 years (range, 1 day to 10.9 years). Among 662(45.1%) diagnosed with a potentially treatable vision-threatening diagnosis [significant refractive error (n=422), strabismus (n=279), amblyopia (n=248), retinal disorder (n=67), anterior segment disorder (n=13)], 313(47.3%) were diagnosed by age 4 years and 498(75.2%) were diagnosed by 6 years. Only 54(8.2%) patients were diagnosed at 8 years or older. Among the 498 diagnosed by 6 years of age, 218(43.8%) were self-referred based on patient/family concerns, 125(25.1%) were identified by primary care as having an ocular symptom or sign, 88(17.7%) were identified through routine school screening, and 67(13.5%) presented from other referral sources (including hospital consultation or other healthcare provider).

Conclusion/Relevance: Only one in 6 of the children observed with a treatable vision-threatening disorder in this population-based cohort were identified through routine school screenings. Children diagnosed at 8 years or older were relatively infrequent but deserve further investigation to maximize earlier identification and management.

**Non-Refractive Vision Screening with Two Binocular Video Games and Birefringent Scanning**

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**Introduction:** Three recent non-refractive devices target sensory and/or strabismus risk factors for amblyopia. Both EyeSwift with eye tracking (Nova-Sight, Israel) and PDI Check on autostereoscopic Nintendo 3DS (Anchorage) are video games estimating acuity, binocularity and color. The Rebion blinq (Boston) assesses foveation by birefringence.

**Methods:** Students were consented to be screened before confirmatory examination with optimized refraction. Results were compared with correlation and Bland Altman plots while screening ability was compared with 2021 AAPOS Guidelines and the strabismus-amblyopia rubric (1).

**Results:** 77 ethnically diverse students, aged 13±6 (4-19) years had a 77% prevalence of 2021 risk factors. Near visual acuity, inter-eye difference and stereopsis correlated significantly (p<0.01) for the EyeSwift (r2 .14, .06 and .45) and PDI Check (r2 .23, .22 and .32). The sensitivity/specificity to target 2021-AAPOS : Hunter-rubric for EyeSwift was 82%/56% : 80%/59%, for PDI Check was 87%/41% :45%/23% and for blinq 62%/78% : 55%/24%. Sensitivity/specificity for the 7 color-deficient students was 86%/84% for EyeSwift and 100%/83% for PDI Check. Screen time was 96±19 seconds for PDI Check and 375±102 seconds for EyeSwift but less than 15 seconds for blinq.

**Conclusion/Relevance:** Reliable near vision acuity, stereo and color testing was obtained from the two binocular, touch screen devices often with the student needing minimal instruction. The blinq rapidly gives an estimate of whether both eyes are steadily fixing, and the ProVersion suggests which eye is deviated or amblyopic. Non-refractive validation metrics were beneficial.

**References:** 1. Bosque LE, et al. Evaluation of the blinq vision scanner... JAAPPOS. 2021
Practice Considerations for the Implementation of Handheld Photo-Screeners in Pediatric Clinics

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**Introduction:** Amblyopia remains a leading cause of reduced visual acuity in children (1). However, only around 40% of children participate in vision screening by the age of 3, attributed to difficulties with examining younger children (1). Due to their portability and ease of use, handheld photo-screeners have been developed to try and address screening gaps (2). We aimed to validate use of the GoCheck Kids (GCK) photo-screener and assess implementation in a large academic medical center.

**Methods:** GCK screening of subjects from 6 months to 6 years old was completed on 169 patients by a medical student in pediatric eye clinics. Results from the photo-screener were compared to that of a complete ophthalmologic exam with pass/fail criteria being determined by a modified version of the AAPOS Vision Screening Committee guidelines (3). GCK was then used in general pediatric clinics, with 3,791 children screened.

**Results:** In eye clinics, sensitivity was calculated to be 87.76 percent and specificity was 67.70 percent, with 23.1 percent of screenings being unreadable. In pediatric clinics, 4.9 percent of children failed GCK screenings, of which 21.2 percent faced difficulty scheduling follow-up with ophthalmology due to insurance coverage issues. 187 children with ungradable results were scheduled for repeat screening at their next pediatrician visit.

**Conclusion/Relevance:** GCK provides a quick and efficient user interface that can be implemented in pediatric clinics. Screening protocols must address potential insurance coverage issues and account for the significant number of ungradable screens as to not overwhelm eye clinics with referrals that may not have true pathology.

**References:**
2021 Instrument Referral Criteria for PlusoptiX, SPOT and 2WIN Targeting AAPOS 2021 Guidelines

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Methods: De-identified data comparing photoscreening with simultaneous confirmatory examinations constituted separate cohorts for the development of IRC via receiver operating characteristic (ROC) curves. The refractions of the devices were also compared.

Results: This study defines three sets of IRC (Sensitive, Medium and Specific) for three leading infrared photoscreening devices, PlusoptiX A12, Welch-Allyn SPOT and Adaptica 2WIN to target the 2021 AAPOS guidelines. The cohorts were similar but the SPOT group (n=755, mean age 9) was older with more astigmatism and the 2WIN (n=1362, mean age 7) were younger with more hyperopia and anisometropia compared to the cohort for PlusoptiX A12 (n=616, mean age 8). The IRC for anisometropia, hyperopia, astigmatism and myopia for SPOT (<4y:1.5,1.75,3.25,2.0) and (>/>=4y:1.5,1.75,2.25,3.5), for PlusoptiX (<4y:1.75,3.0,3.5,3.5) and (>/>=4y:1.75,3.0,2.5,2.5) and for 2WIN (<4y:1.75,2.5,3.5,3.5) and (>/>=4y:1.5,2.0,2.5,2.0). The mean ABCD ellipsoid spectacle matches differed; SPOT 1.8±1.3 (best) versus PlusoptiX 1.9±1.6 and 2WIN 2.2±1.4 (p<0.001).

Conclusion/Relevance: The 2021 AAPOS exam guidelines fosters early, specificity before age 4 and sensitivity after age 4. These evidence-based IRC for photoscreeners should provide evidence for device IRC adjustment to optimize validation. Improved early screening combined with thorough treatment should reduce life-long vision impairment due to amblyopia.

Performance of the Spot Vision Screener in Children with Down Syndrome and Other Special Needs

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Introduction: Amblyopia is a common cause of monocular blindness and disproportionately affects developmentally delayed children. Photoscreeners have been suggested as a method to detect amblyogenic risk factors (ARF) in children with developmental disabilities who may not be amenable to traditional vision screening methods. The Spot Vision Screener is a commonly used photoscreener for detecting ARF and has shown excellent sensitivity and accuracy in the general pediatric population. Spot's performance in children with Down Syndrome and other special needs is not as well substantiated. Our study evaluated the accuracy of Spot in these children.

Methods: Children with various disabilities or delays were recruited from the Children's Hospital of Colorado Eye Clinic, Special Care Clinic and the Sie Center for Down Syndrome. Participants had their photograph taken with Spot pre and post pupillary dilation, and this was then compared to a comprehensive eye exam in the Ophthalmology clinic.

Results: One hundred children participated in the study. Twelve children were unable to get images with Spot. The mean age was 5.9 years (standard deviation, 3.4). The overall sensitivity of Spot was 90% and the positive predictive value was 80% in undilated subjects. The area under the receiver operator curve (AUROC) was 0.68 (95% confidence interval, CI: 0.57-0.79).

Conclusion/Relevance: The Spot Vision Screener performed well in this cohort of special needs children and they did not need to be dilated in order for the Spot to have good accuracy. Spot could be used to better triage which patients need to be referred to Ophthalmology.

Clinical Validation of a Novel Smartphone Application for Measuring Visual Acuity

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Introduction: The rise of telemedicine in the wake of the COVID-19 pandemic has posed challenges for ophthalmologists and optometrists, as there are hardly any smartphone applications that meet high accuracy requirements for obtaining visual acuity (VA) in clinical use. The application vision.app is a novel smartphone app that adjusts the angular size of the optotype based on the face-device distance in real time. The high spatial resolution of modern smartphone screens facilitates measurements at a handheld distance, which makes it particularly valuable for use in pediatric populations which struggle to focus on distant stimuli.

Methods: As part of a prospective validation study, we obtained the best corrected VA (BCVA) in n=48 eyes using vision.app. The app displayed a Landolt C optotype and used a 4 force choice procedure loosely based on FrACT (Freiburg Visual Acuity & Contrast Test). Results were compared to BCVA measurements taken using a standard ETDRS chart placed at 10 feet (3m). To assess the similarity of measurement methods, a statistical analysis was performed based on a two-tailed, paired t-test.

Results: The t-test revealed no significant difference in measured BCVA (p = 0.415), with a mean difference between clinical and app measurements of less than one letter (0.005 logMAR).

Conclusion/Relevance: Self-measured visual acuity with vision.app is accurate compared to the gold standard. This has the potential to facilitate home monitoring for adult patients; however, a separate study is warranted to validate the results for children.


Recovery from Amblyopia with Cholinesterase Inhibition

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Introduction: An elevated threshold for neuroplasticity limits visual gains with treatment of residual amblyopia in late childhood and adulthood. Donepezil, an acetylcholinesterase inhibitor, can enable visual neuroplasticity and promote recovery from amblyopia in adult mice. Motivated by these promising findings, we sought to determine whether donepezil can enable recovery in older children and adults with residual amblyopia.

Methods: Sixteen participants (mean age of 15 years; range 9 to 37 years) with residual anisometropic and/or strabismic amblyopia were treated with daily oral donepezil (2.5-5.0 mg) for 12 weeks. Dosage was increased by 2.5 mg if the amblyopic eye visual acuity did not improve by 1 line from the prior visit. Participants <18 years of age patched the dominant eye. The primary outcome was visual acuity in the amblyopic eye at 22 weeks, 10 weeks after treatment was discontinued.

Results: Mean amblyopic eye visual acuity improved 1.2 lines (range 0.0 to 3.0), and 4/16 (25%) improved by ≥ 2 lines after 12 weeks of treatment. Gains were maintained 10 weeks after cessation of donepezil and were similar for children and adults. Adverse events were mild and self-limited.

Conclusion/Relevance: Donepezil improves residual amblyopia among children and adults in this open-label pilot study, supporting the concept that the critical window of visual neuroplasticity can be pharmacologically manipulated to treat amblyopia. Placebo-controlled studies are needed.

**Dichoptic Treatment Using Virtual Reality Display for Amblyopia - A Pilot Study**

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**Introduction:** While patching and atropine penalization remain the standard of care for management of amblyopia, recent interest in dichoptic treatment has provoked research to study its value as an alternative treatment option.

**Methods:** A prospective pilot study was conducted on 22 subjects with anisometropic amblyopia. Dichoptic treatment was delivered using Vivid Vision software (Vivid Vision Inc, San Francisco, USA) running on Oculus Rift OC DK2 virtual reality head mounted display (Oculus VR, LLC, Irvine, California, USA). Each subject had 20 hours of treatment delivered over 10 weeks, divided into weekly 2 hour-sessions. Best-corrected visual acuity (BCVA) was measured using a single crowded letter in an ETDRS chart before treatment, immediately after treatment, and 10 weeks after cessation of treatment. Near stereoacuity was measured using the TNO test.

**Results:** The mean age of studied patients was 12.9±4.0 years. Thirty-five percent had a history of prior patching treatment. After 10 weeks, mean LogMAR BCVA in the amblyopic eye improved (P =0.066) from 0.6 ±0.26 at baseline to 0.45 ± 0.29 (95% confidence interval [CI]: -0.01-0.18; 0.15 LogMAR). Ten weeks after cessation of treatment, mean BCVA was 0.44 ± 0.24 (95% CI 0.03-0.22, P=0.013). Eighty-six percent of the subjects completed ≥75% of the prescribed treatment. The only two subjects who demonstrated measurable stereoacuity at baseline have shown improvement in stereoacuity at 10- and 20-weeks follow-up. No adverse effects were noted.

**Conclusion/Relevance:** Patients with anisometropic amblyopia treated using virtual-reality dichoptic training setting demonstrated significant improvement in BCVA after 20 weeks of follow-up.

**References:**
Reading Performance Improvement in Amblyopic Children Using Dichoptic Eye-tracking Training and an Eye-tracking Based- 30 Second Reading Test

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Introduction: Reading is fundamental to academic achievement and child development. Strabismic and or anisometropic amblyopes were found to be slower readers when compared with controls. Poor reading among amblyopes is attributed to their fixation instability which causes them to have difficulties in planning and executing accurate forward saccades during reading.

Methods: An automatic diagnostic eye tracking based system (Eyeswift) was used to assess reading performance including speed, saccades and fixations during 30 seconds of overt binocular reading of age-appropriate texts. Ten subjects with amblyopia (8-16 years old) were treated for 12 weeks with the CureSight, a novel eye tracking-based dichoptic amblyopia treatment that overlaps the images perceived in both eyes while inducing dynamic foveal blur in the dominant eye, thus reducing interocular suppression.

Results: Binocular reading speed improved significantly from 100±11 to 147±12 words per minute (an improvement of 47%; P<0.005, paired t-test). Average fixating duration decreased from 319±22 to 268±13 msec (P<0.005, paired t-test) and the average number of fixations during 30 seconds of reading increased from 62±7 to 72±8 (P<0.005, paired t-test). The resulting number of words read per fixation increased from 1.5±0.2 to 1.8±1 (P<0.05, paired t-test).

Conclusion/Relevance: The rapid automatic reading test was very effective in evaluating reading performance. This unique preliminary report indicates that dichoptic training improves binocular reading speed in amblyopic children. Furthermore, the ratio between the number of words read and fixations indicates that more efficient reading occurred. Most notably, this 30 second in office measurement of reading abilities can facilitate amblyopia treatment follow-up and provide additional data on functional improvement following treatment.

References:
Patient Compliance Rates with a Novel, Online Platform for Tracking Amblyopia Treatment

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Introduction: Although effective treatments for amblyopia exist, compliance remains a major hurdle to optimal outcomes [1]. We assessed compliance rates of patients enrolled in a novel, online amblyopia tracking platform.

Methods: Inside Out Medicine is an online platform that improves tracking of amblyopia treatment by creating a virtual ‘log,’ reviewable by providers, in which guardians record daily treatment (hours patched per day, etc.). Providers at an urban academic center enrolled eligible patients (amblyopia patients age 1-12 years undergoing occlusion or penalization therapies) in the platform. Guardians were instructed to log all administered treatment in the platform. Baseline characteristics and treatment compliance (defined as logging >66% of assigned treatment on the platform) were collected for patients enrolled for at least 90 days.

Results: As of 9/01/21, 62 patients had been enrolled in the platform for at least 90 days. The cohort has an average age of 5.42 years (std = 2.10) and is 55% female. The right eye is amblyopic in 49% of patients.

After excluding patients who did not enter a log in the platform, 36% of the cohort were compliant with logging at 90 days. The cohort displayed a strong bimodal distribution, with an average compliance rate of 21% of assigned logs in the noncompliant group, and 88% in the compliant group.

Conclusion/Relevance: We report the use of a novel online platform to provide real-time data on patients’ amblyopia treatment compliance. At 90 days, 36% of enrolled patients were compliant with platform logging, suggesting the potential of this online, easy-to-use platform to improve amblyopia patient outcomes by improving compliance monitoring and oversight.

Implementation of a Novel, Web-Based Platform for Tracking Amblyopia Patients: Now with Automated Compliance and Visual Acuity Reporting

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Introduction: Patient compliance with occlusion and penalization therapy for amblyopia remains a major hurdle to successful outcomes. We attempted to improve patient compliance and education using a novel, web-based platform.

Methods: Inside Out Medicine (Seattle, WA) is an online, HIPAA-compliant platform that allows for enhanced tracking of amblyopia treatment compliance. The platform's functionalities include creating a virtual 'log' in which parents can record details on how they administered the treatment (number of hours of patching per day, number of patches used each day, which eye was patched, etc.), giving instructions for parents to remotely assess and record their child's visual acuity, and providing amblyopia educational materials and free patches.

Results: From 7/14/20 to 9/28/21, 83 patients were enrolled in the platform. As family members log their daily therapy usage, a great amount of data is accumulated in the system. The software is now able to calculate the prescribed treatment and logging compliance along with visual acuity data. The Microsoft Excel based report can be updated anytime with a click of a button, which allows the provider to see the reporting of the entire patient population seamlessly.

Conclusion/Relevance: An online, easy to access, HIPAA-compliant platform provided a secure, daily report on patients' amblyopia treatment compliance. This self-reported tracking system allowed a daily window into patient compliance with amblyopia treatment, improving doctor-patient communication and patient tracking. We believe that this platform has great potential for improving outcomes for amblyopia patients via enhanced education, communication and tracking.

Incidence and Clinical Characteristics of Infantile Conjunctivitis in a Western Population

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Introduction: To describe the incidence and clinical characteristics of conjunctivitis in the first year of life.

Methods: The medical records of all infant (≤ 12 months of age) residents from XXX diagnosed with conjunctivitis from January 1, 2005, through December 31, 2014, were retrospectively reviewed.

Results: A total of 2,175 infants were diagnosed during the 10-year period, yielding an incidence of 10,422 per 100,000 children or approximately 1 in 10 infants by one year of age. The mean age at diagnosis was 4.9 months (range: 1 day to 12 months) and 1001 (46.0%) were female. Both eyes were involved in 1180 (54.3%), the right eye alone in 506 (23.3%), and 489 (22.5%) in the left. Five hundred seventy-six (26.5%) of the 2175 were diagnosed at ≤ 60 days of life, from which topical cultures were obtained in 111 (19.7%). Only 36 (32.4%) of the cultures showed bacterial agents with Chlamydia present in three. Treatment for infantile conjunctivitis, where recorded, included topical antibiotics in 523 (90.8%) and simple observation in 47 (8.2%).

Conclusion/Relevance: Conjunctivitis in the first year of life occurred in approximately 10% of infants in this population-based cohort. More than half involved both eyes, one quarter were identified in the first 60 days of life, and sight-threatening infectious agents were rare.

References:
**Epibulbar Dermoids: Clinical Features and Surgical Outcomes**

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**Introduction:** To report the clinical presentation and outcomes of epibulbar dermoid.

**Methods:** Epibulbar dermoids were reviewed in a Mexican eye-care system over a 22-year period. Patients’ demographic and clinical characteristics, treatment, and follow-up were analyzed.

**Results:** 24 patients (25 eyes), 10 females and 14 males, were included. Mean age at diagnosis was 22.02 months (range 0.3-129 months). Unilateral was the most common presentation (23 patients). No patient had a family history of dermoid. 9 (81.8%) eyes were classified as Mann’s grade I, and 2 (18.2%) as grade II. Only 4 patients underwent surgery: two penetrating keratoplasty and two excisions with primary closure. Systemic associations included Goldenhar syndrome 2 (8.3%) patients, polydactyly, dysmorphic syndrome, and mental retardation one (4.2%) patient each.

**Conclusion/Relevance:** Epibulbar dermoids are infrequent in our clinic. Most cases are sporadic, with no family history, and rarely associated with systemic abnormalities. Most patients had no complications related to the dermoid. Progressive astigmatism, visual axis affection, and cosmetic demands were indications for surgical removal.

**References:**
Introduction: To evaluate central corneal thickness (CCT) in patients with pediatric cataract

Methods: Retrospective review of the medical records of all pediatric cataract patients <=18 years presented to pediatric ophthalmology clinic at Abu al Reesh hospitals, Cairo University between January 2016 to December 2019. Childhood cataract was classified according to morphology into four groups: anterior, posterior, nuclear and total. Data collected include age at time of evaluation, gender, laterality, intraocular pressure, angle morphology, CCT, and cataract morphology.

Results: The current study included 569 eyes of 363 patients. 219 patients had bilateral cataract. 204 patients were males. Right eye was involved in 292 eyes. Of 569 eyes, 38 had anterior cataract, 138 had posterior cataract, 156 had nuclear cataract and 264 had total cataract. The mean CCT was 569µ. There was no statistically significant difference in the mean CCT between the four cataract groups (p>0.2). In unilateral cataract cases, the CCT was higher in the cataractous eye (571µ vs 551µ, p<0.0001). The CCT was thicker in persistent fetal vasculature (PFV) cases compared to non-PVF cataractous eyes (594µ vs 567µ, p=0.017). The mean CCT was thicker in the affected PFV compared to the contralateral unaffected eye (p=0.018).

Conclusion/Relevance: Although there was no difference in the mean CCT in the four cataract groups, CCT was significantly thicker in PFV eyes compared to non-PVF cataractous eyes and to the contralateral unaffected eye.

Characterization of Cataracts Within Trisomy 21 Patients Using Ultrasound Biomicroscopy

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Introduction: The incidence of Trisomy 21 (T21) has steadily increased over the last 30 years due to trends of advancing maternal age, improved disability services, and decreased abortion rates for T21 pregnancies. The most sight threatening comorbidity is early onset cataract, found in 15% of T21 patients. Few studies detail structural variations in the anterior segment of pediatric T21 patients with cataract. The quantitative features of associated subclinical anomalies of the anterior segment in T21 cataracts may inform our understanding of the pathogenesis of disease and may correlate with outcomes. Ultrasound Biomicroscopy (UBM) is a high-resolution imaging technique allowing noninvasive in-vivo imaging of these anterior segment structures. This prospective case-control study compares structural features in UBM images between pediatric T21 patients and age-matched controls.

Methods: We examined 23 subjects (27 eyes) with 2:1 age matching for each eye with T21 (n=9) using generalized estimating equations to account for inclusion of more than one eye per subject. Iris and cornea parameters were compared using Students t-test.

Results: Preliminary data identified significantly lower iris thickness (0.53 vs. 0.68 mm, p<0.05) and lens thickness (3.14 vs. 3.63 mm, p<0.05) in T21 compared to control patients. Data shows no significant difference in angle opening distance (38.67 vs 39.80 degrees, p=0.82) between T21 and controls.

Conclusion/Relevance: In conclusion, some features of the anterior eye are altered in Trisomy 21 compared to age-matched controls. Future studies will evaluate vision and complication outcomes related to the structural variants observed in this study.

Non-Descemet Stripping Endothelial Keratoplasty (nDSEK) in an Adolescent with Aphakia and Glaucoma Drainage Device

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Introduction: Pediatric keratoplasty can be surgically challenging due to softer tissues and difficulties maintaining postoperative positioning. These challenges are magnified in the setting of aphakia or previous glaucoma tube surgery as the air bubble for tamponade may migrate to the posterior segment or out of the eye via the tube. We describe the first pediatric case with aphakia and a glaucoma drainage device undergoing non-Descemet stripping endothelial keratoplasty (nDSEK).

Methods: A 14-year-old boy, with a history of juvenile open angle glaucoma and idiopathic anterior uveitis, was noted to have corneal endothelial failure in the left eye after multiple surgical procedures and repetitive trauma by eye rubbing. nDSEK was performed with limited dissection of diffuse peripheral anterior synechiae and gas tamponade using 10% sulfur hexafluoride.

Results: The graft remained attached and the edema cleared over the following 6 weeks at which point the vision improved to 20/25. Nine months postoperatively the patient developed unexplained bilateral intraocular pressure (IOP) elevation with resultant corneal epithelial edema in the left eye. IOP could not be controlled medically and the patient underwent successful micro-pulse cyclophotocoagulation. At last follow-up, 21 months post nDSEK, the cornea remained clear and IOP was controlled on topical medication.

Conclusion/Relevance: With technique modification, Descemet stripping endothelial keratoplasty can be successfully performed in children with uveitis, aphakia, and glaucoma drainage tube. We believe this procedure warrants consideration for corneal endothelial cell failure in this patient population.

Endoscopic Lensectomy-Anterior Vitrectomy Preceding Keratoplasty for Complex Pediatric Corneal Opacities: A Surgical Technique

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Introduction: Pediatric eyes with cataract and significant corneal opacity present a management challenge. Keratoplasty is not always suitable for all patients. In patients who can have penetrating keratoplasty (PKP), avoiding combined lensectomy improves graft survival. Ocular endoscopy allows visualization of the lens in these patients.

Methods: This was a retrospective interventional case series. We reviewed all patients with cataract and a corneal opacity which precluded a view of the lens under the operating microscope, and who underwent endoscopic lensectomy. All lens material was completely removed under endoscopic visualization using three limbal incisions, swapping the cutter, endoscope and anterior chamber maintainer between incisions to allow complete visualization of the anterior chamber. Posterior capsulotomy, anterior vitrectomy and/or glaucoma drainage device (GDD) were also performed if indicated.

Results: Surgery was performed in 7 eyes of 5 children with corneal opacities, at a median age of 2.5 years. Four eyes had Peters anomaly and 3 eyes had a glaucoma-related corneal opacity. Visual acuity improved in 1/7 eyes and was unchanged in 6/7 eyes due to the corneal opacity. Four eyes of 3 patients underwent a subsequent penetrating keratoplasty (PKP) after a median of 6 months. Grafts remained clear in 3 eyes and was repeated in 1 eye. Two eyes underwent endoscopic lensectomy-anterior vitrectomy combined with Ahmed GDD implantation.

Conclusion/Relevance: Endoscope-assisted lensectomy in children with corneal opacities is feasible both in cases where PKP is not possible and as part of a staged series of procedures prior to keratoplasty.

18-Month Experience of Scheimpflug Imaging in Patients with Trisomy 21 at a Tertiary Pediatric Center

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Introduction: Keratoconus is a progressive corneal ectatic disorder that occurs with high frequency in patients with Down syndrome (DS).

Methods: The clinical characteristics, comorbidities, and rate of successful Scheimpflug imaging screening were collected by retrospective chart review from 219 patients with DS 4 to 18 years old who were seen at a tertiary pediatric hospital over an 18-month period.

