

encephalomyelitis, 5 had multiple sclerosis, 5 had neuromyelitis optica spectrum disorder, and 1 had myelin oligodendrocyte glycoprotein-associated demyelination. Twenty-two (51%) had cerebral white matter lesions and 39 (89%) were treated with steroids. Of the 31 affected eyes with 6-month follow-up, 8 (26%) had VA within age normal range at enrollment (median, 0.50 logMAR; range, -0.20 to 1.70 logMAR) and 24 (77%) eyes had VA within age normal range (median, 0.00 logMAR; range, -0.22 to 0.60 logMAR) after 6 months.

Discussion: Despite poor VA at presentation (median Snellen equivalent, 20/63), there was marked improvement in the majority six months after onset (median, 20/20).

Conclusions: In this prospective study visual acuity outcomes in pediatric ON were often favorable with current treatment practice patterns, although some patients have significant deficits.

030 Comparison of outcomes, adverse events, and treatment burden of intravenous chemotherapy versus intra-arterial chemotherapy for retinoblastoma: results of a pilot study. Pranav R. Santapuram, Jessica L. Burris, Debra L. Friedman, Tatsuki Koyama, Anthony B. Daniels

Introduction: Intra-arterial chemotherapy (IAC) is gaining widespread acceptance to treat retinoblastoma, replacing intravenous chemotherapy (IVC) in many centers. Higher globe salvage rates are reported with IAC than IVC. A direct comparison of adverse events and treatment burden with each modality has not been performed.

Methods: Pilot retrospective cohort study of 20 consecutive patients (IVC only = 9, IAC only = 7, IAC after IVC failure = 4). Globe salvage rate, unplanned healthcare visits, cytopenias, transfusions, and opioid usage were recorded, both during treatment and in the 12-months following treatment completion. Primary outcomes were globe salvage, number of grade 3/4 cytopenias, number of transfusions, number of unplanned healthcare visits, and opioid use.

Results: Compared to patients receiving IAC, patients receiving IVC had more unplanned healthcare visits (1.0 (0.5, 1.0) vs 4.0 (1.0, 5.2) [IAC vs IVC], $P = 0.012$) more grade 3/4 cytopenias (1.0 [1.0, 2.0] vs 6.0 (5.0, 9.2) $P < 0.001$), more transfusions (0.0 (0.0, 0.0) vs 4.0 (1.0, 5.2), $P = 0.004$), required greater use of opioids (mean oral morphine equivalents: 63.5 (37.4, 79.1) vs 120.1 (79.2, 142.5), $P = 0.013$), and lower rates of globe salvage (100% vs. 58% of eyes [IAC vs. IVC], $p = 0.016$).

Discussion: Prior studies have compared success rates for patients undergoing IVC and those undergoing IAC. However, in selecting therapy, likelihood of treatment success, expected adverse events, and treatment burden must be considered. This study provides evidence regarding adverse events and burden associated with each treatment modality.

Conclusions: Treatment success is greater with IAC. IVC is associated with more adverse events and greater treatment burden.

031 The effect of decreasing working distance in stereopsis and its role in perception of closure while texting and driving.

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Introduction: The hypothesis was that working distance as well as the working angle are independent variables that provide a physiologic basis for the dangers of texting while driving.

Methods: A total of 94 medical students with no significant ocular disease volunteered to participate in the study. While viewing a video of a car in front of their own, participants had to respond when the

participant perceived the leading car getting closer, and the trial was repeated while performing a math problem on a cell phone. Trials were done where the math game was held at 30 cm, 60 cm, 30 cm at 30°, and 60 cm at 30°.

Results: All trial had times that were significantly slower than the control. The slowest trial overall was 30 cm at 30°. The trial at 30 cm was significantly slower than the trial at 60 cm ($P < 0.01$). Furthermore, the trial at 30 cm held at 30° was slower than 30 cm at 90° ($P < 0.01$).

Discussion: Both viewing angle and working distance affect the ability to perceive closure. Both visual acuity and stereopsis are severely affected. These findings help explain why texting and driving is so distracting when compared to other distracting tasks such as changing the radio or viewing the dash.

Conclusions: Other authors have established that texting while driving is dangerous. This study helps to isolate the visual effects of altering working angle and distance and the significant effects upon visual acuity and stereopsis.

