**329 (Submitted)**
**Laser-induced Optic Neuropathy as A Model to Study Neuro-protection**

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**Introduction:**
Nonarteritic Anterior Ischemic Optic Neuropathy (NAION) is believed to result from insufficient blood flow to the optic nerve head. However, the precise mechanism of ischemia remains unclear. A successful experimental animal model would help us better understand the pathophysiology of the disease. The purpose of our study is to develop a novel version of the photodynamic model of rodent optic neuropathy currently used, which will give us results with high reproducibility.

**Methods:**
Laser-induced optic neuropathy was induced in Brown Norway rats by intraperitoneal injection of mesoporphyrin IX, followed by application of 532nm diode-laser. Fluorescein angiography (FA), spectral domain optical coherence tomography (SD-OCT) and visual evoked potentials (VEP) were performed at different time points. Immunohistochemistry was used to monitor apoptotic cell death (TUNEL assay), cell survival (Neuronal Nuclei antigen) and macrophage infiltration (CD68+ cells), while ELISA was performed to determine changes in inflammatory cytokine levels.

**Results:**
FA showed early disc staining and late leakage, while SD-OCT allowed visualization of optic nerve edema and accumulation of subretinal fluid. The TUNEL+ cells were significantly elevated from the first day after laser application ($p < 0.01$) and peaked one week later ($p < 0.01$). Similarly, increased recruitment of CD68+ cells observed on day 7 ($p = 0.014$) was indicative of macrophage infiltration, while the inflammatory cytokines examined were upregulated at different timepoints. Finally, the VEPs were suggestive of the functional impairment observed after induction of optic neuropathy.

**Conclusions:**
Photodynamic therapy with Mesoporphyrin IX leads to macroscopic, histologic and physiologic findings similar to those seen in other rodent models of optic neuropathy. The longer half-life of Mesoporphyrin IX and the ease of intraperitoneal injections result in highly reproducible outcomes. Improving the consistency of an experimental model can lead to increased understanding of the pathophysiology of the disorder examined and more accurate detection of changes induced by neuroprotective agents.

**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Retina, YES

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**330 (Submitted)**
**Bilateral third nerve palsy as a manifestation of Multiple intracranial aneurysms in Klippel-Trenaunay syndrome.**

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**Introduction:**
The Klippel-Trenaunay-syndrome (KTS) is a mixed congenital angioosteohyperthrophy dysplasia of blood or lymph vessels characterized by three main symptoms: cutaneous vascular naevi, hypertrophy of a limb and varicose or venous malformations. Arterial system compromise is extremely rare. In this report, we present a 32-year-old woman with Klippel-Trenaunay- (Weber) syndrome who developed bilateral III nerve palsy by intracranial aneurysm

**Methods:**
A 32-year-old developed loss consciousness, bilateral III palsy and right hemiparesis. The personal history was remarkable by two intracranial aneurysm treated with endovascular methods, asymmetric overgrowth of a right superior limb with hemangiomas in this limb and in the right hemi-thorax and varicose.

**Results:**
Neuroradiology studies demonstrated multiples intracranial aneurysm in the posterior circulation and the internal carotid artery. The patient was observed. The third nerve improved in the left eye and also she developed third nerve regeneration signs

**Conclusions:**
Simultaneous occurrence of multiple intracranial aneurysm and syndrome of Klippel-Trenaunay has rarely been described. We emphasize that intracranial, aneurysm should be routinely excluded in Klippel-Trenaunay-Weber syndrome

**References:**

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- Neurosurgery. 2010 May;66(5):E1027-8;

**Keywords:** Cranial Nerves (Paresis etc), Neuro-Imaging (MRI, CT, etc), YES

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**331 (Submitted)**
**Endoscopic Bimanual Approach to an Intraconal Cavernous Hemangioma of the Orbital Apex with Vascularized Flap Reconstruction**

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**Introduction:**
The purpose of this presentation is to describe a unique transnasal endoscopic 4-handed surgical

technique for removal of an intraconal orbital apex cavernous hemangioma with repair of the defect with a vascularized flap.

**Methods:**
A case presentation and surgical video are used to demonstrate this technique.

**Results:**
A 39-year old female, who presented with unilateral visual loss and proptosis, was found to have an intraconal orbital apex mass consistent radiographically with cavernous hemangioma. Because of its extreme posterior and medial location within the orbit, an endoscopic transseptal 4-handed technique was utilized for surgical removal of the tumor. The lesion was excised in toto and the patient had no complications.

**Conclusions:**
This approach is an excellent surgical option for these difficult to reach lesions. In addition to providing direct access to the tumor, it avoids the morbidity of transcranial surgery and the cutaneous facial scar associated with other approaches. The medial wall flap reconstruction may reduce the risk of post-operative diplopia and enophthalmos.

**Keywords:** Orbital and Eyelid Disorders, Orbital and Eyelid Disorders, YES

**Financial Disclosures:** The authors had no disclosures.

**332 (Submitted)**
**Effects of Pentoxifylline on Blood Flow in Patients with Non-Arteritic Ischemic Optic Neuropathy**

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**Introduction:**
Non-arteritic ischemic optic neuropathy (NAION) is a common neuroophthalmic disorder. A second episode of NAION in the fellow eye occurs in 15-35% of patients[1]. Doppler OCT studies have demonstrated a reduction in blood flow in the anterior lamina circulation in patients with NAION[2]. Pentoxifylline is a medication with a long history of use in peripheral vascular disease and has been shown to have a rheological benefit from increased red blood cell compliance[3]. We sought to determine if pentoxifylline improved central retinal artery derived blood flow by Doppler OCT in patients with NAION.

**Methods:**
Nine eyes of five patients with NAION were examined with Doppler OCT. All patients were on pentoxifylline, 3 patients had bilateral NAION. Doppler OCT was performed using high-resolution Fourier domain-OCT scans and post-acquisition blood flow calculations using a previously published technique.[4]

**Results:**
The average blood flow in the eye with NAION was 29 µl/min. The average blood flow in the fellow eye of patients with unilateral NAION was 52 µl/min. In four eyes with a purely altitudinal field loss the blood flow in the affected heminerve was 9 and 17 in the unaffected heminerve.

**Conclusions:**
When compared to normative data pentoxifylline caused a small increase in the retinal blood flow in the fellow eye of patients with unilateral NAION (NAION 52, normal 45)[4]. A similar increase was not seen in the affected eye (NAION 29, Normal 28)[4]. This may represent an effect of pentoxifylline on retinal blood flow that may help protect the fellow eye from a second episode of NAION. This data is part of an ongoing study looking at the effects of pentoxifylline on retinal blood flow.

**References:**


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**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Nerve Fiber Layer and Retinal Testing (OCT, ERG Etc), YES

**Financial Disclosures:** The authors had no disclosures.


**333 (Submitted)**
**Alice in Wonderland Syndrome: Presenting and Follow-up Characteristics**


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**Introduction:**
Alice in Wonderland syndrome (AWS) (change in one's body size) and AW-like syndrome (AWLS) (extrapersonal illusions) are two related and unusual sets of visual symptoms. The purpose of this study was to investigate the distribution of symptoms and etiologies of patients with AWS and AWLS at presentation and to determine their prognosis. This information is not available from a large series, particularly a pediatric one.

**Methods:**
Retrospective chart review and telephone interview. Charts of children diagnosed with AWS by a single neuro-ophthalmologist between July 1993 to July 2013 were reviewed. Patients seen prior to 2012, or their parents, were contacted for follow-up information such as whether the AWS/AWLS symptoms persisted after the initial diagnosis, if there were new visual symptoms, and if the patient was subsequently diagnosed with migraines and/or seizures.

**Results:**
48 patients (avg. age 8.1 years) diagnosed with AWS/AWLS were identified. Common visual

symptoms were micropsia (69%), teleopsia (50%), macropsia (25%), metamorphopsia (15%), and pelopsia (10%). MRI and EEGs were unrevealing in 21/21 and 23/23 cases respectively. The etiology was infection in 33% and migraine and head trauma in 6% each. No cause was found in 52%. Of the 15 patients with follow-up, 20% had a few more events of AWS/AWLS which eventually stopped after initial diagnosis, 40% had no more events, and 40% were still having AWS/AWLS symptoms at the time of the interview, while 4 (27%) developed migraines and 1 (7%) seizures since the diagnosis.

**Conclusions:**
AWS/AWLS typically affects young children, and the most common visual complaints are micropsia and teleopsia. The most common cause is infection, but half of cases have no obvious etiology. MRI and EEG are unhelpful. Usually symptoms of AWS/AWLS stop eventually, but in over one third of the cases, they continue. One third of patients without a history of migraine may subsequently develop migraine.