Results: Corneal tomographic screening with Pentacam images was attempted in 26.5% of children with DS, and useful images were able to be obtained in at least 1 eye in 75.9% of those patients. There was no significant difference in the age of those who had successful imaging compared to those who did not, but children in whom screening was not attempted were significantly younger than those who were (Wilcoxon rank-sum test). Nearly 30% of children who were successfully imaged were under age 10. Rates of high myopia (greater than or equal to -6.00D) or significant astigmatism (greater than or equal to 3.00D) were not different between children with normal corneas and those identified as having keratoconus or being keratoconus suspects.

Conclusion/Relevance: Together, these findings indicate that Scheimpflug imaging of young DS patients is feasible, and suggest that tomographic screening should be employed even when the patient with DS is young, has low refractive error, or small amounts of astigmatism.

Management of Thygeson’s Superficial Punctate Keratitis in Children

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Introduction: Thygeson's superficial punctate keratitis (TSPK), a disorder with exacerbations and remissions,1 has been reported rarely in children.2,3 We describe, to the best of our knowledge, the first pediatric series and outcomes.

Methods: A retrospective chart review of children diagnosed at first presentation with TSPK from 01/2012 to 08/2021 at a children's hospital was conducted.

Results: Fourteen children (7 females), mean age of presentation 8 ± 4 years (range: 2 to 14 years) were found. All were bilateral, had photophobia or foreign body sensation and a BCVA of >= 20/40 in both eyes. All received topical fluorometholone 0.1%, (FML) initially, followed by prednisolone acetate 1% in case of poor response. 78% (11/14) had good response to FML, 2 were switched to prednisolone acetate 1%. Corneal scraping was done to exclude viral infection and microsporidia in 4 due to poor initial response or clinical suspicion. 3 needed EUA for scraping, after which 2 had molecular testing for corneal dystrophy (both resulted TGFBI related stromal dystrophy). For the rest slow steroid taper was used every 6-8 weeks. In case of recurrence, steroid frequency was increased and cyclosporine 0.05% started in 67% (9/14). Initiation of cyclosporine from initial presentation was 8.4 ± 6 months (range: 2 to 20 months). No child developed steroid induced glaucoma.

Conclusion/Relevance: Pediatric patients with TSPK have a rapid response to steroids, however, recurrences are common necessitating a slow taper. Cyclosporin can be used to wean patients off steroids. Non response to steroid needs careful reconsideration of the diagnosis.

Outcomes of Corneal Neovascularization Secondary to Inflammation in the Pediatric Population

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Introduction: Corneal neovascularization (KNV) in children is a rare and often underdiagnosed condition that occurs due to a wide variety of ocular insults that cause angiogenesis. Our study describes the clinical profile of inflammatory KNV in children.

Methods: Retrospective chart review of patients under the age of 18 years with inflammatory KNV seen over 3 years. We excluded patients with trauma, contact lens use, allergy, primary bacterial or fungal ulcer. We included 43 patients between 1 and 18 years, 63% females and 37% males. Hispanic or white origin was preponderant (42% and 44% respectively).

Results: The most common etiology of inflammatory KNV was blepharokeratoconjunctivitis (BKC)-61%, followed by herpetic (HSV)-30%. 9% had combined features of BKC and HSV. Most common chief complaint at presentation was photophobia/eye pain in 56%, followed by red eye, 46%, and recurrent styes in 28%. Scarring developed in 92% of patients with herpetic KNV, 61% of BKC-associated KNV and 100% of patients with combined features. Decreased vision due to amblyopia, scarring or irregular astigmatism was noticed in 92% patients with herpetic KNV, 62% of patients with BKC-associated KNV and in all patients with mixed mechanism. 23% of our patients required EUA mainly due to photophobia.

Conclusion/Relevance: Inflammatory corneal neovascularization in children is due to BKC and HSV both preventable if diagnosed timely. EUA is often needed due to photophobia and poor cooperation in children. Once developed, KNV is difficult to treat and can lead to irreversible vision loss by scarring and amblyopia.

**Waardenburg Syndrome Associated Neurotrophic Keratopathy in a Child Treated with Neurotization Surgery**

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**Introduction:** Waardenburg syndrome (WS) is a genetic disorder characterized by congenital sensorineural hearing loss and pigmentary anomalies in the iris, hair, and skin. Ocular findings in WS include telecanthus, iris heterochromia, congenital cataracts, dry eye, and strabismus. To our knowledge, we report the first case of neurotrophic cornea in a patient with WS.

**Methods:** Case report.

**Results:** An 11-year-old male with WS presented with blurry vision and bilateral epithelial defects. He suffered from recurrent epithelial erosions and persistent epithelial defects starting at age two. Prior work up and treatment included magnetic resonance imaging, permanent lateral tarsorrhaphy, and lubrication. His exam revealed 20/200 vision in each eye, intact trigeminal nerve sensation (V1-V3) on the skin, and bilateral faint corneal scarring. Cochet-Bonnet esthesiometry confirmed severe bilateral corneal anesthesia with no sensation at 10mm. Corneal neurotization was performed on the left side using a sural nerve graft coapted to the distal end of the left supraorbital nerve. There were no complications and he had no further epithelial defects. At 9-month follow up, his vision improved to 20/50 bilaterally and repeat esthesiometry showed sensation at 25mm in his left eye.

**Conclusion/Relevance:** Direct measurement of corneal sensation with esthesiometry in young children is difficult. This can create diagnostic confusion when presented with recurrent or persistent epithelial defects. We present the first case of corneal anesthesia associated with WS and our experience with neurotization surgery.

**References:**
Suture Selection in Repair of Traumatic Pediatric Corneal Injuries

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Introduction: 10-0 non-absorbable nylon suture has traditionally been used for corneal wound repair. These sutures require eventual removal to prevent complications such as suture abscess. Efficacy of non-absorbable versus absorbable sutures has been primarily assessed in the context of penetrating keratoplasty or cataract surgery. Limited data exists discussing the suture selection for corneal injury in the context of pediatric ocular trauma.

Methods: We performed a retrospective review of 4 cases of traumatic corneal lacerations - 3 repaired with absorbable suture by one surgeon and 1 repaired with non-absorbable suture - at one level 1 trauma center. We reviewed literature on suture selection in pediatric corneal wounds.

Results: Eyes with absorbable suture did not require suture removal and had no suture-related complications. Eye repaired with non-absorbable suture was lost to follow-up and re-presented one year later with suture abscess, conjunctival overgrowth and iris incarceration posteriorly of prior laceration site, requiring additional surgical repair.

Conclusion/Relevance: Current literature demonstrates that absorbable polyglactin suture is used in pediatric cataract surgery and able to maintain adequate wound integrity with minimal effect on local tissues and astigmatism. In traumatic pediatric corneal lacerations, one should consider using absorbable suture to mitigate the need for further anesthesia for suture removal and decrease the risk of suture-related complications. Further investigation is required to further understand the role of absorbable sutures in the setting of corneal injury in pediatric ocular trauma.

References:
The Use of Biologics in the Treatment of JIA-Associated Uveitis in a Pediatric Cohort. A Single Center Retrospective Analysis

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Introduction: Juvenile idiopathic arthritis (JIA) is the most common systemic disorder associated with pediatric uveitis. This study analyzes the outcome of biologic therapy in children with JIA-associated uveitis (JIA-U) regarding the control of ocular inflammation, steroid dependence and visual outcome.

Methods: This is a retrospective, observational cohort study on patients from the Uveitis Subspecialty Clinic, who had received treatment with biologics (adalimumab, infliximab, etanercept) for their JIA-U. Pre- and post-treatment data were analyzed to determine their functional success (stable or improved visual acuity), quiescence success (0.5 or less cells in the anterior chamber) and steroid sparing success (complete termination of systemic steroid therapy and/or decreased topical steroids to 2 drops per day).

Results: The study included 35 patients who received biologics to control their JIA-U activity. Seventeen patients used systemic steroids prior to biologics, of which 15 had their dose either decreased or completely discontinued. Corrected visual acuity remained the same in 15 patients (42.9%), improved in 10 and worsened in 10 (28.6%). Functional success was achieved in 25 eyes (71.4%), 28 (80%) achieved quiescence, 20 (57.1%) achieved steroid sparing success and 12 (34.3%) achieved complete success (steroid sparing, quiescence and functional). Patients of the older age group were significantly more successful than younger patients (mean age 11.5 versus 9.02, p= 0.037)

Conclusion/Relevance: Treatment with biologics led to decreased steroid dependence, control of intraocular inflammation and stabilization of vision. Biologics can be initiated once inflammation is resistant to conventional therapy. Further prospective studies are required to compare different types of biologics.

Population-Based Incidence and Clinical Features of Pediatric Ocular and Adnexal Trauma

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Introduction: The purpose of this population-based study was to report the incidence and characteristics of pediatric ocular and adnexal trauma.

Methods: The medical records of all patients <19 years diagnosed with any ocular or adnexal trauma in both inpatient and outpatient settings while residing within a well-defined geographic region from January 1, 2000, through December 31, 2009, were retrospectively reviewed.

Results: A total of 751 patients were diagnosed with ocular or adnexal trauma during the 10-year period, yielding an incidence of 205 (95% CI 191-220) per 100,000 per year. Median age at diagnosis was 10.0 years and 469 were males (62.5%). Patients were most likely to present to the emergency department or urgent care clinics (69.9%) after accidental injury (88.5%) that occurred during outside or street play (31.7%). The most common injury mechanisms were blunt force (21.4%), foreign body (13.9%) and sports-related activities (13.1%). The 10 most common diagnoses were subconjunctival hemorrhage (205, 27.2%), corneal abrasion (199, 26.4%), eyelid contusion or edema (169, 22.5%), hyphema (71, 9.5%), conjunctival abrasion (52, 6.9%), conjunctival foreign body (45, 6.0%), corneal chemical injury (37, 4.9%), traumatic iritis (36, 4.8%), commotio retinae (32, 4.3%), and conjunctival chemical injury (30, 4.0%). One hundred forty-eight patients (19.7%) had a recorded visual acuity of 20/40 or worse at their initial exam and 98 (7.7%) by their final eye exam.

Conclusion/Relevance: Ocular and adnexal trauma are common injuries in children with a higher incidence than previously reported. Although vitreoretinal disorders were relatively uncommon in this cohort, visual acuity was significantly reduced in 1 in 13 patients.

Outcomes of Unilateral Cataract Surgery in Children 7 to 18 years of Age: a Comparison to Younger Cohorts

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Introduction: Unilateral cataract surgery in young children often results in a disappointing final visual acuity due to developmental anomalies, surgical complications, and deprivation amblyopia. We previously demonstrated that complications, need for additional intraocular surgery, and adverse events is reduced in children aged 2 to 7 years undergoing unilateral cataract surgery with primary intraocular lens implantation (IOL) compared to infants and toddlers. The purpose of this study is to evaluate and compare the surgical outcomes of older children, aged 7-18 years, who are typically considered to be outside the amblyopic age range.

Methods: The medical charts of patients who underwent unilateral cataract surgery between the ages of 7-18 years at the Storm Eye Institute were analyzed retrospectively. Outcomes were compared to those of younger cohorts reported previously.1-3

Results: Forty-two children aged 7-18 years with a median follow-up of 5.5 years were included. Although markedly reduced from those reported in infants, there were similarly low proportions of intraoperative complications (12%), adverse events (5%) and need for additional intraocular surgery (5%) in this older cohort compared to 2-7 year olds (p>0.05). Unlike in infants, there were no cases of glaucoma suspect or glaucoma after cataract surgery. The median visual acuity continued to improve as the age of cataract surgery increased from 20/159 in infants to 20/126 in toddlers, 20/44 in school-aged children, and 20/32 in this 7-18 year old cohort.

Conclusion/Relevance: The current study highlights the satisfactory visual acuity outcomes and reduced complications of cataract surgery with IOL in older cohorts of children where glaucoma and micophthalmia are rare.

Outcomes of Bilateral Cataract Surgery in Children 7 to 18 years of Age: a Comparison to Younger Cohorts

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Introduction: To evaluate the outcomes of bilateral cataract surgery in children 7 to 18 years of age and to compare them to the outcomes of bilateral cataract surgery in younger cohorts.

Methods: Children who underwent bilateral cataract surgery between the ages of 7-18 years of age with minimum follow-up of 2 years were analyzed after approval by the IRB. Outcomes were compared to those of younger cohorts previously reported.1-3 In eyes with an intact posterior capsule at the time of cataract surgery, removal of PCO once was not considered as an adverse event (AE). Complications are reported for the first operated eye.

Results: 74 eyes of 37 children with median age at surgery of 8.9 years and median follow-up of 7.5 years were analysed. All eyes received primary IOL implantation. The median postoperative BCVA is better in older children (Better seeing eye: infants 20/44, toddlers 20/30, 2-7 years old 20/22, 7-18 years old 20/25; Worse seeing eye: infants 20/60, toddlers 20/50, 2-7 years old 20/30, 7-18 years old 20/25). AE were observed in 46.9% of infants, 20% of toddlers, 7% age 2-7 years and 8.1% for age at surgery 7-18 years. Unplanned intraocular reoperations were also noted less frequently in older children (Infants, 28.1%; toddlers, 15.0%, 2-7 years old, 12.3%; 7-18 years old 10.8%). In eyes with an intact posterior capsule, 11/26 (42.3%) eyes required removal of PCO in 7-18 years old as compared to 5/8 (62.5%) in 2-7 years old children.

Conclusion/Relevance: Compared to younger similar groups, bilateral cataract surgery performed between 7 to 18 years was associated with better BCVA and less additional intraocular surgery.

Risk of Complications within Five Years of Primary Intraocular Lens (IOL) Surgery for Pediatric Cataract

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Introduction: Children birth to <13 years of age undergoing cataract surgery with primary IOL implantation were enrolled into a prospective registry to describe the incidence of complications within 5 years.

Methods: Data were collected from medical records at enrollment (≤45 days after the cataract surgery) and annually thereafter. We calculated cumulative incidence of complications and evaluated associations using Cox proportional hazards models.

Results: Cumulative incidence of any complication in primary childhood pseudophakia was 49% (95%CI=39%-57%) when bilateral (n=376 eyes) and 53% (95%CI=45%-60%) when unilateral (n=286 eyes). Visual axis opacification (VAO) was the most common complication and occurred in 40% (95%CI=34%-45%) of eyes. Risk of VAO increased with age at lensectomy (HR=Hazard Ratio (95%CI), 1 to <4 years: 0.31 (0.20-0.48), 4 to <7 years: 0.68 (0.49–0.95), and 7 to <13 years: 1.00 (reference)). VAO was more common with capsular bag than sulcus fixation, HR=2.86 (95%CI=1.59–5.14). Regarding need for surgery to clear VAO, eyes without primary vitrectomy/capsulotomy had greater risk, HR=6.05 (95%CI=3.84-9.54). Cumulative incidence of glaucoma was 5% (95%CI=1%-8%) after bilateral surgery and 8% (1%-14%) after unilateral; and was highest in 7 to <13 year-olds after unilateral surgery, 11% (95%CI=0%-21%). Serious adverse events were rare.

Conclusion/Relevance: VAO was the most common complication of childhood pseudophakia, especially in older children. Surgery for VAO was more frequent in eyes without primary capsulotomy. Pseudophakia in children was associated with a risk for development of glaucoma. These children require long-term monitoring for development of VAO and/or glaucoma.

References: None
Intraocular Lens Exchange for the Management of Myopic Shift in Pseudophakic Children

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Introduction: A significant and/or an unpredicted myopic shift following pediatric intraocular lens (IOL) implantation contributes to the difficulties in visual rehabilitation of pseudophakic children. Standard management using spectacles is usually recommended for small degrees of myopic shift. However, larger degrees of myopic shift might warrant surgical intervention. The aim of this study was to evaluate the outcome of IOL exchange for the management of myopic shift in pseudophakic children.

Methods: The medical records of children who underwent IOL exchange for myopic shift were examined. The preoperative data, operative details and the postoperative outcome were analyzed.

Results: A total of 21 eyes that underwent IOL exchange (15 patients) for myopic shift were identified. Average age of cataract extraction was 20 ± 26 months (range 2-84 months). 11 patients had primary IOL implantation. The mean age at IOL exchange was 6±3 years (range 1-11 years) following cataract surgery. The mean spherical equivalent (SE) at IOL exchange was -14 ± 5 D (range, -21_-7). The mean axial length at IOL exchange was 24 ± 1.3 mm (range, 23-27). Following IOL exchange, the mean SE was reduced to -2 D ± 1.8 (range - 4_+2.5). An average of three-line improvement in the best-corrected visual acuity was observed in 12/16 eyes of patients for whom pre- and post-exchange visual acuity were available, while visual acuity remained unchanged in 4 eyes.

Conclusion/Relevance: IOL exchange is a safe procedure that should be considered to improve visual rehabilitation in pseudophakic patients with myopic shift

Clinical Spectrum of Ectopia Lentis Presenting to a Specialist Children's Hospital

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Introduction: We have undertaken targeted genetic testing of children presenting to a specialist children's hospital with ectopia lentis. We report the presenting clinical features of our case series and the genes identified.

Methods: We retrospectively searched electronic medical records (Epic Systems Corp.) using appropriate search terms (ectopia lentis; subluxated lens; dislocated lens) to identify subjects diagnosed with ectopia lentis at our institution. Medical records were scrutinized to confirm presence of ectopia lentis and cases only included if genetic testing was performed. For included subjects, sex, age, ophthalmic features, medical features, and associated gene (together with disease causing variant when reported) were examined.

Results: We identified 48 children with ectopia lentis in whom a genetic disorder had been confirmed. There was a male predominance (63%) and a median age of 10 years at the time of data extraction (range 2-19 years). The majority of our sample (77%, n=37) had FBN1-related ectopia lentis (Marfan syndrome) with consistent ocular features but variable systemic features - we explore the phenotype-genotype correlation with different disease-causing variants in FBN1 and compare to the literature 1. We identified eight children (17%) with ADAMTSL4-related ectopia lentis. These children typically exhibited inferior lens displacement, anterior segment dysgenesis and missing zonules. There were two children with Homocystinuria in this series, and one with LTBP2-related ectopia lentis who also had megalocornea.

Conclusion/Relevance: Genetic investigation of children with ectopia lentis enables early, precise identification of a range of disorders beyond FBN1-related ectopia lentis and thus subsequent individualization of further investigations and medical care.

Clinical Ophthalmic Findings in Children with Alström Syndrome

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Introduction: Alström syndrome is a rare autosomal recessive disorder affecting multiple systems including the eyes. Despite knowing the causative gene, ALMS1, the spectrum of its clinical manifestations has not been fully characterized, which has been a challenge due to the great variability of presentation, reduced life expectancy, and the less-than-one-per-million prevalence of this disease. This study aims to summarize the clinical ophthalmic findings in children with Alström syndrome using data from the largest known existing cohort, and to familiarize pediatric ophthalmologists with these findings.

Methods: Thirty patients of all ages with a known diagnosis of Alström syndrome participated at biannual multidisciplinary Alström syndrome clinics (2015 – 2020) at a centralized academic center. These patients received comprehensive eye examination by a pediatric ophthalmologist. Clinical data were then extracted and summarized from the charts.

Results: Twenty-five pediatric patients had a median age of 7, ranging from 15 months to 16 years. Among these children, nystagmus (22/25) and photophobia (22/25) are not only the most commonly documented ophthalmic findings, but also the most common first presenting symptoms. Retinal vascular attenuation (19/25) and retinal internal limiting membrane changes (15/25) are the most commonly documented retinal findings. In contrast, only 2 children had documented retinal pigment clumps. Previous misdiagnoses included achromatopsia, cone-dystrophy, cone-rod dystrophy, retinitis pigmentosa, and spasmus nutans.

Conclusion/Relevance: We believe that knowledge of these clinical findings would benefit pediatric ophthalmologists to better recognize this potentially vision-threatening and life-threatening condition.

Craniosynostosis and GAPO Syndrome: A Report of Two Siblings and Histopathologic Findings

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Introduction: GAPO syndrome (growth retardation, alopecia, pseudoanodontia, optic atrophy) is autosomal recessive with only 60 reported cases.1 Ophthalmic manifestations vary and include hypertelorism, optic atrophy, and glaucoma.2 Three reported cases had craniosynostosis.

Methods: We describe two new siblings with GAPO syndrome and craniosynostosis and the first histopathologic analysis of Tenon's capsule and extraocular muscle in this syndrome.

Results: Six and seven-year-old brothers presented with 20/20 acuity both eyes, V pattern exotropia, and marked papilledema. They had alopecia, brittle eyelashes, ‘geriatric’ facies, frontal bossing, and pseudoanodontia. One had short stature. Genetic testing confirmed the associated ANTXR1 mutation. Neuroimaging demonstrated multisuture craniosynostosis and prominent emissary and scalp veins. Both underwent fronto-orbital advancement with cranial vault remodeling complicated by lack of distinct periosteal layers, thin dura adherent to bone, and extensive venous bleeding. One brother had resolution of papilledema but later developed mild optic atrophy. The second brother's surgery was aborted due to massive bleeding. Postoperatively, he developed a pseudomeningocele acting as a ventricular shunt significantly reducing papilledema.

Bilateral lateral rectus recessions and inferior oblique myectomies were performed on one. The extraocular muscles appeared normal, but Tenon's capsule was extremely inelastic and highly vascular. Histopathological analysis revealed hyalinization of Tenon's and a thickened, homogenized, amorphous appearance. Extraocular muscles were histologically normal.

Conclusion/Relevance: Craniosynostosis with secondary optic neuropathy may occur with GAPO syndrome. Management may be complicated by abnormalities of dura, peristeme, and intracranial veins. Histopathologic findings in Tenon's capsule resemble the extracellular matrix abnormalities previously described in skin and other organs.3


Introduction: Glaucoma surgery complication rates in children and adults have been reported in single- and multi-center studies but have not been characterized in large, nationally representative cohorts. We examine claims data from a US commercial insurance database.

Methods: A retrospective population-based study of children (<=18 years old) and adults who underwent glaucoma surgery was identified using a US claims database (MarketScan) between 2008-2015.

Results: From 2008 to 2015, 423 children (mean age, 9.1 ± 6.0 years) and 29,274 adults underwent glaucoma surgeries. Post-operative complications occurred more frequently in children: hyphemas (3.8% vs 1.4%, p < 0.001); retinal detachments (5.2% vs 2.2% p < 0.001); and revisions (11.8% vs 3.1%, p < 0.001). Being <=18 years old was associated with higher risk of any complication (OR 1.76, CI 1.38-2.23, p < 0.001). Children were more likely than adults to have angle surgery or glaucoma drainage device (GDD) surgery compared to cyclophotocoagulation or trabeculectomy (p < 0.001). Compared to angle surgery, children undergoing GDD insertion were at higher risk of complications (OR 1.78, CI 1.38-1.97, p < 0.001), which was further increased when excluding hyphemas (OR 2.20, CI 1.57-3.09, p = 0.02), a common complication after angle surgery. Finally, time from initial surgery to first complication was lower in children (0.9 vs 1.6 years, p < 0.001).

Conclusion/Relevance: Children have a significantly higher rate of complications following glaucoma surgery than adults. Additionally, angle and GDD surgery were performed more commonly in children, with increased risk of complications in GDD.

'Coming Up Short' with an Illuminated Microcatheter for Circumferential Trabeculotomy Ab Externo in the Buphthalmic Infant Eye: Frequency and Options

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Introduction: Angle surgery constitutes initial surgical treatment for most primary congenital glaucoma (PCG) cases.1,2 An illuminated microcatheter (iTrack microcatheter/Nova Eye Medical, Fremont, CA) facilitates circumferential trabeculotomy (360trab) but may not "reach" 360º in buphthalmic PCG eyes. This study's purpose is the creation and validation of a model using pre-operative horizontal corneal diameter (HCD) to predict whether the iTrack will traverse all 360º of Schlemm canal (SC) to assist surgical planning.

Methods: Ongoing IRB-approved retrospective study of all angle surgery for PCG by one attending 7/2013-8/2021. Data collected (pre-operative) included: HCD/clarity, axial length, procedure performed, and whether iTrack allowed 360º SC cannulation. The iTrack microcatheter was measured to predict the maximal SC circumference that could be traversed.

Results: Included are 116 eyes (74 children) with mean surgical age 10.4±13.2months, HCD 13.2±1.1mm, and axial length 23.1±2.5mm. Trabeculotomy was ultimately performed in 45 eyes (39%) and goniotomy in 71 (61%). The iTrack microcatheter measures 46.5mm of available cannulation length. Assuming SC’s anterior aspect runs circumferentially under the limbus, the iTrack should successfully cannulate 360º of SC in eyes with HCD<14.8mm (46.5/π=14.8mm). Overall, 6/116 (5.2%) of eyes had a corneal diameter greater than 14.8mm; of these, iTrack was attempted in 3/6 and failed to reach 360º in all 3 instances.

Conclusion/Relevance: When considering angle surgery in eyes with PCG, pre-operative HCD>14.8mm suggests the iTrack microcatheter may not "reach" all 360º of SC. Alternatives then would include goniotomy, rigid-probe trabeculotomy, attempted suture trabeculotomy, or iTrack use with a "cut-down" retrieval of the distal catheter tip.

Ologen Augmentation of Ahmed Glaucoma Valves in Children

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Introduction: We aimed to analyze the effectiveness of Ologen-augmentation of Ahmed glaucoma valves (OAGV) performed by a single surgeon.

Methods: Ocular examination and surgical details of pediatric patients who underwent OAGV placement between 2018 and 2021 with at least 6 months of post-operative follow-up. Complete success was defined as intraocular pressure (IOP) between 5 and 20 mmHg without glaucoma medications or additional IOP-lowering surgeries. Qualified success was defined as above, except IOP control was maintained with or without glaucoma medications.

