When the Eye Pain is a Pain in the Neck

Jacqueline Theis, OD, FAAO, FNAP

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INTRODUCTION

Financial Disclosures

C. Light Technologies - Chief Medical Officer
Myze – Advisory Board
Vision Science Labs - Advisory Board
Oculus - Speakers Board
MedEvolve - Speakers Board
Dompe – Speakers Board
Tarsus – Speakers Board
Alcon – Consulting, Speakers Board
Abbvie – Consulting
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Roche - Speaking

All risks have been mitigated

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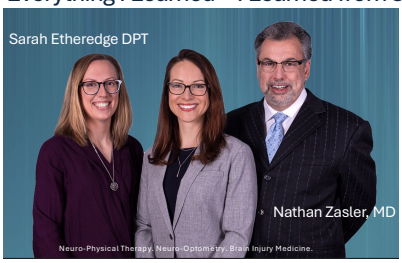
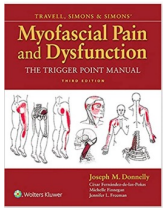
INTRODUCTION

Everything I Learned – I Learned from someone else!





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Introduction

Course Objectives

- Define cervicogenic referred eye pain and Review the anatomy and pathophysiology of the neck and its pain referral patterns to the face and eye
- Differentiate cervicogenic eye pain from primary ocular conditions
- Recognize exam findings and red flags
- Integrate cervical screening into optometric practice
- Discuss computer/reading ergonomics and the impact on cervicogenic dysfunction
- Describe the importance of refractive error correction on cervicogenic ergonomics
- Coordinate care with PT, neurology, or manual therapy providers

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CASE STUDY

45 year old Caucasian male

Chief complaint: "I have eye pain and light sensitivity after 15 minutes on the computer"

HPI: Eye pain

- Unilateral or bilateral?
- Where?
- What does it feel like?
- How long does it last?
- What makes it feel better?

- Both eyes
- Behind the eyes and radiates backwards towards the back of his head
- Needle going through his eye to the back of his brain
- Lasts for Hours
- Nothing helps

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CASE STUDY

45 year old Caucasian male

Chief complaint: "I have eye pain and light sensitivity after 15 minutes on the computer"

HPI : Light Sensitivity

- Unilateral or bilateral?
- What does the light trigger?
- What types of lights/situations?
- How long does it last?
- What makes it feel better?
- What are you doing to make it better?

- Both eyes
- Headache/Eye pain
- Computer/Phone
  - Sunlight is okay
  - Some fluorescent lights are okay but not all
  - Incandescent light is fine
- As long as the headache lasts
- Screen on lowest brightness, blue blocker coated glasses (not helping)

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DIFFFERENTIAL DIAGNOSIS OF PAIN

Computer Vision Syndrome

Symptoms
- Eyestrain
- Headaches
- Tired eyes
- Irritation
- Blurred Vision
- Double Vision
- Neck and Shoulder Pain

Etiology - Ocular
- Ocular surface etiology
- Uncorrected/overcorrected refractive error
- Oculomotor dysfunction
  - Convergence Insufficiency
  - Accommodative Insufficiency
  - Accommodative Spasm

Etiology - Environmental
- Lighting
- Glare
- Working/viewing distance
- Lack of breaks
- Ergonomics

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DIFFFERENTIAL DIAGNOSIS OF PAIN

Types of Pain

Nociceptive
- Results from tissue damage and inflammation → activation of nociceptors
- Usually transient
- Insults to ocular surface can include
  - Infection, inflammation, trauma, adverse environmental conditions, abnormal ocular anatomy (Graves orbitopathy, post-oculoplastic surgery etc), and high tear osmolarity

Neuropathic
- Results from a lesion or disease affecting the somatosensory system
- Usually chronic
- Etiology:
  - Degenerative
  - Traumatic
  - Infectious
  - Metabolic
  - Toxic

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PATHOANATOMY OF PAIN

Direct Activation of Trigeminal Afferent Pathway (V1)