032 Comparison of hand-held spectral domain optical coherence tomography (HH-SDOCT) findings in nonaccidental injury (NAI) and non-NAI. Bhamy Hariprasad Shenoy, Vinod Sharma, William Newman, Jane Ashworth, Susmito Biswas

Introduction: We previously reported the utility of HH-SDOCT in identifying characteristic and unique vitreoretinal abnormalities not detected on clinical examination in children with NAI. The aim of this study was to compare HH-SDOCT findings in retinal haemorrhages of NAI and non-NAI and evaluate their usefulness in differentiating NAI from non-NAI.

Methods: Retrospective comparative study of HH-SDOCT findings in children with confirmed diagnosis of NAI and children with retinal hemorrhages due to non-NAI. All the children underwent complete ophthalmic evaluation in addition to the HH-SDOCT imaging.

Results: A total of 10 children with retinal findings due to child protection multidisciplinary confirmed NAI and 4 children with retinal hemorrhages due to non-NAI causes were included in the study. All children with NAI induced retinal hemorrhages showed evidence multi-layered retinoschisis and multi-layered retinal haemorrhages. None of the eyes with retinal hemorrhage due to non-NAI causes demonstrated vitreo-retinal interface changes or inner retinal schitic changes.

Discussion: This HH-SDOCT study represents the largest consecutive NAI series reported to date. It demonstrates that the HH-SDOCT identifies characteristic retinal findings associated with NAI cases which may not be seen in non-NAI cases and are usually not evident using routine examination techniques and imaging. These findings add further evidence that could potentially help distinguish between lesions secondary to NAI from non-NAI causes.

Conclusions: HH-SDOCT helps in identifying characteristic retinal findings associated with NAI which may not be seen in retinal hemorrhages due to non-NAI. Future studies with larger sample is needed to validate this finding.

033 Redesigning surgical magnification loupes: effect of angle of declination, weight, and strap design on the postural ergonomics of ophthalmic surgeons. Safer F. Siddicky, Hozhabr Mozafari, Gregory W. King, Donny W. Suh

Introduction: Ophthalmologists using surgical loupes often report chronic neck pain. We designed a surgical loupe and head-strap to reduce neck loading in surgeons. To quantify the effect of this

new loupe design on surgeons' posture, we utilized kinematic motion capture, musculoskeletal modeling and electromyography (EMG).

Methods: We customized a Galilean loupe through 3 D printing. It was lighter than conventional designs, had a large angle of declination, and was fitted with a novel head strap that reduced loupe slippage and offloaded weight from the nasal bridge. We compared the redesigned loupe to a conventional loupe by quantifying the force on the nasal bridge, operating neck flexion, and neck muscle effort and activity by using material properties, a bubble inclinometer, computational modeling, and EMG, respectively.

Results: Results are presented as conventional loupe vs redesigned loupe. Loupes' forces on the nasal bridge were calculated as 0.648 N vs 0.272 N. Operating neck flexion angles were 40° vs 15°. From the computational model, the counter torques needed to maintain the neck at the loupes' operating postures were 1537 Nmm vs. 933 Nmm. Upper trapezius EMG activity was found to be 0.521 ± 0.047 vs 0.150 ± 0.037 (% of maximal voluntary muscle contraction).

Discussion: The reduction in nasal bridge force, operating neck flexion, and neck muscle effort and activity indicate that using a lighter Galilean loupe, with a high angle of declination and an offloading head strap, has the potential to reduce neck muscle loading in surgeons.

Conclusions: New designs of surgical loupes may reduce the risk of musculoskeletal disorders of the neck and lower back of ophthalmologists, by improving the surgeons' ergonomics.

034 Optical coherence tomography guided localization and laser photocoagulation of invisible new retinoblastoma. Sameh E.

Soliman, Cynthia VandenHoven, Leslie Mackeen, Brenda L. Gallie
Introduction: Invisible retinoblastoma tumors are now detected by prenatal identification of *RB1* pathogenic variants inherited from affected parents, followed by early delivery with screening for retinal tumors using handheld optical coherence tomography (OCT). Laser photocoagulation is challenging, requiring exact localization of an invisible tumor. We describe an OCT-guided localization and photocoagulation technique and its preliminary outcome.