Results: Twenty-six eyes of 18 patients underwent OAGV (21 FP7 and 5 FP8) at a median age of 2.0 years. Seventeen eyes had a history of at least 1 eye surgery with an average of 1.6 ± 0.9 surgeries per eye (median 1). Prior surgeries included trabeculotomy (7), goniotomy (5), lensectomy (3), retinal laser (3), contact cycloablation (3). Preoperative IOP was 29.4 ± 9.9mmHg on an average of 2.7 ± 1.0 glaucoma medications. At final follow-up (1.2 ± 1.0 years, median 1.0), IOP (13.4± 4.7 mmHg) and number of glaucoma medications (0.3 ± 0.7, median 0) were significantly decreased (p<0.0001). Complete success rate was 77% (20 of 26 eyes) with 1- and 3-year survival rates of 82% with 95% CI[59, 93] and 60% with 95% CI [25,83]. Qualified success rate was 100% (26 of 26 eyes) at final follow-up.

Conclusion/Relevance: Ologen augmentation shows a high rate of success in childhood glaucomas, significantly decreasing IOP and medication dependency.

Outcomes of Glaucoma Valve Implantation with Mitomycin-C, after Failure of a First Glaucoma Valve in Pediatric Glaucoma

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Introduction: The use of Mitomycin-C (MMC) for implantation of Ahmed glaucoma valve (AGV) in pediatric glaucoma is still debated. The objective of the present study was to report the outcomes of subsequent AGV implantation with MMC after failure of a first valve in children.

Methods: The retrospective chart review included all children with history of at least one shunt surgery receiving an AGV implantation with MMC between 2000 and 2019. We defined complete success as an IOP of 5 to 21 mmHg without glaucoma medication and qualified success as a final IOP of 5 to 21 mmHg with one or more glaucoma medication, without loss of vision.

Results: Twenty-two eyes of 21 patients were included. The probability of qualified success was 74% [95%CI: 56% - 97%] at 2 years, and 54% [95%CI: 34% - 84%] at 5 years. The probability of complete success was 47% [95%CI: 29% - 75%] at 2 years and 34% [95%CI: 18% - 65%] at 4 years. Failure happened in 10 eyes after a mean time of 4.3 years ±3.6 [6 months – 15 years], 5 of which (23%) for severe complication or loss of vision.

Conclusion/Relevance: This study of implantation of a second valve with MMC reports good medium- and long-term complete and qualified success rates. The risk of complications is high in this population and, compared to the existing literature, did not seem to be increased by the use of MMC.

Safety and Efficacy of Netarsudil in the Management of Refractory Glaucoma

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Introduction: Netarsudil, a rho kinase inhibitor, has recently acquired approval for use in adults in the United States to lower intraocular pressure (IOP) in patients with glaucoma. There remains limited data on the effectiveness and safety profile of Netarsudil in children.

Methods: IRB approved retrospective review of patients with pediatric glaucoma that were started on Netarsudil in a single instruction. Patients were considered to successfully being treated with Netarsudil if they maintained an IOP below target at the 6 month mark without requiring additional oral anti-hypertensive or additional surgical intervention.

Results: A total of 24 eyes from 19 patients were included in the study. Mean age at start of medication was 9.6±4.8 years (min – 6 months, max – 17 years). All patients were already on an average of 3.5±0.7 glaucoma drops. Average IOP prior to starting Netarsudil was 28.2±9.1mmHg and average IOP 1 month after starting Netarsudil was 27.4±9.6mmHg (p = 0.56). Netarsudil was discontinued in 2 patients due to adverse events (conjunctival injection, concern for worsening of pre-existing corneal edema). Only 2 eyes out of 24 reached the end goal of being successfully managed with only the addition of Netarsudil.

Conclusion/Relevance: Netarsudil offers a valuable alternative medication in the management of pediatric glaucoma. However, its efficacy may be limited in a population of refractory glaucoma patients. Further larger studies are necessary to determine the effectiveness and safety profile of the medication in children.

Micropulse Laser Cyclophotocoagulation For Childhood Glaucoma

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Introduction: Childhood glaucoma generally requires surgical intervention. Although angle surgery is effective, filtering and tube surgery can be associated with many complications. MicroPulse transscleral cyclophotocoagulation (MP-TSCPC) has the potential to add a high benefit/ratio treatment option.

Methods: We report a prospective, descriptive analysis of patients who had a single MP-TSCPC as part of a glaucoma treatment regimen. Including general demographic and clinical data, this report included; intraocular pressures (IOP) changes, MP-TSCPC settings, adverse events and medication changes.

Results: Data was obtained from 10 eyes in 7 patients with multiple glaucoma diagnoses. 80 seconds of 2500 mW energy was applied over 10 clock hours in all patients. Age was 3-19 years (average 7.8). Follow up after laser was 2-5 months. Group mean IOP decreased 43.7 % (0-69%) although 1 patient had a simultaneous second goniotomy of 180 degrees. Three eyes in 2 patients had a > 65% decrease in their pre laser IOP. In all 10 eyes there was an average 53% reduction in topical IOP reducing medications. There were no adverse events.

Conclusion/Relevance: We are beginning to understand how MP-TSCPC can be used in the pediatric population. However, this data shows that this laser can become a safe therapeutic tool to help lower IOP whether by itself or in addition to traditional surgical interventions. It is well tolerated compared to traditional cyclophotocoagulation. We hope this report stimulates further study of this novel technology.


Ocular Manifestations of Ruptured Arachnoid Cysts in Pediatric Patients

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Introduction: Arachnoid cysts are intra-arachnoidal collections of cerebrospinal fluid, which can rupture spontaneously or secondary to trauma, resulting in subdural hemorrhage and increased intracranial pressure. However, there is little published data examining the ocular manifestations of ruptured arachnoid cysts. By examining the records of children treated for ruptured arachnoid cysts who also underwent an ophthalmologic exam, we sought to characterize ocular manifestations of ruptured arachnoid cysts in children.

Methods: We performed a retrospective review of all children treated for ruptured arachnoid cysts at our institution from 2010-2018 and recorded the findings of their ophthalmology exams. Children who were not seen by ophthalmology during their initial admission were excluded, as were children suspected to have suffered abusive head trauma.

Results: Twenty-two children were treated for ruptured arachnoid cysts during the study period, 15 of whom met eligibility criteria. Rupture was spontaneous in 11 children and traumatic in four. Subdural hemorrhage or fluid was noted in all patients on MRI. Papilledema was seen in 10 patients, but no papilledema was noted in any of the 4 patients under 3 years old. Two patients developed retinal hemorrhages, which were confined to the posterior pole and intraretinal layer. Final best-corrected visual acuity in one eye of one patient was 20/400 due to optic atrophy from severe papilledema, but all other eyes in verbal children saw at least 20/30 at last follow-up.

Conclusion/Relevance: Children with ruptured arachnoid cysts commonly develop ocular sequelae. Ophthalmology should be consulted in all cases, though the visual prognosis of these children is generally good.


Etiologies and Outcomes of Optic Neuritis in Ohio’s Pediatric Population

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Introduction: Anti-myelin oligodendrocyte glycoprotein (anti-MOG) optic neuritis is common in the pediatric population. This study sought to compare presenting characteristics, clinical course, treatment methods, and outcomes of pediatric patients with anti-MOG optic neuritis to those with optic neuritis of alternate etiologies.

Methods: A retrospective chart review between 04/2017 and 04/2020 was conducted at three pediatric referral centers in Ohio.

Results: 30 subjects were identified. Seventeen had MOG-associated disease and 13 had non-MOG associated disease. There were no differences in age, gender, ethnicity, race, or symptomatology. Serology, neuroimaging, and cerebrospinal fluid parameters were similar except the non-MOG group had higher oligoclonal band numbers, 4.9±5.6 vs 0.3±1.3 (p=0.005). Visual acuities of the worse eye were 1.1±0.8 vs 1.3±0.83 LogMAR in the MOG and non-MOG groups (p = 0.584). Time from symptom onset to the initiation of IV steroids (17.2±23.6 vs 12.7±15.17 days, p=0.558), and duration of IV steroids (4.9±1.4 vs 4.8±1.0 days, p=0.95) were identical. Although the MOG group had more relapses (8/17 vs 4/13) more quickly (131±201 vs 290±205 days, p=0.228), there was no difference in time to recovery (114±151 vs 246±590 days, p=0.382) or final visual acuity, 0.3±0.7 vs 0.1±0.3 LogMAR (p=0.394). Relapses were treated with IVIG, PLEX, and biologics.

Conclusion/Relevance: Pediatric MOG-associated disease is more prevalent in Ohio than estimated. Further study is needed to elucidate characteristics of this potentially blinding condition.

Oral Fluorescein Angiography for the Diagnosis of Papilledema versus Pseudopapilledema in Children

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**Introduction:** To evaluate the accuracy and safety of oral fluorescein angiography (OFA) in differentiating pediatric papilledema versus pseudopapilledema

**Methods:** We retrospectively reviewed medical records of all children ≤ 18 years who presented to the Arkansas Children’s Hospital between May 2018 to August 2021 with suspected optic disc (OD) swelling that had OFA and images > 30 minutes after oral ingestion. Two masked specialists interpreted the images as either OD leakage, no leakage, or indeterminate results. Optic disc swelling was graded clinically according to Frisen grading scale (0-5). We compared OFA images to the final clinical diagnosis and calculated the accuracy of the test. Accuracy of OFA was calculated as [number of eyes correctly identified as papilledema (true positive) + number of eyes correctly identified as pseudopapilledema (true negative)] / [total number of eyes] x 100%.

**Results:** Forty-five patients (90 eyes) were included, 11 patients with papilledema and 34 patients with pseudopapilledema. The mean age was 14.1±6.5 years; 66.7% were females. Indeterminate OFA results were 3 and 9 for reviewer 1 and 2, respectively. The accuracy of OFA was 77% for reviewer 1 and 90% for reviewer 2. No ocular or systemic side effects after OFA were observed. There was a strong agreement between reviewers when OFA images were taken > 45 minutes after oral ingestion.

**Conclusion/Relevance:** The accuracy of OFA for classifying optic disc swelling as papilledema versus pseudopapilledema is inferior to intravenous FA. OFA can not definitively distinguish papilledema from pseudopapilledema and should be interpreted in conjunction with other clinical findings

**References:**
Leukemic Optic Neuropathy in Pediatric Patients: A Case Series

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Introduction: Leukemic or lymphomatous infiltration of the optic nerve is a neuro-oncologic emergency characterized by cancerous cells invading the optic nerve. Diagnosis is complicated as biopsy is innately high risk and urgent intervention is required to prevent permanent vision loss. Literature is limited on this condition in pediatric patients, the majority of which are case reports. This study characterizes the presentation, clinical course, and treatment of a case series of children presenting with leukemic optic neuropathy.

Methods: Patients with leukemia or lymphoma who were treated at a children's hospital for optic nerve infiltrate were included (n=11). Demographic information, cancer history, ophthalmologic exam findings, treatment, and outcomes were collected.

Results: Mean age was 10.0 ± 4.6 years and 63.6% were male. The most common cancer diagnosis was B-precursor acute lymphoblastic leukemia (ALL) (n=7, 63.6%). The majority presented with the optic nerve infiltrate during remission (n=9, 81.8%), but it was the initial cancer symptom for 2 patients (18.2%). Central nervous system (CNS) disease was confirmed by lumbar puncture (LP) in only 36.4%. On MRI, 63.6% had optic nerve enhancement and 36.4% had optic nerve enlargement. Eight patients (72.7%) received emergent local radiation within 1.1 ± 1.4 days on average.

Conclusion/Relevance: Most patients had a negative LP and MRI findings varied, emphasizing the importance of clinical context in making this diagnosis. Clinicians should consider an optic nerve infiltrate in patients with leukemia or lymphoma with visual complaints, as urgent treatment is required to preserve vision and manage systemic disease.

Presumed Vincristine Ganglion Cell Toxicity Resulting in Binasal Visual Field Loss

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**Introduction:** Vincristine sulfate, a common chemotherapeutic, can be neurotoxic, causing severe axonal damage and loss of myelinated fibers. We describe a patient with bilateral optic disc pallor and binasal visual field loss secondary to presumed Vincristine neurotoxicity.

**Methods:** Case report and review of literature.

**Results:** A 10 year-old boy with T-cell lymphoblastic lymphoma treated with vincristine with no visual symptoms presented with bilateral optic disc pallor on routine optometric exam. Despite normal visual acuity (20/20 OD, 20/25 OS) and color vision (Ishihara 15/15 OU), optical coherence tomography showed bilateral diffuse loss of the optic nerve RNFL OU and bitemporal macular ganglion cell layer loss. Visual field testing demonstrated bilateral nasal visual field defects. Neurologic exam showed subtle sensory changes to the distal toes and mild slapping foot gait consistent with sensorimotor peripheral neuropathy. A contrast-enhanced MRI of the brain was normal.

**Conclusion/Relevance:** Optic atrophy is a rare complication of vincristine neurotoxicity but this is the first case in the literature to demonstrate associated bitemporal macular ganglion cell loss with consequent binasal visual field loss. This highlights a rare but potentially devastating result of presumed vincristine toxicity, which is a widely used chemotherapeutic. It is important to note that vincristine-associated optic neuropathy may initially be subtle, and children in particular may not report loss of vision and may present too late. We recommend that clinicians should maintain a high index of suspicion for this drug’s neurotoxic adverse effects.

**References:**
Poster #B38
Saturday, March 26, 2022
9:55 AM – 10:55 AM

Re-Evaluating Clinical Signs of Orbital Cellulitis

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Introduction: We sought to determine clinical signs predictive of orbital cellulitis in children with periorbital swelling to help guide decision making for imaging.

Methods: Retrospective consecutive cohort study of children with periorbital swelling admitted to a children’s hospital and evaluated by an ophthalmologist over an 8-year period. Clinical signs, including conventional ‘orbital signs’ and fever, as well as combinations of significant factors were evaluated to predict orbital cellulitis diagnosed based on orbital imaging.

Results: Three hundred seventy-three children with periorbital swelling were studied, mean age 6.8 years (range 0.1-17). 231 (62%) children had radiographic evidence of orbital cellulitis. Clinical signs associated with orbital disease included motility limitation (p<0.001), proptosis (p<0.001), and moderate or severe chemosis (p=0.02). Both rAPD (n=2) and optic disc abnormality (n=1) were seen only in orbital cellulitis but were rare and always accompanied by at least one of the 3 associated signs. Change in vision and injection were not associated. The presence of one or more of motility abnormality, proptosis, moderate-severe chemosis, or temperature >100.4 within 24 hours of presentation had a sensitivity of 76% (95% CI 70%-81%) and specificity of 76% (95% CI 69%-83%) for orbital cellulitis.

Conclusion/Relevance: Consideration of only 4 clinical signs (one or more of motility limitation, proptosis, moderate-severe chemosis, or temperature >100.4 F) as indication for orbital imaging results in higher sensitivity and specificity than both conventionally used orbital signs and other published clinical decision-making algorithms. Future studies may validate this approach and determine if ancillary testing helps to further improve performance.

Pediatric Eyelid and Canalicular Lacerations: Epidemiology and Outcomes

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Introduction: Eyelid lacerations are among the most common types of pediatric facial trauma and require surgical intervention to optimize cosmetic and functional outcomes. The objective of this study was to characterize the epidemiology of eyelid lacerations, identify risk factors for canalicular involvement, and describe postoperative complications following laceration repair.

Methods: A retrospective chart review was performed of all patients undergoing eyelid laceration repair at a tertiary care, level I trauma center children's hospital from November 2010 to April 2021. Univariate analysis and multivariate logistic regression were performed to identify risk factors for canalicular involvement and postoperative complication.

Results: 165 patients were identified, of whom 136 had at least one week of follow-up and were further assessed for postoperative complications. The most common mechanisms of injury were dog bites (62, 38%), falls (33, 20%), and being struck by an object (22, 13%). Lid margin involvement was present in 108 patients (65%) and canalicular involvement in 77 (47%). Risk factors for canalicular involvement were hook-related injury, lid margin involvement, and lower lid injury. Thirty-three patients (24%) had postoperative complications, most commonly ptosis (7, 5%), premature stent loss (7, 5%), and lid margin notching (6, 4%). There was no association between postoperative complication and antibiotic use, delayed repair, or wound class.

Conclusion/Relevance: Hook-related injury, lid margin involvement, and lower lid injury are risk factors for canalicular involvement. Postoperative complications of lid lacerations are generally minor and are not associated with perioperative factors. Close postoperative follow-up is needed to monitor for complication development.

Surgical Results and Aesthetic Outcomes of Percutaneous Aspiration of Superficial Periorbital Dermoid Cysts vs Excision in Toto

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Introduction: The aim of our study was to test the efficacy of percutaneous aspiration of superficial periorbital dermoid cysts technique and to compare it with the traditional excision in toto technique regarding postoperative complications and parents' satisfaction with aesthetic outcome.

Methods: The study was conducted on 46 children having superficial periorbital dermoid cysts [23 cases underwent excision in toto technique (group A), and 23 underwent percutaneous aspiration technique (group B)]. The outcome measures included length of skin scar in millimeters and parents' satisfaction with the aesthetic outcome of the scar; using a grading system (grade 0: unsatisfied, grade 1: moderately satisfied, and grade 2: fully satisfied with the scar).

Results: In group A, the mean post-operative skin scar length was (15) mm, while it was (6) mm in group B, which was highly statistically significant (p=< 0.001). There were no recurrences in both groups after the end of follow-up period.

Conclusion/Relevance: Percutaneous aspiration technique appears to be a promising, safe and effective technique for management of superficial periorbital dermoid cysts in the pediatric age group; with reduction of the surgical time, better post-operative small skin scar, and better parents' satisfaction with the aesthetic outcome. No recurrences had been encountered in our study.


Development and Evaluation of a Novel Online Case-Based Learning Tool in Pediatric Ophthalmology for Pediatric Clerkship Students

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Introduction: Pediatricians are often the first-line providers to screen children for sight threatening problems. However, trainees may have limited exposure to pediatric ophthalmology (PO) [1-3]. We developed a novel, online case-based learning tool (CBLT) in PO for medical students (MS) and piloted its use in a workshop during the pediatric clerkship.

Methods: We created five high-yield PO cases based on ophthalmology and pediatric core competencies and published them on 2020SIM.com via WordPress, a web publishing software. The CBLT was modeled after NephSim.com, a free open access medical education (FOAMEd) resource. Prior to the session, MS completed a five-item pre-test. MS worked through cases in a one-hour workshop facilitated by an ophthalmologist. Post-test/exit survey data will be collected four weeks following the session.

Results: At interim analysis, 36 MS participated in the workshop, of which 19 and 9 completed the pre-test and post-test/exit survey, respectively. Mean knowledge assessment increased from 36% to 42% (p=0.41). Of exit survey respondents, all enjoyed the CBLT, with 89% perceiving the session to be relevant to their medical training. Two-thirds reported increased comfort with common PO presentations and 22% visited 2020SIM.com after the session.

Conclusion/Relevance: Through partnership with the pediatric department, this PO CBLT was integrated into the MS curriculum, facilitating early engagement and potential recruitment to PO. Preliminary findings suggest that the CBLT was well-received, with a trend towards improved student knowledge. The online nature of the CBLT supports exposure to core PO content for interested learners worldwide.

Ophthalmology on Tiktok: An Analysis of Hashtags

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Introduction: Forty-five percent of patients report that health information on social media influences their decision to seek health care (1). The focus of this study is to determine social media's influence on ophthalmology through analysis of twenty-two general and pediatric related ophthalmic hashtags on Tiktok.

Methods: The hashtags were selected based on the American Association for Pediatric Ophthalmology & Strabismus most searched diagnoses and the top twenty diagnoses as per a regional billing company. Hashtags are keywords users can add to label their videos. The Tiktok algorithm automatically highlights the top posts for each hashtag in order of engagement. The analysis consisted of determining if each post was created by a self-reported physician, board-certified ophthalmologist (verified by American Board of Ophthalmology), board-certified physician (other than ophthalmology), optometrist, allied health personnel in ophthalmology or lay person. The content of each post was further divided into categories including health-related, non-health related, educational, product advertisement, self-promotional, and patient-posted.

Results: Posts on Tiktok with the queried hashtags have been viewed a cumulative 668 million times. 25% identified as working in eye care, either as an ophthalmologist, optometrist, allied health personnel in ophthalmology. Board certified ophthalmologists were responsible for 9.5% of the top posts (230).

Conclusion/Relevance: We found that only a small percentage of ophthalmology-related content published on Tiktok is produced by board-certified ophthalmologists. As more Americans search for health related content on social media, our patients stand to benefit from the increased presence of ophthalmologists on these platforms.

Accuracy of the International Classification of Diseases, 9th Revision for Identifying Infantile Eye Disease

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Introduction: Although administrative claims data have been utilized in ophthalmology database research, it is unknown whether they accurately capture pediatric ocular diagnoses.1 The objective of this study was to determine the predictive value of International Classification of Diseases, 9th Revision (ICD-9) codes for identifying infantile eye diagnoses.

Methods: Population-based retrospective cohort study of all residents of Olmsted County, Minnesota diagnosed at ≤1 year of age with an ocular disorder. The medical records of all infants diagnosed with any ocular disorder from January 1, 2005, through December 31, 2014, were identified. To assess ICD-9 code accuracy, the medical records of all diagnoses with at least 20 cases were individually reviewed and compared to their corresponding ICD-9 codes. Main outcome measures included positive predictive value (PPV), negative predictive value (NPV), sensitivity, and specificity of ICD-9 codes.

Results: In a cohort of 5,109 infants with ≥1 eye-related ICD-9 code, 10 ocular diagnoses met study criteria. The most frequent diagnoses were conjunctivitis (N=1,695) and congenital nasolacrimal duct obstruction (N=1,250), while the least common was physiologic anisocoria (N=23). The PPVs ranged from 8.3% to 88.0%, NPVs from 96.3% to 100%, sensitivity from 3.0% to 98.7%, and specificity from 72.6% to 99.9%. ICD-9 codes were most accurate at identifying physiologic anisocoria (PPV: 88.0%) and least accurate at identifying preseptal cellulitis (PPV: 8.3%).

Conclusion/Relevance: The predictive value of ICD-9 codes for capturing infantile ocular diagnoses varied widely in this cohort. These findings emphasize the limitations of database research methodologies that solely utilize claims data to identify pediatric eye diseases.

Non-Inferiority of a Small Volume Eye Drop Adapter for Pediatric Pupillary Dilation and Cycloplegia

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Introduction: Traditional eye drop bottles elute drops that are five times the absorbing capacity of the human eye, leading to overflow and waste. An eye drop adapter, Nanodropper, allows for instillation of a 10.4 µL drop.

Methods: Twenty patients aged 4-17 years old (mean 10) received dilating drops with one eye randomized to Nanodropper drops and the other to standard of care (SOC) drops. Dilation was performed with one drop each of 1% cyclopentolate, 1% tropicamide, and 2.5% phenylephrine. Pupil constriction to a 180 uW flash was measured by pupillometry (Neuroptics PLR-200), and autorefraction (Retinomax K plus 3) was performed at baseline and 30 minutes after drop administration. Paired t-tests were used to compare parameters between groups.

Results: Baseline mean±SD spherical equivalent (SE) was -2.56±3.41 D for Nanodropper eyes and -2.62±3.28 D for SOC eyes (P=0.44). Baseline pupil constriction percentage was 30.3±6.1% (Nanodropper) and 28.7±6.2% (SOC, P=0.02). After dilation, mean SE was -1.07±3.60 D (Nanodropper) and -1.28±3.56 D (SOC, P=0.19) with pupil constriction percentage of 4.0±3.1% (Nanodropper) and 3.0±2.0% (SOC, P=0.08). Cycloplegia was similar between groups with mean intra-eye change in SE after dilation of 1.50±1.6 D for Nanodropper and 1.34±1.86 D for SOC (P=0.29). Change in constriction percentage was also similar between groups: -26.3±5.5% for Nanodropper and -25.7±6.28% for SOC (P=0.25).

Conclusion/Relevance: An eye drop adaptor that elutes a 10.4 µL drop produces a non-inferior effect on pupillary dilation and cycloplegia in a pediatric population and has the potential to decrease unnecessary medical waste and medical toxicity.

References:
A Large Population Study Reveals a Novel Association between Congenital Color Vision Deficiency and Environmental Factors

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Introduction: The molecular genetics underlying color-vision deficiencies (CVD) has been established and widely studied [1-3]. The aim of this study is to assess the associations between the prevalence of CVD and both genetics (place of origin) and environment (place of birth).

Methods: A retrospective study of 53,895 consecutive male Jewish conscripts aged 16-19 years, who completed the medical profiling process between 1988 and 2011. CVD was diagnosed using the 24-pseudo-isochromatic plates Ishihara test. Associations of CVD prevalence with socio-demographic variables, anthropometric indices, refractive errors were tested by both univariate analysis and multivariate regression models.

Results: Elevated BMI (obesity) and blood pressure (hypertension), as well as myopia, were all positively associated with congenital CVD. The composition of the study population provided a unique opportunity to investigate the relationship of CVD with both ethnicity and environment. The prevalence of CVD significantly differed among subpopulations of different ethnic background as well as among those who were born in different geographical locations. Additionally, differences in the prevalence of CVD (1.2%-1.6%) were observed among conscripts from the same origin, who were born in Israel, compared to those who were born in the corresponding countries of origin. Both place of origin (p<0.01) and place of birth (p<0.05) were associated with the prevalence of CVD in a multivariable regression model.

Conclusion/Relevance: This study affirms previously established associations of CVD with certain variables and reveals a possible novel association of CVD with environmental factors. Further studies are warranted to explore the possible underlying mechanisms, such as epigenetic ones.

Conclusion/Relevance: This study affirms previously established associations of CVD with certain variables and reveals a possible novel association of CVD with environmental factors.