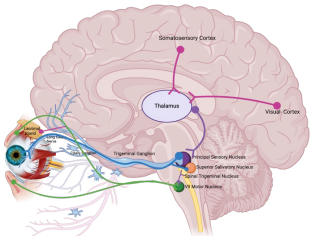

Image courtesy of Jacqueline Theis

- 1st order Trigeminal afferents innervate the conjunctiva, cornea, eyelid → sends signal to **cell body** in Trigeminal nucleus → axons project to the trigeminal brainstem nuclei
  - Spinal trigeminal nucleus
    - Thermoceptive and nociceptive fibers
  - Principal sensory nucleus
    - Fine touch and pressure fibers
- 2nd order neuron: → thalamus
  - Join the contralateral spinothalmic pathway
- 3rd order → Somatosensory cortex
  - Supraspinal centers include somatosensory cortex

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DIFFFERENTIAL DIAGNOSIS OF PAIN

Typical Differential Diagnosis of Eye Pain

Ocular
- Asthenopia
  - Uncorrected refractive error
  - Improper near add
  - Oculomotor dysfunction
- Anterior segment disorder
  - Ocular surface disease/Dry Eye syndrome
  - Contact lens related dryness
  - Iritis/Uveitis
  - Optic nerve disorder

Orbital
- Sinusitus, trauma, cellulitis, orbital tumor, mass, optic neuritis, dacryoadenitis, migraine, cluster headache, herpetic neuralgia

Periorbital
- Trauma, hordeolum, preseptal cellulitis, dacrycystitis, dermatitis, giant cell arteritis
- Other
  - Glare sensitivity
  - Photophobia

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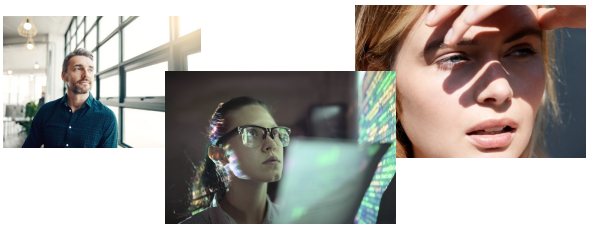
DIFFERENTIAL DIAGNOSIS OF PAIN

Glare vs. Photophobia vs. Photo-oculodynia



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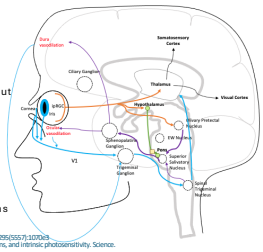
MECHANISM OF PHOTOPHOBIA

ipRGCs

- Retinal ganglion cell with melanopsin photopigment
  - 1-3% of ganglion cells in the retina
  - Also found in the iris
- Peak activation is at 480nm (between green and blue cones) but can also be stimulated by input from rods and cones
- Send axons to
  - Thalamus (light-pain matrix)
  - Pretectal Nucleus/Edinger-Westphal nucleus (pupillary light response)
  - Hypothalamus/Suprachiasmatic nucleus (circadian rhythm)
- Hypothesis of connections between ipRGCs and TBI symptoms of headaches, ocular pain, light sensitivity and sleep disturbances



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Noseda R, Constandil L, Bourgeais L, Chalus M, Villanueva L. Changes of meningeal excitability mediated by corticotrigeminal networks. J Neurosci. 2010;30(43):14420e9
Noseda R, Kainz V, Jakubowski M, et al. A neural mechanism for exacerbation of headache by light. Nat Neurosci. 2010;13(2):239e45

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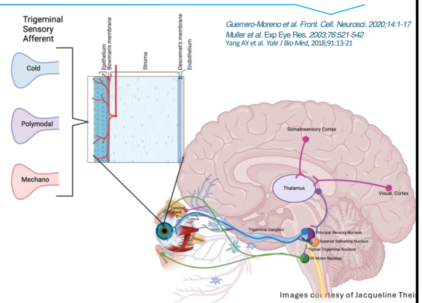
PATHOANATOMY OF PAIN

Corneal Blink Reflex – When Pain has Purpose

1) Reflexive Blink
   - Bilateral Symmetric Contraction of Orbicularis Oculi
2) Tear
   - Lacrimal Gland
   - Meibomian Glands



