

## It's All In Their Head: Diagnosing Neurological Related Eye Conditions

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## Cecelia Koetting Financial Disclosures

**\*All relevant relationships have been minimized\***

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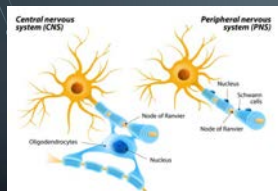
Intrepid

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## Types of Pain

<h3>Nociceptive</h3> <ul style="list-style-type: none"> <li>• Results from tissue damage and inflammation leading to activation of nociceptors</li> <li>• Usually transient</li> <li>• Insults to ocular surface             <ul style="list-style-type: none"> <li>• Infection, trauma, high tear osmolarity, inflammation</li> </ul> </li> </ul>	<h3>Neuropathic</h3> <ul style="list-style-type: none"> <li>• Results from a lesion or disease affecting somatosensory system</li> <li>• Usually chronic</li> <li>• Etiology:             <ul style="list-style-type: none"> <li>• Degenerative</li> <li>• Traumatic</li> <li>• Infectious</li> <li>• Metabolic</li> <li>• Toxic</li> </ul> </li> </ul>
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## Central Pain

- **Origin:**
  - Lesions or diseases of the Central Nervous System (CNS), the brain and spinal cord.
- **Cause:**
  - Stroke, spinal cord injury, multiple sclerosis, Parkinson's disease.
- **Characteristics:**
  - Can include pain from non-painful stimuli (allodynia), heightened sensitivity (hyperalgesia), fatigue, negative mood, emotional changes (anxiety, depression).
- **Mechanism:**
  - Involves [central sensitization](#), where pain pathways in the spinal cord and brain become hyperactive and amplify signals.

## Peripheral Pain

- **Origin:**
  - Lesions or diseases of the Peripheral Nervous System (PNS), the nerves connecting the CNS to the body.
- **Cause:**
  - Trauma, infections (shingles), metabolic issues (diabetes), toxins, compression (nerve entrapment).
- **Characteristics:**
  - Often burning, shooting, stabbing pain, numbness, weakness, typically in specific areas.
- **Mechanism:**
  - Involves peripheral sensitization, making peripheral nerve endings overly sensitive.

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## Corneal Pain: Trigeminal Nerve

<ul style="list-style-type: none"> <li>• V1 afferent pathway             <ul style="list-style-type: none"> <li>• 1<sup>st</sup> order innervation of conj. cornea eyelid</li> <li>• 2<sup>nd</sup> order – spinal trigeminal nuclear complex to thalamus                 <ul style="list-style-type: none"> <li>• and to other areas</li> </ul> </li> <li>• 3<sup>rd</sup> order- thalamus to</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Perception of pain is simultaneously modified by descending pain pathways</li> <li>• Signals transmitted from limbic system and midbrain thru periaqueductal grey → brain stem → trigeminal subnucleus</li> </ul>
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“Signs and symptoms don’t make sense”  
if you don’t understand the neurosensory innervation of the eye

		Signs of Dry Eye	
		+	-
Symptoms of Dry Eye	+	Dry Eye (non-neurosensory)	Neuropathic
	-	Neurotrophic	"Normal"

Image courtesy of Jaci Theiss, OD, used with permission

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**Don't forget the cornea has the highest concentration of nerves**

Healthy cornea contains no blood vessels and is extremely sensitive to pain<sup>1</sup>

Corneal sensory nerves originate from the ophthalmic branch of the trigeminal nerve

Cornea also receives sympathetic innervation from the superior cervical ganglion

1. Marmoraro L, et al. J Refract Surg. 2013;29(12):741-7. Miller J, et al. Exp Eye Res. 2005;79(2):20-32. Sun H, et al. Prog Retin Eye Res. 2018;69:1-13. 2. Marmoraro L, et al. J Refract Surg. 2013;29(12):741-7. Miller J, et al. Exp Eye Res. 2005;79(2):20-32. Sun H, et al. Prog Retin Eye Res. 2018;69:1-13. 3. Labetoulle M, et al. Role of corneal nerves in ocular surface homeostasis and disease. Acta Ophthalmol. 2019 Mar;97(2):137-145.