Selected References:
The Epidemiology of Strabismus and Cataracts Within a Pediatric Population in Saint Vincent and the Grenadines: An Analysis of 201 Consecutive Cases

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Introduction: Childhood cataracts and strabismus are among the most common causes of visual impairment in children worldwide and can lead to amblyopia, thus requiring prompt diagnosis and correction [1-2]. In certain regions, such as the Eastern Caribbean, access to adequate treatment can be limited and epidemiological data can be scarce. This study aims to analyze the epidemiological data of pediatric strabismus and cataract cases in St. Vincent and the Grenadines from a population receiving care from a non-profit volunteer organization.

Methods: A retrospective study of 201 consecutive cases of pediatric strabismus and cataracts over an 18-year period (2002-2020) was performed. Factors analyzed include patient age, sex, geographical location, and type of cataract, strabismus, and surgical intervention. The findings were compared to publicly available demographic information to determine the annual cumulative incidence.

Results: The cases were divided into 3 groups: cataract (n=51), strabismus (n=134), and both strabismus and cataract (n=16). Mean ages (years) were 5.96, 5.54, and 4.50, respectively. The most frequent type of cataract and strabismus were congenital cataracts (n=35) and esotropia (n=95), respectively. The highest annual cumulative incidence based on the estimated national pediatric population were 3 and 5 cases per 10,000 people for cataracts and strabismus, respectively.

Conclusion/Relevance: This study provides regional epidemiological data on pediatric strabismus and cataracts, including cumulative incidence and common disease presentations. The results in this study offer a basis for which further epidemiological studies can be performed. Ultimately, these findings can help guide public health efforts to prevent visual impairment in St. Vincent and the Grenadines.

Trends in the Incidence and Sex Differences of Type I and Type II Diabetes Mellitus Diagnosed in a 50-year Population-based Cohort of Youth

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Introduction: Although Type 1 diabetes (T1D) is the predominant form of diabetes occurring in the pediatric population, complications of youth-onset Type 2 diabetes (T2D) are becoming more prevalent [1,2]. This study reports the incidence and demographic features of diabetes diagnosed in a population-based cohort of children.

Methods: The medical records of patients < 22 years diagnosed with diabetes mellitus while residing in Olmsted County, MN, from January 1, 1970, through December 31, 2019, were retrospectively reviewed.

Results: Of the 606 children diagnosed with diabetes over the 50-year period, 519 (85.6%) had T1D and 87 (14.4%) had T2D. The incidence of T2D increased 23-fold (p<0.001) over five decades with an overall incidence of 5 per 100,000 children per year while T1D remained stable (p=0.08) with an overall incidence of 26 per 100,000 per year. In children with T1D, 235 (45.3%) were female compared to 60 (69.0%) with T2D (p<.0001). The mean BMI of females with T2D was 36.8 ± 11.0 compared to 32.7 ± 8.6 in males with T2D (p=.11). At T2D diagnosis, males had a median HbA1c of 11.8% compared to 8.4% among females (p=.02). The hazard ratio of developing any retinopathy in females compared to males with T2D was 6.83 (95% CI, 1.53-30.44; p=.012).

Conclusion/Relevance: While T1D incidence remained stable in this population over the past 50 years, T2D has increased significantly, demonstrating a female predominance. The increasing incidence and gender predominance have potential implications for screening guidelines and public health efforts to prevent complications of this chronic condition.

Adult Retinal Vascular Severity Score Significantly Correlates with History of Preterm Birth

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Introduction: Preterm birth is associated with adverse health outcomes underlying greater mortality in this population. Despite risk associations, this metric does not inform current screening paradigms owing to often incomplete patient medical histories. An objective measure demonstrating likelihood of preterm birth could inform adult risk stratification and screening.

Methods: Fundus images for 100 term and 190 preterm (any ROP n=29) born patients within the New Zealand Very Low Birthweight study cohort were assigned a vascular severity score (VSS) using the i-ROP deep-learning algorithm as an objective measure of retinal vascular tortuosity and dilation. As published, patients were enrolled at birth; fundus imaging (Kowa Genesis-D) and adult health information were obtained at average age 28.4 years. No patients demonstrated disease shown to independently inform retinal vascular morphology. VSS were correlated with preterm birth, birth weight (BW), gestational age (GA), history of any ROP and plus disease, sex, blood pressure, cholesterol, triglycerides, height, weight, and BMI in term versus preterm-born patients using univariate and logistic regression analysis.

Results: Univariate analysis demonstrated a significant association between VSS and history of ROP or preterm birth (p<0.001), history of plus disease (p=0.026) and inversely correlated with GA and BW and LDL cholesterol (p<0.009). In multivariate analysis, VSS remained significantly correlated (p=<0.01) with history of preterm birth, BW, LDL cholesterol and GA.

Conclusion/Relevance: Use of a VSS in adults with an incomplete past medical history may assist in personalized screenings relative to known risks of preterm birth and may uniquely associate with specific health parameters.

Refractive Changes in Children in the Chicagoland Area during the COVID-19 Pandemic

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Introduction: The increasing prevalence of myopia is a global epidemic predicted to worsen [1]. The COVID-19 pandemic has led to increased near work and decreased time spent outdoors, which are associated with myopic progression [2,3]. In this study we aim to investigate the association between recent behavioral changes and myopic shift in a racially diverse pediatric population in Chicagoland.

Methods: All patients (ages 2-19) seen at a single tertiary children's hospital with a cycloplegic refraction in January-March in the years 2019, 2020, or 2021 were retrospectively reviewed. Patients with aphakia, pseudophakia, and connective tissue diseases (e.g. Marfan syndrome, Stickler syndrome) were excluded.

Results: 2,063 patients were included in this study. The overall mean spherical equivalent (SE) was 0.12±3.70D in 2019, -0.07±3.95D in 2020, and -0.49±3.85D in 2021. The 6-9 year old age group displayed the greatest increase in myopia prevalence from 0.29 to 0.39 between 2020-2021, respectively. 109 patients returned in 2019, 2020, and 2021. Mean SE in return patients was 0.66 ± 3.40D in 2019, 0.51 ± 3.58D in 2020, and 0.22 ± 3.72D in 2021. Repeated measures ANOVA demonstrated significant difference in myopic shift between years (F-ratio = 14.4, p < 0.00001), and post-hoc testing with Bonferroni correction demonstrated significant decrease from 2020-2021 (p = 0.00008), but not 2019-2020.

Conclusion/Relevance: These results demonstrate an increase in myopic progression in a pediatric population during COVID-19. The mean myopic shift in cycloplegic SE was significantly greater in 2020-2021 compared to 2019-2020. This may be explained by the behavioral changes during the COVID-19 pandemic.

Novel 3-D Printed Adjustable Glasses to Address the Global Financial Burden of Pediatric Eye Glasses

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Introduction: Globally, the need for cost-effective delivery of corrective lenses for pediatric refractive error is great. The present study aims to assess the global burden of uncorrected pediatric refractive error and to introduce a novel 3-D printed model intended to provide an accessible and affordable avenue to improve the outcomes of the affected populations.

Methods: The present study involved an investigation into the global need for corrective lenses for pediatric refractive errors in resource poor regions via extensive literature review. Several key features (Fit, Pathologies Corrected, Cost to Patient) were identified to drive the preliminary design process. With these features in mind, several iterations of the glasses design were developed and reviewed for feasibility.

Results: The estimated pediatric pooled prevalence (EPP) of myopia, hyperopia, and astigmatism was 11.7% (95% CI: 10.5-13.0), 4.6% (95% CI: 3.9-5.2), and 14.9% (95% CI: 12.7-17.1), respectively. Existing solutions delivering coverage to underserved areas often lacks the ability to correct for astigmatism. The newly proposed design provides a one-size-fits-all frame with circular lens mounts to accommodate any axis of astigmatism. 3D printed materials allow these frames to be constructed at a fraction of the cost of conventional frames.

Conclusion/Relevance: The need for a financially feasible and easily accessible solution warrants further research and design of gadgets such as the proposed 3-D printed model. The flexible design allows for these glasses to be distributed in rural and urban environments alike, with minimal training required to fit and assemble, at a low cost to patients.

Defining the Gold Standard of a Red Reflex Exam: A Systematic Review.

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Introduction: The Red Reflex Examination (RRE) is a simple and ubiquitous test used for decades but an evidence-based standard of the screening test for pediatric visual impairment remains undefined. Variations of the test procedure exist, including the Brückner’s Test and pharmacodilation. Interpretations also vary, especially in children with pigmented fundi. This research intends to identify what constitutes the gold standard of the RRE and how it can be taught and interpreted.

Methods: Relevant electronic databases were searched with the help of an information scientist. Search terms included [Eye examinations/ Red Reflex/ Ophthalmoscopy/ Brückners] AND [pediatric*/vision screening/primary care]. Publications in English that address i) Bruckner's Test, ii) Distant Direct Ophthalmoscopy, iii) Red Reflex, OR iv) Infrared Photorefraction, performed with any instrument on or concerning a pediatric population will be included. Publications where the purpose surrounds screening for retinopathy of prematurity alone OR pertaining to an instrument that observes the fundus and does not discuss an RRE will be excluded. A team of 18 independent reviewers from across the globe were recruited to conduct a two-stage literature screening process, data extraction, and quality appraisal. Studies included for review will be analyzed by thematic analysis. A narrative synthesis is being used to summarize our findings.

Results: The search was conducted on July 21st and 10,078 unique manuscripts were identified.

Conclusion/Relevance: This systematic review collates the existing information and provide a foundation of evidence regarding the RRE as a screening tool in pediatric populations. Collating robust evidence could facilitate the development of clinical guidelines for the RRE.

Full Field Electroretinography with Skin Electrodes to Diagnose Inherited Retinal Disease in Pediatric Patients

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Introduction: A single-site retrospective study was undertaken to validate a handheld electroretinogram (ERG) system utilizing skin electrodes to complete full-field ERGs as a stand-alone test in the workup for inherited retinal disease.

Methods: Between October 2016 to December 2020, 73 patients between the ages of 1 month and 18 years old obtained a full field ERG with the RetEval system and subsequent genetic testing. During this time there were no sedated or anesthetized ERGs performed at this institution. The patients underwent ERG testing by ISCEV standard; however, the bright flash dark-adapted b-wave amplitude and the light-adapted 28 Hz flicker amplitude were chosen as the measure of rod and cone system function respectively. The normal range for these values had been predetermined and was reported by Keck, et al.

Results: In 76.7% of patients the rod and cone function as measured with this modality agreed with the diagnosis found on subsequent genetic testing. 70.5% of patients with both abnormal cone and rod function, 80% of patients with only abnormal cone function and 83.3% of patients with only abnormal rod function were diagnosed with expected inherited retinal diseases by genetic testing.

Conclusion/Relevance: This study provides evidence that the diagnosis of inherited retinal disease can be reliably obtained with the handheld ERG system with skin electrodes in children of all ages when using the 5-step test as outlined by ISCEV. Sedation and anesthesia to perform ocular surface contact electrode ERG may be unnecessary in most cases.

Utility of Electroretinogram for Screening for Vigabatrin Toxicity in a Pediatric Cohort

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Introduction: The purpose of this study is to review the Electroretinogram (ERG) outcomes of screening for vigabatrin toxicity at a tertiary care center.

Methods: This is a retrospective analysis of pediatric ERG’s performed between December 2009- February 2015 to screen for Vigabatrin toxicity. We performed full-field ERG’s using LKC equipment and bipolar Burian-Allen electrodes. General anesthesia was required to perform ERG’s in younger patients. All the ERG’s were interpreted by a single qualified interpreter, according to age-appropriate normative data.

Results: Seventy-two patients underwent 256 ERG’s for this purpose, of which 176 ERG’s were normal for age. Out of eighty eyes that demonstrated abnormal parameters in photopic/scotopic parameters, sleep, sedation, anesthesia, improper contact lens position were thought to be the cause of abnormal parameters in fifty eyes (62.5%). Ten patients (30 ERG’s) had unexplainable reasons for abnormal ERG parameters. Five out of these ten patients got repeat ERG’s at follow-up, of which two patients (4 ERG’s) became normal, and three patients (16 ERG’s) had persistently abnormal ERG’s. The median duration between the start of Vigabatrin and the ERG was seven months (range: 0-72 months). There was no negative correlation between the ERG parameters and duration on Vigabatrin treatment. Thirty-three patients had a longitudinal follow-up, which showed no significant decline in any ERG parameter from initial visit to final follow-up (median: 12 months; p>0.05).

Conclusion/Relevance: There was no negative correlation between the ERG parameters and the duration of Vigabatrin.

References: None
Hydroxychloroquine Retinopathy in Children

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Introduction: Hydroxychloroquine (HCQ, Plaquenil) is an anti-malarial medication commonly used to treat various autoimmune conditions. HCQ has limited systemic toxicities, but may cause irreversible retinopathy in adults. [1] There is limited data on HCQ retinopathy in children and no specific screening guidelines for children. [2] We set out to identify and describe children with evidence of HCQ toxicity.

Methods: At a tertiary care hospital, a retrospective chart review was performed to identify pediatric patients treated with HCQ that demonstrated signs of retinopathy on multifocal electroretinogram (mfERG), Humphrey Visual Fields (HVF) or spectral-domain optical coherence tomography (SD-OCT).

Results: 232 patients were identified of whom 2 had normal ophthalmoscopic examinations, but changes in function on HVF and anatomic changes on SD-OCT. Case I was an 8-year-old girl with systemic lupus erythematosus (SLE) who was treated with HCQ for 5.5 years at a maximum dose of 6.4 mg/kg. She exhibited a paracentral scotoma on HVF, bilateral parafoveal thinning of both the inner and outer retina on SD-OCT, and marked attenuation of responses on mfERG. Case II was a 15-year-old girl with SLE treated with HCQ for approximately 4 years who had a paracentral scotoma on HVF and thinning of the ganglion cell layer on SD-OCT in both eyes.

Conclusion/Relevance: Retinal toxicity from HCQ occurs in children and presents with changes similar in function and anatomy to the characteristic changes in adults. Screening children with HVF and SD-OCT identified HCQ retinopathy prior to the development of a clinically apparent bull's eye maculopathy.

Retinal Laminar and Vascular Characteristics in Patients with Incontinentia Pigmenti

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Introduction: Incontinentia pigmenti (IP) is a rare systemic disease of x-linked dominant inheritance associated with abnormalities of the retina microvasculature. The recent development of optical coherence tomography angiography (OCT-A) permits non-invasive, quantitative analysis of the retinal vascular architecture. We aimed to characterise the retinal vasculature and structure at the macular region in patients with IP.

Methods: Case Series. Retrospective analysis of patients with IP who were examined at our institution over the previous 10 years. Optical coherence tomography (OCT) and, where available, OCT-A findings were analysed. OCT and OCT-A parameters of interest were central retinal thickness (CRT) and total macular volume (TMV), and foveal avascular zone (FAZ) area, vessel density (VD), and vessel length density (VLD), respectively. Six patients were identified, who were aged between six and 20 years old at the time of imaging acquisition.

Results: Three patients had received previous treatment for peripheral retinal manifestations of the disease in one eye only, resulting in deep amblyopia in 2/3 patients. CRT and TMV were normal in all eyes analysed (analysis was not possible in 2 eyes due to amblyopia precluding fixation in one eye and a visible pseudohole configuration preventing accurate quantification in the other). FAZ was variable, but conclusively large only in 1/3 untreated patients. No obvious differences in VD and VLD of the superficial and deep plexuses were apparent.

Conclusion/Relevance: In patients with IP who had not required treatment, retinal lamination in the macular area is normal, whilst vascularization in the same region is variable.

Pediatric Optical Coherence Tomography (OCT) Made Easy: Establishing Normative Retinal Layer Thickness Ratios for Interpretation of Handheld Macular OCT in Clinic

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Introduction: Handheld OCT lacks integrated segmentation/analysis software. Optic neuropathies have been shown to cause ganglion cell layer (GCL) thinning, with normal to thickened inner nuclear layer (INL), suggesting the potential value of simply computing the GCL/INL ratio on single-line foveal scans.

Purpose: Determine normative values for GCL/INL ratio in macular scans from handheld OCT of young children unable to perform tabletop OCT.

Methods: Review of prospectively-obtained macular OCT in normal eyes of supine children ages 0-5 years, using either handheld Bioptigen OCT (Leica) or overhead-mounted Spectralis FLEX-OCT (Heidelberg Engineering), when under clinically-indicated anesthesia. For Bioptigen images, GCL and INL were manually measured (ImageJ) from single-line macular scans at the thickest point nasal and temporal to the fovea, respectively, by two readers (values averaged), and GCL/INL ratio was calculated. For FLEX images, a similar protocol was aided by automated segmentation (+/-manual correction), including total GCL and INL volumes from a 3mm circular grid centered over the fovea.

Results: Bioptigen images were obtained on 48 eyes (39 children, mean age 2.3±1.8yrs) and FLEX on 56 eyes (56 children, mean age 2.3±1.5yrs). Mean nasal GCL/INL for Bioptigen vs. FLEX images was 1.24±0.18 (min/max=0.92/1.75) vs. 1.29±0.18 (min/max=0.96/1.66), respectively, p=0.17. Mean temporal GCL/INL for Bioptigen vs. FLEX was 1.22±0.24 (min/max=0.66/1.70) vs. 1.19±0.16 (min/max=0.86/1.47), p=0.46. FLEX-derived mean GCL/INL volume ratio was 1.17±0.09.

Conclusion/Relevance: We report similar normative GCL/INL ratios in children on a single-line foveal OCT scan using two different modalities. This normative GCL/INL ratio data may be useful when clinically evaluating children with suspected optic neuropathies.


Risk Factors Associated with the Development of Foveal Hypoplasia in Preterm Children

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Introduction: Foveal hypoplasia (FH) frequently leads to decreased visual function, and is associated with several ocular/systemic disorders and genetic mutations. Increased frequency of FH has been reported among children born preterm, but there is limited data on the risk factors associated with prematurity that contribute to this outcome.

Methods: Retrospective case series including 159 children born ≤36 weeks gestation, between 1996-2016. OCT imaging was obtained between age 4.4-18.3 years. Patients’ birth history, demographics and fovea structure were examined and analyzed.

Results: Children born at gestational age (GA) ≤31 weeks had a greater frequency (62.6%, N=99) of developing FH than children born at GA 32-36 weeks (40.0%, N=60) (X²=7.70, p=0.006). GA was negatively correlated with foveal thickness even in children without FH (R²=0.049, p=0.01). There was also a greater proportion of low birth weight (BW) children (57.2%, N=138) with FH than those with a normal BW (31.6%, N=19) (X²=4.43, p=0.035). Males born ≤31 weeks exhibited a higher rate of FH (73.9%, N=46) than did females (52.8%, N=53) (X²=4.68, p=0.031). Ethnicity did not significantly impact on developing FH in children born preterm (X²=1.84, p=0.398). However, among those with FH, white children had a higher GA at birth compared to African Americans (29.72 vs 27.22, p=0.004).

Conclusion/Relevance: Low GA, low BW, and male sex are risk factors for FH in children born preterm. Ethnicity is not a risk factor for developing FH, but white children are more likely to have FH at a later GA, suggesting that the timing of foveal development and its susceptibility to stressors may differ among ethnicities.

Anterior Segment Complications after Intravitreal and Periocular Injections of Chemotherapeutic Agents in the Treatment of Retinoblastoma Patients

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Introduction: To identify anterior segment complications following intravitreal (IV) and periocular (subconjunctival) injections of chemotherapeutic agents for retinoblastoma and to evaluate treatment options for these complications.

Methods: This was a retrospective, non-comparative analysis including 87 eyes of 69 consecutive patients with persistent and recurrent vitreous seeding after systemic retinoblastoma treatment. All of the eyes received either IV Melphalan (IVM) (20 microgram/0.1ml) or subconjunctival Carboplatin (SCC) (20mg/2ml)/ Topotecan (SCT)(2mg/2ml) injections. Injection types, anterior segment complications such as cataract, posterior synechia, increased intraocular pressure (IOP), iris atrophy, persistent conjunctivitis, enucleation status and cataract surgery rates were reviewed.

Results: Of 87 eyes; 80 received SCC, 8 received SCT, 20 received IVM and 16 received combined SCC/IVM injections. Anterior segment complications included cataract (22/87, 25.2%), posterior synechia (5/87, 5.7%), increased IOP (1/87, 1.1%), iris atrophy (1/87, 1.1%) and persistent conjunctivitis (2/87, 2.2%). Of eyes with cataract, 14 eyes (63.6%) were treated with cataract surgery. One eye with posterior synechia needed pupilloplasty due to restricted fundus view. Enucleation rate was 47/87 (54.02%).

Conclusion/Relevance: In our review, the most frequent anterior segment complication was cataract (seen in 25%) following intravitreal and/or subconjunctival injections of chemotherapeutic agents. Almost 2/3 of these eyes required cataract extraction. One patient required pupilloplasty for synechia. All other anterior segment complications were infrequent.


Quantifying General Anesthesia Exposure for Pediatric Retinoblastoma Patients

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Introduction: Prolonged or repetitive general anesthesia (GA) during childhood has been associated with neurocognitive deficits, though these findings remain controversial.\(^1\)\(^-\)\(^3\) Proper diagnosis and treatment of retinoblastoma (Rb) requires significant GA exposure. This is the first study to estimate the number and duration of GA exposures in the Rb patient population.

Methods: A retrospective study of 45 pediatric patients treated for Rb between 2011 and 2021 was performed. Demographic data, tumor info, and treatment type were collected. Number of GA exposures and anesthesia time (AT) was stratified by clinical characteristics and procedure type, including intra-arterial chemotherapy (IAC), enucleation, brainstem auditory evoked response testing (BAER), port placement, MRI, and exam under anesthesia (EUA). Descriptive statistics were performed when appropriate.

Results: Total AT was 44976 minutes (min) for 561 procedures, with the average patient undergoing 12.5 procedures (standard deviation (SD) = 10.7 procedures). Mean ATs per exposure in min were 272, 152, 81.8, 62.5, 61.0, and 46.2 for IAC, enucleation, BAER, port placement, MRI, and EUA, respectively (SD = 80.9, 27.9, 29.8, 30.9, 13.6, 23.3 min, respectively). The most common procedure was EUA, with 35 patients undergoing an average of 9.11 EUAs each (SD = 8.17 procedures).

Conclusion/Relevance: We achieved the original aims of quantifying the amount of GA exposure 1) per procedure and 2) per patient. Although this study does not assess the resulting effects of extensive GA exposure on the patient, if any, clinicians and patients ought to be aware of the extensive GA often required in Rb care.


Evaluating the Efficacy of Targeted Written Patient Education Materials in the Improvement of Understanding and Outpatient Follow-up Compliance for Retinopathy of Prematurity

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Introduction: Retinopathy of prematurity (ROP) is a leading cause of preventable childhood blindness worldwide. Poor outpatient follow-up compliance in infants with ROP increases the risk of vision loss. Educating parents about ROP has the potential to significantly improve follow-up compliance. However, information currently available about ROP is written at an 11th grade level, despite NIH and AMA recommendations that patient education materials (PEM) be written at a 3rd-7th grade level. Our study investigates the effects of implementing newly developed PEM adherent to reading level recommendations on improving parent understanding of ROP and follow-up compliance.

Methods: We enrolled 240 parents of infants at risk for developing ROP in a pre-post-test study. Surveys assessing knowledge and perceived importance of ROP were distributed to parents before and after receiving either the newly developed PEM or currently available PEM. Follow-up appointment attendance data was also collected.

Results: Participants demonstrated a significant increase in knowledge of ROP after receiving either handout (p<0.001). Average scores on post-survey questions that assessed knowledge of ROP were higher for those who received the new PEM in comparison to current PEM (90.6% vs 83.1%, p = 0.027). There is a trend toward improved follow-up attendance for the new PEM (79.7% vs 75.9%, p=0.289).

Conclusion/Relevance: Our findings demonstrate that PEM that adhere to reading level guidelines significantly improve parent knowledge of ROP. Our results have the potential to change the standard for educating parents of infants with ROP and improve clinic follow-up rates following discharge.

References:
The Role of Informational Videos in Parental Education Concerning Retinopathy of Prematurity Exams

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Introduction: Increased parental involvement in care of their preterm infants has led to a need for improved information delivery. This study examines the usefulness of educational videos in preparing parents for their infant's ROP exam over print materials.

Methods: Educational videos explaining the ROP exam were created and shown to parents of at-risk infants. Prior to the use of educational videos, parents were given standard print materials explaining the purpose of exams. All the neonatal units in our ROP network were asked to show the videos to parents. Prior to the initial exam, parents saw video #1 explaining ROP and reasons for the exam; video #2 was seen prior to discharge explaining outpatient follow-up. Surveys were administered to both groups and evaluated for parent satisfaction and preparedness. Chi-square testing was used to determine differences between groups.

Results: 50/51 (98%) and 53/73 (73%) parents reported being very satisfied after either seeing the videos or just reading the printed material (p-value < 0.01), respectively. Additional statistically significant differences were found between groups as well; the video group felt more prepared for the eye exam and had more information about how the exam is performed (50/52 vs. 58/69, p-value < 0.01), were more likely to respond that they had direct contact with the ophthalmologist (27/53 vs. 20/71, p-value < 0.01), receive paperwork explaining exam results (39/52 vs. 32/61 p-value = 0.01), and appeared more knowledgeable regarding the reasons for the exam and consequences of untreated ROP (43/51 vs. 42/71, p-value < 0.01).

Conclusion/Relevance: Educational videos may play a role in improving parental experience and increase understanding of the ROP exam.

Risk Factors for Severe Retinopathy of Prematurity among Low-Risk Infants

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Introduction: The Postnatal Growth and ROP Studies (G-ROP-1&2) developed new ROP screening criteria with 100% sensitivity for type 1, and 30% fewer infants requiring exams. However, the criteria are slightly less sensitive for type 2. Currently under conventional screening criteria, outlier infants are identified with a subjective criterion of neonatologist judgment of a 'poor postnatal course.' We identified risk factors for developing stage 2 and 3 in infants who were older, larger, or had faster weight gain than the G-ROP criteria to help neonatologists identify these outlying infants.