Guerrero-Moreno et al. *Front. Cell. Neurosci.* 2020;14:1-17
Muller et al. Exp Eye Res. 2003;76:521-542
Yang AY et al. *Yale J Bio Med*, 2018;91:13-21

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PHOTOPHOBIA

Blue Light and Circadian Rhythms

- Suprachiasmatic nuclei (SCN) of the hypothalamus = circadian pacemaker
- Input pathway
  - Light-dark cycle
  - Feeding cycles
  - Scheduled exercise
  - Social activities
- Output pathways
  - Rhythmic change in parasympathetic/sympathetic balance
  - Pineal release of melatonin during darkness
- Light suppresses melatonin in humans – strongest response from short=wavelength light 446-477nm
- Blue monochromatic light shown to be more effective than longer-wavelength light for enhancing alertness

West KE, Jablonski MR, Warfield B. Blue light from light-emitting diodes elicits a dose-dependent suppression of melatonin in humans. J Appl Physiol. 110:619-626. 2011

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COMPUTER VISION SYNDROME

Computer and Blink Rate

- Mean blink rate 19.74 +/-9.12 per min… 15-20, higher in women than men
- Mean blink rate with reading a book 11.35 +/-10.20 per min
- Mean blink rate with reading a tablet 14.93 +/-10.90 per min

Abusharha, Ali A. "Changes in blink rate and ocular symptoms during different reading tasks." *Clinical optometry* vol. 9 133-138. 20 Nov. 2017
Sforza C, Rango M, Galante D, Bresolin N, Ferrario VF. Spontaneous blinking in healthy persons: an optoelectric study of eyelid motion. Ophthalmic Physiol Opt (2008) 28(4):345–53.

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Blue Light and Circadian Rhythms

- Compared the radiation produced by smartphones that reaches the eye when using night-mode functions vs blue light reducing lenses
- To determine impact they had on visual and nonvisual (circadian) parameters to compute a melatonin suppression value (MSV)
  - Night-mode functions reduced MSV by up to 93%
    - Warmest mode produced the least suppression
  - Blue light reducing spectacles reduced melatonin suppression by 33%
    - Coated lenses more efficient than tinted lenses

Splitschan M, Lazar R, Cajochen C. Visual and non-visual properties of filters manipulating short-wavelength light. Oph & Physiol Optics. 39:2019:459-468

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PHOTOPHOBIA

Migraine and Blue Light

- Developed in England in the 1980s for fluorescent light sensitivity
- Transmission minimum is 480nm
- Wavelength of light plays a role in the degree of discomfort in Migraine
  - Short (blue) and long (red) wavelengths can be uncomfortable for migraine patients
  - 480nm is particularly triggering in migraine patients
- FL41 is helpful in patients with
  - Migraine
  - Benign Essential Blepharospasm
  - Vestibular dysfunction/migraine

Wilkins AJ, Nimmo-Smith I, Slater AI, Bedocs L. Fluorescent lighting, headaches and eyestrain. Lighting Res Technology. 1989;21:11e8
Blackburn MK, Lamb RD, Digre KB, et al. FL-41 tint improves blink frequency, light sensitivity, and functional limitations in patients with benign essential blepharospasm. Ophthalmology. 2009;116(5):997e1001
Tatsumoto M, Eda T, Ishikawa T, Ayama M, Hirata K. Light of intrinsically photosensitive retinal ganglion cell (ipRGC) causing migraine headache exacerbation. Cephalalgia. 2013;33(8 Suppl):2, (abstract OR-3).

