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