**Keywords:** Miscellaneous, Miscellaneous, YES

**Financial Disclosures:** The authors had no disclosures.

**334 (Submitted)**
**Optical treatment in the Balint Syndrome**

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**Introduction:**
Simultagnosia, optic ataxia and gaze apraxia constitute the clinical triad of Balint syndrome that is typically caused by pathology affecting the parietal-occipital regions bilaterally. Because there are not treatment or therapeutic visual aids for these patients, we introduced prism and filter in order to help in the rehabilitation

**Methods:**
A 22-year-old woman with encephalitis developed simultagnosia, optic ataxia, ocular apraxia, visual agnosia and achromatopsia. Prism and ChromaGen filters were tried. Prism lens and ChromaGen filter was calculated subjective until the patient improved the symptoms. The total power of the prism was 4 DP vertically and 2 DP horizontally. The filter selected was blue. The prism power decreased progressive over the time. The average period of prism and filter wearing was 4 years.

**Results:**
With the prism lens correction the patient was able to identified object, persons, parts of the any picture and also she can read the letter of the Snellen chart together and not isolated. The blue filter results useful in identified color and also the Ishihara test.

**Conclusions:**
We conclude that prism can fusion the image and ChromaGen lenses may enhance subjective color vision.Prism and color filter can be used in patients with any of the clinical manifestations of the Balint syndrome in order to improved the visual quality and to help in the rehabilitation

**Keywords:** Posterior Afferent Visual Pathway (Post-Chiasmal), Disorders of Vision Processing, YES

**Financial Disclosures:** The authors had no disclosures.

**335 (Submitted)**
**Etiology and Prognosis of Central Vision Loss at Presentation in Idiopathic Intracranial Hypertension**

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**Introduction:**
Early central vision loss in idiopathic intracranial hypertension (IIH), while not common, can result from different mechanisms, including subretinal fluid, papilledema/optic neuropathy, choroidal folds, hyperopic shift, macular hemorrhages macular edema, or rarely subretinal neovascularization.[1-3] The mechanism of the visual loss is important to determine to help guide management decisions, such as the need for early surgical intervention. This study examines the etiology and prognosis of central vision loss in IIH at presentation, and provides objective measures to predict visual outcomes.

**Methods:**
A retrospective review of 605 patients with IIH (2009 - 2013) identified 28 patients (4.6%) with best-corrected visual acuity of 20/25 or worse on presentation. Fundus photography, spectral-domain optical coherence tomography (OCT) of the disc and macula, and perimetry were used to determine the causes of central vision loss and evaluate visual prognosis. Segmentation of the macula OCT was performed with the Iowa Reference Algorithm[4] to determine the retinal ganglion cell-inner plexiform layer complex (GCL-IPL) thickness and subretinal fluid volume. The correlation between the subretinal fluid volume and visual acuity was examined. GCL-IPL thinning on OCT was considered indicative of optic neuropathy as a contributor to central vision loss.

**Results:**
Outer retinal changes alone caused decreased central vision in 10 patients: subretinal fluid in 6, chorioretinal folds in 3, and peripapillary choroidal neovascularization in 1. The vision loss was reversible except in the patients with chorioretinal folds. Papilledema/optic neuropathy alone caused decreased central vision in 7 patients. Co-existing outer retinal changes and optic neuropathy caused central vision loss in 11 patients, whose outcome was largely dependent on the degree of optic neuropathy.

**Conclusions:**
Central vision loss in IIH can be caused by both outer retinal changes and optic neuropathy. The correlations between visual acuity, GCL-IPL, and subretinal fluid volume may be useful to predict reversibility.

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**Keywords:** CSF (Intracranial Hypertension, Intracranial Hypotension, etc), Nerve Fiber Layer and Retinal Testing (OCT, ERG Etc), YES

**Financial Disclosures:** The authors had no disclosures.

**336 (Submitted)**
**Long-term clinical outcomes as a function of BMI of pseudotumor cerebri patients who have been stented for severe cerebral venous sinus stenosis.**

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**Introduction:**
Pseudotumor cerebri (PTC) can devastate vision, preferentially afflicting obese females. A subgroup of patients with severe cerebral sinus stenosis appears to benefit from sinus stenting. We hypothesized a retrospective analysis of patients at our institution who received such stenting would reveal those with a BMI >35 did not experience long-term clinical benefit while those with a BMI <30 did.

**Methods:**
The charts of 21 patients who otherwise met modified Dandy criteria for the diagnosis of PTC and who subsequently received cerebral sinus stents were included for clinical and statistical analysis. BMI at time of stenting and their clinical course to time of chart review were evaluated.

**Results:**
Mean time from stenting to chart review was 33.4 months (range 4.8-68.7). Only one patient was male. He had a BMI >35 and experienced sustained resolution of all active signs and symptoms clearly attributable to PTC. Of the seven others with a BMI >35, three continued to clinically deteriorate, two mildly to moderately improved and two had sustained resolution. Five patients had a BMI between 30-35. Three worsened; the other two mildly improved. Eight patients had a BMI <30. One of these worsened. The remaining seven experienced sustained resolution of all active signs and symptoms attributable to PTC. Outcome was significantly linked to BMI as a continuous variable ($p=0.0286$), to specific BMI categories (<30, 30-35 and >35, $p=0.012$), and to race (white vs. non-white, $p=0.05$).

**Conclusions:**
Long term outcomes of patients who have been stented for severe cerebral venous sinus stenosis associated with PTC are significantly correlated to BMI. Patients with a BMI <30 at time of stenting are more likely to benefit than those with a BMI >30. Non-white patients suffer worse outcomes. Two disease processes may be at play. A prospective, randomized study is needed.

**Keywords:** CSF (Intracranial Hypertension, Intracranial Hypotension, etc), Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), YES

**Financial Disclosures:** The authors had no disclosures.

**337 (Submitted)**
**A Retrospective Review of Bisphosphonate-Induced Orbital Inflammation**

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**Introduction:**
Orbital inflammatory disease comprises a spectrum of entities that may affect the various structures within the orbit. The etiology of the inflammation is often idiopathic, although some progress has been made in recent years to elucidate specific causes. This study documents the largest series to date of patients presenting with orbital inflammation in whom it was determined that recent systemic bisphosphonate treatment was the likely causitive factor.

**Methods:**
This retrospective case series reviews 6 patients with orbital inflammatory disease secondary to intravenous or oral bisphosphonate treatment for osteoporosis or cancer. Collected data includes clinical history and examination, type of bisphosphonate drug, radiographic imaging, treatment regimen and clinical outcome.

**Results:**
Six patients (2 males, 4 females) with an average age of 62.2 years had onset of orbital inflammatory symptoms 1 to 11 days after intravenous bisphosphonate infusion or, in 1 case, 4 weeks after initiation of oral bisphosphonate treatment. Four patients were being treated for osteoporosis and 2 for metastatic lung cancer. Radiographic imaging revealed diffuse orbital involvement in 3 cases, isolated lateral rectus muscle involvement in 2 cases, and superior rectus-levator complex involvement in 1 case. Two patients symptoms resolved spontaneously within 2 weeks, 3 responded rapidly and completely to steroid therapy, and the 1 patient on oral bisphosphonate had a slower but complete response to steroid treatment.

**Conclusions:**
Clinicians should be aware of the association between acute orbital inflammation and recent treatment with systemic bisphosphonate medications in patients being treated for cancer or osteoporosis.

**Keywords:** Orbital and Eyelid Disorders, Orbital and Eyelid Disorders, YES

**Financial Disclosures:** The authors had no disclosures.

**338 (Submitted)**
**Infiltrative Optic Neuropathy Caused by Hematologic and Lymphomatous Malignancies (HLM)**

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**Introduction:**
Malignancies can cause optic neuropathy by invading the perineural sheath or the optic nerve and HLM seems to account for the majority of such cases. Overall, 5-9% of non-Hodgkin's lymphoma and 20% of leukemia patients have CNS involvement. There have been a few case reports of optic neuropathy with HLM in the past and the diagnosis is often delayed because of the lack of familiarity with this entity. However, high mortality of CNS and optic nerve involvement makes early diagnosis very valuable.

**Methods:**
A PubMed literature review from 1978 to 2012 revealed 24 cases of vision loss secondary to HLM. We performed a retrospective review of patients presented to our center with a new-onset optic neuropathy with HLM and a clinical presumption that the malignancy caused the optic neuropathy.

**Results:**
Six patents were identified. The clinical presentations were: temporal 16%, altitudinal 16%, arcuate 8%, restrictive 8% and diffuse 8%, and severe central vision loss (16%), optic nerve head swelling (66%), retinal hemorrhage (50%), and optic nerve atrophy (33%) and no pain. One patient (16%) developed severe central vision loss. Only one patient (16%) did not have a diagnosis of a malignancy prior to the vision loss. Four patients had positive, one had negative and one had no CSF cytology.

**Conclusions:**
To our knowledge this is the largest number of patients with optic neuropathy secondary to HLM that have been reported in a single study. The clinical presentations of optic nerve involvement in HLM are non-specific and variable. One must have a high index of suspicion in patients with known HLM. A presumption of this diagnosis should prompt consideration of obtaining repeat neuroimaging and lumbar punctures, steps that would not normally be taken in patients with a presumption that they have a more common form of optic neuropathy, especially if visual loss is not progressive.