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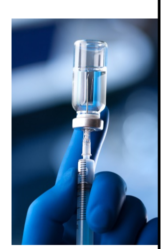
PHOTOPHOBIA

Blepharospasm

- Focal dystonia
- Involuntary, bilateral, synchronous, symmetrical contraction of orbicularis oculi muscles (preseptal and pretarsal)
- Decreased spasms and blink rate (increased eyes open) with reading and writing vs speaking
  - Occipital cortical activation may modulate orbicularis oculi spasms and blink response through the basal ganglia to reduce activity in the trigeminal blink reflex circuit
- DDx
  - Tics
  - Hemifacial spasm (unilateral, microvascular compression of facial nerve)
  - Meige syndrome (involuntary contraction of both upper and lower face)
  - Apraxia of eyelid opening (inability to open eyes)
- Tx
  - Botox
  - FL41
  - Orals: Benzodiazepines, anticholinergics, tetrabenazine, baclofen



Defazio G, Hallett M, Jinnah HA, et al. Blepharospasm 40 years later. Mov Disord 2017; 32:498–509
Ferrazzano G, Conte A, Belvisi D, et al. Writing, reading, and speaking in blepharospasm. J Neurol 2019; 266:1136–1140.

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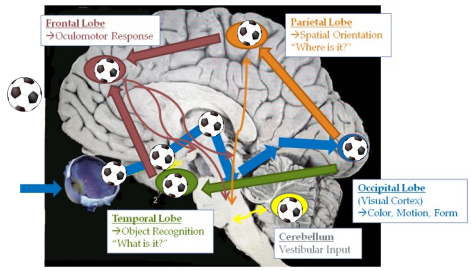
Visual Pathways in the Brain



50-70% of brain circuitry is related to vision

Vision can be impacted in many different ways after injury!

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EYE MOVEMENTS

Eye-Brain Connection

Definitions:

EYE MOVEMENT	BRAIN STRUCTURES INVOLVED
Fixational eye movements (FEMs)	Occipital Lobe Parietal Lobe Frontal Lobe Temporal Lobe Brainstem Cerebellum
Accommodation	
Saccades	
Smooth Pursuit	
Vergence	

Vergences (disconjugate) cross the eyes in and out as an object moves towards and away

Accommodation (disconjugate) each eye engages focus of the lens in the eye to clear an image as it comes towards you

Smooth pursuits (conjugate) allow us to track moving objects with our eyes

Saccades (conjugate) are large, voluntary eye movements moving from point A to point B

Vestibular-Ocular Reflex and **Opto-Kinetic Reflex** holds the image steady on the retina during head and body movement

Cervical-Ocular Reflex and **Vestibulo-Spinal Reflex** engages the cervical postural muscles to keep the head steady during eye movements and make appropriate head movements when necessary

Fixational eye movement microscopic eye movements that allow for

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CASE STUDY

Case Study: Optometric Evaluation

Afferent Visual Pathway: Normal
- Distance Visual acuity: 20/20 OD/OS with -1.25DS
- Near Visual acuity: 20/20 OD/OS with and without distance glasses
- Color Vision: normal OD/OS
- Visual Fields: Full to confrontation OU

Efferent Visual Pathway/Oculomotor evaluation: Normal

Ocular health evaluation: normal
- (-) Angle closure
- (-) Apparent optic neuropathy

Orbital palpation – even/symmetric
- (-) Exophthalmos/enophthalmos

What is causing the eye pain?

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DIFFERENTIAL DIAGNOSIS OF EYE PAIN

The Proparacaine Challenge

- Central vs Peripheral Pain
  - 0.5% proparacaine will attenuate peripheral corneal pain but not central pain or referred cervicogenic pain
  - Rules in/out nociceptive pain

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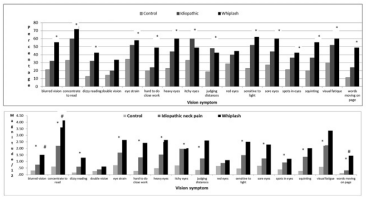
CERVICOGENIC EYE PAIN

Visual Symptoms in Neck Pain/ Whiplash Injury

50 % of patients with whiplash assoc. disorders complain of vision problems
- Concentration problems during reading ~70%
- Light sensitivity ~ 58.6%
- Visual Fatigue
- Eye strain

Severity is higher in traumatic neck pain patients than non-traumatic neck pain patients



Treleaven J, Takasaki H. Characteristics of visual disturbances reported by subjects with neck pain. Man Ther. 2014 Jun;19(3):203-7. doi: 10.1016/j.math.2014.01.005. Epub 2014 Jan 27. PMID: 24521926.