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**NERVES, NERVES, NERVES**

**Neuromediators<sup>1</sup>**

Substance P	Serotonin
Neurokinin A	Neuropeptide Y
Calcitonin gene-related peptide	Vasointestinal peptide
Acetylcholine	Met-enkephalin
Choleystokinin	Brain natriuretic peptide
Galinin	Vasopressin
Nordrenaline	Neurotensin
	Beta endorphin

**Job #1:** react to injury at the ocular surface by registering pain and irritation and triggering protective reflexes, such as tear production and blinking<sup>1</sup>

**Job #2:** release neuromediators that provide trophic support to corneal epithelial cells and keratocytes<sup>2</sup>

1. Marmoraro L, et al. J Refract Surg. 2013;29(12):741-7. Miller J, et al. Exp Eye Res. 2005;79(2):20-32. Sun H, et al. Prog Retin Eye Res. 2018;69:1-13. 2. Marmoraro L, et al. J Refract Surg. 2013;29(12):741-7. Miller J, et al. Exp Eye Res. 2005;79(2):20-32. Sun H, et al. Prog Retin Eye Res. 2018;69:1-13.

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**CORNEAL SENSITIVITY TESTING: ESTHESIMETRY**

- Qualitative
  - Cotton tip applicator
  - Dental floss
  - Tissue paper
- Quantitative
  - Cochet-Bonnet
  - Belmonte Non contact gas esthesiometer
  - Brill esthesiometer

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**But wait... don't forget the other nerves!**

- CN1 – Olfactory nerve
- CN2 – Optic nerve
- CN3 – Oculomotor nerve
- CN4 – Trochlear
- CN5 – Trigeminal
- CN6 – Abducens
- CN7 – Facial nerve
- CN8 – Acoustic nerve
- CN9 – Glossopharyngeal nerve
- CN10 – Vagus nerve
- CN11 – Accessory nerve
- CN12 – Hypoglossal nerve

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**But wait... don't**

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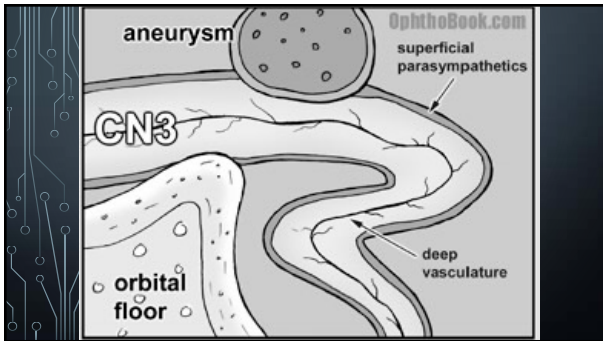
### PROPARACAINE CHALLENGE

- Central vs Peripheral pain
- Instill a drop of proparacaine
  - Does the patient still have pain?
    - Yes - then the issue is further back in the trigeminal nerve than the eye
    - No - then ocular pain is ocular surface related
  - Only works on nociceptors on they ocular surface.
    - 0.5% proparacaine with help with peripheral pain (eye is a peripheral area) not with central pain.

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### What about outside the clinic?

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### How to order an MRI

**MRI**

- Order an MRI of the head and orbits with and without contrast within a few weeks
- Consider neck as well
- Can be scheduled with out patient clinics or at MRI centers
- Your front desk staff can help the patient with this.

**MRA vs MRV**

- Artery vs veins
- Aneurysms, dissections, cerebral venous sinus thrombosis

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### Details to Consider

MRI of Head vs MRI of Orbits Vs MRI of Neck

Do you really need both?

When should you order both?

Pregnancy ok but no contrast

Do NOT order in patients with metal implants or pins, pacemakers, or implanted cardiac defibrillators

Claustrophobia patients consider open MRI if option

Valium helps

T1 MRI w/ contrast

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### When is CT helpful?

**Good to view**

- Bone abnormalities
- Calcification
- Bony involvement from soft tissue mass
- Metallic foreign bodies
- Fresh blood

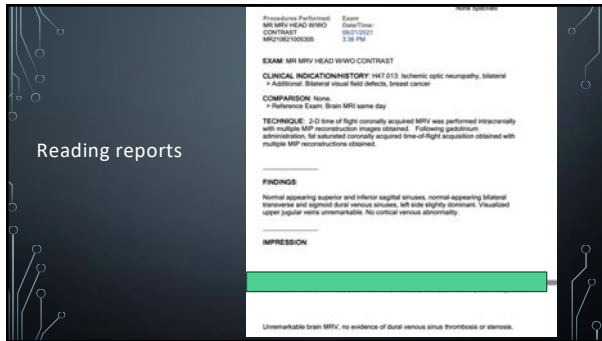
**Indicated when:**

- Orbital trauma
- Proptosis, swelling of eyelids (orbital cellulitis, abscess, etc)
- Some instances MRI may still be preferred
- Intraocular or intracranial foreign bodies
- Graves' patients (can also use MRI)