Methods: OCT revealed round homogeneous invisible tumors within the inner nuclear layer. Software calipers placed beside anatomical retinal landmarks (branched/curved vessels, fovea or optic disk) mapped the tumor location and extent. A single laser (532 nm) burn flagged the location and OCT evaluated the tumor-laser burn relationship; laser treatment was then continued in the correct location. Post-laser OCT ensured complete treatment. This technique was used to treat 11 new invisible posterior pole tumors in 7 eyes of 5 children.

Results: Localization and tumor-laser burn relationships were 100% accurate. All showed swelling and hyper-reflectiveness in post-laser OCT. A maximum of 2 photocoagulation sessions (2 weeks apart) were sufficient to successfully manage 10/11 (91%) tumors with resulting permanent scars. Two tumors (18%) developed OCT-detected subclinical recurrences within 4 months, each treated by one laser session. No treatment scar showed migration, foveal involvement or retinal traction at 1 year follow-up.

Discussion: Precise localization avoided misapplied laser burns, preserving normal retina resulting in small treatment scars with less treatment burden and a good visual outcome (no foveal involvement by tumor/laser).

Conclusions: OCT-guided localization and photocoagulation technique is valuable in achieving precision results in managing invisible new retinoblastoma tumors.

035 Determining the tractional forces on vitreoretinal interface using computer simulation and animal models to elucidate the retinal hemorrhage patterns in abusive head trauma. Donny W. Suh

Introduction: Pathophysiology of the retinal findings in abusive head trauma (AHT) is not clearly understood, but the role of vitreoretinal traction has been hypothesized. Combining computer simulation (CS) and animal models, we test the hypothesis that vitreo-retinal traction during forcible shaking can exceed the vitreo-retinal adhesion.

Methods: CS model of pediatric eye was developed to determine stresses on various layers of retina and its vessels during shaking. To provide empirical context surrounding the computationally predicted stresses, young sheep eyes ($n = 7$) were harvested at 6 months of age. A 5x5 mm sclerotomy was created, and the underlying retina exposed. Polytetrafluoroethylene patch was attached to the subretinal surface and then pulled to measure the stress required to create vitreoretinal separation.

Results: Stress values from the CS ranged from 3 to 16 kilopascal (kPa). Maximal stress was observed at the peripheral retina, retinal vessel bifurcations, and the posterior pole. Stress values were similar in preretinal, intraretinal, and subretinal layers. Stresses predicted by the computer simulations exceeded those measured in the ex vivo animal eye model, which showed stress values of 2–5 kPa.

Discussion: Ocular manifestations from abusive head trauma reveal unique retinal characteristics. Our model predicted stress patterns consistent with the diffuse retinal hemorrhages (RH) typically found in the posterior pole and around the peripheral retina in AHT. Our computer model demonstrated that similar stress forces were produced in different layers of the retina, consistent with the finding that retinal hemorrhages are often found in multiple layers of the retina. The computer model predicted that intraocular forces attained during forcible shaking of an eye can exceed the minimum threshold needed to produce vitreoretinal separation as measured in ex vivo sheep eyes. These data also support the theory that vitreous traction at the retinal surface is an important contributor to retinal hemorrhages and retinoschisis in AHT.

Conclusions: CS demonstrated that similar stress forces were produced in all three layers of the retina, consistent with the clinical findings that pan-retinal hemorrhages. Also, CS demonstrated that forces generated during shaking can potentially exceed the minimum threshold needed to produce vitreoretinal separation as measured in ex vivo sheep eyes. Our data support the theory that vitreous traction at the retinal surface may be an important contributing factor to retinal findings in AHT.

036 Diagnosis of inherited retinal degenerations in pediatric patients using the RETeval handheld electroretinogram. Cole J.

Swiston, Melanie A. Schmitt, James N. Ver Hoeve

Introduction: To investigate practicality and utility of the RETeval handheld electroretinogram (ERG) in the diagnosis of inherited retinal degenerations (IRD) in pediatric patients.

Methods: Electronic medical records of pediatric patients who received RETeval ERG testing at our institution were searched for patient demographic information, ophthalmic diagnoses, ocular exam data, and ERG results. Patients were stratified based on ophthalmic diagnosis and the presence of abnormal RETeval photopic and/or scotopic waveforms.

Results: In total, 64 pediatric patients with an average age of 6.7 years (median, 5.63 years; range, 2.86 months to 16.9 years) received 71 RETeval ERG's. 68 (96%) were performed without sedation. Among