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CERVICOGENIC EYE PAIN

Common Patients Complaints with Neck Problems

"I can't look at a screen for more than 10 minutes"

"My eyes feel tired and blurry"

"I get dizzy when I scroll or move my head"

"Work takes twice as long and gives me a headache"

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CERVICOGENIC EYE PAIN

Can We Rely on Just Symptom Reporting To Determine Which Individuals Need a Cervical Screen?

Symptoms are evenly distributed between Concussion and Concussion + Cervical	In Concussion + Cervical	Persistent Symptoms
• Dizziness • Headache • Cognitive • Mood	• Only 56% % neck pain • Only 38% % neck stiffness • 28% % neither	• More likely to have cervical involvement and when treated, symptoms improve

Kennedy, Ewan, et al. "Clinical Characteristics and Outcomes of Treatment of the Cervical Spine in Patients with Persistent Post-Concussion Symptoms: A Retrospective Analysis." *Musculoskeletal Science and Practice*, vol. 29, 2017, pp. 91–98.,
Leddy, John J., et al. "Brain or Strain? Symptoms Alone Do Not Distinguish Physiologic Concussion from Cervical/Vestibular Injury." *Clinical Journal of Sport Medicine*, vol. 25, no. 3, 2015, pp. 237–242.,

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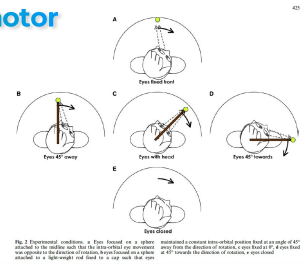
CERVICAL OCULOMOTOR CONNECTION

Cervical-Oculomotor Connection



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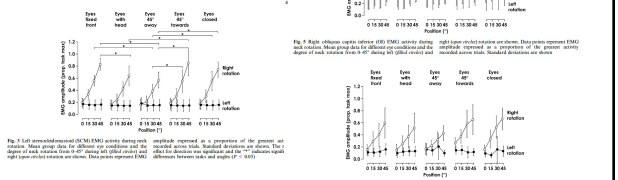
CERVICAL OCULOMOTOR CONNECTION

Cervical-Oculomotor Connection



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CERVICOGENIC REFERRED EYE PAIN

Is it the Neck?

Structures of the upper cervical spine can refer pain up into the face including behind the eye and around the eye.

- Facets (Joints)
- Ligaments
- Muscles
- Nerves

Slide courtesy of Sara Etheredge, DPT

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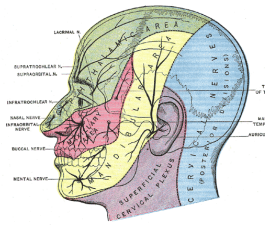
PATHOANATOMY

Is it the Neck? Pathophysiology



Nerves from the cervical spine converge onto the trigeminocervical nucleus along with the trigeminal nerve, which shares pathoanatomy with the eye patterns

Slide courtesy of Sara Etheredge, DPT

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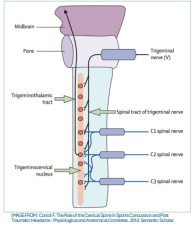
PATHOANATOMY

Pathophysiology



- Most studies support this theory for C3 and above, however, anastomosis between the spinocervicothalamic tract and the TCN may provide an avenue for lower cervical levels to refer along the trigeminal nerve.