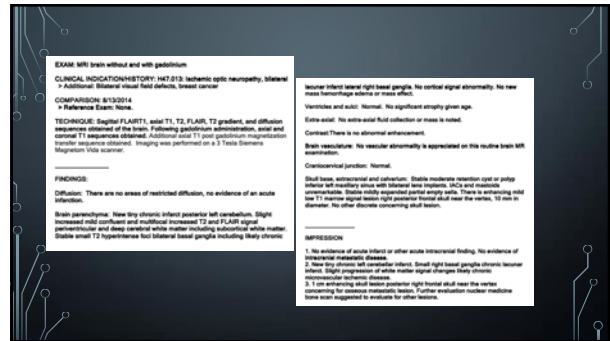
**Avoid if possible in**

**contrast patients.**

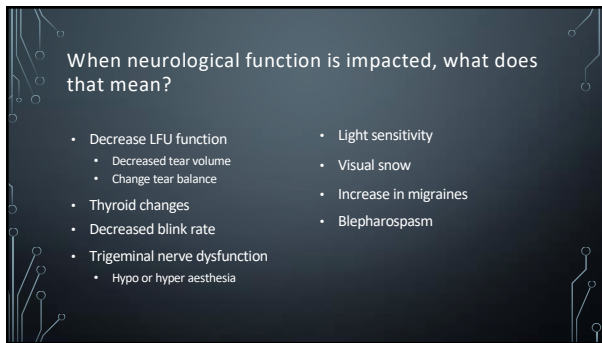
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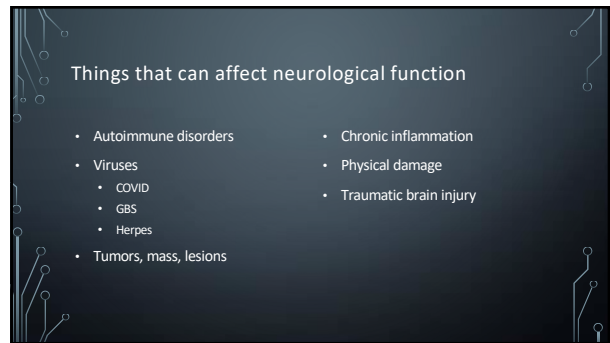
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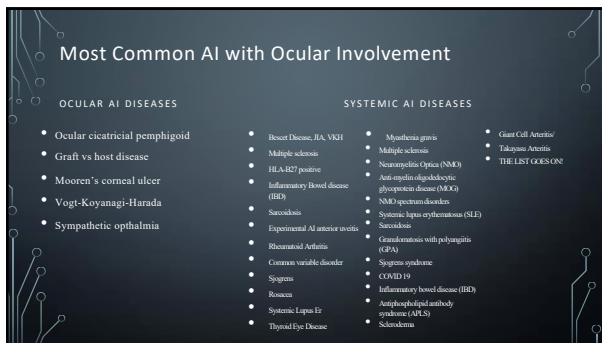
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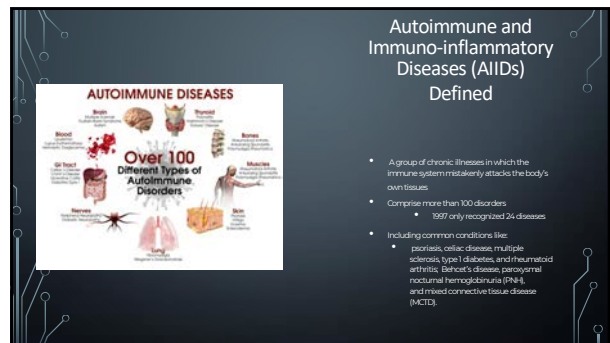
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### Growing Numbers and Concerns

- Data indicates that autoimmune diseases affect approximately **50 million Americans**.
  - However, given the complexity of diagnosing these conditions, this number is likely an underestimate.
  - No national reporting system to track AI incidence and prevalence data
- Autoimmunity is reaching **epidemic levels**, with **some studies estimating** an increase of 3-12% annually.
- Between 2006 to 2021, the prevalence of inflammatory bowel disease (IBD) increased **40%**.
- The estimated number of people with multiple sclerosis worldwide increased **30%** from 2013-2022.
- The prevalence of type 1 diabetes has nearly **doubled** in the past 40 years in the adult population.
- Over the past 30 years, the prevalence of celiac disease in the U.S. has increased **five-fold**, doubling approximately every 15 years.