**References:**

- None

**Keywords:** Orbital and Eyelid Disorders, Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**339 (Submitted)**
**Optic Nerve Head Meningocele**

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**Introduction:**
Optic nerve head meningocele (ONHM) also known as dural ectasia of the optic nerve sheath is rare. It is reported in patients with neurofibromatosis type 1 [1], but can also be idiopathic. ONHM can cause optic nerve dysfunction [2], cystoid macular edema, acquired hyperopia and choroidal folds [3, 4].

**Methods:**
An 82 year old male patient was referred for a pressure-like feeling and blurring of vision in the left eye of one year duration. On examination best corrected visual acuity was 20/20 OU and color vision 13/13 Ishihara plates OU. There was a relative afferent pupillary defect in the left eye. The left optic disc appeared hyperemic and mildly elevated with indistinct margins. The blood vessels over the left disc were not obscured and there were no hemorrhages or exudates. There was a subtle macular edema, a few choroidal folds and tortuosity of the retinal vessels in the left eye. The right optic disc was normal. 24-2 threshold Humphrey visual fields were normal. There were no skin lesions suggestive of neurofibromatosis.

**Results:**
MRI of the brain and orbits showed enlarged left optic nerve sheath with prominence of the CSF around the normal appearing optic nerve without evidence of orbital masses. CSF opening pressure was normal and so were the constituents of the CSF. Based on these findings a diagnosis of ONHM was made.

**Conclusions:**
The combination of macular edema, chorioretinal folds, and optic nerve dysfunction can be seen in patients with ONHM. The natural course of this entity is not clearly known due to the rarity of the condition, but progressive visual loss can happen [2] which underscores the importance on early recognition. Carbonic anhydrase inhibitor has been tried in ONHM [5]. In severe cases, optic nerve decompression may halt the progression of the visual loss [5].

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**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), CSF (Intracranial Hypertension, Intracranial Hypotension, etc), YES

**Financial Disclosures:** The authors had no disclosures.

**344 (Submitted)**
**Simultaneous optic disc drusen and papilledema causing delayed diagnosis of idiopathic intracranial hypertension**

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**Introduction:**
Optic disc drusen (ODD) can masquerade as papilledema. The difficulty in diagnosing papilledema arises when ODD coexist with idiopathic intracranial hypertension (IIH). This has rarely been reported in a child. We describe a case where ODD led to a delay in diagnosis of IIH and discuss using optical coherence tomography (OCT) as an adjunct for follow-up.

**Methods:**
Case report.

**Results:**
A 9-year-old girl consulted for myopia and was incidentally found to have asymmetric blurring of her optic disc margins (right > left). No relative afferent pupillary defect was elicited. Visual acuity, color vision and Goldmann visual fields were normal. With low gain, B-scan detected right ODD. She was diagnosed with pseudopapilledema. Seven months later, the blurring of her left disc margin had worsened while the right disc remained swollen. No symptoms of raised intracranial pressure were experienced. Tests of optic nerve function were normal. Spontaneous venous pulsation was absent. Spectralis OCT measured retinal nerve fiber layer thickness (RNFLT) of 178µm and 147µm on the right and left respectively. MRI brain was normal. The opening pressure on lumbar puncture was elevated at 27cm$H_2O$. The child was diagnosed with IIH and treated with acetazolamide. OCT scans were performed on follow-up.

**Conclusions:**
When tests of optic nerve function are normal, and in the presence of disc margin blurring secondary to ODD, RNFLT measured with OCT may be a useful objective quantitative adjunct for monitoring disc edema secondary to IIH. Using the Stratus OCT-3, average RNFLT of 108µm has been reported in normal children age 3-17 years[1]; in IIH, values of 155-165µm were reported.[2] As functional testing may be unreliable in children, optic nerve imaging parameters obtained with OCT could be useful in assessing response to treatment in IIH. Clinical monitoring is challenging in this case with co-existence of ODD and IIH.

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**Keywords:** CSF (Intracranial Hypertension, Intracranial Hypotension, etc), Nerve Fiber Layer and Retinal Testing (OCT, ERG Etc), YES

**Financial Disclosures:** The authors had no disclosures.

**345 (Submitted)**
**Ipilimumab-related orbital inflammation and hypophysitis in patients with metastatic melanoma: a brief case series.**

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**Introduction:**
Ipilimumab is a monoclonal antibody directed against cytotoxic T-lymphocyte antigen-4 used for the treatment of metastatic melanoma. The most frequent adverse reactions associated with Ipilimumab have been autoimmune disorders, including enteritis, uveitis and arthritis. Myasthenia Gravis and hypophysitis have also been previously identified as potential adverse events, but orbital inflammation has not been well established as a potential adverse affect of this medication yet, with only one case previously described.

**Methods:**
On this short case series we describe two patients with orbital inflammation and hypophysitis following this treatment, as well as a third patient with hypophysitis only.

**Results:**
Two of our patients developed diplopia and bilateral orbital edema shortly after initiating this chemotherapy (a few days after the second and third cycles respectively) with evidence of orbital inflammation on exam, and were later found to have enlargement of the pituitary gland with evidence of hypophysitis. The first patient had fluctuating symptoms, with consideration of possible ocular myasthenia, but extensive evaluation was unremarkable, including acetylcholine receptor antibody and anti-MuSK antibody, as well as repetitive stimulation EMG and single fiber EMG. The second patient developed acute onset of diplopia and periorbital edema, with consideration of thyroid disease as possible culprit, but hormonal studies were unremarkable at that time, with later development of hypophysitis as well. Our third patient developed hypophysitis only and had no ocular findings.

**Conclusions:**
We described two patients with orbital inflammation attributed to Ipilimumab, known to cause autoimmune adverse effects. The same patients and a third subject also developed hypophysitis, and notably neither had visual field defects, with all ocular symptoms likely associated with myositis as an adverse effect.

**References:**

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**Keywords:** Orbital and Eyelid Disorders, Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**346 (Submitted)**
**Applying laboratory data in temporal artery biopsy decisions**

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**Introduction:**
Studies have described the sensitivity and specificity of acute phase reactants for predicting biopsy-proven giant cell arteritis (GCA).[1,2] The purpose of this study was to assess how well clinicians apply laboratory data to temporal artery biopsy (TAB) decisions.

**Methods:**
We retrospectively reviewed patient charts of all TABs performed at 9 institutions between January 1, 2007 and April 30, 2012. Data abstracted included: age at time of biopsy, sex, preoperative acute phase reactants including platelets, corticosteroid use, and tabulation of whether the biopsy was positive or negative. ESR was adjusted for patient age and sex. Patients were excluded if they were using steroids for more than 14 days in the 30 day period prior to the TAB. Multiple logistic regression was used to measure the association between all measured clinical variables and biopsy results. Because all patients in the study had a post-test probability high enough to warrant TAB, variables in the model that continue to predict a positive biopsy are being underutilized by clinicians in selecting patients for TAB. For example, if clinicians perfectly incorporated ESR information into biopsy decisions, ESR should not predict which biopsied patients would have a positive biopsy.

**Results:**
We identified 546 cases; 156 were excluded based on exclusion criteria and missing data for missing data, for a total of 390 cases (67.7% female) with a median age of 74.5 years (IQR: 67,81). 89 (23.%) were positive for GCA. After controlling for age, sex, and clustering within institutions, age (OR 1.05, $p<0.0001$), CRP (OR 1.89, $p<0.038$) and platelets (OR 1.01, $p<0.0001$) continue to predict a positive biopsy. ESR and sex did not.

**Conclusions:**
Clinicians are effectively utilizing the diagnostic information in ESR and sex and underutilizing CRP, platelets, and age in selecting patients to undergo temporal artery biopsy. A robust clinical risk prediction tool may improve patient selection for TAB.

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**Keywords:** Systemic Disease, Miscellaneous, YES

**Financial Disclosures:** The authors had no disclosures.

**347 (Submitted)**
**The Case of the Vanishing Optic Disc Capillary Hemangioma**

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**Introduction:**
Capillary hemangiomas of the optic disc are endophytic or exophytic vascular hamartomas that may arise from the optic nerve. These congenital hereditary lesions may be associated with central nervous system diseases such as von Hippel–Lindau disease (VHL).

**Methods:**
Case report and review of literature.

**Results:**
A 71-year-old female with past medical history of hypertension presented in October of 2008 with an asymptomatic right optic nerve mass. Her visual acuity refracted to 20/20 in each eye. On examination, her disc was large, sloped with a cup/disc ratio of 0.8, and a small, pink, elevated, vascular mass arising from the nasal optic nerve rim, partially obscuring the cup. She denied any visual or neurological symptoms. Her optical coherence tomography (OCT) demonstrated normal retinal nerve fiber layer thickness bilaterally. Automated visual field testing detected a subtle right nasal field defect. Documentary disc photos were
obtained. Fluorescein angiography exhibited normal choroidal and arterial filling without leakage from the mass, and late staining of the nasal side of the mass. Brain Magnetic Resonance
Imaging (MRI) was normal, other than a small, left temporal horn cyst. The diagnosis of optic disc capillary hemangioma was made. She has been examined at regular intervals for 5 years with stable clinical findings, visual fields, and OCT scans. Given her prominent cupping, she has been monitored by Glaucoma service as well, with stable IOP and optic nerve exam. In 2013, on routine follow up, her hemangioma became nearly indistinguishable from the disc rim, without any detectable vascular patterns. She denies any changes in her medications (atenolol, valsartan and spironolactone) since 2008.