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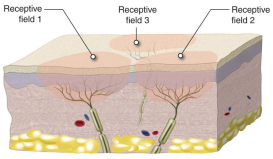
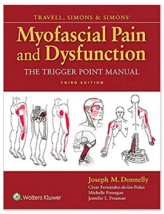
PATHOANATOMY

Chronification

The longer someone has been in pain, pain referral patterns can change and diverge from "textbook"





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CERVICOGENIC EVALUATION

PT Evaluation: Subjective Information

- Neck pain/stiffness
- History of car accident or fall or trauma (assault, brain injury/concussion, sports injury, hit to the head by falling object or hit head on an object - stand up too quickly and hit their head)
- Headache history (sinus, migraines, tension-type)
- Recent increase stress levels
- Change in ergonomics/activities

Slide courtesy of Sara Etheredge, DPT

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CERVICOGENIC EVALUATION

PT Evaluation: Subjective Information

- Pain descriptors - sharp/stabbing, burning, aching, throbbing, hot, pressure, lightening, electricity, intense Feel better in standing
- Feel like they needs to move around or adjust their positioning while at the desk
- Feels worse with prolonged sitting/driving/schoolwork or desk work
- Head feels "heavy"
- History of "Hypermobility"
  - Connective tissue disorders, Ehlers Danlos Syndrome

Slide courtesy of Sara Etheredge, DPT

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CERVICOGENIC EVALUATION

Quick Cervical Screen

- Review subjective information for RED flags
- Check cervical range of motion
- Have patient self-palpate neck muscles
  - Any change in symptoms when patient applies pressure to specific muscles
    - Side by side pictures of which neck muscles to consider

Slide courtesy of Sara Etheredge, DPT

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CERVICOGENIC EVALUATION

Red Flags: SNOOP

S: Systemic symptoms or illness:
- Fever • Weight loss • Pregnancy • Cancer

N: Neurologic symptoms or signs:
- Clumsiness • Visual problems • Aphasia • Weakness • Confusion

O: Onset recent or sudden
- Thunderclap • Positional • Progressive

O: Onset after age 40 years:
- vascular • infection • tumor

P: Pattern Change:
- Prior headache history that is different

Slide courtesy of Sara Etheredge, DPT

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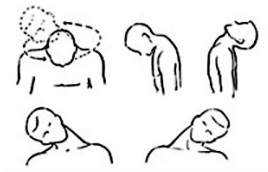
CERVICAL EVALUATION

Cervical Range of Motion

- Movement is smooth
- No pain or stiffness
- Range is normal
  - Can look over each shoulder
  - Chin to chest / forehead parallel with ceiling



Neck Exercise

Slide courtesy of Sara Etheredge, DPT

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CERVICAL EVALUATION

Palpate Muscles

- Sternocleidomastoid
- Upper Trapezius
- Temporalis
- Suboccipitals
- Occipito-frontalis
- Splenius cervicis/capitis

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CERVICOGENIC EVALUATION

Sternocleidomastoid Muscle

Referral Pattern:

- **Forehead**
- **Over and above the eye**
- **Side of face**
- **In the ear**
- **Top of head**
- **Back of head**
- **Tip of jaw**

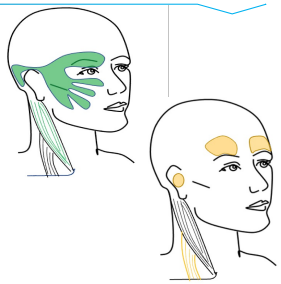

Image Courtesy of Jacqueline Theis

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CERVICOGENIC EVALUATION

Upper Trapezius Muscle

Referral Pattern:

- **Over the eye**
- **Temple**
- **Side of neck**
- **Back of head**

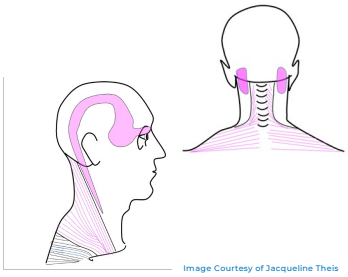

Image Courtesy of Jacqueline Theis

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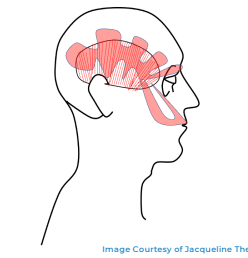
CERVICOGENIC EVALUATION

Temporalis

Referral Pattern:

- **Behind eye**
- **Temple**
- **Above eyebrow**
- **Upper jaw tooth pain**



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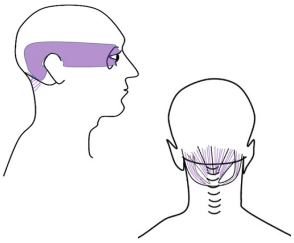
CERVICOGENIC EVALUATION