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### Why the trend in increased numbers?

- Overall better understanding and diagnostic capabilities?
  - ↳ 1911 led to the discovery
- Genetic predisposition
  - Environmental response genes
- Environmental factors
  - Vitamin
  - Chemicals
  - Air pollution
  - Geographic
- Lifestyle
  - Gut microbiome changes?
  - Benzene contacts
  - Obesity
  - Sleep deprivation
  - Stress

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### Other Causes: Post Infection Syndromes

- Long COVID is 28M?
  - Forcing to look at this long ignored post viral syndromes
- Viral triggered Autoimmune
- Shingles/PHN 1.1M/yr
- HIV Neurodegenerative diseases
  - Recent research linking Epstein Barr virus to MS, SLE and other AI

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### A 3<sup>rd</sup> Category? Contentious Illnesses

- Overlaps with other 2 significantly
- Diseases with inflammatory symptoms that may be triggered by infections but hard to characterize and often dismissed as psychosomatic
- Fibromyalgia → 4million
- Chronic fatigue syndrome/myalgic encephalitis → 0.8-2.5Million
- Inflammatory food sensitivities
- Chronic Lyme Diseases → 40-80K/yr

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### When is it not JUST dry eye?


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### Blepharospasm, its not just stress

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### Speaking of botox. . . What about TMJ?

- **Symptoms of TMJ-related neuropathic pain**
  - **Facial pain & numbness:** Sharp, burning, or tingling sensations, or "pins and needles".
  - **Headaches & migraines:** Often tension-type, originating in the jaw area.
  - **Ear symptoms:** Ringing (tinnitus), fullness, or earaches.
  - **Muscle spasms:** Involuntary twitching of facial muscles.
  - **Neck & shoulder pain:** Referred pain or stiffness due to muscle tension.



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### Causes and mechanisms

- **Nerve compression:** A misaligned TMJ can press on nearby nerves, especially the trigeminal nerve.
- **Proximity:** A shorter distance between the TMJ disk and the mandibular nerve can increase neuropathic pain risk, possibly from direct compression, traction, or friction during jaw movement.
- **Central sensitization:** TMJ issues can alter pain processing in the brain, making it more sensitive to pain signals, a feature of neuropathic pain.

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### Wait what else does this stuff do?!

- Fine lines and wrinkles. . . .
- Migraines
- Inferior incomplete lid closure (sometimes)

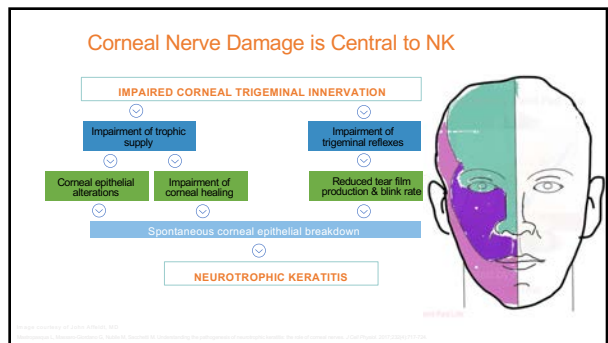
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### Trigeminal neuralgia

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### Neurotrophic Keratitis

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### ETIOLOGIES ASSOCIATED WITH NK