Methods: Secondary analysis of 2312 of 7483 infants in G-ROP-1 who did not meet the proposed G-ROP criteria. 5 (0.2%) had stage 3; 57 (2.5%) had stage 2. Medical and surgical comorbidities of prematurity during the first 28 postnatal days were evaluated using multivariable analysis.

Results: Factors associated with stage 2 or 3 were no enteral feeding in first 3 weeks (aOR 5.6, 95% CI 2.6-12.1; 9 or more days on supplemental oxygen in first 4 weeks (aOR3.4, 2.0-5.6); NEC (aOR 4.2, 1.0-17.5); IVH grade III/IV (aOR 2.6, 0.9-7.6). Risk of stage 2 or 3 increased with number of risk factors: 20/1575(1%) for 0; 34/636(5%) for 1; 7/51(14%) for 2; 1/3(33%) for 3.

Conclusion/Relevance: NEC, IVH grade III/IV, and 9 or more days on supplemental oxygen in first 4 weeks, and no enteral feeding in first 3 weeks, are associated with increasing risk of stage 2 or 3. Counting the number of factors may help identify outlier infants requiring ROP examinations.

Evaluation of a Single-Exam Risk Prediction Model of Severe Retinopathy of Prematurity on Premature Infants from India

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Introduction: Retinopathy of prematurity (ROP) screenings are essential to reduce the risk of ROP-related visual loss; however, exams are often physiologically stressful and most do not reveal treatment-requiring (TR-) ROP.[1,2] Thus, strategies to reduce the number of examinations, without missing cases of TR-ROP, are desired. We previously demonstrated that a risk model based on gestational age (GA) and an artificial intelligence-derived vascular severity score (VSS) can predict TR-ROP more than one month prior to diagnosis.[3] However, this model has yet to be calibrated for babies from developing countries. Herein, we do so using a population of Indian babies.

Methods: As part of an Indian ROP telemedicine screening program, retinal fundus images from 4,840 eyes (244 eventually developing TR-ROP) were collected. A VSS was derived from the first exam after 30 weeks postmenstrual age. Using five-fold cross-validation, logistic regression models were trained on GA and VSS for the eventual outcome of TR-ROP. Sensitivity and specificity were evaluated using two different test datasets.

Results: At the subject level, both the held-out and prospective test datasets (n = 474 and n = 884 subjects) had sensitivity equal to 100.0%. Specificity was 65.4% and 52.4%, respectively. On average, TR-ROP was predicted 2.5 weeks prior to diagnosis.

Conclusion/Relevance: There are two potential advantages to implementation of this risk model: (1) the number of examinations for low-risk babies could safely be reduced, and (2) high-risk babies could be identified prior to diagnosis of TR-ROP, reducing the risk of late treatment.

Retinopathy of Prematurity (ROP) Rates After Transition from Multi-bed to Single-bed Neonatal Intensive Care Unit (NICU)

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Introduction: NICUs play a critical role in optimizing respiration while minimizing ROP in premature infants. We sought to evaluate the rates of ROP and ROP treatment after a transition from a multi-bed NICU to a single-bed NICU. We hypothesized that frequent monitoring and regulation of oxygen may be more difficult in a single-bed NICU and that ROP rates may be higher in the single-bed NICU.

Methods: We performed a retrospective chart review of 455 consecutive infants (910 eyes) that qualified for ROP screening at a single institution. A Fisher's exact test was used to compare the rates of ROP and treatment-requiring ROP between patients born on 4/24/2012 - 9/7/2013 (multi-bed) to 11/15/2013 - 12/31/2014 (single-bed). Exclusion criteria included: patient transferred to or from our institution during ROP screening, patient discharged home prior to ROP screening, birth during transition between units, or death.

Results: More eyes required treatment for ROP in the single-bed NICU (48/386 [12.4%]) compared to the multi-bed NICU (30/386 [7.8%]), (p=0.0418). Rates of ROP (stages 1-3) did not significantly differ between the single-bed NICU (164/386 [42.5%]) and the multi-bed NICU (146/385 [37.8%]), (p=0.212).

Conclusion/Relevance: The rate of treatment-requiring ROP significantly increased after transitioning from a multi-bed to a single-bed NICU, possibly due to greater logistical difficulties managing oxygen. While single-bed NICUs have increased in popularity and offer many advantages over multi-bed NICUs, the transition to single-bed units may require additional strategies for optimal monitoring and regulation of oxygen in order to minimize the risk of treatment-requiring ROP.

Video Indirect Ophthalmoscopy Training Curriculum for Retinopathy of Prematurity

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Introduction: The gold standard for retinopathy of prematurity (ROP) screening is dilated fundus examination using binocular indirect ophthalmoscopy (BIO) with scleral depression, skills which are difficult to master. Video indirect ophthalmoscopy (VIO) has been utilized in residency training to teach scleral depressed retina examinations in adult patients. This study uses VIO technology and a customized 3-D printed infant model eye to help ophthalmology residents gain proficiency with BIO and scleral depression for ROP screening.

Methods: Postgraduate-year-2 (PGY-2) trainees completed three 15-minute individualized VIO sessions within the first two months of starting residency. VIO sessions were recorded and later graded according to a standardized rubric by a pediatric ophthalmologist. Surveys were completed before and after completion of the training program to evaluate residents’ experience and confidence in ROP examination techniques.

Results: Five PGY-2 residents completed VIO training which targeted visualization of the posterior pole, mid-peripheral retina, and the ora serrata with scleral depression. The resident videos were notable for improvement in ability to visualize markers placed at the ora serrata in each quadrant with good focus and minimal glare. Importantly, each resident rated improved confidence in visualizing the optic nerve, macula, and peripheral retina after completing the curriculum.

Conclusion/Relevance: A limited series of hands-on VIO training sessions appeared effective in improving new residents’ confidence and ability to perform simulated ROP examinations on a customized infant eye model. Future studies should aim to evaluate the applicability of simulated sessions to real ROP examinations on premature infants and to determine how well residents retain learned skills.

Effect of Gender on Retinopathy of Prematurity Severity Among Multiple Gestation Infants

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Introduction: Previous studies suggest a 'male disadvantage' among premature infants, perhaps due to genetic, hormonal, and/or immunological differences between genders which contribute to worse systemic outcomes.1,2 This association may extend to retinopathy of prematurity (ROP) severity. The purpose of this study is to explore whether gender affects ROP severity among mixed gender multiple gestation premature infants.

Methods: A retrospective chart review was performed of all multiple gestation births including at least one male and one female who had ROP screening between 9/2013 and 8/2021. Multiple gestations were grouped. Within groups, we explored the effects of gender on ROP severity (i.e. maximum stage developed and need for treatment) and postmenstrual age at time of treatment.

Results: A total of 31 multiple gestation groups [68 infants (26 twin-, 4 triplet-, and 1 quadruplet-) were included, with mean gestational age 27.5 weeks (range: 22.9-32.0), and mean birthweight 978.5 grams (range: 470-1820). Overall, when males and females differed in maximum ROP stage, males had worse stage by 0.04 among twin groups (n=10), 0.08 among triplet groups (n=2), 0.5 in the quadruplets. Overall, there was no difference in treatment rate among twins or triplets by gender, but among a group of quadruplets, all 3 males were treated. Among twins where both twins were treated (n=3), the males were treated on average 4 weeks earlier.

Conclusion/Relevance: Among multiple gestation premature infants, males overall developed worse ROP stage and required ROP treatment more often. Among twins, males tended to be treated earlier than their female counterpart. Further larger studies are warranted.

Type 1 Retinopathy of Prematurity (ROP) in Near Full-Term Heavier Birth Weight (BW) Infants

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Introduction: Prematurity and low birth weight (BW) are the most common factors associated with retinopathy of prematurity (ROP). However, several case reports have shown the occurrence of ROP in full term heavier BW babies with or without the presence of other risk factors.

Methods: A retrospective review of 8 eyes of 4 near full term infants diagnosed to have type 1 ROP. We assessed clinical characteristics, risk factors, and management outcomes of those cases.

Results: Mean BW and gestational age- (GA) were 2275±326.9grams (range, 1900-2600grams) and 36.75±0.82weeks (range,36-38weeks). Mean age at the time of diagnosis was 42±1.41weeks Post Menstrual Age (range,40-44weeks). Six eyes (75%) had stage 3ROP, 2 eyes (25%) Aggressive ROP (A-ROP). Eight eyes (100%) received single intravitreal injection of Anti-VEGF. At the last follow-up, 8 eyes (100%) had a favorable structural outcome with full vascularization (P<0.001). Multiple births (P=0.013), respiratory distress syndrome(RDS) (P=0.001), phototherapy (P=0.001), and oxygen administration (P<0.001) were significantly associated with the development of ROP in these full-term infants.

Conclusion/Relevance: Type 1 ROP can occasionally occur in full term heavier infants. The risk factors appear to be similar to those seen in premature infants. This highlights the need for screening of full term high risk neonates for possible sight-threatening ROP.

Evaluating Sucrose as Pain Management in Retinopathy of Prematurity (ROP) Exams at the Alberta Children's Hospital Vision Clinic

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Introduction: Controversy exists regarding the efficacy of sucrose for pain relief in outpatient neonatal retinopathy of prematurity (ROP) exams. This study is a prospective, randomized control trial (RCT) to determine the efficacy of sucrose in reducing pain in babies under 12 months of adjusted age during ROP eye examinations.

Methods: This is a data and process evaluation of the initial 24 patients in an ongoing RCT involving 150 infants undergoing ROP eye exams. Visit one is a standard visit for all infants, then at the second visit those randomized to the treatment group will receive a dose of 24% oral sucrose solution 2 minutes prior to the eye exam. At both visits a parent, nurse, and physician will complete a subjective survey of patient discomfort. Objective measurements including patient oxygen saturation, heart rate, and Face, Legs, Activity, Cry, Consolability (FLACC) scores will be recorded.

Results: 24 infants with an average gestational age of 27+6 weeks, and an average weight of 1060 grams were available for analysis. The objective FLACC pain score during examination was improved in 8/15 (86.7%) of sucrose patients compared to baseline, opposed to 0/9 (0%) patients who received standard treatment. The subjective survey revealed that 7/15 (46.7%) of parents in the sucrose group perceived less patient discomfort at the second visit, compared to 1/9 (11.1%) in the control group.

Conclusion/Relevance: Although this study is ongoing, preliminary findings indicate sucrose may be helpful in ROP exams to reduce the amount of discomfort experienced by neonates and improve the overall experience for caregivers.

References:
3. Hartnett ME. Major review Advances in understanding and management of retinopathy of prematurity. Published online 2016
Out of Sight: ROP Screening in Infants with Significant Corneal Opacity

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Introduction: Retinopathy of prematurity (ROP) remains a leading cause of pediatric vision loss. Routine screening is therefore critical to prevent lifelong morbidity (1). However, limited literature exists on ROP screening in infants with severe corneal opacity and limited retinal view.

Methods: Retrospective case-series of infants identified with clinically significant corneal opacity while undergoing ROP screening between 2010-2018. Demographics, clinical characteristics and ophthalmic imaging were collected.

Results: Eight infants (14 eyes) comprising three males with mean gestational age of 26.5±3.3 weeks and birthweight of 878.7±383 grams were included. Diffuse corneal haze (8 eyes), stromal edema or scarring (4 eyes) and type 1 Peters anomaly (2 eyes) significantly obscured retinal details in all children. Calculation of ROP risk, B-scan ultrasonography, topical hyperosmotic eyedrops, and frequent examination were utilized to compensate for poor fundus view. Three patients (6 eyes) received intravitreal bevacizumab for presumed plus disease through a hazy cornea, with subsequent disease regression. All other patients did not develop treatment-warranted ROP. Eventually, three patients (4 eyes) required surgery including optical iridectomy, superficial keratectomy, and penetrating keratoplasty for visual rehabilitation. Spontaneous resolution of corneal haze was observed fully in another 4 eyes.

Conclusion/Relevance: Significant corneal opacity can impede ROP screening and increase risk of poor outcomes. Risk calculation and ancillary imaging such as B-scan ultrasound may be required and intravitreal bevacizumab is effective in cases of poor retinal view. Investigation for treatable causes of corneal clouding such as glaucoma, corneal dystrophy, and infectious keratitis should be performed, in addition to visual rehabilitation strategies.

Retinopathy of Prematurity in Triplets

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Introduction: To assess the incidence, severity and influence of birth weight on the incidence and severity of Retinopathy of prematurity (ROP) amongst surviving triplets of same gestational age

Methods: Records of preterm babies born to mothers with triplet and quadruplet pregnancies were retrieved from our prospectively collected database between 1 Jan 2000 to 1 Jan 2020 (20 year period). One hundred and eight sets of preterm triplet babies and one set of quadruplet were assessed for Retinopathy of Prematurity. 56 sets had all 3 surviving babies. The surviving triplets were subdivided into groups based on their birth weights ones with the higher birth weight was placed in group A and the relatively lower birth weight was placed in group B

Results: Total of 253 surviving triplet babies born to 108 mothers were analyzed. Data was available for 229 babies. Mean gestational age was 31.76 weeks, range 26-38 weeks. The mean birth weight was 1.45kg, range 0.57-2.76kg. At first screening,(n= 152) had an immature retina and of these n=34 babies progressed to some form of ROP (either stage I,II or III ROP in either of the zones) and n=11 progressed to treatable ROP requiring laser and/or Avastin

Conclusion/Relevance: Although multiple factors play a role in the incidence and severity of ROP, smallest and least weight babies overall remain more at risk than larger and higher weight babies in the group. The gestational age seems to be more important for ROP incidence than the birth weight. Hence the heavier (larger) of the triplets need mandatory screening and should not be missed


Neonatal Vital Signs using Non-Contact Laser Speckle Contrast Imaging Compared to Standard Care in Retinopathy of Prematurity Screening

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Introduction: The current standard screening for Retinopathy of Prematurity (ROP), indirect ophthalmoscopy (IO), is widely considered to induce physiologic stress in infants.1-3 This study aims to characterize the stress associated with ROP examination by assessing changes in vital signs during standard examination and XyCAM, a new noninvasive retinal imager that utilizes laser speckle contrast imaging (LSCI) to capture information on ocular blood flow dynamics without directly contacting the eye. We tested the hypothesis that LSCI examination will cause less physiologic stress to the infants as indicated by more stable heart rate, respiratory rate, and oxygen saturation.

Methods: In this comparative ongoing study, vital signs were recorded from subjects (n=30) with gestational ages between 22-32 weeks and birthweights between 400-1500 grams receiving ROP examinations with LSCI and IO. Heart rate, oxygen saturation, and respiratory rate were compared for each examination. Students t-test was used to compare changes from baseline heart rate, respiratory rate, and oxygen saturation during and after LSCI and IO.

Results: Oxygen saturation exhibited a mean decline of 24% during IO examination, but a mean decline of only 9% during LSCI examination revealing a significant difference (p=0.0025). While we observed differences in all measures of vital signs, heart rate and respiratory rate remained within normal range for all exams.

Conclusion/Relevance: These findings inform our understanding of changes in vital signs associated with LSCI compared to IO in ROP screening examinations. This information will guide development and usability of non-contact techniques for ROP examination to minimize the physiologic stress associated with ROP screening.

Human Grader versus Semi-Automated Computer Ranking of Tortuosity and Dilation of Posterior Pole Vessels using Retinal Vessel Maps Generated from Bedside Optical Coherence Tomography

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Introduction: Optical coherence tomography (OCT)-generated retinal vessel maps can demonstrate pre-plus and plus disease,1,2 which lie along a continuum of vascular tortuosity and dilation.3 The purpose of this study is to evaluate the correlation between human graders versus a semi-automated computer program (i.e., ROPtool) for ranking OCT-generated retinal vessel maps by increasing vascular dilation and/or tortuosity.

Methods: Previously collected OCT-generated retinal vessel maps from 42 eyes (21 infants) were (1) ranked by 3 ophthalmologist graders by increasing vascular tortuosity and/or dilation and (2) traced by 2 tracers using ROPtool to calculate the following vascular indices: tortuosity index (TI), dilation index (DI), and sum of adjusted indices (SAI, combined tortuosity/dilation index). For each ROPtool index (i.e., TI, DI, and SAI), the vessel maps were ranked 1-42 in order of increasing index value. Summary (i.e., mean) rankings were calculated for human and ROPtool rankings. Inter-grader and inter-tracer ranking agreement was calculated using the intraclass correlation (ICC). Pearson correlation coefficients were used to evaluate the correlation between the mean human and ROPtool rankings.

Results: Inter-grader agreement was good for tortuosity (ICC=0.83), dilation (ICC=0.77), and combined tortuosity/dilation (ICC=0.88) rankings. Inter-tracer agreement was good for TI (ICC=0.87) and SAI (ICC=0.83) and poor for DI rankings (ICC=0.36). The correlation between mean human and ROPtool rankings was strong for tortuosity (r=0.87) and combined tortuosity/dilation (r=0.86) and moderate for dilation rankings (r=0.47).

Conclusion/Relevance: Human graders can reliably rank OCT-generated retinal vessel maps for relative tortuosity and combined tortuosity/dilation, which correlate well with objective rankings by a computer program.

Semi-Automated Analysis of Foveal Maturity in Premature and Full-term Infants using Handheld Swept-Source Optical Coherence Tomography

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Introduction: Semi-automated foveal analysis using an investigational handheld swept source-optical coherence tomography (SS-OCT) may identify foveal immaturity in awake infants.

Methods: In this prospective, observational study, full-term infants under 72 hours old and preterm infants undergoing routine retinopathy of prematurity screening were imaged June 2018 - February 2019. Semiautomated analysis measured the foveal angle in degrees and the thickness of the choroid at 3 locations: central fovea and 2-sided parafovea (2.5mm from fovea) by 2-grader consensus. Choroidal thicknesses and foveal angles were correlated with OCT features, demographics, and preterm weight gain at days 10-19, 20-29, 30-39. A mixed model approach adjusted for multiple eyes and visits.

Results: 194 imaging sessions from 70 infants were included (47.8% female, 37.6±3.4 weeks postmenstrual age at imaging, 26 preterm with birth weight 1057±325 and gestational age 29.0±3.0 weeks). Choroidal thickness at fovea (mean 447.8±120.6) and parafovea (mean 420.9±109.2) correlated with foveal ellipsoid (P=.007, P=.01, respectively), postmenstrual age at imaging (P<.001), decreasing inner retinal layers (P<.001), birthweight (P<.001) and gestational age (P<.001). Foveal angle (mean 96.1 ± 22.0) steepened with decreasing inner retinal layers (P<.001), increasing birthweight (P=.003), gestational age (P<.001), postmenstrual age (P<.001), foveal or parafoveal choroidal thickness (P<.001) and weight gain between days 10-19 (P=.02) and 20-29 (P<.009). Kappa intergrader agreement was 1.00. No other associations were found with OCT features, demographics or preterm weight gain.

Conclusion/Relevance: Foveal development is a dynamic process that can be partially observed through semi-automated analysis of awake handheld SS-OCT retinal and choroidal imaging on awake infants.

Evaluation of Artificial Intelligence-Based Retinopathy of Prematurity Screening in South India

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Introduction: Artificial intelligence (AI) based retinopathy of prematurity (ROP) screening has shown promise in India, but there remains a gap in knowledge as to how to implement AI, and how well it would perform against the clinical diagnosis of treatment-requiring (TR) ROP. The purpose of this paper was to evaluate the performance of the i-ROP DL algorithm, and a vascular severity score (VSS) against clinical diagnosis of treatment-requiring (TR) ROP in the Aravind Eye Hospital (AEH) network.

Methods: We reviewed the results of telemedicine eye examinations from 2,730 consecutive patients seen in the AEH ROP telemedicine program in 2019–2020. None were excluded. We retrospectively applied the i-ROP DL algorithm to each eye exam to determine the presence of “pre-plus or worse” ROP, and calculated a vascular severity score (VSS) from 1-9. We calculated the sensitivity and specificity for the binary cut-point and the area under the receiver operator characteristic curve (AUC-ROC) for the VSS with the outcome of a telemedical diagnosis of TR-ROP.

Results: Using a binary cutoff, the i-ROP DL system had a sensitivity of 0.99, specificity of 0.65, and using the continuous VSS we found an AUROC of 0.91 for a diagnosis of TR-ROP, and 0.88 compared to any baby who received treatment.

Conclusions: We found near perfect diagnostic accuracy of the i-ROP DL algorithm when evaluated against a real-world population and clinical diagnosis of TR-ROP. Future work will evaluate optimal cut-points to ensure high sensitivity in autonomous implementation.

References:

Introduction: To evaluate the utility of Telemedicine (TM) in the management of adult patients with strabismus.

Methods: A 27-question online survey was sent to ophthalmologists of the American Association of Pediatric Ophthalmology (AAPOS) Adult Strabismus Committee. The questionnaire focused on the frequency of TM utilization, the benefits in the diagnosis, follow-up and treatment of adult strabismus, and barriers of current forms of remote patient visits.

Results: The survey was completed by 16 of 19 members of the committee. Most respondents (93.8%) reported 0 to 2 years of experience with TM. TM was found to be useful for initial screening and follow-up of established adult strabismus patients, mainly to reduce wait time for a subspecialist visit (43.3%). A successful TM visit could be completed with a basic PC camera (75%) or a camera (25%) or could be assisted by an orthoptist. Most participants agreed that common forms of adult strabismus (cranial nerve palsies, sagging eye syndrome, myogenic strabismus, and thyroid ophthalmopathy) could be examined via webcam. It was easier to analyze horizontal than vertical strabismus. Among the paralytic forms, the sixth nerve palsy was the easiest one to assess. Latent forms of strabismus can be partially diagnosed and evaluated using TM, however, half of the respondents underlined the importance of in-person exams in these cases. Sixty-nine percent felt that TM could be a low-cost and time-efficient health service solution.

Conclusion/Relevance: Most members of the AAPOS Adult Strabismus Committee consider TM to be a useful supplement to the current adult strabismus practice.

Strab-Bot - A Data Processing Algorithm to Facilitate use of Strabismus Exam Data in Clinical Research and Quality Outcome Measurements

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Introduction: Strabismus quality-care metrics and large-scale research using electronic medical record (EMR) data have been limited due to exam complexity and varying abbreviations, documentation syntax, and exam-template use across clinicians. We developed an algorithm that abstracts and processes EMR strabismus-exam data into discrete coded variables to facilitate analysis.

Methods: SQL was used to program rules that extracted information from 100 EPIC-EMR strabismus-exam fields into relevant elemental variables, e.g., alignment measurements included testing method (alternate cover, etc.), glasses correction, gaze direction, and deviation direction (eso, etc.), type (tropia, etc.), and magnitude. The program was iteratively tested and updated using clinical pediatric ophthalmology registry data. Performance was manually assessed using a randomly selected testing set.

Results: The registry contained 288,974 strabismus exams of 99,750 patients, from which Strab-Bot extracted 4,146,328 separate exam measurements. A testing set of 175 examinations was randomly selected and included 365 misalignment measurements converted to 2920 elemental-variable data points with 96.99% accuracy by measurement, 99.38% by variable; 197 ortho measurements identified accurately 100%; 43 (7%) measurements flagged for manual review by the user due to excessive text length, ambiguous phrases, or too many empty variables; and 2601 motility measurements extracted with 99.8% accuracy and 3 (0.1%) flagged for manual review. Further algorithm updating raised alignment and motility accuracy to 100%. Free-text control descriptions were too variable to be reliably abstracted.

Conclusion/Relevance: Strab-Bot accurately translates strabismus-exam data into coded data to facilitate large-scale strabismus research. Future study can involve natural-language processing for control descriptions and deep-learning to identify strabismus syndrome patterns.

Accuracy of Eyemeter as a Deep Learning Tool for Identifying Strabismus in Pediatric Patients

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Introduction: With its promising advances in image recognition, deep learning (DL) as a form of artificial intelligence is positioned to become integral to the field of ophthalmology.1,2 Eyemeter is a DL tool previously developed to assess external features of adult eyes. This study tested the functionality and accuracy of Eyemeter in assessing direction and magnitude of strabismus in primary gaze based on external photographs.

Methods: Pilot cohort study of 22 children (mean age 3.9±2.7 years, range 2 weeks – 10 years) with known horizontal strabismus who presented to our institution between 08/2018 and 01/2021. Digital single-lens reflex (DSLR) camera-obtained photographs in primary gaze were analyzed using Eyemeter. Qualitative analysis of the accuracy of Eyemeter in detecting eyelid margins, cornea, and corneal light reflex was performed. DL strabismus measurements were compared to clinic Krimsky and alternate cover test measurements.

Results: Eyemeter accurately identified eyelid margins, cornea, and corneal light reflex in both eyes 32% of the time. For cases where not all anatomic landmarks were identified, errors included failure to find: cornea (100%); corneal light reflex (27%); or eyelid margins (13%). For cases where all anatomic landmarks were successfully identified, the direction of strabismus was correctly diagnosed 86% of the time and mean difference between clinic and DL measurements was 12.9±7.6 prism diopters.

Conclusion/Relevance: DL has the potential to broaden diagnostics in strabismus, but adult technologies may require significant calibration to provide accurate data in children. In our cohort, Eyemeter functioned well only when the cornea was correctly identified, and further optimization is needed.

Comparison between the Time Required to Take Nine-Direction Ocular Photographs using Conventional Method and a Novel Convenient Application

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Introduction: We aimed to compare the time required to produce nine-direction ocular photographs using the conventional method and the novel application named 9Gaze.

Methods: Twenty healthy adults were included in this study. All participants underwent ocular photography using the three devices: digital camera with PowerPoint 2010, iPad and iPod touch with 9Gaze. We measured the time required to combine the nine photographs into a single image. We also compared the usage time based on the years of experience of the five orthoptists. The participants were divided into two groups; those examined by orthoptists with more than one year of experience and by those with less than one year of experience.