Suboccipitals



Referral Pattern:

- **From the occiput toward the orbit**
- **From the eye to the back of the head**

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CERVICOGENIC EVALUATION

Occipito-Frontalis

Referral Pattern:

- **Deep eye pain**
- **Back of head**
- **Forehead**
- **Behind the eye**
- **Eyelid**

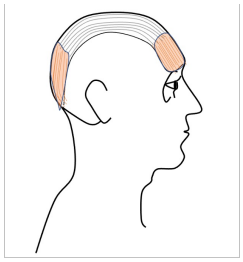

Image Courtesy of Jacqueline Theis

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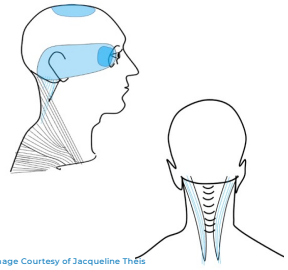
CERVICOGENIC EVALUATION

Splenius Cervicis



Referral Pattern
- Nape of neck
- Behind eye
- Side of head
- Occiput

Image Courtesy of Jacqueline Theis

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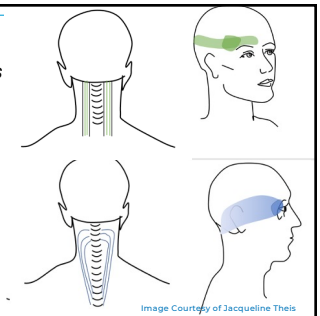
CERVICOGENIC EVALUATION

Semispinalis Cervicis and Capitis



Referral Pattern
- Band feeling
- Head in a vice
- Posterior Occiput
- Above the eye

Image Courtesy of Jacqueline Theis

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CERVICOGENIC EVALUATION

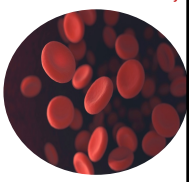
Eye Pain in the Quiet Eye: Other Structures/Honorable Mentions

Muscle & Joint

Dental

Nerves

Vascular & Inflammatory



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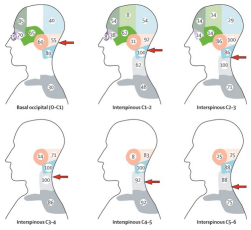
CERVICOGENIC EVALUATION

Facet Referral Patterns



Slide courtesy of Sara Etheredge, DPT

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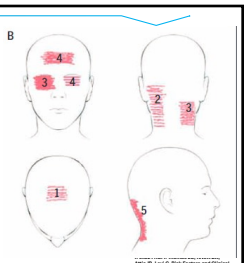
DIFFERENTIAL DIAGNOSIS

Vascular Considerations

- Cervical/Carotid Artery Occlusions/Dissection
  - Ocular signs/symptoms
    - Acquired Horner's Syndrome
    - Ocular Ischemic Syndrome
    - Amaurosis fugax
  - Risk Factors
    - Hypertension/Atherosclerosis
    - Smoking
    - Oral contraceptive use
    - Elevated homocysteine
    - Pregnancy/Postpartum
    - Connective Tissue Disorders – Ehlers Danlos, Fibromuscular Dysplasia
    - Recent h/o of neck trauma



Silbert PL 1995., Keser Z 2022., Long B 2023

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NEURITIC/NEURALGIC PAIN

Referred Nerve Pain

- Supratrochlear Nerve
- Supraorbital Nerves

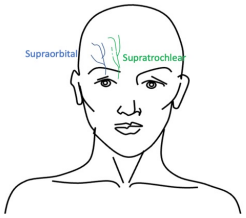

Image Courtesy of Jacqueline Theis

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NEURITIC/NEURALGIC PAIN

Referred Nerve Pain: Greater and Lesser Occipital Nerves

- Location of Pain:
  - Back of head
  - Neck
  - Scalp
  - Forehead
  - BEHIND THE EYES
- Type of Pain:
  - Burning, hot, electric like, intense, stabbing, brief or chronic