**Conclusions:**
Review of the literature reveals only 3 cases reporting spontaneous regression of optic disc capillary hemangioma. The mechanism and etiology of the tumour regression remains unknown.

**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Miscellaneous, YES

**Financial Disclosures:** The authors had no disclosures.

**348 (Submitted)**
**Tracking the Course of Giant Cell Arteritis: Symptoms or Labs?**

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**Introduction:**
The standard of treatment for giant cell arteritis (GCA) consists of IV steroids followed by one year of oral steroids. The literature asserts that 30-50% of patients will relapse in disease during the course of their steroid taper, at which point the patient's steroid dose would be increased and symptoms or lab values will resolve. The rheumatologic and neuro-ophthalmologic literature differ with regards to the treatment for giant cell arteritis. Rheumatologists consider a relapse to be symptom-based, while neuro-ophthalmologists use laboratory values to define relapse. This study aims to reconcile these differences.

**Methods:**
Retrospective repeated measures-analysis was performed on 17 biopsy positive GCA-patients (28 eyes) for progression of visual loss. Patient symptoms included visual loss, headache, jaw claudication, blurred visions, diplopia, temporal artery tenderness, and evidence of polymyalgia rheumatica (PMR). Laboratory values were erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). The visual acuity is presented as the LogMar equivalent of Snellen and the visual fields were tracked using the Pattern Standard Deviation (PSD).

**Results:**
Twenty-eight eyes were followed for an average of 161 weeks. One-hundred percent of patients relapsed in disease, presenting with the aforementioned symptoms or elevations in laboratory values. Mean time to first relapse was 36 weeks with an average dose of prednisone at 12mg. Linear mixed effects models were used to correlate symptoms and laboratory values with visual outcomes. In one set of eyes, patient labs tracked with LogMar values ($p=0.002$) while in the contralateral eye, patient symptoms tracked with the PSD values ($p=0.02$). When we reversed the eyes, the LogMar values trended with labs, and the PSD values with symptoms, but did not reach statistical significance ($p=0.078$, $p=0.19$, respectively).

**Conclusions:**
Our data suggests that both laboratory values ***AND*** patient symptoms should be utilized to decide the course and duration of treatment for individual patients.

**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**350 (Submitted)**
**Vestibular Signs of Thiamine Deficiency during the Early Phase of Suspected Wernicke's Encephalopathy**

Jorge C. Kattah[1], Sara S. Dhanani[1], John H. Pula[1], Georgios Mantokoudis[2], Ali S. Saber Tehrani[1], David E. Newman-Toker[2]

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**Introduction:**
Non-encephalopathic presentations of central nervous system thiamine deficiency may be difficult to diagnose. Vestibular findings in the pre-encephalopathy phase, despite their potential value to assist early diagnosis and enable early treatment before severe neurologic morbidity occurs, are not widely known. We describe neuro-otologic findings of Wernicke's syndrome in five patients with vestibular manifestations.

**Methods:**
We conducted a retrospective chart review of five cases of thiamine deficiency presenting with vestibular findings to a single center (07/2008-10/2011). All patients underwent clinical neurologic, neuro-ophthalmologic, and neuro-vestibular evaluation. Vestibulo-ocular reflex (VOR) testing was performed by clinical head impulse testing in all five, video-nystagmography in two, and by video head impulse testing in one. Diagnosis was confirmed by low serum levels of thiamine, response to replacement, and brain MRI to exclude other causes.

**Results:**
One of the patients presented with an acute vestibular syndrome characterized by acute, persistent, vertigo, with severe vomiting and gait ataxia for 48 hours, mimicking vestibular neuritis or stroke. The others presented with subacute, progressive imbalance, unsteadiness, falls and oscillopsia. All 5 patients had bilaterally abnormal horizontal head impulse VOR responses and pathologic gaze-evoked nystagmus, without encephalopathy. In three where vertical-VOR responses were tested, two had dissociated loss of horizontal-VOR function with spared vertical -VOR function. After thiamine replacement, four had total resolution of vestibular and oculomotor findings. Novel findings included two patients whose VOR function improved within minutes of intravenous repletion and one whose recovery was documented by serial quantitative recordings.

**Conclusions:**
Patients with thiamine-deficiency may present with predominantly vestibular symptoms and signs without encephalopathy. Head impulse VOR responses in these patients could be an important bedside marker for diagnosis, response to therapy, or prognosis. Early diagnosis of Wernicke's by examining vestibular reflexes and prompt intravenous treatment might prevent encephalopathy and other neurologic or systemic complications of thiamine depletion.

**Keywords:** Misc Motilility Disorders (Nystagmus etc), Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**351 (Submitted)**
**Bilateral Sequential Optic Neuropathy Secondary to IgG4 Infiltrative Disease**

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**Introduction:**
A 49 year old Peruvian woman noted acute, painless decrease in right eye vision. She visited an optometrist, followed by a retinal specialist who raised suspicion for non-organic visual loss. Given progressive visual loss, she presented to our institution 2 months after initial onset.

**Methods:**
Interventional case report

**Results:**
She was previously healthy, no medications, and ROS was negative for systemic concerns. We noted VA 20/400 OD, 20/80 OS, absent color vision OU, subtle right RAPD, normal IOP, and depressed visual fields OU, greater depth of scotoma centrally OU. Orbital, adnexal, and SLE revealed no relative proptosis, nor signs of inflammation or infection. DFE demonstrated an absence of optic atrophy or swelling, however arcuate bundle RNFL thickening was evident. Enhanced MRI brain/orbits, LP, and syphilis, lyme, SPEP, and LHON serologies were ordered. Imaging demonstrated optic nerve sheath complex enhancement OU, diffuse pachymeningeal thickening, and an intraconal right orbital infiltrate posterolateral to the globe, which was biopsied urgently. Immediately following a negative fungal stain, high dose IV solumedrol was given. Vision improved to 20/30 OU within 24 hours. Biopsy revealed IgG4+ predominant lymphoplasmacytic inflammatory cells (>50 IgG+ cells/HPF, >60% of plasma cell fraction). CSF profile and bloodwork was normal, except elevated IgG -- IgG subclass analysis showed IgG4 predominance. CT chest/abdomen: paraortic inflammation, no pancreatitis or retroperitoneal fibrosis. At 3 month follow up, 20/30 vision OU is maintained but decreases when prednisone falls below 40 mg daily – she will begin rituximab shortly

**Conclusions:**
We are becoming increasingly aware of potential optic nerve, orbital and intracranial involvement in IgG4-disease. Recognition of this entity carries major systemic implications since multi-organ involvement is common. Early diagnosis can lead to dramatic recovery, as many cases are exquisitely sensitive to steroid therapy. Neuro-ophthalmic presentations are diverse, ranging from orbital inflammatory disease to infiltrative optic neuropathy as in our case.

**Keywords:** Orbital and Eyelid Disorders, Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), YES

**Financial Disclosures:** The authors had no disclosures.

**352 (Submitted)**
**Using enhanced-depth imaging optical coherence tomography (EDI-OCT) features to distinguish pseudopapilledema and true papilledema**

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**Introduction:**
In patients with tilted, anomalous optic discs, pseudopapilledema (PP) may be difficult to differentiate from true papilledema (TP). Patients with suspected TP may be subjected to expensive and invasive testing such as MRI and lumbar puncture. In this study, we aim to identify features on spectral domain optical coherence tomography (SD-OCT) that may help distinguish pseudopapilledema (PP) from true

papilledema (TP).

**Methods:**
This was an IRB-approved prospective study. Ten patients with presumed PP, 10 patients with TP, and 10 control patients with normal-appearing optic nerves were recruited. Patients with optic nerve head drusen were excluded. TP patients presented with symptoms and signs of intracranial hypertension (ICH), with documented neuroimaging and lumbar puncture. Only TP patients with mild papilledema modified Frisén grade I and II were included, as their optic nerve appearance is clinically similar to those with PP.All patients underwent ophthalmologic examination with automated perimetry, stereo disc photographs, and SD-OCT. Both Zeiss Cirrus™ and Heidelberg Spectralis® images were acquired and analyzed. Enhanced-depth imaging (EDI) OCT was also performed.

**Results:**
In PP and controls, average RNFL thickness as measured by SD-OCT was within normal limits, whereas it was significantly increased in TP. In addition in TP, the prelaminar neuroglial tissue bulges into the peripapillary region in all directions, whereas in PP and controls, it is more likely to bulge into the nasal area only. Peripapillary intraretinal fluid pockets are more likely to be seen in TP, but not in PP or controls. Finally, the optic discs tend to be tilted in PP with elevation of the nasal aspect only.