Results: The participants were 26.7 ± 4.7 (mean ± SD) years old. The required time for the three devices was statistically significant (P < 0.05). The digital camera’s required time was 515.5 ± 187.0 sec, iPad was 117.4 ± 17.8 sec, and iPod touch was 76.3 ± 14.1 sec. A significant difference between the years of experience of the examiners was observed for the digital camera (P=0.02), but not for the iPad and iPod touch. The required time was significantly longer with the digital camera than with the iPod touch in both groups (P <0.001) based on the years of experience of examiners.

Conclusion/Relevance: The nine-direction ocular photographs using 9Gaze shortened the time required for measurement. Furthermore, 9Gaze can be recorded without regard for the years of experience of the examiner.

Understanding the Use of Control Scores in Intermittent Exotropia: Newcastle, PEDIG, and LACTOSE

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Introduction: The Newcastle(1), PEDIG(2), and LACTOSE(3) control scores for intermittent exotropia (IXT) were developed to quantify control of exodeviations. These scores may be used to monitor disease progression, guide treatment including surgical intervention, and ensure uniformity of reporting in studies of IXT. However, it is unclear whether pediatric ophthalmologists have adopted these control scores in clinical practice.

Methods: A short survey was posted on the American Association of Pediatric Ophthalmology and Strabismus (AAPOS) forum in August and September 2021. Respondents were asked about their assessment of control in IXT including knowledge and use of the various control scales.

Results: 114 pediatric ophthalmologists responded. 54.4% (n=62) reported not using any specific control score for IXT, although 61.4% (n=70) were familiar with the PEDIG score, 37.7% (n=43) with the Newcastle control score, and 7.9% (n=9) with the LACTOSE control score. The PEDIG score was the most widely used (26.3%, n=30), but 36.7% (n=11) of respondents reported that the scale is too time-intensive, limiting its usage. To improve the use of the control scores, participants recommended promoting wider understanding of the scales (45.6%, n=52).

Conclusion/Relevance: The majority of responding pediatric ophthalmologists do not use a specific control score in managing IXT. The PEDIG control score is the most frequently used but is reported as time-consuming. Although the LACTOSE control was designed to provide a quicker alternative, it is not widely known. Promoting wider awareness and understanding of IXT control scores may be helpful to allow for more objective quantification of control in IXT.

References:
Standard vs. Reduced Numbers for the Management of Intermittent Exotropia in Children <= 6 Years

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Introduction: Reduction of the surgical dose in intermittent exotropia in younger age groups might reduce the rate of consecutive esotropia and improve the success rate. The aim of the study was to compare using the standard surgical dose vs. a reduced surgical dose in intermittent exotropia in children <= 6 years, and to determine whether this outcome is influenced by the degree of preoperative control.

Methods: In this prospective randomized study, 92 children with intermittent exotropia were randomized to two group. In the standard group, bilateral lateral rectus (BLR) muscle recession was performed according to the standard tables, while in the reduced group, the surgical dose was reduced by 1 mm for each muscle. Both groups were further subdivided according to the degree of preoperative control. Duction, versions, angle of alignment and postoperative outcome of both groups were compared.

Results: The difference in the success between the standard group (54%) and the reduced group (72%) was statistically insignificant (P=0.08) Overcorrection at 6 months was significantly higher (P =0.032) in the standard group (28.2%) vs. the reduced group (8.6%). Undercorrection occurred more in the reduced group in those with poor preoperative control (P=0.01), while overcorrection was more common in the standard group in those with good preoperative control (P <0.01).

Conclusion/Relevance: Overall, reduction of the surgical dose reduced the overcorrection rate in intermittent exotropia in children <= 5 years of age. However, reduction of surgical dose was associated with higher rate of undercorrection in those with poor preoperative control of exotropia.

Gaze Fixation as a Predictive Marker for Strabismus and Vergence Insufficiency in Parkinson’s Disease

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**Introduction:** Strabismus and vergence insufficiency are prevalent deficits, affecting the quality of life in Parkinson’s disease (PD)[1]. Lack of understanding of their mechanistic underpinnings are associated with limited treatment options[2]. We hypothesize that the two deficits, affecting binocular coordination in PD are interrelated[3].

**Methods:** We measured binocular eye positions during vergence and gaze-holding using high-resolution video-oculography (EyeLink 1000™) in 19 participants: 13 PD patients and six healthy controls. Clustering algorithm was implemented in MATLAB to analyze data.

**Results:** Binocular coordination in PD was better with binocular compared to monocular-viewing (p=0.03; pairwise comparison with Bonferroni correction). Supervised clustering technique classified the patients into three groups according to their severity of binocular misalignment during gaze-holding. Group:1 was comparable to healthy controls in monocular and binocular-viewing conditions (n:5, Binocular maximal mean deviation (MMD):2.01±0.96; Monocular-MMD:3.42±0.80). Group:2 had a significantly worse alignment in monocular-viewing conditions but not during binocular viewing (n:2, Binocular-MMD:2.23±0.25; Monocular-MMD:6.65±1.63, monocular-viewing, p<0.05). Binocular alignment during monocular and binocular-viewing was significantly impaired in group:3 (n:6, Binocular-MMD:6.08±4.78; Monocular-MMD:4.72±2.15, p<0.05). Consistent with our hypothesis, vergence gain and latency were normal in group:1, while they increasingly worsened in groups:2 and 3. In group:1 the vergence latency was 420±0.24ms(binocular) and 356±0.12ms(monocular); and gain was 0.55±0.66(binocular) and 0.20±0.10(monocular). In group:2 the latency and gain were 242±0.43ms(binocular) and 458±0.15ms(monocular); and 0.40±0.22(binocular) and 0.14±0.14(monocular), respectively. They were 372±0.07ms (binocular) and 526±0.10ms(monocular); and 0.12±0.17(binocular) and 0.17±0.07(monocular) in group:3.

**Conclusion/Relevance:** Objective analysis of gaze-holding using eye-tracking is a sensitive marker of both angle and control of strabismus and vergence insufficiency in PD.

Clinical Characteristics of Adult Onset Myopic Eye Sagging Syndrome (MESS)

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Introduction: Patients with adult-onset, gradual, acquired, comitant esotropia present a diagnostic challenge. Heavy eye syndrome (HES) and sagging eye syndrome (SES) have been postulated to explain this pathophysiology. HES affects high myopes, typically over 10 diopters.1 SES typically affects patients over 60 from LR-SR band degeneration.2 In our study we review clinical, imaging and laboratory findings of patients falling outside the parameters of SES and HES.

Methods: A retrospective chart review identified adults with esotropia. Patients aged 18-60 with a myopic spherical equivalent of up to -10 diopters in one eye, adult-onset esotropia, and a distance deviation exceeding or equal near deviation were included. Patients with a history of childhood strabismus, strabismus surgery, or other cause of esotropia were excluded. Age, sex, visual acuity, refractive/spherical error, distance esotropia, and near esotropia were recorded.

Results: Eighteen patients met the inclusion criteria. Eleven were female. The average age was 43.6 (range: 20 to 59) years. The average spherical equivalent was -4.63 (-1.13 to -7.75) OD and -4.57 (-0.5 to -7.5) OS and average visual acuity was 0.03 logMAR OD and 0.02 logMAR OS. The average esotropia in primary gaze was 17.9 (3 to 35) prism diopters. Average near esotropia was 12.7 (0 to 35) prism diopters.

Conclusion/Relevance: Adult-onset esotropia can occur in moderately myopic adults under 60. This may be due to an extended spectrum of HES and/or SES that does not currently meet either criterion. Future MRI studies are warranted to determine the relative positions of the extraocular muscles in these patients.

Association of Fusional Amplitudes with Surgical Outcomes in Pediatric Strabismus

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Introduction: Fusional vergences provide quantitative information about the ability to maintain binocular vision in strabismic patients. The purpose of this study was to determine whether there is an association between fusional amplitudes and motor, sensory, and stereoacuity outcomes after strabismus surgery in pediatric patients.

Methods: An IRB-exempt retrospective chart review of patients with fusional amplitude measurements who underwent strabismus surgery from 2010 to 2020 was conducted. Children age 18 and under with non-restrictive strabismus and at least one post-operative visit were included. Fusional amplitudes were measured with prisms or the synoptophore. Motor alignment, sensory fusion (Worth-4-Dot), and stereoacuity (Titmus stereo test) were assessed at the pre-operative, initial post-operative (at 6-8 weeks), and final post-operative (last documented) visits.

Results: Thirty-nine patients were included; synoptophore measurements were documented in 56.4% of patients. There was no association between fusional amplitudes and alignment, sensory, or stereoacuity outcomes when data from both prism and synoptophore measurements was analyzed. Low fusional amplitudes, measured by synoptophore only, showed worse distance sensory fusion at the initial (Fisher’s exact test, p = 0.050) and final (p = 0.021) post-operative visits and worse stereoacuity at the initial (p = 0.01) but no final (p = 0.135) post-operative visits compared to pre-operative findings. There was a weak correlation between total horizontal amplitudes on the synoptophore and worsening distance sensory fusion at the final post-operative visit (r = -0.496, p = 0.071).

Conclusion/Relevance: Patients with low fusional amplitudes on synoptophore testing may have worse short-term and/or long-term sensory and stereoacuity outcomes.

Cylindrical Lens Transforms Red and Green Laser Pointers into Streak Generators Used for Lancaster Red-Green Testing at Minimal Cost

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Introduction: The limited availability and high cost of the red and green streak generators (over $100 each) is a primary factor hindering many clinicians’ use of the Lancaster Red-Green (LRG) testing in managing cyclovertical strabismus. Our aim is to describe a simple optical design that clinicians can use to make their own red and green laser streak generators at minimal cost.

Methods: We made use of a cylindrical lens cut from a bar magnifier to smear a point source of light into a line. We secured a clear acrylic bar magnifier (~$8 in online stores) in a milling machine vise and used a 0.5" plug cutter with continuously sprayed water as a coolant, centered on the crest of the bar magnifier, to cut out 0.5" round plastic cylindrical lenses, each about +35 D in power. We placed a rubber washer in a cut-off plastic test tube, followed by the cylindrical lens. We then secured the tube onto the cap of a red or green 5 mw laser pointers (~$8 each). The tube serves to hold a rotatable rectangular aperture about 3" beyond the lens and secure it in place while squarely cutting off the streak at the desired length (3mm wide, 7cm long for 1m testing distance).

Results: When compared with the conventional Foster Torches, the home-made streak generators showed greater light intensity facilitating the test for patients with suppression tendency, while maintaining dissociation.

Conclusion/Relevance: Transforming an affordable technology into a clinical tool for LRG testing can improve the test accessibility at minimal cost.

Inferiorly Displaced Lateral Rectus Muscles in V-Pattern Exotropia

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Introduction: Heterotopic displacement of the lateral rectus (LR) has been identified in subsets of patients with V-pattern exotropia (XT) through imaging. However, intraoperative discovery and surgical management of inferior displaced LR have not been discussed. The purpose of this study was to describe the preoperative, intraoperative, and postoperative findings of patients undergoing surgery for V-pattern XT with an inferiorly displaced LR.

Methods: A retrospective study of patients with V-pattern XT that underwent surgery between 2013 and 2021. All procedures were performed using an operating microscope. Ductions, versions, stereoaucuity, and fundus torsion were analyzed. Documentation of anatomical abnormality were made on basis of surgical inspection.

Results: Of the 211 patients that underwent surgery for primary XT, 42 (20%) had a V-pattern. Inferiorly displaced LR was found intraoperatively in 67% (28/42) of patients with V-pattern XT. Additional intraoperative findings included tight inferior obliques (IO) in 39% of patients with anomalous LR and 14% of patients with normal anatomy (p=0.095). Posteriorly displaced IO were found in 25% of patients with anomalous LR and 7% of patients with normal anatomy (p=0.17). In patients with inferiorly displaced LR, reduction of V-pattern occurred in 17/20 (85%) that underwent bilateral LR recession with bilateral IO myectomy, and 6/8 (75%) with additional upward transposition (p=0.45).

Conclusion/Relevance: Intraoperative discovery of an inferiorly displaced LR should be considered in patients with V-pattern XT as it can alter the intended surgical plan. Bilateral LR recession with bilateral IO myectomy is effective in these patients either with or without transposition of the lateral rectus.

Global Virtual Strabismus Surgery Teaching for Ophthalmology Residents During Covid-19

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Introduction: In response to the Covid-19 pandemic, the World Society of Pediatric Ophthalmology and Strabismus (WSPOS) piloted strabismus surgery simulation webinars providing real-time surgical instruction using an accessible model eye. The purpose of this study was to demonstrate improvement in confidence level with strabismus surgery among ophthalmology residents who participated in the webinar.

Methods: Five strabismus surgeons (from 5 different countries) taught 10 beginning ophthalmology residents (from 5 different countries) using a homemade model eye and a cell phone streaming the surgical view. Surgical techniques taught included needle handling, scleral passes, and suturing extraocular muscles. Residents watched a video demonstrating techniques prior to the webinar. Three surveys completed Pre-Video, Post-Video, and Post-Webinar evaluated comfort level in surgical skills using Likert scales. Survey responses were analyzed using paired t-tests and repeated measures ANOVA (SPSS v24). Queen's University Health Sciences Research Ethics Board approval was obtained.

Results: Nine of 10 trainees answered the surveys: 66% were 25-29 years old; 62.5% were second-year residents. Paired t-test showed a statistically significant increase in comfort level in performing scleral passes, suturing an extraocular muscle, and creating a locking bite at the muscle pole between Pre-Video to Post-Webinar surveys (p<0.05). Exploratory repeated measures ANOVA revealed improvements in scores for 4 of the 5 questions (p<0.05).

Conclusion/Relevance: Our pilot study demonstrates effective teaching of strabismus surgery techniques virtually using an accessible model eye. Virtual teaching allows delivery of world expertise teaching to trainees worldwide, diminishing barriers to learning and improving eye care to patients globally.

Use of 3D Heads-Up Display for Strabismus Surgery

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Introduction: Strabismus surgery can lead to back and neck injuries for surgeons and their assistants due to the adoption of unnatural postures when using the operating microscope or loupes. The surgical team may have difficulty following the flow of surgery when the surgical field is not projected, leading to poor anticipation and efficiency. Heads-up surgical displays have been shown to improve ergonomics in many fields.

Methods: The Orbeye (Olympus America) is a heads-up 3D video system that allows the surgical team to view the field on multiple large 4K monitors. Our strabismus and oculoplastics surgeons piloted the use of the Orbeye for ocular surgery. We have incorporated this video system into our surgical practice and have met regularly to discuss optimization for surgical care, education, and ergonomics. The results of these discussions during our first 100 cases using the Orbeye for ocular surgery will be presented.

Results: Discussions between surgeons allowed improved room set-up for Orbeye strabismus surgery. Camera head movement and positioning were optimized for safe surgery. The use of loupes under the polarized goggles allowed reversion to traditional surgery at any time, if needed. The foot pedal settings can be programmed to mirror traditional microscope settings. (Photos, videos, and diagrams of the room set-up for Orbeye strabismus surgery will be shown)

Conclusion/Relevance: Heads-up surgery using high-resolution 3D monitors can improve surgeon and assistant ergonomics, surgical team communication, and teaching ability during strabismus surgery. As with any new surgical technique, case selection for early procedures is important to flatten the learning curve.


Extraocular Muscle Ductions following Nasal Transposition of the Split Lateral Rectus Muscle

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Introduction: To quantify changes in ductions following nasal transposition of the split lateral rectus (NTSLR) muscle for treating third nerve palsy.

Methods: We analyzed an international, multicenter registry of patients treated with NTSLR. We compared preoperative and postoperative ductions using Wilcoxon rank-sum tests. We identified the sub-group of patients that demonstrated ability to adduct from midline postoperatively and performed multivariable logistic regression to identify associated factors including patient demographics and surgical techniques. We report odds ratios (OR) and 95% confidence intervals (CI).

Results: NTSLR was performed on 132 patients in this study. We found a decrease in median abduction limitation from zero (full ability to abduct) (IQR, 0 to 0) preoperatively to -4 (IQR, -4 to -3) postoperatively (p < 0.001). There was a corresponding improvement in median adduction limitation from -5 (IQR, -5 to -4) preoperatively to -4 (IQR, -4 to -3) postoperatively (p < 0.001). There was no difference in preoperative vs. postoperative grade of elevation or depression (p > 0.05). 42% of patients demonstrated postoperative ability to adduct from midline. None of the factors investigated were significantly associated with this ability including age (OR 0.51; 95% CI, 0.22-1.29), weak lateral rectus muscle (OR 2.39; 95% CI, 0.68-8.42), posterior location of transposed muscle (OR 1.05; 95% CI, 0.26-4.21), and superior oblique tenotomy (OR 4.88; 95% CI, 0.68-34.89).

Conclusion/Relevance: NTSLR improves the horizontal midline positioning of eyes with third nerve palsy. Most eyes lose the ability to abduct; however, some regain a modest ability to adduct, while vertical ductions remain unchanged.

Surgical Approach for Treatment of Congenital Exotropia in Children with Neurologic Impairment

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Introduction: Bilateral lateral rectus recession (BLR-recess) is a common surgical procedure for exotropia but often is insufficient for treatment of congenital exotropia, particularly among children with neurological impairment.1 We sought to determine factors predictive of surgical failure of BLR-recess in congenital exotropia and describe an alternative surgical approach.

Methods: Retrospective cohort study of children who had moderate to severe neurologic impairment, demonstrated some visual effort/function, underwent surgical correction for congenital exotropia, and had minimum 12 months post-operative follow-up. A successful surgical outcome was defined as orthotropia, well-controlled intermittent exotropia, or poorly controlled exotropia of less than 10 prism-diopters (pd).

Results: 25 children were studied: mean age at surgery 35 months (SD 23), mean follow-up 57 months (SD 34), mean pre-op deviation 50 pd (SD 11). 17 children underwent BLR-recess, among whom 12 (71%) had a successful outcome. Degree of neurologic impairment appeared to be a predictor of failure: success was 9/10 (90%) among those with moderate impairment and 3/7 (43%) among those with severe impairment. Those with severe neurologic impairment appeared possibly to have a "central convergence deficit." Therefore, an alternative strategy of bilateral medial rectus resection (BMR-resect) was pursued for 8 such children with demonstrated success of 75% (6/8).

Conclusion/Relevance: We hypothesize existence of a subtype of children with exotropia for who BMR-resect may be a preferable surgical approach. Such children are characterized by relatively severe neurologic impairment but exhibit some perceptible visual effort and have a "central convergence deficit," which is better addressed with medial rectus resection.

Unilateral 4-Muscle Surgery for Large Monocular Constant Sensory Exotropia

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Introduction: Recurrent exotropia is common following horizontal rectus muscle surgery for monocular constant sensory exotropia. Surgery is limited to avoid operating on the better-seeing eye. Simultaneous oblique weakening surgery may enhance the effect of the horizontal rectus muscles surgery by decreasing the abducting oblique force. We report the results of simultaneous inferior and superior oblique muscle weakening procedures combined with horizontal muscle recession/resection for large angle constant monocular sensory exotropia greater than 35 prism diopters (PD).

Methods: Retrospective case series of patients who underwent unilateral lateral rectus recession combined with medial rectus muscle resection, inferior oblique myectomy and superior oblique tenectomy. Medical records were reviewed for demographic information, pre-operative alignment, surgical procedure performed, post-operative alignment and ocular rotations. Primary outcome measure was ocular alignment in primary position.

Results: Twelve eyes of 12 patients were included. Preoperative exotropia improved from 59.2+-13.3(35-80) PD to 3.3+-5.5(0-16) PD postoperatively. Two of 3 patients with a pre-existing vertical deviation resulted in less vertical deviation postoperatively. All patients demonstrated an improvement in their exodeviation postoperatively. At the last follow up at 5.7+-4.5 months (1-14 months), 11(92%) patients were aligned within 10 PD of exotropia and 7(64%) measured near and distance orthotropia. Postoperative abduction measured -0.5+-1(0 to -3) and adduction -0.3+/-0.7(0 to -2). No patient developed enophthalmos or palpebral fissure changes postoperatively.

Conclusion/Relevance: Weakening the ipsilateral oblique muscles appears to increase the surgical effect and stabilize the alignment when operating for a large angle monocular sensory exotropia. An additional potential advantage, oblique muscle surgery may simultaneously address associated vertical deviations.

Surgical Outcomes of Combined Ipsilateral Inferior Oblique and Superior Rectus Recession for Superior Oblique Palsy with Hypertropia in Abduction

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Introduction: To assess surgical outcomes of simultaneous inferior oblique (IO) and ipsilateral superior rectus (SR) recessions for superior oblique palsy (SOP) with hypertropia in abduction despite negative forced ductions.

Methods: Retrospective record review including patients with unilateral symptomatic SOP with hypertropia $\geq 10$PD in abduction who underwent recession of IO and ipsilateral SR with adjustable sutures. The IO was recessed 10 mm, and SR was recessed 3 mm in 2 patients and 4 mm in 4 patients. Age, sex, and pre- and postoperative vertical deviation in primary position (PP) and lateral gaze were assessed.

Results: Between July 2020 to August 2021, 28 patients received surgery for SOP, of which 6 (21%) underwent combined IO and SR recessions. Mean age was 50.2 ± 11.1 years; mean follow-up was 2.5 ± 2.0 months. Mean preoperative vertical deviation in PP and lateral gaze were 17.8 ± 4.6PD and 13.7 ± 2.9PD, respectively. At postoperative month (POM) 1, the deviation had improved to 1.8 ± 2.9PD (p=0.001) in PP and 0 ± 0.6PD (p=0.0004) in lateral gaze. At POM3, there was improvement to 0.7 ± 5.0PD (p=0.015) in PP and -1.0 ± 5.0PD (p=0.073) in lateral gaze. No postoperative adjustments or reoperations were required.

Conclusion/Relevance: Combining IO with ipsilateral SR recession to treat SOP demonstrating hypertropia of $\geq 10$PD in abduction is an effective procedure, even in patients without signs of SR contracture or positive forced ductions. This technique, which is contingent on vertical deviation size in abduction, also treats large hypertropias in PP with surgery on only one eye.

Y-Split Muscle Technique with Adjustable Sutures as an Alternative to Faden Sutures in Incomitant Paralytic or Restrictive Strabismus

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Introduction: Faden sutures can correct incomitant strabismus, but may be difficult to perform, predict or adjust. In 2020, Erth1 presented Y-split muscle technique to increase the field of single binocular vision by 'slowing down the overacting muscle'.

Methods: Consecutive case series of patients operated during an 11 month period by 12-15mm Y-split technique on the overacting muscle, sutured to sclera at predefined locations1. Adjustable short-tag-resorbable sutures (Vicryl6-0) were utilized. We recorded pre-and post-operative deviations at near and distance, and the gaze direction with increased deviation. If needed, other surgical procedures were added. Delayed adjustment was optional.

Results: 7 patients, 3 females, age 16-74 (median 51 y). Diagnoses: Traumatic orbital fracture repair (N=3), Duane (N=1), Ruthenium Plaque (N=1), V-pattern ET (N=1), TED (N=1). Y-split was performed on recti muscles; SR (N=3), IR (N=2), MR (N=2), and combined with recession of same muscle (N=3), or other procedures on different muscles (N=2). The effect on primary position was 0 (0.0PD) and the desired overaction was reduced median 5 (4.5PD) in pure Y-split procedures, and 20-25 PD when combined with recessions of same muscle. 6 of 7 suffered from diplopia in one or more gaze positions preoperatively, this was resolved in all at last follow up (median 180 days (3,180)). Adjustment was performed on day 7 after surgery in one patient.

Conclusion/Relevance: Y-split muscle suture technique is a safe and predictable alternative to Faden sutures in incomitant strabismus, and may be combined with recession of the same muscle. Adjustable short tag noose sutures allows for fine-tuning of the deviation up to 7 days after primary operation.

References: 1: Erth, Oliver: ESA webinar, 8th November 2020: ‘Y-split muscle techniques’
Additional information: If accepted as paper, additional film of the procedure will be presented.
Small Tuck for Superior Oblique Palsy

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Introduction: Some surgeons only treat superior oblique (SO) palsy with a tuck when the SO tendon is lax, either for fear of creating a secondary Brown syndrome or out of belief that a lax tendon signifies a distinct etiology that uniquely responds to SO tuck (1,2). This study reports a series of patients with SO palsy treated by small SO tuck in whom lack of tendon laxity precluded a larger tuck.

Methods: Retrospective record review of consecutive patients with unilateral SO palsy who underwent isolated SO tuck less than or equal to 6 mm from 2000-2018 at Kellogg Eye Center, University of Michigan.

Results: Twenty-seven cases met inclusion criteria. The mean SO tuck (total, both sides of tuck) was 4.9 mm [range 2-6 mm]. After surgery, mean hypertropia decreased from 11.6 PD to 3.7PD in primary position, from 19.8 PD to 6.6 PD in the SO field of action, and lateral incomitance [difference in hypertropia between contralateral and ipsilateral gaze] decreased from 11.6 PD to 1.9 PD (P<0.0001 in each case). Six patients had diplopia in upgaze that was not symptomatic enough to require re-operation. Six patients had residual hypertropia requiring additional surgery.

Conclusion/Relevance: Small SO tuck is an effective surgical option for SO palsy when the greatest deviation is in the SO field of action and there is marked lateral incomitance, even in the absence of tendon laxity.

Z-Split Myectomy versus 7/8 Posterior Tenectomy for Brown Syndrome

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**Introduction:** Brown syndrome is an extraocular muscle disorder that can cause motility restrictions, diplopia, and alternate head positioning. Multiple surgical techniques have been developed to resolve this problem. One technique, the superior oblique Z-split, lengthens the superior oblique tendon by partial-thickness cuts. Another technique, posterior 7/8 tenectomy, weakens the superior oblique while preserving its torsional action. This study aims to compare the outcomes of both surgeries.