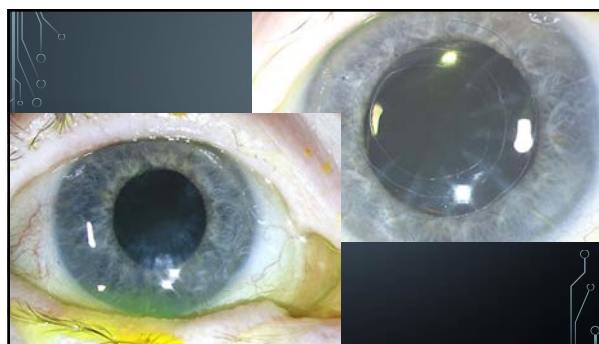
 <b>OCULAR</b> <ul style="list-style-type: none"> <li>• Post-herpes infection                             <ul style="list-style-type: none"> <li>▪ 6% of herpetic keratitis</li> <li>▪ 13% of herpes zoster keratitis</li> </ul> </li> <li>• Other infections with nerve damage</li> <li>• Chemical and physical burns</li> <li>• Abuse of topical anesthetics</li> <li>• Drug toxicity</li> <li>• Chronic ocular surface injury</li> <li>• Contact lens wear</li> <li>• Orbital neoplasia</li> <li>• Corneal dystrophies</li> </ul>	 <b>SYSTEMIC</b> <ul style="list-style-type: none"> <li>• Diabetes</li> <li>• Multiple sclerosis</li> <li>• Vitamin A deficiency</li> <li>• Leprosy</li> <li>• Amyloidosis</li> </ul>	 <b>GENETIC</b> <ul style="list-style-type: none"> <li>• Riley-Day syndrome</li> <li>• Goldenhar-Gorlin syndrome</li> <li>• Moebius syndrome</li> <li>• Familial corneal hypoesthesia</li> </ul>	 <b>CNS</b> <ul style="list-style-type: none"> <li>• Neoplasm</li> <li>• Aneurysms</li> <li>• Stroke</li> <li>• TBI/TBSI</li> <li>• Degenerative disorders of the CNS</li> <li>• Neurosurgical procedures</li> <li>• Congenital/developmental malformations (eg trigeminal nerve hypoplasia)</li> </ul>
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IATROGENIC
 

- Trauma to ciliary nerves by laser treatment and surgery
- Corneal incisions
- LASIK

CNS, central nervous system.  
 Dua HS et al. *Prog Retin Eye Res.* 2018;66:107-131. Semeraro F et al. *Ophthalmologica.* 2014;231(4):191-197.

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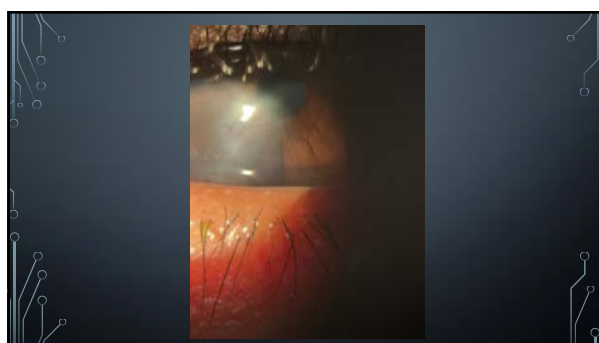


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### Pt #1 Dude, whats this white spot

- 32 year old white male
- Presents because has a white spot on his eye OD. Habitually sleeps in CL and every few months he will have significant pain in his eye. Usually goes in dark room for a day and sleeps and its better. This occurred 3 days ago and this time it did not get better and now has a white spot. Always his OD
- OD Corneal edema, stromal neovasc, scarring likely, all extending into visual axis.
- Likely has been experiencing HSV flares and has an active HSV disciform.
- Pt started on topical steroid/ antibiotic and oral antiviral
- RTC 1 week improved, kept on steroid and antiviral
- 1 month FU receding neovasc, referred for possible corneal avastin injection/PTK as well as scleral CL fit.
- 6 month FU BCVA improved to 20/30, ghost vessels in stroma, no recurrence. Deferred fit in scleral and is not wanting to return to CL use at all.

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### MACKIE CLASSIFICATION

STAGE 1 Mild: Punctate epithelial keratopathy (PEK)  
 STAGE 2 Moderate: Persistent epithelial defect (PED)  
 STAGE 3 Severe: Corneal ulcer

- Some vision loss can potentially be seen in all stages of NK<sup>3</sup>
- If untreated, moderate NK progresses to severe disease with associated risks of profound vision loss resulting from scarring and corneal perforation<sup>3</sup>

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### NK Study Group (NKSD) Classification

Stage	NKSG	Mackie
Stage 1	Altered sensation without keratopathy	
Stage 2	Punctate epithelial keratopathy without stromal haze	Stage 1
Stage 3	Persistent/recurrent epithelial defects without stromal haze	Stage 2
Stage 4	PEK or PED WITH stromal haze	Stage ½
Stage 5	Persistent PED with corneal ulceration	Stage 3
Stage 6	Corneal perforation	Stage 3