**Conclusions:**
SD-OCT may be a useful, non-invasive tool for clinicians to help distinguish PP from TP, sparing patients the need for neuroimaging and lumbar puncture.

**Keywords:** Nerve Fiber Layer and Retinal Testing (OCT, ERG Etc), CSF (Intracranial Hypertension, Intracranial Hypotension, etc), YES

**Financial Disclosures:** The authors had no disclosures.

**353 (Submitted)**
**An Alternative Surgical Treatment of Torsional Diplopia Secondary to Bilateral Superior Oblique Palsy**

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**Introduction:**
Torsional diplopia causes significant visual disturbance for patients with bilateral superior oblique palsies and often poses a surgical challenge. The Harada-Ito procedure may address the excyclotorsion by inducing an intorsion effect from transposition of the anterior superior oblique tendon fibers, however this procedure may be technically challenging, may induce a Brown syndrome and may not address the associated V-pattern esotropia. We present a case of a patient with severe torsional diplopia secondary to a bilateral superior oblique palsy that resolved with a bilateral inferior rectus recession with nasal transposition.

**Methods:**
A 25 year old female with a pineal Schwannoma underwent resection via a right occipital craniotomy and post-operatively developed constant diplopia with 15 degrees of excyclotorsion in primary position and 14 prism diopters of esotropia in down gaze, requiring her to occlude one eye. We performed a bilateral inferior rectus recession of four millimeters with nasal transposition. Two months after surgery she had no diplopia or torsion, except in extreme downgaze, where she demonstrated 5 degrees of

excyclotorsion and 4 prism diopters of esotropia. Binocular diplopia fields did not reveal diplopia.

**Results:**
This case was unique in that the Harada-Ito procedure was not attempted as the first line for torsional diplopia. Bilateral inferior rectus recessions in combination with nasal transposition decreases excyclotorsion and adduction in downgaze, making it an ideal procedure of choice when excyclotorsion and esotropia are worse in downgaze. In addition, it has the advantage of being a less technically challenging surgery with a more predictable outcome.

**Conclusions:**
Vertical rectus muscle recession and transposition may be an alternative to consider as first line in the presence of significant excyclotorsion and V-pattern esotropia. Future studies should replicate this procedure to further quantify the results and support the successful outcome.

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**Keywords:** Cranial Nerves (Paresis etc), Miscellaneous, YES

**Financial Disclosures:** The authors had no disclosures.

**354 (Submitted)**
**Neuroprotective effect of High blood pressure treated with ARB and ACEI in the retina of diabetes mellitus type 2 patients studied by MfERG**

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**Introduction:**
To show the effect of angiotensin receptor blocker (ARB) and angiotensin converting enzime inhibitor (ACEI) for high blood pressure in the retina of diabetic type 2 patients observational comparative case series.

**Methods:**
Multifocal electrorretinogram (MfERG) were recorded monocular after pupil dilation in both eyes of diabetic patients without diabetic retinopathy, they were separated in two groups depending on high blood pressure or normal blood pressure. First order kernel multifocal ERGs were extracted at 61 visual field locations. Amplitudes and implicit times were determined for the multifocal ERG components N1 (first negative deflection), and P1 (first positive deflection). Five rings of the MfERG were analized.Patients didn´t have retinopathy, and photographys of the fundus of the eye were taken and reviewed.

**Results:**
The study evaluated 44 patients (88 eyes). Typical multifocal ERG were obtained from both eyes with

and without HBP (High Blood Pressure) groups.The results of the electrorretinogram were abnormal in both groups of patients compared with normal individuals. So diabetics have abnormality in electrical responses before they show retinopathy.Also adjusted by age, patients with high blood pressure showed better responses in the ERG concluding that the amplitude and implicit time of the MfERG showed protective effect in the retina of HBP group, and was statistically significant.In a logistic regression model from all the variables studies, Age, gender, Hb glucosilate glycaemia dislipidemia HBP and tabaquism, HBP showed a Protective effect in beta standarized result for IT (implicit time) 0.35 p=0.002, Amplitud 0.30, p= 0.007

**Conclusions:**
A statistically significant result, showed retinal function protective effect was demonstrated by mfERG in the amplitude and implicit time of the high blood pressure in diabetic patients Type 2. We explain the protective effect of high blood pressure due to the angiotensin receptor blocker (ARB) and angiotensin converting enzime inhibitor (ACEI) that hipertensive patients were taking.No financial or proprietary interest in any material or method mentioned.

**References:**

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**Keywords:** Retina, Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**355 (Submitted)**
**Traumatic optic neuropathy by pellet. Three cases.**

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**Introduction:**
The optic nerve wounds by shot are rare in the eye trauma.

**Methods:**
We report three cases of patients who had presented severe ocular wounds with optic nerve injuries. The first case is about a 44 year-old man who had received shoots of hunting gun in both eyes. The second and the third cases are about a 36 year-old man and a 16 year-old girl who had received a gunshot in their left eyes. At the first examination, the patients could only hardly see bright in the touched eyes. In emergency the perforans wounds were stiched for these three patients.

**Results:**

The eye tomography showed for the first patient an explosion of the right eye, and air into the left eye. For the three patients, there were also a shot in every optic nerve canal.The echography of eyes found a bruise of the posterior pole in two eyes and a retinal detachment in the two others eyes. The visual evoked potential of the eyes with shot in the optic nerve canal were flat and the latency of the wave P 100 increased as well that the amplitude of it decreased. For every patient an intravenous antibiotic therapy and bolus of one gram per day for three days of methylprednisolone were realized. A retinal surgery was performed for patients who had retinal breaks associated with retinal detachment. No improvement of the visual acuty was observed at the end of all treatments. All the affected eyes presented at the end of care a negative bright perception.

**Conclusions:**
Traumatic optic neuropathy by pellet is rare and its prognosis is unmistakably poor. No treatment gave evidence of its efficiency for a visual recovery even a small one.

**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Cranial Nerves (Paresis etc), YES

**Financial Disclosures:** The authors had no disclosures.

**357 (Submitted)**
**Small Posterior Fossa Strokes Causing Severe Vertigo: Anatomic Distribution and Clinical Features of the "Lacunar" Acute Vestibular Syndrome**

David E. Newman-Toker[2], Ali S. Saber Tehrani[1], Georgios Mantokoudis[2], Jorge C. Kattah[1], John H. Pula[1], Deepak Nair[1], Ari Blitz[3], Sarah Ying[3], Daniel F. Hanley[2], David S. Zee[2]

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**Introduction:**
Small brainstem and cerebellar strokes affecting central vestibular pathways may present clinically with acute vestibular syndrome (AVS). Careful study of acute sub-centimeter lesion locations may help elucidate structure-function relationships. We sought to describe the frequency, anatomic distribution, and clinical manifestations of small posterior fossa strokes in patients with AVS.

**Methods:**
Prospective cross-sectional study of consecutive AVS patients (acute vertigo or dizziness, nystagmus, nausea/vomiting, head-motion intolerance, unsteady gait) with at least one stroke risk factor from 1999-2011 at a single stroke referral center. Patients underwent HINTS examination (Head Impulse, Nystagmus, Test-of-Skew), neuroimaging to confirm diagnoses (almost all by MRI), and repeat MRI in those with initially normal imaging but clinical signs of a central lesion. We identified all patients with diffusion weighted imaging (DWI) strokes <10mm in axial diameter. We sought to identify the principal vestibular structures involved.

**Results:**
Of 190 high-risk AVS presentations including 105 strokes, we found sub-centimeter lesions in 15 patients (median age 64, range 41-85). Structures involved were inferior cerebellar peduncle (9), medial vestibular nucleus (1), both (2), root entry zone of 8th nerve (1), nodulus (1), and interstitial nucleus of Cajal (1). Initial MRIs were falsely negative in 53% (n=8/15) of those with sub-centimeter

strokes compared to 7.8% (n=7/90) of those with larger strokes (Fisher's exact p<0.001). In 93% (n=14/15), the HINTS exam suggested a central localization. Non-lacunar stroke mechanisms were responsible in 47% (n=7/15 cases), including 2 vertebral dissections, 4 vertebral occlusions, and 1 cardiac embolism.

**Conclusions:**
Small strokes involving vestibular projections within the brainstem or cerebellum can produce AVS. The HINTS battery identifies these patients with greater accuracy than early MRI with DWI, which is falsely negative in more than half. Non-lacunar mechanisms are often the cause, suggesting greater risk than might be assumed for patients with such small infarctions.

**Keywords:** Misc Motilility Disorders (Nystagmus etc), Neuro-Imaging (MRI, CT, etc), YES

**Financial Disclosures:** Authors have received research support from GN Otometrics (loaned video-oculography goggles).

**358 (Submitted)**
**The Characteristics of Square Wave Jerks in Normal Subjects**

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**Introduction:**
Although square wave jerks (SWJ) have been well documented in normal subjects, the range of normal for frequency is not well defined. Even the definition of SWJ based on the intersaccadic internal (ISI) has been very inconsistent. This study was done to better define the characteristics of SWJ in normal subjects.