**Methods:** This a retrospective chart review of 14 patients under 25 year of age who underwent either of the above surgeries for Brown syndrome. Outcomes were assessed in terms of decrease in restriction of upgaze in adduction, decrease in hypertropia in primary gaze, and improvement of alternate head position.

**Results:** Seven patients underwent each Z-split and 7/8 posterior tenectomy. Both procedures caused statistically equal reductions of grade of restriction of upgaze (2.6, 1.1; \( p = 0.17 \)), decreases in vertical strabismus (7.3 diopters, 4.1 diopters; \( p = 0.45 \)), and resolutions of alternate head position (50%, 57%; \( p = 0.80 \)). In the Z-split population, one patient developed upshoot in adduction, and two patients reversed their hypertropia.

**Conclusion/Relevance:** Although the Z-split appears to produce stronger effects in motility and primary alignment, these are not statistically significant and seem to come with the trade-off of a less predictable outcome. Both the Z-split and 7/8 posterior tenectomy are successful in reducing clinical measures of Brown syndrome.

**References:**
Superior Rectus Recession for Vertical Strabismus with Limitation of Depression in Abduction

Michael Langue, MD; Sean P. Donahue, MD, PhD
Vanderbilt Eye Institute
Nashville, TN

Introduction: Ocular misalignment can occur from a tight vertical rectus muscle, as is seen with thyroid eye disease. Hypertropia from a tight superior rectus is less common, but would show an increase in vertical deviation in the field of action opposite the involved muscle. We report outcomes of superior rectus recession for hypertropia increasing in downgaze.

Methods: Retrospective chart review of superior rectus recession for hypertropia increasing in downgaze with limitation of depression in abduction. Post-operative data were collected up to two months. Outcomes were rated according to presence of diplopia and need for additional treatment as excellent (no diplopia or treatment), good (diplopia managed with prism) and poor (diplopia requiring re-operation).

Results: 15 patients (mean age 59.8 +/- 10.8) underwent superior rectus recession. Pre-operative hypertropia in primary position ranged from 8-35 prism diopters (median 20). Thyroid eye disease was the most common etiology (n = 6, 40%), followed by a longstanding superior oblique palsy (n = 4, 26.7%). A tight superior rectus was found at surgery in all cases. The amount of recession ranged from 2.5 - 10mm +/- 2.1 (median 6mm and mean 5.5mm). 12 patients (80%) had an excellent outcome, 2 (13.3%) had a good result with prism managed diplopia and 1 (0.7%) poor result with residual hypertropia in primary and downgaze requiring an inferior rectus resection that was successful.

Conclusion/Relevance: Superior rectus recession is useful in treating patients with a hypertropia that increases in downgaze and abduction and is associated with limitation of depression in abduction.

References:
Strategic Business Concepts for Physicians and Administrators

Eric A. Packwood, MD; Traci Fritz; Socioeconomic Committee
Cook Children’s Hospital
Fort Worth, Texas

**Purpose/Relevance:** With COVID-19 related factors accentuating the increasing socioeconomic challenges of practicing pediatric ophthalmology, this full day pre-meeting tackles many of the most significant practice management topics.

**Target Audience:** Presentations target all those involved in pediatric ophthalmology practice operations including pediatric ophthalmologists and practice managers.

**Current Practice:** Pediatric ophthalmology practices face a decreasing margin for error in the realm of practice management. To thrive, decision makers must lead themselves and their team, maximize collections, optimize human resources, master the basics of practice finances and insure efficient clinic and operating room flow.

**Best Practice:** Experienced pediatric ophthalmologists and highly regarded consultants address the granular detail of practice leadership, human resources, practice efficiency, collections and practice finances.

**Expected Outcomes:** Attendees should receive knowledge and tools that increase their ability to improve practice operations in these specific areas.

**Format:** The all day meeting will include didactic lectures, panel discussions and a period of time for questions and answers.

**Summary:** Especially due to COVID-19 related issues, pediatric ophthalmology practices face increasing challenges and decreasing margins for error in practice management. The panel discussions, didactic lectures and question and answer sessions will address practice leadership, collections, human resources, practice finances and practice efficiency. Speakers include experienced pediatric ophthalmologists and highly regarded consultants.

**References:** Delaney-Gesing A, Stevenson S. Adjusting Ophthalmology Practice to a Pandemic. Ophthalmology Times; April 18, 2021.
Best Practices in Informed Consent, Documentation, and Disclosure of Medical Errors

R. Michael Siatkowski; Denise Chamblee
Ophthalmic Mutual Insurance Company
San Francisco, CA

Purpose/Relevance: Even in the absence of permanent patient harm, physicians bear medicolegal exposure when the process of informed consent and disclosure of medical errors is not optimally performed.

Target Audience: all ophthalmologists

Current Practice: In a busy practice, key details of informed consent may be glossed over, and explicit details to changes in informed consent may not occur. Similarly, when medical errors occur, full disclosure and appropriate empathy or apology may not be provided, due to the difficulties of these conversations or the fear of legal action.

Best Practice: Detailed informed consent for each procedure in an operative episode must be obtained and appropriately recorded in the medical record. When errors occur, timely disclosure and ongoing dialogue with the patient and family are crucial to ensure their understanding. Studies have shown that patients who sued their physician often did so because their doctor did not help them understand the unanticipated outcome. Patients want their physician to do 3 things after poor outcomes: explain what happened, say he/she is sorry that the patient experienced this outcome, and take steps to prevent the same thing from happening to other patients.

Expected Outcomes: Physicians will understand the details of the informed consent process as well as appropriate ways to document changes in informed consent when necessary. In addition, they will be able to more comfortably disclose medical errors and offer appropriate empathy or apology to the patient and family.

Format: case presentation, didactic lecture, Q/A forum

Summary: This workshop will utilize a closed claim involving a medical error in which indemnity payment was made despite the absence of permanent physical harm. Discussion will contrast events of this case with best practices in informed consent, documentation, and disclosure.

What We Are Learning from the COVID-19 Pandemic

Eric A. Packwood, MD; Traci Fritz; Shira Robbins, MD; Lance Siegel, MD; Maureen Waddle, RN, MBA

Cook Children’s Hospital
Fort Worth, Texas

Purpose/Relevance: The COVID-19 pandemic created unprecedented socioeconomic challenges for pediatric ophthalmology practices over the past 2 years. Understanding the effectiveness of different practice responses helps all practices to better understand their own experience and to apply learned concepts moving forward.

Target Audience: The presentation should benefit anyone involved in practice operations for pediatric ophthalmology including pediatric ophthalmologist, orthoptists and practice managers.

Current Practice: No one could predict the challenges created by the COVID-19 pandemic. Pediatric ophthalmology practices experienced unprecedented circumstances that severely affected practices’ ability to provide access to care for patients and to maintain financial viability.

Best Practice: The authors will present survey results of pediatric ophthalmologists obtained during the course of the pandemic, that illustrate the socioeconomic impact of the pandemic on their practices. We then share the practice attributes and practice choices that yielded the most favorable socioeconomic outcomes, thus far, in responding to the pandemic.

Expected Outcomes: Attendees will gain a better understanding of the measurable, socioeconomic practice outcomes caused by the COVID-19 pandemic and learn which practice patterns are common to practices that have survived, if not thrived, during the pandemic.

Format: The workshop will consist of pediatric ophthalmologists presenting survey results and a highly regarded practice management consultant sharing observations about socioeconomic outcomes experienced by practices during the pandemic.

Summary: The COVID-19 pandemic caused unprecedented and harsh challenges for pediatric ophthalmology practices. We present the survey results of pediatric ophthalmologists sharing their experience pertaining to the socioeconomic impact of the pandemic. We then look at practice attributes and decisions that favorably influenced socioeconomic outcomes for some practices.

Documentation and Coding Updates for the Pediatric Practice in 2022

Anthony P. Johnson, MD, FACS, FAAP, OCS; Traci Fritz, COE; Robert S. Gold, MD, FAAP; Eric A. Packwood, MD

American Academy of Ophthalmology
San Francisco, CA

Purpose/Relevance: To achieve ‘best practice’, pediatric practices must be familiar with these key issues and objectives:
1. Recognize when to submit E/M vs. Eye visit code by knowing each payer’s criteria.
2. Understand documentation requirements and code options for exams performed out-side the office, such as hospital and emergency department visits.
3. Discover answers to the top pediatric coding scenarios.
4. Recognize what aspects of telemedicine continue to exist including hybrid examples

Target Audience: Pediatric ophthalmologists, administrators, billers, coders, orthoptists, technicians and scribes

Current Practice: Erroneously applying one payer’s rules or a perception of a payer rules to all payers. Each payer can/does have their own documentation requirements.

Best Practice: Best practices are aware of the 2022 documentation and coding updates unique to each payer.

Expected Outcomes: Best practices are aware of the 2022 documentation and coding updates unique to each payer.

Format: Lecture, panel discussion, audience polling

Summary: 1. Test participant’s knowledge of E/M and Eye visit code documentation guidelines
2. Implement a strategic plan of when to submit an Eye visit code vs. E/M code by payer
3. Documentation requirements and code options for exams performed out-side the office, such as hospital and emergency department visits.
4. Discover answers to the top pediatric coding scenarios
5. Recognize what aspects of telemedicine continue to exist including hybrid examples

References: CPT 2021 vs. CPT 2022
Academy’s Health Policy Committee
AAPOS Practice Management Section
Purpose/Relevance: Superior oblique (SO) palsy is a diagnostic consideration in most cases of cyclovertical strabismus. Participants will learn if they can beat artificial intelligence to distinguish actual SO palsy from another common diagnosis using only patient alignment measurements, in all cases objectively verified by imaging.

Target Audience: Strabismologists and orthoptists.

Current Practice: Positive three-step test (3ST) is commonly assumed to be diagnostic of SO palsy. This may lead to misdiagnosis by neglecting other causes of cyclovertical strabismus.

Best Practice: Participants will broaden their differential diagnosis in cyclovertical strabismus, and consider utilizing diagnostic information from orbital imaging and supervised machine learning, a form of artificial intelligence.

Expected Outcomes: Participants may discover that their diagnostic acumen for SO palsy is not quite as robust as assumed, motivating them to expand the differential diagnoses of cyclovertical strabismus, use appropriate diagnostic studies in addition to the motility exam, and thereby improve their surgical planning.

Format: Didactic lectures, and entertaining game format case presentations with audience response, pitting audience diagnoses versus machine learning, arbitrated by radiological confirmation of SO palsy and sagging eye syndrome (SES). Using only alignment measurements in multiple actual strabismus cases, participants will compare their diagnostic acumen against artificial intelligence to distinguish SO palsy from SES. Individual diagnostic performance will be confidential, unless you want to brag about yours! Are you up for the challenge?

Summary: The workshop will review how pulley degeneration and selective atrophy in the SO muscle compartments innervated by the two trochlear nerve divisions is associated with different strabismus patterns. These abnormalities can be demonstrated by orbital magnetic resonance imaging (MRI). Alignment patterns of congenital versus acquired SO palsy will be described, and compared with claims of diagnostic specificity. SES will be shown to commonly fulfill the 3ST. Principles of machine learning will be described, and its performance evaluated in MRI-proven cases to distinguish SO palsy from SES.

Demystifying Dyslexia: Hints for the Ophthalmologist

Laura J. Heinmiller, MD; D. M. Alcorn, MD; Ta Chen Peter Chang, MD; Sheryl Handler, MD; Tammy Yanovitch, MD; on behalf of the Learning Disability and Dyslexia Committee

Purpose/Relevance: To continue educational efforts based upon previous AAPOS member survey demonstrating that many members are not comfortable evaluating children with learning disabilities/dyslexia. Despite some increasing awareness in the general public and education amongst our peers, a majority felt they did not receive specific education regarding learning disabilities in their training. Appropriate recognition, evaluation and referral for learning disabilities should be an integral part of the ophthalmologist's regimen.

Target Audience: Medical students, residents, fellows, ophthalmologists, orthoptists

Current Practice: Pediatric ophthalmologists have varied experience and training in evaluating/recognizing children at risk for learning disabilities/dyslexia despite frequent referrals for vision evaluations or second opinions for vision therapy. Though pediatric ophthalmologists are aware that dyslexia is a learning disorder and not a visual disorder, more specific information, education, and next steps must be provided to patients and families.

Best Practice: Learning disorders/dyslexia can be recognized in young children while there is still brain plasticity and when interventions are known to be more effective. Pediatric ophthalmologists should be aware of the tools and diagnostics available to enable them to best evaluate these children at risk for dyslexia. They should provide appropriate referrals and references for the children at risk and be aware of the associated comorbidities.

Expected Outcomes: Clinicians will become familiar with:
1. Better understanding of dyslexia and recent advances in dyslexia research
2. Evidence based and practical strategies for identification of learning disorders
3. Increased awareness of learning disabilities and their comorbidities so as to better evaluate and advocate for patients and families.

Format: Didactic lecture including dispelling myths with question/answer forum and panel discussion.

Summary: This workshop will aid the provider with a better understanding of dyslexia, its comorbidities, and social implications while providing helpful clinical hints for identification and evaluation for those at risk. Recent advances in dyslexia research will be discussed as well as updated resources and references.


Diagnostics that Changed What We Do in Pediatric Ophthalmology: AAPOS Research Committee Workshop

Stacy Pineles; Mary O'Hara; Saurabh Jain; Eric Gaier; Tamara Wygnanski-Jaffe; Kara Cavuoto;
Alejandra de Alba Campomanes

UCLA
Los Angeles CA

Purpose/Relevance: Pediatric ophthalmologists must stay abreast of new diagnostic modalities within the field of pediatric ophthalmology as well as in the global ophthalmology research community at large.

Target Audience: Pediatric Ophthalmologists

Current Practice: Pediatric ophthalmologists may not be aware of the newest diagnostic tests from within our field and from the adult ophthalmology world. New and exciting techniques utilizing fundus photography, optical coherence tomography (OCT), OCT-angiography, genetic testing, and algorithms for disease management are all being utilized with increasing frequency for various diseases.

Best Practice: We must continue to learn about and incorporate new diagnostic testing methods into our practice to provide modern care to our patients.

Expected Outcomes: Workshop participants will have a further understanding into newer techniques as it relates to our practice as pediatric ophthalmologists. Physicians will understand best practices from recent research and have the ability to discuss new technologies from adult ophthalmology literature with their patients and families.

Format: The format will include didactic lectures and panel discussions.

Summary: Our workshop will consist of multiple presentations that summarize recent research in newer diagnostic tests in ophthalmology. We will describe and appraise the literature in areas that the history of innovation in our specialty, wide field fundus photography, OCT, OCT-angiography, genetic testing, and algorithms for the management of diseases such as retinopathy of prematurity. A question and answer session will be held at the end of the workshop.

Pediatric Cataract Surgery - Techniques and Strategies for 2022 and Beyond

M. Edward Wilson, MD; Erick Bothun, MD; David Morrison, MD; Erin Stahl, MD; Serena Wang, MD

Storm Eye Institute, Medical University of South Carolina
Charleston, South Carolina

Purpose/Relevance: Pediatric Cataract Surgery continues to evolve as technology improves. As pediatric surgeons, we are interested in simplicity and safety but must also be aware of the emergence of innovative techniques designed for adult eyes and know when it is appropriate to modify them for our unique purposes or reject them as potentially harmful to kids’ eyes. In this video-based workshop, brief videos will be presented for the panel to comment on. Interaction between panelists and the audience will provide debate on what to start doing differently in 2022 and what to be cautious about in your OR back home.

Target Audience: Pediatric cataract surgeons

Current Practice: Many pediatric cataract surgeons stay with the comfortable techniques they learned in fellowship or developed in their practice. While this may be appropriate, surgeons are constantly evaluating what new approaches we should adopt and which we should reject, to get the best possible surgical results. In addition, we all seek guidance about how to handle rare and complicated surgeries.

Best Practice: Best practice is to be careful but innovative. This can be a difficult balance. When it's time to buy new surgical equipment or choose IOLs to stock, we all want to benefit from each other’s experience and recommendations. How can we help our patients now and what will become the standard in the future? These will all be debated by the panel and we will answer submitted audience questions as well.

Expected Outcomes: As a result of this workshop, surgeons in the audience will be able to describe both new and old surgical techniques and strategies that will improve their pediatric cataract surgery outcomes now and in the future.

Format: Surgical videos will stimulate panel debate and discussion. Time-proven techniques to keep and emerging technologies and techniques to try will be debated as it relates to the future of pediatric cataract surgery.

Summary: The authors will answer, using surgical videos, ‘What should we keep doing and what should we learn to do?’ as we move through 2022 and beyond. We will also debate which existing or emerging technologies will have the greatest impact on pediatric cataract surgery in the future.

References:


What Do I Do Next? Approaching Diagnostic and Management Dilemmas in Congenital Anterior Segment Anomalies

Ta C. Chang; Deborah K. VanderVeen; Raymond G. Areaux; Bibiana J. Reiser; Faruk Orge

Bascom Palmer Eye Institute
Miami, FL

Purpose/Relevance: This workshop will focus on the decision-making process in diagnosing and managing nonacquired anterior segment anomalies.

Target Audience: Pediatric ophthalmologists

Current Practice: Congenital anterior segment anomalies have variable presentations, and some have multiple management options. Decisions about diagnostic and management modalities may be complex. Patient and eye characteristics, surgical risks, and available resources all play a role in decision-making.

Best Practice: Pediatric anterior segment surgeons must be familiar with all available diagnostic tools, be committed to long-term care of pediatric patients, and be familiar with a variety of surgical options. Often several choices are reasonable and provide good outcomes, and classic and newer techniques or instrumentation may be utilized. Consensus opinion is useful to help guide decision making.

Expected Outcomes: Panelists will use case-based presentations of diagnostic and management dilemmas in pediatric patients to illustrate decision making process. Different diagnostic, treatment and surgical approaches will be discussed, with video demonstration. Panelists will provide tips for accurate diagnosis, and discuss how to avoid and manage complications.

Format: The format is case presentation with diagnostic and management examples and panel discussion, with use of audience polling if available.

Summary: This workshop will use case-based presentations highlighting different congenital anterior segment anomaly diagnoses and treatment modalities. Panelists will discuss why a diagnostic test and/or procedure was chosen for their patient, with a review of pros and cons of the choices, and consensus opinion. Discussion will cover practical tips for deciphering ambiguous presentations, as well as how to avoid and deal with complications.

Advancing Health Equity in Pediatric Eye Care: The Role of School-Based Vision Programs, Community Engagement, Advocacy, Research, and Medical Education

Megan E. Collins; Christina Ambrosino; Mary Lou Collins; Michael X. Repka

Johns Hopkins University Wilmer Eye Institute
Baltimore, Maryland

Purpose/Relevance: Disparities in access to pediatric vision care remain a pressing issue in the United States. School-based vision programs are regarded as a way to advance health equity, especially for disadvantaged students. While they can be beneficial, especially by providing glasses to students who need them, these programs are only part of the solution. This workshop will frame the role of school-based vision programs as part of a larger conversation about strengthening the pediatric eye care delivery system through advocacy, community engagement, research, and medical education.

Target Audience: Pediatric ophthalmologists, researchers, orthoptists, trainees

Current Practice: School-based vision programs serve as a strategy to advance health equity, yet challenges remain.[1, 2] Even when children are prescribed glasses or diagnosed with non-refractive ocular findings, they are rarely connected with appropriate long-term community care.[3] Further, operational approaches vary widely across programs and there remains a need for evidence-based guidelines for screening, eye exams, and glasses prescribing practices within the school setting.

Best Practice: Partnerships between school/community organizations and pediatric ophthalmologists can help to ensure children receive appropriate eye care. To facilitate these efforts, we will explore considerations for best practices in building school-based vision programs, and approaches to advocacy, community engagement, involvement of trainees in public health outreach, and harnessing research from existing programs.

Expected Outcomes: Participants will learn about health equity challenges in pediatric eye care and the opportunities to create provider-school/community partnerships.

Format: Panel discussion on school-based vision programs (ME Collins), advocacy (Repka), community engagement (ML Collins), research to inform evidence (Guo), and medical education (Ambrosino).

Summary: Providing children with needed eye care can advance health equity. It is imperative that we explore opportunities to refine the role of school-based vision programs and other community partnerships. The ultimate goal of this work is to ensure that all children receive appropriate care, informed by evidence and best practices.

References:
Recognizing Pediatric Eye Problems That Can Save Lives- Cases Not to Miss!
Alex V. Levin, MD, MHSC, FRCSC; Andrea Avila, MD; Benjamin Hammond, MD; Matthew Gearinger, MD; Bayan Al Othman, MBBS; Vikas Khetan, MD
Flaum Eye Institute
Rochester, New York

Purpose/Relevance: As pediatric ophthalmologists we deal with many conditions that present as the first manifestation of a systemic disease. Some of these cases can actually be life threatening if not diagnosed and treated in a timely manner. Physicians need to avoid the clinical decision making error of confirmation bias. The purpose of this workshop is to show and discuss cases with life saving impact that should not be missed, including eye findings that can lead to a diagnoses of occult Hirschprung disease, rare manifestations of occult child abuse, unusual presentation of retinoblastoma and others.

Target Audience: Pediatric ophthalmologists, pediatric ophthalmology fellows, ophthalmology residents

Current Practice: Sometimes in a busy clinical practice, confirmation bias will lead clinicians to too readily ascribe a given ocular sign to a more common diagnosis and fail to recognize potential underlying manifestations which can even lead to loss of life.

Best Practice: By raising awareness and familiarizing oneself with these unusual signs of life-threatening diseases, even busy clinicians will be more likely to pause when these findings occur and consider alternate diagnoses that might save a child's life.

Expected Outcomes: The attendee will become familiar with signs of life threatening systemic diseases that are 'hiding in plain sight' and thus be more likely to consider these diagnoses.

Format: Didactic lecture with case presentations and open discussion

Summary: The multidisciplinary panel representing all aspects of pediatric ophthalmology will present cases with life-saving impact that should not be missed, but could be readily overlooked in busy practice. We as pediatric ophthalmologists can be the first ones to encounter a manifestation of a deadly condition and should be able to detect, manage or refer cases that need urgent diagnosis and treatment.

What's New and Important in Pediatric Ophthalmology and Strabismus

Emily McCourt; Prashanthi Giridhar; Robert Clark; Smith Ann Chisholm; Carolina Adams; Hersh Varma; Lance Siegel; Julius Oatts; Austin Bach; Alina Dumitrescu

AAPOS Professional Education Committee
USA

Purpose/Relevance: The attendees will be able to give an overview of the most current and important published information in pediatric ophthalmology and strabismus. The course is intended to keep both comprehensive and pediatric ophthalmologists current in pediatric ophthalmology and strabismus, and to help them decide which articles to read in full.

Target Audience: Pediatric ophthalmologists, general ophthalmologists, researchers, orthoptists

Current Practice: Reviewing all of the current literature relevant to the pediatric ophthalmologist is impossible. Our committee has reviewed all the pediatric relevant journals over the last year, summarized all of these articles in a handout. Next, we created an all stars handout of the top articles and finally will present the best articles over the last year.

Best Practice: The learner will be updated on the most current and important papers and improve their practice based on the latest data presented in this workshop.

Expected Outcomes: This course is updated annually to provide a clinically-relevant summary of the latest and most important pediatric ophthalmology and strabismus literature to the audience.

Format: This will be a didactic lecture.

Summary: The American Association for Pediatric Ophthalmology and Strabismus (AAPOS) Professional Education Committee has been hard at work reviewing journals to bring you the latest developments in the field of pediatric ophthalmology and strabismus. The course instructors will summarize, analyze and present the most important information published in the last year from more than 20 medical journals. The audience will receive a summary of all published articles in pediatric ophthalmology and strabismus, organized by topic area, as well as an abbreviated summary of the truly 'best and most important' articles published this year.

References: Ophthalmic manifestations associated with SARS-CoV-2 in newborn infants: a preliminary report Luis Gilberto Perez-Chimal, MD, Gabriela Garcia Cuevas, MD, Andreas Di-Luciano, MD, Pablo Chamartín, MD, Gabriela Amadeo, MD, and Maria A. Martinez-Castellanos, MD.

**Surgical Techniques in Strabismus: An International Masterclass**

Saurabh Jain, FRCOphth; Jon Peiter Saunte, MD; Jan Tjeerd de Faber, MD; Ashwin Reddy, FRCOphth; Federico Velez, MD; Rosario Gomez de Liano, MD; I. Christopher Lloyd, FRCOphth; Gill Adams, FRCOphth

The Royal Free Hospital
Pond Street, London

**Purpose/Relevance:** The management of strabismus is a discipline that seems at times more an art form than a science. Although nomograms and tables are helpful, suboptimal outcomes can still occur. In this workshop a panel of experts will discuss surgical strabismus cases that challenged them and helped refine their understanding and management of strabismus.

**Target Audience:** Anyone who manages patients with strabismus

**Current Practice:** In spite of best efforts, it has been very difficult to standardize the evaluation and management of strabismus. This is because of the heterogeneous nature of conditions that may present with an ocular deviation and the resultant variability in surgical results. In this symposium we will discuss a number of such scenarios including unusual sequelae of cranial nerve palsies, supranuclear and restrictive disorders, convergence insufficiency and thyroid eye disease. We will aim to illustrate the decision making process used by our faculty and present strategies to address these and other management dilemmas in this workshop.

**Best Practice:** Maybe more than other surgical subspecialties within Ophthalmology, strabismus is learnt by observing expert surgeons and latterly from clinical experience of managing unusual cases and dealing with unexpected surgical outcomes. Recent developments have meant that some commonly performed procedures have been redesigned. Certain techniques may only be encountered in fellowship or not at all until the strabismus surgeon is called upon to suddenly perform them. This workshop will give delegates the tools to develop robust surgical algorithms and techniques to assist in this eventuality.

**Expected Outcomes:** We anticipate that the case based approach in this workshop will assist delegates by introducing them to different surgical scenarios, develop assessment and management strategies to manage these patients and change their surgical practice where applicable.