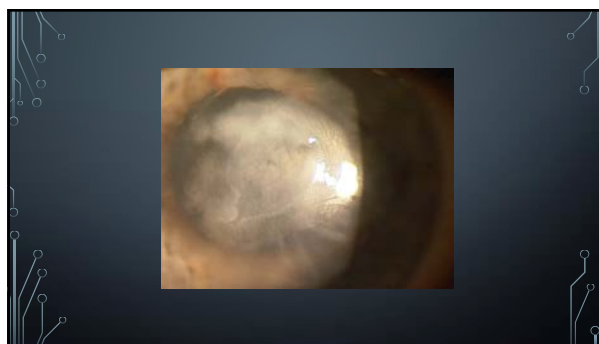
Neurotrophic Keratopathy Study Group. *Ocul Surf.* 2023;30:129-138

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### Pt # The Hat Trick

- 45year old Asian Female
- Presents for corneal abrasion, diagnosed with RCE
- RTC 1 week FU
  - Unhealing corneal defect
  - Stromal haze
  - HSV flare, started on antivirals
- F/U → improves over 2 weeks but corneal defect and haze still persistent
  - Corneal sensitivity testing, 100% desensitized, now has NK
  - AM membrane, cyclosporine, vit A ung, corticosteroids
    - No improvement, moved to Oxervate
    - When stable referred for scleral lens fit and DALK/PK consult with Cornea

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NK FROM RCE

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### When do you consider ordering testing?

- Lets talk about James. . . .

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### When is corneal pain, not corneal pain?

- Needle/stabbing behind eye to back of brain
- Ache behind eye
- Pressure above brow
- Deep throbbing
- Hot searing radiating pain
- BUT the eye is completely normal?

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### WHATS REALLY GOING ON HERE?

- Corneal sensitivity
  - 100% sensitivity OD; 50% sensitivity OS
- Started on topical cenegermin Q2hr x 8 weeks
  - Improvement to approximately 70% sensitivity OS

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## Trigeminal Nerve Damage and NEUROPATHIC CORNEAL PAIN

- Persistent ocular pain
  - Burning
  - Increased light sensitivity
  - Increased sensitivity to wind
  - Shooting pains from one or both eyes
- May be present WITH or WITHOUT ocular surface abnormalities

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## WHAT CAUSES THIS?

- Suggested that there is an initial insult to the eye causing chronic nerve abnormality
- The initial trigger may be any of the following:
  - trauma (e.g., corneal abrasion, radiation therapy)
  - chemical exposures (e.g., preservatives in topical medications, chemical burns, systemic chemotherapy)
  - infection (e.g., herpes simplex virus, herpes zoster virus)
  - eye surgery (e.g., refractive, cataract, glaucoma, and retinal surgery)
  - systemic disease (e.g., autoimmune or inflammatory conditions, diabetes, fibromyalgia)
  - other neurological disease (e.g., trigeminal neuralgia, migraine)

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## 70 Year old male

- Excruciating ocular pain both eyes the last 6 months.
- Presenting for 3<sup>rd</sup> opinion.
- Ocular exposure to DermalogicaPro Precleanse at Hand & Stone Denver on May 8, 2023. To my knowledge, the patient did not receive an eyewash or irrigation until May 11, 2023.
  - Some initial staining seen at that time cornea and conj (initial exam non-eyecare professional)

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## My Exam

- No staining
- significant discomfort and severe light sensitivity
- Cognitive issues brought his brother because in so much pain couldn't concentrate
- Cochet-Bonnett
  - significant decrease in corneal sensitivity from normal in 2 out of 3 areas tested in both eyes.

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## Fast forward





- Significant inflammation control

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## When eye is a pain in the neck

- Post TBI
  - Neck injury or whiplash common
- Post surgery
- Ergonomics of sitting and working on computer
- Do they have worsening of pain when reading, especially on a computer screen?
  - Saccadic eye movement
    - Neck muscles engage to keep head still while eyes move for saccades
    - If someone has a neck injury to these supporting muscles, when a patient uses a lot of saccades doing visual tasks can trigger pain
- Sensory nerves in the neck overlap with some trigeminal sensory nerves of the eye
  - Trigger points