**Methods:**
During a study of gaze-evoked nystagmus using binocular video-oculographic recordings at 240 Hz, 30 patients were asked to fixate a center target in the light for 30-60 seconds before and/or after calibration. These baseline periods were analyzed for the presence of two sequential saccades in opposite directions separated by two seconds or less. Four patients were eliminated for excessive blinking and one had no SWJs.

**Results:**
Using the most accepted definition of SWJ (ISI <400 msec), 25 subjects had SWJ frequencies ranging from 0-131 SWJ/minute (median=10.1, mean=19.4,std=26.3). Nine of 25 had greater than 16/minute (which would be considered abnormal by all papers) and two had more than 50 SWJ/minute. Histograms of ISI for each subject showed that 20 had a median peak incidence of 200msec (std=57) and 11 had a second peak at 600msec (std=77). The overall incidence of SWJs with ISI of 700-2000msec was similar throughout that range suggesting these were random movements. In addition to an unexpectedly high incidence of isolated SWJs, patterns previously seen only in abnormal subjects were noted including macroSWJs (amplitude greater than 5 degrees), clusters of SWJ at times similar to macrosaccadic oscillations, and staircase SWJs.

**Conclusions:**
The incidence of SWJs in normals is significantly greater than previously reported. Further, patterns of SWJs previously documented only in abnormals can also be found in normal subjects. We suggest that the definition of SWJ should include those with ISI up to 700msec and that different mechanisms

may underlie SWJs with different ISI.

**Keywords:** Misc Motilility Disorders (Nystagmus etc), Miscellaneous, YES

**Financial Disclosures:** The authors had no disclosures.

**359 (Submitted)**
**Differentiating Vertical Misalignment Using Different Head Positions**

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**Introduction:**
To evaluate whether testing ocular vertical alignment in the seated position vs. supine position aids in diagnosis of vertical diplopia.

**Methods:**
Prospective patients with binocular vertical diplopia, over the age of 18 were recruited. Subjects with childhood strabismus, extraocular muscle surgery, neuromuscular junction disease, intraorbital disease or visual acuity worse than 20/70 were excluded. Ocular alignment in the seated position was measured using alternate cover and/or red Maddox rod in the nine positions of gaze in addition to head tilt; subjective torsion in primary position was recorded using double Maddox rod. These measurements were then repeated in the supine position (only primary position, head tilt and torsion). In this ongoing study, 8 patients were recruited so far; 5 had skew deviation while 3 had other causes. Over 30 patients are planned for recruitment prior to data analysis and presentation.

**Results:**
To be presented at the NANOS meeting.

**Conclusions:**
It is anticipated that our findings will help determine the usefulness of measuring ocular alignment in different head positions.

**Keywords:** Misc Motilility Disorders (Nystagmus etc), Cranial Nerves (Paresis etc), YES

**Financial Disclosures:** The authors had no disclosures.

**360 (Submitted)**
**CT Diagnosis of Terson syndrome**

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**Introduction:**
Terson syndrome is a known complication of subarachnoid hemorrhage (SAH) that causes potentially reversible vision loss, due to vitreous and subhyaloid hemorrhage. In some cases, a blood-vitreous

level can be identified on CT scans, but this finding is often overlooked.

**Methods:**
We describe two patients with Terson syndrome. CT scans at presentation demonstrated extensive subarachnoid and intraparenchymal blood with obstructive hydrocephalus. Although the scans also demonstrated an intra-ocular blood-vitreous level, this finding was not reported by neuroradiologists interpreting the studies.

**Results:**
The first patient carried a diagnosis of Ehlers-Danlos syndrome and was found unresponsive. She was found to have diffuse subarachnoid and left frontotemporal hemorrhage due to a large left MCA bifurcation aneurysm. After surgical clipping, she remained minimally responsive for several days before gradually becoming alert. Weeks into her recovery she demonstrated severe aphasia. It was observed that she was unable to see. A dilated fundus examination revealed extensive vitreal clot in both eyes with no view of the posterior pole.The second patient was also found unresponsive due to extensive subarachnoid hemorrhage from a right MCA bifurcation aneurysm. After clipping of the aneurysm, she recovered consciousness but described severe visual loss in both eyes. Examination revealed hand motions vision in both eyes. Dilated examination demonstrated no view to the retina in either eye.Following the diagnosis of Terson syndrome, both patients underwent successful vitrectomy with restoration of normal vision.

**Conclusions:**
Careful evaluation of the initial CT scans in these patients demonstrated that both had bilateral intra-ocular blood-vitreous levels.

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**Keywords:** Neuro-Imaging (MRI, CT, etc), Retina, YES

**Financial Disclosures:** The authors had no disclosures.

**361 (Submitted)**
**Further Characterization of the Melanopsin-Mediated Pupillary Light Reflex in Multiple Sclerosis**

Ethan Meltzer[1], Peter Sguigna[1], Marlen Lucero[1], Mirna Lucero[1], Amy Conger[1], Darrel Conger[1], Victoria Stokes[1], Josh Beh[1], Rob Rennaker[2], Laura Balcer[3], Peter Calabresi[4], Teresa Frohman[1], Randy Kardon[5,6] , Elliot Frohman[1]

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**Introduction:**
Optic neuritis, the hallmark of multiple sclerosis (MS), causes well-documented dysfunction of the retinogeniculocalcarine, and retinomesencephlic pathways. Recent work in our laboratory indicates that there is dysfunction of the intrinsically photosensitive melanopsin containing retinal ganglion cells (ipRGCs), which are responsible for the vast majority of the input into the retinohypothalamic tract, and to a degree the retinomesencephalic tract. It has been postulated that this dysfunction could contribute to the symptomatology of multiple sclerosis, specifically affecting sleep-wake cycles, sexual drive, glucose homeostasis, and other neuroendocrine reflex arcs. Previous studies have shown dysfunction of this ipRGC-mediated retinomesencephalic tract in multiple sclerosis; however, exactly where along this tract the dysfunction lies is undefined.

**Methods:**
Normal controls, and patients with MS were recruited through our clinical center. Using a pupillometer with highly selective light frequencies and pupil tracking software, we preferentially stimulate the ipRGCs and measured the consensual light reflex. We also correlate selective pupillary light reflexes with spectral domain optical coherence tomography, looking specifically at both longitudinal and depth axes, duration of disease, subtype of disease, and other metrics.

**Results:**
Further localization of the drivers of the melanopsin-mediated pupillary light reflex yields results that are consistent with human histological studies. This defect correlates with metrics of disease activity using rigorous statistical analysis.

**Conclusions:**
Retinohypothalamic dysfunction is a potential contributor to fatigue, depression, and disease burden in multiple sclerosis. Our work indicates retinohypothalamic dysfunction is a potential contributor to MS symptoms that may be amenable to future therapeutic intervention.

**Keywords:** Neuro-Imaging (MRI, CT, etc), Pupil, YES

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**362 (Submitted)**
**Unusual Neuro-Ophthalmic Manifestations Of Herpes Zoster Ophthalmicus**

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**Introduction:**
Cranial nerve palsies and pupillary changes after herpes zoster ophthalmicus (HZO) are rare but have important therapeutic implications.

**Methods:**
Case-series

**Results:**
Case 1: HZO with presumed vasculitic cavernous sinus involvement: A 28 year old immunocompetent male presented with pain and left sided Horners pupil, limited abduction, periorbital erythema and swelling. MRI showed preseptal and lacrimal gland and cavernous sinus enhancement. A week later, he developed HZV forehead skin lesions and anterior uveitis. Treatment with IV antivirals and topical steroids led to relief. Anisocoria persisted.Case 2: HZO with orbital involvement of the lateral rectus and ciliary ganglion: A 54 year old immunocompetent female with HZO- conjunctivitis, keratouveitis and forehead/scalp lesions was treated with oral antivirals. One month later she developed diplopia (left eye abduction limitation) and anisocoria (tonic pupil and light-near dissociation). MRI showed enhancement of left lateral rectus close to superior orbital fissure. Diplopia resolved in 1 week with oral antivirals. The tonic pupil persisted with supersensitivity to dilute cholinergics at follow-up.Case 3:HZO with 3rd nerve palsy and stroke: A 76 year old immunocompetent male presented with HZO (keratouveitis and V1 skin lesions) treated with 10 days of oral antivirals. 2 weeks later he developed altered mental status which was treated with IV antivirals for 3 days until a negative CSF HSV PCR. Three weeks later he developed a right pupil involving oculomotor nerve palsy. MRI revealed a small acute infarct in the ipsilateral centrum semiovale. CSF showed lymphocytic pleocytosis with positive HZV DNA. Treatment included intravenous antivirals followed by long-term prophylaxis. A year later he had full eye movements with residual upper lid ptosis.