**Format:** Case presentation, Videos, Audience quiz and Skills transfer

**Summary:** Strabismus assessment and management is a specialized skill that is complicated by the heterogeneous nature of the presentation and variability in surgical outcomes. This workshop will showcase techniques, algorithms and strategies developed by an experienced group of strabismologists and highlight pitfalls to avoid. We anticipate that this workshop will assist delegates in evaluating and refining their own practice.

**References:**
AAPOS Pediatric Uveitis Committee: COVID-19 - Infection, Inflammation and Challenges in Children with Non-Infectious Uveitis

Brenda Bohnsack, MD, PhD; Virginia A. Miraldi Utz, MD; Stefanie Davidson, MD; Iris Kassem, MD, PhD; Ashley Cooper, MD; Mays El-Dairi, MD; Jing Jin, MD, PhD; Erin Stahl, MD

AAPOS Pediatric Uveitis Committee

N/A

Purpose/Relevance: Pediatric cases of COVID-19 have increased in the setting of the highly transmissible delta variant which has impacted the care of children by ophthalmologists. Inflammatory ocular manifestations of acute COVID-19 infections have been observed and are important to recognize and expeditiously manage. Further, ocular involvement has been recognized in MIS-C. Finally, new challenges in treating and monitoring patients with non-infectious uveitis (NIU) evolved. Guidance is needed regarding immunosuppression, reducing clinic visits/in-hospital exposures while maintaining disease control, and vaccination.

Target Audience: Pediatric ophthalmologists, fellows, residents

Current Practice: Ocular inflammatory manifestations are reported in children during or after symptomatic or asymptomatic COVID-19 infection and may go unrecognized. Guidelines for managing children with NIU on immunosuppressive treatment (IMT) continues to evolve, and updated information is needed.

Best Practice: Knowledge of ocular manifestations of acute and post-infectious COVID-19 including Multisystemic Inflammatory Syndrome in Children (MIS-C) will improve clinical care of children. Patients may present with conjunctivitis, optic neuritis, transient myasthenia-like syndrome, acute anterior uveitis, keratitis, pan-uveitis and papilledema. Ophthalmic management often involves systemic work-up and coordination of care amongst a multi-disciplinary team. Consensus guidelines for monitoring uveitis and preventing COVID-19 infection in children with NIU on IMT may be applied to clinical practice.

Expected Outcomes: Clinicians will develop an understanding of (1) Ophthalmic manifestations of acute and post-infectious COVID-19 infection and MIS-C (2) Challenges and strategies to manage NIU during a pandemic (3) Updates on infection risk and vaccination strategies for children on IMT.

Format: Didactic, case presentations, rheumatology, ophthalmology panel discussion with audience participation.

Summary: COVID-19-related ocular manifestations such as conjunctivitis, uveitis, pan-uveitis and optic neuritis are rare but are important to recognize. Children with NIU on IMT represent a unique patient population balancing ophthalmic follow-up and control of ocular/systemic disease and preventing infection.


Pediatric Eye Trauma Primer for the On-Call Ophthalmologist: A Case-Based Approach with Review of Seminal Papers

Ankoor S. Shah; Kara M. Cuvuoto; Natalie C. Weil; Casey J. Beal
Boston Children's Hospital and Harvard Medical School
Boston, MA

Purpose/Relevance: This course prepares attendees to evaluate pediatric eye injuries on-call while reviewing seminal papers in pediatric eye trauma.

Target Audience: Pediatric ophthalmologists.

Current Practice: Approximately 250,000 serious pediatric eye injuries occur worldwide each year (1). However, medical and surgical eye trauma training is limited with 83% of ophthalmology residents reporting less than 10 open-globe injury surgical cases during their training (2).

Best Practice: Perceived competence in ocular trauma is associated with case discussion, structured curriculum, and expert discussion (2). This course provides 8 case discussions, a structured curriculum reviewing seminal papers in eye trauma, and expert and audience discussion for each case.

Expected Outcomes: After attending this workshop, participants will be prepared to evaluate, diagnose, and initiate management of common eye injuries.

Format: This workshop will be interactive between panelists and audience members. A panelist will present a case. Audience members will be polled. Other panelists will comment, and the presenter will provide a contemporary paper on the topic. For example, the timing of ocular hypertension will be reviewed after closed-globe injury (3). The last 15 minutes of the session will be an open discussion between panelists and audience.

Summary: Panelists will present common pediatric eye injuries such as open- and closed-globe injury, eyelid injury, eye muscle injury, and orbital trauma. The presenting panelist will invite audience participation through interactive questions, polls, and open discussion. The audience will leave with a handout listing evidence-based guidelines on how to evaluate, diagnose, and initially manage these cases.

References:
Pediatric Ophthalmology Recruitment

Hawke H. Yoon, MD; Jennifer L. Rossen, MD; Phoebe D. Lenhart, MD; David G. Morrison, MD

Lurie Children's Hospital of Chicago/Northwestern University
Chicago, IL

**Purpose/Relevance:** Many Pediatric Ophthalmology fellowship positions remain unfilled each year in the U.S. If we do not continue to train more Pediatric Ophthalmologists, access to care for patients will become exceedingly difficult.

**Target Audience:** Pediatric Ophthalmologists, particularly those that participate in training medical students, residents and fellows.

**Current Practice:** Many Ophthalmology residents begin training without a chosen subspecialty, and the majority primarily consider adult patient focused fellowships. Most medical students who are interested in treating pediatric patients apply for Pediatric residency spots and may later subspecialize, but this is not a current path for Pediatric Ophthalmology training.

**Best Practice:** In this workshop, we will discuss the challenges of recruiting Pediatric Ophthalmology fellows and our techniques for engaging medical students and residents with a focus on diversity, equity and inclusion. We feel that if we engage medical students interested in pediatrics before they choose a residency, we can increase applicants for Pediatric Ophthalmology fellowship training. Also, reviewing why trainees chose a fellowship in Pediatric Ophthalmology will elucidate successful recruitment strategies.

**Expected Outcomes:** After this workshop, physicians involved in training medical students and residents will be equipped with concrete strategies for inspiring the next generation of Pediatric Ophthalmologists.

**Format:** This workshop will be a panel discussion.

**Summary:** This workshop will review techniques to recruit medical students and residents for Pediatric Ophthalmology fellowship.

Does My Patient Have Glaucoma? Pearls and Pitfalls in Evaluation of Pediatric Glaucoma Suspects

Amgad Eldib, MD; Kanwal Ken Nischal, MD; Alkiviades Liasis, MD; Preeti Patil, MD

UPMC Children's Hospital of Pittsburgh
Pittsburgh, PA, USA

Purpose/Relevance: Glaucoma suspects is a term describing those at risk or suspected of having glaucoma without a definite diagnosis. The ideal workup for children who are glaucoma suspects has not been well established and remains difficult. We present an algorithm of evaluation to help the practitioner manage these children.

Target Audience: Pediatric Ophthalmologists, trainees, orthoptists and general ophthalmologists

Current Practice: Visual field analysis is not always reliable in children and while optical coherence tomography (OCT) is now more commonly used to evaluate for glaucomatous nerve fiber and ganglion cell layer damage, normative data in children are still lacking. This leaves the practitioner struggling to assess the risk of glaucoma development.

Best Practice: Ideally an algorithm including clinical signs, family history, additional ocular signs, systemic disease, gonioscopy, central corneal thickness, OCT parameters, Visual field and if possible electrophysiology should be used to determine those patients at risk of developing glaucoma.

Expected Outcomes: The workshop will describe such an algorithm including how to identify pseudo-glaucomatous disc changes so that the practitioner can more confidently assess risk of glaucoma development.

Format: Four didactic lectures followed by a Q&A session and open discussion with the audience

Summary: We will discuss the evaluation of glaucoma suspects due to neuro-ophthalmic or genetic conditions. We will then discuss pure clinical signs and pearls identifying glaucomatous risk correlated with VF and OCT testing. We will also discuss the role of electrophysiology in assessing the risk of glaucoma in glaucoma suspects.

References:
Lids in Kids
Laura Enyedi, MD; Ploy Ploysangam, MD; Daniel Weaver, MD; Smith Ann Chisholm, MD; Tanuj Nakra, MD
Duke University
Durham, NC

Purpose/Relevance: This workshop will discuss surgical and non-surgical management of pediatric eyelid challenges including lid margin disease, eyelid trauma, congenital eyelid malpositions, and ptosis repair. Emphasis will be on treatment of these conditions including pre-operative evaluation and planning, and a post-operative care and complications.

Target Audience: Pediatric ophthalmologists and trainees

Current Practice: Pediatric ophthalmologists are presented with a challenging variety of cases including many disorders of the eyelid. Pediatric ophthalmologists can benefit from discussion of surgical and non-surgical techniques and pearls for their own practices and to help them manage patients, sometimes in conjunction with an orbital/oculoplastic surgeon.

Best Practice: Pediatric ophthalmologists will review common procedures and learn new techniques to manage pediatric eyelid problems and improve patient outcomes.

Expected Outcomes: At the conclusion of the workshop the panel will have shared their experiences and techniques for the surgical and non-surgical management of pediatric eyelid problems. The practitioner in the audience is expected to gain understanding and confidence in these procedures. Attendees will utilize this knowledge to manage lids in kids.

Format: Panelists include pediatric and oculoplastic ophthalmologists with extensive experience in oculoplastics. Each panelist will present photographs, videos and diagrams of pediatric eyelid cases and discuss surgical and non-surgical management techniques.

Summary: This workshop will present surgical and non-surgical approaches to eyelid problems commonly encountered by pediatric ophthalmologists. Pediatric and oculoplastic ophthalmologists will discuss lid margin disease, ptosis repair, congenital eyelid malpositions, and eyelid trauma including canalicular laceration.

References:


Innovations in Pediatric Ophthalmology and Strabismus: Diagnosis and Treatment

Federico G. Velez; Stacy L. Pineles; Yasmin S. Bradfield; Mays Dairi; Kamiar Mireskandari; Matthew S. Pihlblad; Deborah VanderVeen

Stein Eye Institute UCLA, Stein Eye Institute UCLA, University of Wisconsin, Duke Eye Center, Duke University, SickKids Hospital, UPMC Children's Hospital
Los Angeles, CA, Madison WI, Durham NC, Toronto ON, Pittsburgh, PA

Purpose/Relevance: To familiarize pediatric ophthalmologists and strabismus surgeons with new and innovative diagnostic and treatment techniques used to manage complex conditions typically associated with high levels of morbidity.

Target Audience: Pediatric Ophthalmologists, Fellows and Strabismus Specialists.

Current Practice: Serious pediatric ophthalmic conditions are often characterized by the need for highly specialized care, often at tertiary centers. However, complex anterior and posterior segment disease, and orbital and extraocular muscle conditions may also be managed at primary and secondary care centers if clinicians are aware of the special diagnostic and management techniques that are available.

Best Practice: Basic and advanced discussion with videos when applicable followed by ample discussion time.

Expected Outcomes: Participants will become familiar with new diagnostic and surgical techniques to manage anterior and posterior segment disorders, strabismus and orbital conditions that are associated with serious ocular morbidity.

Format: Video and case presentations with discussion.

Summary: Panelists will present and discuss innovative diagnostic and treatment techniques. Audience participation will be expected and encouraged. Techniques discussed will include anterior segment and glaucoma imaging; genetic testing and posterior segment imaging for congenital diseases; ocular surface, glaucoma and cataract procedures; and complex pediatric, adult and paralytic strabismus procedures.

References:
AOC Workshop on Strabismus and Amblyopia: We're in Arizona - Let's Count the Vote! Searching for Truth in the Desert

Doug Fredrick, MD; Steven Archer, MD; Cynthia Beauchamp, MD; Brian Forbes, MD; Dusty Gronemyer, CO; Chris Lloyd, MD; Lindsay Klaehn, CO; Kim Merrill, CO; Omondi Nyong'o, MD; Jocelyn Zurevinsky, CO

American Orthoptic Council

Purpose/Relevance: As pediatric ophthalmologists and orthoptists we often worship those who served as our mentors and maintain practice patterns despite conflicting evidence in the literature. This workshop will address strabismus and amblyopia topics where practice varies widely, indicating a need for more rigorous study. Ophthalmologists and orthoptists will debate best practices on topics including:
- Vision screening in young children
- Inferior oblique recession as a necessary procedure
- Importance of preoperative surgical measurements
- Adherence to occlusion therapy guidelines
- Value of the synoptophore

Target Audience: Pediatric ophthalmologists, orthoptists

Current Practice: Therapeutic decisions are often made on an empiric basis and familiarity can often interfere with changes in clinical practice that will improve outcomes for our patients.

Best Practice: High value care requires examination of the desired outcomes of an intervention and the costs of providing that care. Vision screening, amblyopia treatment and surgical interventions comprise a large proportion of clinical practice and generate significant costs to patients and health systems. Continual examination of current practices will improve the value of care provided by ophthalmologists and orthoptists.

Expected Outcomes: Attendees will learn to take a more critical view of their current clinical practices, recognizing the importance of examination of historic and current literature to inform best practices.

Format: Panelists will debate a question taking Pro/Con position - audience polling will be used to determine baseline belief and change following debate.

Summary: By observing focused debate on common but controversial clinical conditions encountered by pediatric ophthalmologists and orthoptists, attendees of this workshop will learn how to:
- Honestly assess the value of long learned clinical practice and custom
- Appreciate the value of new analysis of old data

Purpose/Relevance: The clinical and diagnostic evaluation of optic nerve head elevation remains one of the pediatric ophthalmologist's most common and daunting challenges. The purpose of this workshop is to discuss a step-wise approach to diagnostic testing that may reduce the need for unnecessary, and sometimes, invasive procedures.

Target Audience: Pediatric ophthalmologists, imaging specialist.

Current Practice: Depending on location/practice setting, a pediatric ophthalmologist may not have access to the requisite imaging modalities or knowledge of their analysis to properly evaluate a child with suspected optic nerve head elevation. Even when ‘state of the art’ equipment is available, many young children are unable to cooperate with testing. Also, some practices may not have access to specialists skilled in evaluating and managing children with suspected optic nerve head elevation.

Best Practice: Pediatric ophthalmologists should be equipped to use commonly available imaging modalities, in a step-wise approach, to determine if the child has true optic nerve head swelling and thus needs referral to a specialist.

Expected Outcomes: Upon completion of the workshop, participants will be empowered to use and analyze diagnostic imaging for optic nerve head elevation and will understand the benefits and limitations of each test. The knowledge gained will help reduce unnecessary testing, clarify the significance of certain results and optimize referral to specialty providers. Even though this workshop received very positive reviews from our 2021 presentation, we will update the talks to incorporate the feedback provided.

Format: Didactic lectures, case presentations, and question/answer period.

Summary: This workshop will describe the rationale, acquisition and interpretation of the most commonly used imaging techniques to evaluate optic nerve head elevation including B-scan ultrasonography, fluorescein angiography, autofluorescence and optical coherence tomography. Conditions mimicking or causing optic nerve head elevation, unrelated to elevated intracranial pressure, will be discussed as their diagnostic approach can be much different. Lastly, the workshop will describe how to incorporate MRI and lumbar puncture findings along with input from consultants into your evaluation and management of children with suspected optic nerve head elevation.

Workshop #22
Friday, March 25, 2022
2:45 PM – 4:00 PM

**Congenital and Pediatric Cataract is Not a Diagnosis: Important Systemic Disorders a Pediatric Ophthalmologist Doesn’t Want to Miss**

I. Christopher Lloyd, FRCOphth; Jane L. Ashworth, PhD, FRCOphth; Deborah M. Alcorn, MD; Douglas Fredrick, MD

Great Ormond Street Hospital for Children
London, UK

**Purpose/Relevance:** Review the important systemic disorders associated with congenital and pediatric cataract. Illustrative case presentations to demonstrate how the use of modern investigative pathways can enhance diagnostic precision and thus enable improved patient care.

**Target Audience:** Pediatric Ophthalmologists, Ophthalmic Geneticists, Researchers, General Ophthalmologists, Trainees

**Current Practice:** Congenital and pediatric cataract (CC) is an uncommon but sight threatening condition. It is largely caused by genetic mutations. Some of these mutations are also linked to inborn errors of metabolism. Early intervention in cases amenable to treatment can not only improve visual function but also prevent systemic disease progression. Traditional diagnosis is unwieldy and costly for health services and is typically unsuccessful - particularly in providing precise diagnosis in congenital cataract.

**Best Practice:** The use of targeted and appropriate clinical investigations, alongside next generation sequencing (NGS) techniques. This has revolutionised the utility of genomics for children with cataracts associated with systemic disorders, aiding diagnostic precision and enabling subsequent provision of accurate prognosis, management and treatment.

**Expected Outcomes:** Recognition of the importance of precise diagnosis in children with congenital and pediatric cataracts. An understanding of the modern diagnostic pathways, and models of care, now available for children presenting with congenital and pediatric cataracts.

**Format:** Case presentations, Panel Discussion followed by open question and answer forum

**Summary:** In this workshop clinicians from the UK and USA will present cases of infants and children with congenital and pediatric cataract associated with systemic disease. The methods used to reach a diagnosis will be outlined and the utility of modern investigative techniques discussed. Revised models of care for children affected by these disorders will be suggested.

**References:**
AAPOS Pediatric Uveitis Committee: Pediatric Uveitis Cases: A Multi-Disciplinary Approach to Management Challenges

Virginia A. Miraldi Utz; Stefanie Davidson, MD; Sheila Angeles-Han, MD, MSc; Alex Levin, MD, MPH; Jennifer Jung, MD; Catherine Jordan, MD; Bharti Gangwani, MD; Mays El-Dairi, MD

AAPOS Pediatric Uveitis Committee
N/a

Purpose/Relevance: Increased understanding of the evaluation and medical management of non-infectious pediatric uveitis is vital in preventing severe complications and vision loss. In this workshop, the approach to diagnosis, workup, imaging, and management of pediatric uveitis using a multi-disciplinary approach will be discussed.

Target Audience: Pediatric ophthalmologists, fellows and residents

Current Practice: Although clinical guidelines and treatment algorithms exist, the optimal timing of systemic treatment initiation and escalation, and discontinuation of topical and systemic treatments in pediatric uveitis needs further clarification. Smoldering disease/ocular inflammation may go undetected without the use of multi-modal ophthalmic imaging.

Best Practice: Ideal management of pediatric uveitis includes timely diagnosis, evaluation for underlying etiology, and implementation of appropriate steroid-sparing medications. With advances in ancillary imaging techniques, multimodal imaging may be used to detect occult or subclinical disease. Attempts to taper systemic immunosuppression may be initiated only after long-term steroid-free remission with close monitoring and coordination of care with rheumatology. In most cases, vision-threatening complications can be avoided when the disease is expeditiously treated and closely monitored.

Expected Outcomes: Clinicians will develop an evidence-based approach to the work-up and management of pediatric uveitis with emphasis on: 1) diagnostic evaluation 2) use of multi-modal imaging to assess disease activity such as fluorescein angiography (oral and intravenous), optical coherence tomography, and wide-field imaging 3) treatment algorithm that focuses on timely initiation and duration of systemic treatment, 4) coordination of care amongst rheumatologists and ophthalmologists.

Format: Case presentations with audience participation followed by key points and algorithms by pediatric ophthalmology and rheumatology faculty.

Summary: Ophthalmology and rheumatology faculty will present an update on the current practice patterns for the evaluation and management of pediatric uveitis. Routine as well as challenging clinical vignettes encountered in clinical practice will be presented. A multi-disciplinary approach is often required to achieve optimal vision outcomes.

References:


IPOS C Workshop: Nightmares in Strabismus

Faruk H. Orge; Jonathan M. Holmes; Jan deFaber; Giovanni B. Marcon; Alejandro L. Armesto; Tamara Wygnanski-Jaffe

IPOS C

Purpose/Relevance: Although strabismus surgeries are commonly performed, surgeons often encounter complicated cases or unpredicted findings. We seek to share experiences and different approaches to such cases via discussion by expert strabismus surgeons.

Target Audience: Pediatric ophthalmologists and strabismus surgeons

Current Practice: Ophthalmologists may not be familiar with strategy, surgical pearls, tips and tricks to handle nightmares in strabismus cases. Sharing various experiences can teach us to expect, be aware, avoid and plan for complications, if/when they should occur in order to avoid further surgeries and poor outcome.

Best Practice: Ophthalmologists should be familiar with possible complications, plan to avoid or appropriately deal with these situations. Strabismus surgeons should also be familiar with particularly complex cases and be able to plan surgical approaches to be able to adequately help their patients.

Expected Outcomes: Through many case presentations and expert panel discussion, the attendee will be able to familiarize themselves with complex strabismus cases to enhance their surgical skills and management.

Format: Members of the panel will present surgical cases with management dilemmas followed by a question/answer period from the panel and the audience.

Summary: The workshop will focus on nightmares in strabismus surgery either due to underlying conditions (i.e. thyroid orbitopathy, neuropathies, complex strabismus), previous surgeries or significant complications during strabismus surgeries. Several topics will be led by one of the authors with a case presentation followed by a panel discussion and author’s approach and outcome presentations. There will be a dedicated time for attendee questions and contributions.

References: None
**Introduction:** Vision care remains one of the greatest unmet health needs. Hispanic and Black patients have fewer outpatient ophthalmologic visits than their non-Hispanic white counterparts, as do the uninsured compared to the insured, those with less income and education compared to those with greater affluence and more education, and those living in the Midwestern, southern, or western United States. Many factors affect how we can address issues such as race, ethnicity, income, insurance coverage, etc.

**Methods:** Organizations such as AAPOS need to compose strategic plans to increase the diversity of the workforce, the racial composition of executive board membership and expose under-represented minorities to the profession and subspecialty. We will look at existing Pathway programs such as the NMA’s Rabb-Venable Excellence Ophthalmology Program and the AAO and AUPO’s Minority Ophthalmology Mentoring (MOM) as initiatives to decreasing disparities in the healthcare workforce. Organizations need to be intentional in diversifying their boards, educating the members to unconscious biases and micro-aggressions by increasing community involvement.

**Results:** Summary: Short and Long term initiatives to help decrease health inequities can be explored. The ultimate goal is that our patients’ can be adequately treated no matter their race and ethnicity. Difficult conversations about attitudes, expectations and behavior around race can help shape future success in this field of forward thinking leaders.

**Conclusion:** Organizations such as AAPOS will help initiate some suggestions to help educate members of their association and continue this audacious goal.

**References:**
Difficult Problems: Non-Strabismus

Phoebe D. Lenhart; Michael Brodsky; Faruk Orge; Jason Peragallo; Mimi Cabrera; Priyanka Kumar

Emory University
Atlanta, GA

Purpose/Relevance: This workshop will discuss pediatric ophthalmology cases in which the diagnosis, findings, and/or treatment pose a clinical dilemma to even an experienced pediatric ophthalmologist. These cases may include rare diagnoses or more common diagnoses with unusual presentations and/or atypical courses. Discussion will include the experiences with similar cases of a panel of seasoned pediatric ophthalmologists, as well as audience participants, and consideration of alternative evaluation and treatment plans.

Target Audience: Pediatric ophthalmologists, orthoptists, vision scientists, and trainees

Current Practice: Pediatric ophthalmologists are presented with a challenging variety of cases. Consultation with colleagues and review of the literature can provide insights into best practices.

Best Practice: If the diagnosis and/or treatment plan for a particular patient is in doubt, consultation with colleagues can help to provide patients with the best potential for good outcomes. Group presentation of cases is helpful, particularly with very rare pediatric ophthalmology problems. Advanced practitioners and audience members have valuable insights that can improve patient care.

Expected Outcomes: At the conclusion of the workshop the audience and the panel will have shared their experiences and strategies for the diagnosis and management of a few challenging non-strabismus pediatric ophthalmology cases. The practitioner in the audience is expected to gain new insights into the clinical reasoning behind each diagnosis and the purpose of any intervention.

Format: Each panelist will present one case and invite the other panelists to discuss their approaches to diagnosis and treatment. The audience will participate by asking questions or providing personal insights.

Summary: This workshop will be a case-based learning experience involving challenging non-strabismus pediatric ophthalmology cases discussed by experienced pediatric ophthalmologists. Panelists will present teaching points that are important for complicated and rare conditions, but also pearls that are relevant for less complex cases.

References: TBD
Difficult Problems in Strabismus

William Good; Erin Schotthoefer; Nandini Gandhi; Jane Edmond; Linda Dagi; Stephen Christiansen; Steven Brooks; Susan Carden; Kristina Tarczy-Hornoch

Smith-Kettlewell Eye Research Institute
San Francisco, California

Purpose/Relevance: This workshop will address difficult cases of strabismus to fill a potential knowledge gap for the practicing ophthalmologist.

Target Audience: Pediatric ophthalmologists, strabismus specialists, orthoptists, fellows and residents

Current Practice: Strabismus has many different etiologies, and management of some cases can be challenging. There are few randomized trials guiding practice. Practitioners often utilize strategies and surgical techniques taught in fellowship or addressed at professional meetings, on the listserv, in journals, and/or as a result of peer-to-peer discussion.

Best Practice: This workshop allows the attendees to observe challenging cases presented and discussed by experienced strabismologists, and the discussion will be enhanced by audience participation.

Expected Outcomes: At the conclusion of the workshop, the audience and the panel will have shared their experiences and strategies for the diagnosis and management of challenging cases. The future practice of participants will be enhanced when they apply concepts they learn during the workshop.

Format: The workshop will consist of case-based presentations of patients with interesting and/or difficult forms of strabismus. Panelists will discuss the differential diagnoses and potential treatment options. Treatment options will include surgery, optical treatments, chemical treatments, with discussion about exercises. Audience questions and participation will be encouraged, time permitting.

Summary: Each panelist will present a difficult strabismus case for discussion by other panelists and the audience.

References: N/A