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<p><b>TENSION</b> pain is like a band squeezing the head</p> 	<p><b>CERVICAL</b> pain is at the top and/or back of the head</p> 	<p><b>MIGRAINE</b> pain, nausea and visual changes with classic form</p> 	<p><b>TMD</b> pain is at the temples, in front of the ear</p> 
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### Cervicogenic referred ocular pain and Cervicogenic Headache

- Referral to Orthopaedic Physical Therapist
- Headache clinic
- Possible treatments include:
  - Physical therapy
  - Massage therapy
    - Point trigger release
  - Botox
  - Acupuncture
  - Ergonomics



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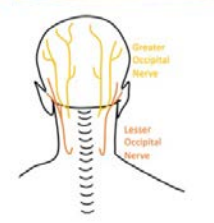
47 year old male

- "My eyes hurt when I try to read especially on computer."
  - Better if wearing glasses with his contacts

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### Occipital Neuralgia

- Headaches caused by irritation to greater or lesser occipital nerve
- Where is location of pain?
  - Back of head, neck, scalp, forehead, behind eyes
- Type of pain
  - Burning, hot, electric like, intense, stabbing, brief or chronic
  - Zndary symptoms: vision/ocular pain (67%), tinnitus (33%), dizziness (50%), nausea (50%)
- Pillow sign:
  - Pain with lying on pillow in supine with hyperextension or rotation of head




Picture courtesy of Jaci Theis

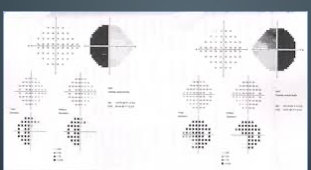
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### Conjunctivochalasis with or without Microblepharospasm

- Blinking with mechanical rubbing causes irritation and inflammation
- Oculoplastics?
  - Functional botox? ( our good friend)
  - Surgical resection of conjunctiva
  - Plasma pen?
  - Optilight Trilift?

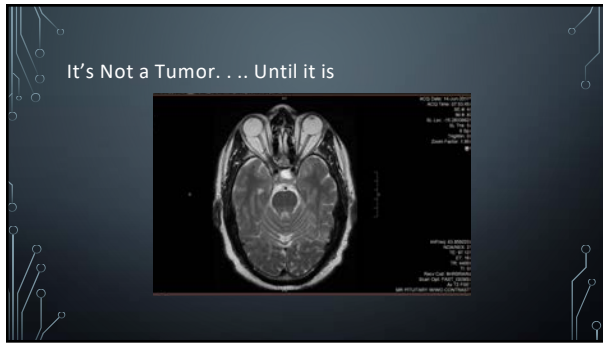


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What's causing this?

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**Pituitary Adenoma**

- Tumors arising from the pituitary gland
  - Can cause optic chiasm compression
    - Visual field defects
      - Classically defects
      - Dejager
      - Nottingham
      - Optic atrophy
      - Sequelae of pituitary apoplexy

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**Pituitary Adenoma and Pregnancy**

- Previously asymptomatic PA or microadenomas may grow during pregnancy
  - Headaches
  - visual field changes (bitemporal)
  - Decreased VA
- After pregnancy will usually shrink
- If patient is known to have this prior to pregnancy, should monitor with visual fields for tumor growth
- Patients without a pituitary adenoma can also experience visual field defects when the pituitary gland grows during pregnancy
- Can mimic PA VF defects with a bitemporal defect

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**Testing and Treatment**

- Visual Field VHF 30-2
  - Bitemporal hemianopsia
    - Typically respect vertical midline
  - Junctional field defect
    - Less common
- MRI of head with and without contrast
- Endocrinologist and Neurosurgeon
  - Resection vs medical treatment vs monitoring
- Continued monitoring with serial HVF after treatment

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**Systemic Diseasea Considerations**

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**AUTOIMMUNE DISEASES**

Over 100 Different Types of Autoimmune Disorders

**Autoimmune and Immuno-inflammatory Diseases (AIIDs) Defined**

- Group of chronic illnesses in which the immune system mistakenly attacks the body's own tissues
- Comprise more than 100 disorders
- 1997 only recognized 24 diseases
- Including common conditions like: psoriasis, celiac disease, multiple sclerosis, type 1 diabetes, ankylosing spondylitis, rheumatoid arthritis, Behcet's disease, paronychia, nocturnal hemoglobinuria (PNH), and mixed connective tissue disease (MCTD)