**Conclusions:**
HZO with pupil changes or cranial nerve palsies warrants emergent imaging of the orbit and brain for possible disseminated HZV, which may need intravenous and long-term antiviral therapy

**Keywords:** Pupil, Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**363 (Submitted)**
**Ocular Neuromyotonia noted after Recent Botulinum Toxin Injection for Sixth Nerve Palsy following Resection of a Posterior Fossa Skull Based Meningioma**

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**Introduction:**
Ocular neuromyotonia (ONM) is a rare paroxysmal neuromuscular disorder characterized by involuntary contraction of one or more ocular muscles resulting in episodic diplopia and strabismus. Reported etiologies include radiation, chronic nerve palsy, Graves' disease, compressive lesions, stroke or idiopathic. The disorder is thought to be secondary to axonal instability; therefore membrane-stabilizing agents such as carbamazepine and gabapentin have been utilized. Sparse literature exists describing the role of radiation, the onset of prior nerve palsies in causing ONM, or the association with botulinum toxin. We present a case of ONM following bolutinum toxin for a recent postoperative 6th nerve palsy with a prior history of radiation.

**Methods:**

A 56 year old female , with a history of a left skull base tuberculum meningioma treated fifteen years prior with resection and stereotactic radiation, now presents with a left 6th nerve palsy after a second operation for tumor recurrence on neuroimaging. There was no prior history of a 6th nerve palsy. The patient measured 70 prism diopters of esotropia and a complete left abduction deficit. She was treated with 7.5 units of botulinum toxin to the left medial rectus muscle. Three months after the injection, the patient had significant improvement of the left sixth nerve palsy; however was noted to have a strabismus characterized by an esotropia in primary gaze converting to an exotropia after prolonged lateral gaze, suggestive of ONM.

**Results:**
Unique features of this case include whether the ONM was related to the recent use of bolutlinum or to the radiation treatment 15 years prior. The simultaneous development of ONM at the time of the partial recovery of the 6th nerve palsy is also of interest.

**Conclusions:**
Further studies must be conducted to decipher the timing of onset of ONM as related to cranial nerve palsies, radiation and whether botulinum toxin had any role in this case.

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**Keywords:** Cranial Nerves (Paresis etc), Miscellaneous, YES

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**364 (Submitted)**
**Characterizing the Pathobiological Mechanisms of Binocular Acuity Summation versus Inhibition in MS: Central Adaptation or Not?**

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**Introduction:**
Research has shown that the 'fellow' unaffected eye, and its afferent visual pathway, in patients with unilateral optic neuritis, can exhibit physiologic changes which synchronize the arrival of visual

information within the cortex. This 'temporal reorganization', if confirmed, would represent an important central adaptation for visual processing, with implications for binocular fusion and stereopsis. Recent visual evoked potential studies show prolonged latency in visual cortical responses in both the optic neuritis eye and fellow ‘adapting eye.’ Detailed analysis revealed a delay in ‘time to peak’ of the cortical response in the adapting eye, as opposed to a delay in ‘time to onset’ in the optic neuritis eye. A similar process of central adaptation, may explain the phenomena of binocular summation and inhibition, observed in patients with asymmetric monocular visual acuities. The aim of our study is to analyze the structural and functional measures of the anterior visual system in MS patients exhibiting binocular summation versus inhibition, to elucidate the pathobiological underpinnings that differentiate these distinctive processes. Additional studies on the influence of body temperature and potassium channel modulation with 4-aminopyridine will be conducted.

**Methods:**
In this cross sectional, observational study, high and low-contrast acuities were assessed binocularly and monocularly in Multiple Sclerosis patients and healthy controls. Retinal architecture was analyzed using spectral domain optical coherence tomography and scanning laser polarimetry. Functional assessments included Humphrey automated perimetry, multifocal visual evoked potentials, multifocal electroretinogram and pupillary light reflex responses.

**Results:**
We will present the findings of our ‘structure-function’ investigation, on the different mechanisms underlying binocular low contrast acuity summation and inhibition in MS.

**Conclusions:**
Central adaptive processes may account for temporal reorganization, and synchronized arrival of visual information within cortex, of MS patients exhibiting binocular acuity summation. Alternately, binocular acuity inhibition signifies the presence of bona fide, and distinctive MS-associated pathological changes (albeit on an occult basis), affecting the fellow ‘unaffected’ eye.

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**Keywords:** Anterior Afferent Visual Pathway (Optic Neuropathy and Chiasm), Nerve Fiber Layer and Retinal Testing (OCT, ERG Etc), YES

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**365**
**Ipilimumab-related orbital inflammation and hypophysitis in patients with metastatic**

**melanoma**

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**Keywords:**

**Financial Disclosures:** The authors had no disclosures.

**366 (Submitted)**
**Optic Canal Hemangioblastoma Treated with Canal Decompression in a Patient with von-Hippel Lindau Disease**

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**Introduction:**
To report a patient with an optic canal hemangioblastoma associated with von Hippel-Lindau (VHL) disease, which was treated with canal decompression.

**Methods:**
A 25-year-old man presented with progressive temporal visual loss in the left eye over 3 months. Visual acuity was 20/20 right eye and 20/30 left eye with a left afferent pupillary defect. Humphrey visual field was normal right eye (MD -0.30 dB) and constricted left eye (MD -19.83 dB). Left optic nerve swelling and a small far peripheral lesion consistent with a retinal hemangioblastoma in the right eye were found. Ganglion cell layer analysis revealed an average thickness of 79 microns right eye and 52 microns left eye. The patient's father has VHL disease. MRI demonstrated a left retrobulbar enhancing lesion confluent with the apical and canalicular portion of the optic nerve as well as a cerebellar enhancing lesion consistent with hemangioblastomas. Further systemic imaging revealed the presence of pancreatic and renal cysts. The patient underwent neurosurgical intervention for resection of the lesion.

**Results:**
The hemangioblastoma was found to be intertwined with the left optic nerve and sharing the blood supply, therefore resection was not attempted. The optic canal was unroofed to decompress the optic nerve. Post-operatively, the vision was better subjective with expansion of the visual field from -19.83 to -17.78 dB with preservation of central visual acuity.

**Conclusions:**
VHL is an inherited neoplastic syndrome consisting of retinal and central nervous system hemangioblastomas, as well as pancreatic, adrenal and kidney lesions. Orbital and intracanalicular hemangioblastomas are exceedingly rare. Resection is often not possible without further optic nerve damage. Decompression is a potential palliative treatment option.

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**Keywords:** Orbital and Eyelid Disorders, Retina, YES

**Financial Disclosures:** The authors had no disclosures.

**367 (Submitted)**

**Protective effect of the optic nerve sheaths fenestration on optic nerve injury caused by intracranial hypertension in patients with cerebral venous sinus thrombosis Protective effect of the optic nerve sheaths fenestration on optic nerve injury caused by intracranial hypertension in patients with cerebral venous sinus thrombosis**

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**Introduction:**

Objective: Study on the protective effects of the optic nerve sheaths fenestration on optic nerve injury caused by intracranial hypertension in patients with cerebral venous sinus thrombosis (CVST).

**Methods:**

Methods: Thirty six cases of patients with papilledema, impaired vision, and visual field defect induced by CVST related intracranial hypertension from June 2007 to December 2010 underwent the optic nerve sheaths fenestration operation with the method of conjunctiva approach. The efficacy of the operation was evaluated by comparing the degree of the improvement of the operated eyes with themselves before operation on the items of the vision, the visual fields and the thickness of retinal nerve fibre layer at day-3, 7, 30, 90,180 and 360 after operation; and the safety was estimated by observing the status of local bleeding at the operative site and the changes of the intracranial pressure.

**Results:**

Results： A total of 67eyes underwent the optic nerve sheaths fenestration operation at the days of (37.25±20.40) after the onset of clinical symptoms. The average interacranial pressure before operation was 334.72±44.75mm$H_2O$, visual acuity was 0.40±0.24, visual field defect was -16.21±7.34, and the thickness of retinal nerve fibre layer was 269.16±62.66μm. All the items above were improved remarkably at day 7 after operation（see Table-1, p=0.018, P<0.01, P<0.01）. The visual acuity, visual field and thickness of retinal nerve fibre layer increasingly recovered after operation during 360 days of dynamic observation, the peak of the recovery appeared at about day 90 to 180

after operation. The recovery contitue thereafter (Figure 1-A to D, p=0.711). No local bleeding and intracranial hypertension aggravation appeared in the cohort of patients during the preoperative period.

**Conclusions:**

Conclusions：Optic nerve sheaths fenestration may be an effective and safe method on saving optic nerve injury caused by intracranial hypertension in patients with CVST.