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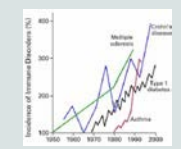
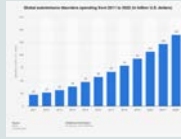
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- Between 2006 to 2021, the prevalence of inflammatory bowel disease (IBD) increased **45%**.
- The estimated number of people with multiple sclerosis worldwide increased **30%** from 2013-2022
- The prevalence of type 1 diabetes has nearly **doubled** in the past 40 years in the adult population.
- Over the past 30 years, the prevalence of celiac disease in the U.S. has increased **two-fold**, doubling approximately every 15 years

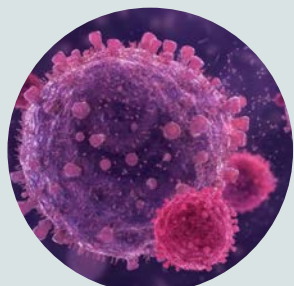
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### Why the trend in increased numbers?

- Overall better understanding and diagnostic capabilities?
  - YES but not the only thing
- Genetic predisposition
  - Environmental response genes
- Environmental factors
  - Viruses
  - Chemicals
  - Air pollution
  - Geographic
- Lifestyle
  - Gut microbiome changes!
  - Xenobiotic contacts
  - Obesity
  - Sleep deprivation
  - Stress

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### Other Causes: Post Infection Syndromes

- Long COVID 19/23M?
  - Forcing to look at this long ignored post viral syndromes
- Viral triggered Autoimmune
- Shingles/PHN 1.1M/yr
- HIV Neurodegenerative diseases
  - Recent research linking Epstein Barr virus to MS, SLE and other AI

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### A 3<sup>rd</sup> Category? Contentious Illnesses

- Overlaps with other 2 significantly
- Diseases with inflammatory symptoms that may be triggered by infections but hard to characterize and often dismissed as psychosomatic
- Fibromyalgia → 4million
- Chronic fatigue syndrome/myalgic encephalitis → 0.8-2.5Million
- Inflammatory food sensitivities
- Chronic Lyme Diseases → 40-80K/yr

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### Most Common AI with Ocular Involvement

OCULAR AI DISEASES	SYSTEMIC AI DISEASES
<ul style="list-style-type: none"> <li>Ocular cicatricial pemphigoid</li> <li>Graft vs host disease</li> <li>Mooren's corneal ulcer</li> <li>Vogt-Koyanagi-Harada</li> <li>Sympathetic ophthalmia</li> </ul>	<ul style="list-style-type: none"> <li>Beset Disease, RA, VKH</li> <li>Multiple sclerosis</li> <li>HLA-B27 positive</li> <li>Inflammatory Bowel disease (IBD)</li> <li>Sarcoidosis</li> <li>Experimental AI anterior uveitis</li> <li>Rheumatoid Arthritis</li> <li>Common variable disorder</li> <li>Sjogrens</li> <li>Rosacea</li> <li>Systemic Lupus Er</li> <li>Thyroid Eye Disease</li> <li>Myasthenia gravis</li> <li>Multiple sclerosis</li> <li>Neuromyelitis Optica (NMO)</li> <li>Anti-stylin oligodendrocytic glycoprotein disease (MOG)</li> <li>NMO spectrum disorders</li> <li>Systemic lupus erythematosus (SLE)</li> <li>Sarcoidosis</li> <li>Granulomatosis with polyangiitis (GPA)</li> <li>Sjogrens syndrome</li> <li>COVID 19</li> <li>Inflammatory bowel disease (IBD)</li> <li>Antiphospholipid antibody syndrome (APS)</li> <li>Scleroderma</li> <li>Giant Cell Arteritis/ Takayasu Arteritis</li> <li>THE LIST GOES ON!</li> </ul>

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### Blood Work: Order it

- TSH/TSI/T3/T4
- ESR
- CRP
- Total CBC
- Sjo panel (some in ENA panel)
- ANA
  - Order more specific if positive or refer out
  - Extractable Nuclear Antigen panel (ENA)
- HLA-B27
- ANCA
- RF
  - Anti-CCP Test
- Complements: C3, C4, C5
- Anti-dsDNA

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### Interdisciplinary Considerations

- Autoimmune
  - Rheumatology
  - Immunology
- Neurology
- Allergist
- Pain Clinic
- PCP
- PT/OT
- Nutritionists
- Psych
- Cognitive behavioral specialists
- Oculoplastics
- Cornea
- Uveitis specialist
  - GVH

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