**Keywords:** CSF (Intracranial Hypertension, Intracranial Hypotension, etc), Posterior Afferent Visual Pathway (Post-Chiasmal), YES

**Financial Disclosures:** The authors had no disclosures.

**368 (Submitted)**
**Low Conversion Rate Of Ocular To Generalized Myasthenia Gravis In An Asian Population**

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**Introduction:**

Ocular myasthenia gravis (OMG) is a common, localized form of myasthenia gravis limited to the extraocular, levator palpebrae superioris, and orbicularis oculi muscles. Generalization of OMG is believed to occur in 50-80% of patients, usually within 2 years.[1] The prevalence of OMG generalization in Asian populations is unclear, although previous studies have suggested that conversion to generalized myasthenia gravis (GMG) may be lower in this part of the world.[2]

**Methods:**

We conducted a retrospective review of all patients with OMG seen at our Ophthalmology and Neurology departments between 2008 and 2012. Inclusion criteria were: patients aged 18 or older with clinical signs suggestive of isolated OMG (variable, fatigable ptosis and/or double vision) associated with at least one of the following positive findings: ice test, acetylcholine receptor antibodies, single fibre EMG, repetitive nerve stimulation, Tensilon or Prostigmin test, response to treatment. GMG was defined as the development of generalized motor weakness including symptoms and signs of proximal limb and bulbar weakness.

**Results:**

Among the 155 patients diagnosed with OMG (74 female; 81 male patients), 99 had a follow-up duration of more than 2 years. Isolated variable ptosis was the presenting symptom in 48% (75/155 patients), diplopia with ptosis in 42% (65/155 patients) and diplopia without ptosis in 10% (15/155 patients) of patients. Acetylcholine receptor antibodies were found in 36 (53%) of the 67 tested patients. Among patients who had at least 2 years follow-up, the overall generalization rate was 15%. Administration of corticosteroids did not appear to modify conversion of OMG to GMG in a subgroup analysis.

**Conclusions:**

The conversion rate to GMG in our study is lower than in other reported series performed in Caucasians populations. This may be due to genetic or other yet unknown factors. Our novel findings

have relevant implications in the management of MG patients.

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**Keywords:** Misc Motilility Disorders (Nystagmus etc), Systemic Disease, YES

**Financial Disclosures:** The authors had no disclosures.

**371 (Submitted)**
***In vitro* Physiology of RPE65 Gene Therapy for Congenital Blindness Highlights the Importance of Early Treatment**

Steven F. Stasheff[1-4], Frederick R. Blodi[2], Malini Shankar[2], Jeannette Bennicelli[5], Jean Bennett[5], Sajag Bhattarai[3], Stewart Thompson[3], Arlene V. Drack[3]

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**Introduction:**
To help improve Rpe65 gene therapy for Leber's congenital amaurosis (LCA), we examined its effectiveness at the resolution of single cells and retinal circuits. Here we report substantial improvements in retinal ganglion cell (RGC) responsiveness to light *in vitro*, but also persistent background hyperactivity that may degrade the quality of visual signals. Emergence of hyperactivity was prevented only in some cases treated prior to the age of eye opening. Further understanding of underlying mechanisms may help explain the superior response of children in early clinical trials and improve treatments.

**Methods:**
We recorded RGC activity in rd12 (Rpe65-/-) mouse retinas using in vitro multielectrode techniques, after subretinal viral transfection of retinal pigment epithelium (RPE) cells with normal RPE65 (AAV2/1-hRPE65). We compared spontaneous and light-evoked activity in treated and untreated eyes 7-90 days after injecting this vector at various ages.

**Results:**
In retinotopic regions receiving gene therapy, RGC responses were robust, including multiple recognizable types of response to full field flashes and reliable receptive field mapping with pseudorandomized checkerboard stimuli in many (but not all) cells. No light-evoked responses were detected in untreated eyes. Spontaneous hyperactivity equivalent to that in untreated eyes persisted after gene therapy, unless treatment began at P4.

**Conclusions:**
In vitro multielectrode recording evaluates the effectiveness of gene therapy at high resolution not possible in human patients. This provides detailed understanding of mechanisms underlying imperfect treatment responsiveness, to guide further improvements in treatment. Our current study suggests that spontaneous hyperactivity corrupts the neural code of RGCs, decreasing the precision of some RGC responses and limiting gene therapy's effectiveness unless it is initiated sufficiently early. Some of this material was presented at the 2013 Annual Meeting of the Child Neurology Society and of the Association for Research in Vision and Ophthalmology.

**Keywords:** Retina, Disorders of Vision Processing, YES

**Financial Disclosures:** The authors had no disclosures.

**372 (Submitted)**
**Gap Junctions Propagate Melanopsin-like Responses Among Retinal Ganglion Cells in a Mouse Model of a Macular Degeneration**

Steven F. Stasheff[1-4], Frederick R Blodi[2], Malini Shankar[2], Pratibha Singh[3], Robert F. Mullins[3], Michael P. Andrews[2], Edwin M. Stone[3], Stewart Thompson[3]

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**Introduction:**
A missense mutation, R345W, in the extracellular matrix protein *Efemp1* (or *Fibulin-3*) causes the autosomal dominant macular degenerative disease Malattia Leventinese (Stone et al. 1999). In mice with the same mutation, we previously discovered that about twice as many retinal ganglion cells as normal display melanopsin-like responses to light: long latency, sustained duration, and persistence when rod and cone photoreceptor input has been blocked pharmacologically (wild type: 45/354 [12.7%, SD = 7.0%]; *Efemp1*$^{R345W}$: 109/449 [24.5%, SD = 4.3%] This study was designed to determine the origin of this physiological phenotype.

**Methods:**
We counted melanopsin-positive retinal ganglion cells in whole mount retinas of wild type (*wt*) and *Efemp1*$^{R345W}$ mice, and recorded ganglion cell responses to light *in vitro*, using multielectrode arrays. Pharmacologic blockade of synaptic transmission revealed cells whose responses were independent of rod and cone inputs. Additional blockade of gap junctions with 18B-glycyrrhetinic acid and/or meclofenamic acid showed whether responding cells were intrinsically photosensitive (ipRGCs, containing melanopsin), or propagated from ipRGCs to other cell types via electrotonic synapses.

**Results:**
There was no difference in the number of melanopsin-positive ganglion cells between wild type and *Efemp1*$^{R345W}$ mice. Under pharmacologic blockade of synaptic transmission, *Efemp1*$^{R345W}$ retinas had 15 to 25 light-responsive cells per array, compared with 2-4 cells per array in control (wt) retinas. Gap junction blockade reduced the number of cells in *Efemp1*$^{R345W}$ retinas with melanopsin-like responses to that of *wt*.

**Conclusions:**

We discovered that in a model of the macular degeneration Malattia Leventinese, mice with the causative mutation (*Efemp1*$^{R345W}$) have a higher than normal number of ganglion cells with light responses not originating in rods and cones. There are no more melanopsin-containing ganglion cells; rather, signals appear to propagate abnormally from melanopsin-containing ganglion cells to other classes of ganglion cells, via gap junctions.

**References:**

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**Keywords:** Retina, Disorders of Vision Processing, YES

**Financial Disclosures:** The authors had no disclosures.

**373 (Submitted)**
**A Novel Hand Held Instrument for Quantitating Diplopic Visual Fields.**

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**Introduction:**
Diplopia assessment is critical in evaluating conditions including: thyroid associated orbitopathy (TAO), orbital trauma, and idiopathic orbital inflammation (IOI) among others. Currently diplopia is assessed using: qualtitative clinical assessment, prism quantitatition of deviation, and techniques like Goldmann perimeters which though accurate, require specialized unavailable instruments. We developed a simple hand-held instrument (diplopometer) that allows reproducible quantitative assessment of the diplopic field. It has the resolution and reproducibility of the most sophisticated instruments.

**Methods:**
The diplopometer was developed to assess the point of onset of diplopia with gradations of 1 degree. An orientation component of the device allowed for aligmnment along the vertical and horizontal meridia and the 4 oblique meridia. 3 measurements were taken for each gaze direction using a white linear target 1.5 mm in diameter. Intrapatient measurement reproducibility was analyzed by noting the difference between the greatest and smallest measurement for each direction, Δ. The ranges and standard deviations for Δ were calculated. Patients included those with TAO, IOI, fracture, and orbital abscess.

**Results:**
In >90% of patients reproducible measurements were obtained and Δ was less than 3 degrees. Patients denying diplopia with gross acute misalignment of the eyes were assumed to be suppressing and excluded. Rare patients showed inconsistent measurements with Δ of 10-20 degrees. If this occurred repeatedly, they were excluded. The diplopometer identified unsuspected diplopia in some patients not felt to have diplopia qualitatively.

**Conclusions:**
The diplopometer can identify unsuspected diplopia and patients who are supressing. It can reproducibly quantitate diplopic fields and allow for serial assessment of diplopia to quantiatatively follow the resolution or worsening of active conditions. It also allows assessment of a patient's

perceived diplopia which can help guide their functional assessment as well as that of ability/disability. Its reproducibility equals those of the most sophisticated instruments, while requiring less time, space and technical help.

**Keywords:** Misc Motilility Disorders (Nystagmus etc), Orbital and Eyelid Disorders, YES

**Financial Disclosures:** David Bardenstein co inventor of diplopometer (No financial support to date)