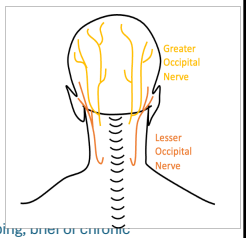

Image Courtesy of Jacqueline Theis

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NEURITIC/NEURALGIC PAIN

Occipital Neuralgia

Headache caused by irritation to the greater or lesser occipital nerve

- Additional Symptoms:
  - vision impairment/ocular pain (67%)
  - tinnitus (33%)
  - dizziness (50%)
  - nausea (50%)
  - congested nose (17%)

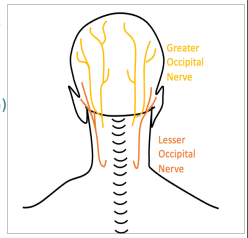

Image Courtesy of Jacqueline Theis

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Occipital Neuralgia

(+) Pillow Sign:
Pain elicited with lying on a pillow in supine with hyperextension or rotation of the head

When To Consider:
•Migraine
•Neck trauma
•Descriptor of pain

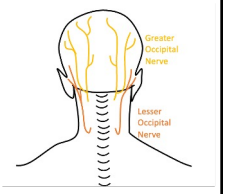

Image Courtesy of Jacqueline Theis

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PAIN MODIFIERS

How's Your Sleep?

- How many hours do you sleep?
- What position do you sleep in?
  - Why do you sleep in this position?
- Do you have to avoid certain positions when you sleep?
- Do you wake up with headaches or from headaches?
  - Occipital Neuralgia, Cervicogenic pain, Increased intracranial pressure, Sleep Apnea, Bruxism

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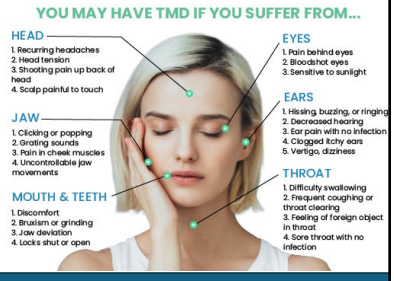
REFERRED PAIN

Temporomandibular Joint Dysfunction



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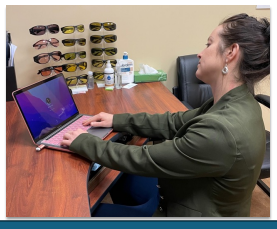
CASE STUDY

Optometric Evaluation of Patient Ergonomics

- Patient is 6'2"
- Desk: 4 feet away
- Chair: regular but likes to lay back
  - Myopia who takes his glasses off ~ 50cm working distance
  - Forward head position



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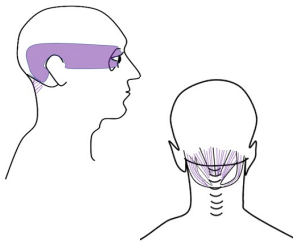
CERVICOGENIC EVALUATION

Suboccipitals



Referral Pattern:

From the occiput toward the orbit

From the eye to the back of the head

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CASE STUDY

Management

1. We need to get the neck/ergonomics fixed first and figure what workstation works for them

2. Follow back with optometry once settled, to determine working distance

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Prescribing Pearls

- Problems with Progressives
  - Exacerbate Vestibular Dizziness
  - Exacerbates Cervicogenic Dizziness/Headache
  - Does not fix asymmetric traumatic accommodative dysfunction

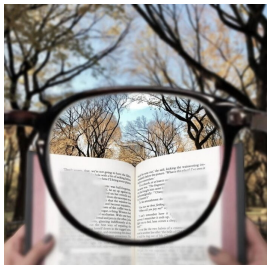

Image from https://cdn.shopify.com/s/files/1/0601/5415/1102/files/proressive-lenses-700x698.jpg

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Can We Rely on Just Symptom Reporting To Determine Which Individuals Need a Cervical Screen?

Symptoms are evenly distributed between Concussion and Concussion + Cervical	In Concussion + Cervical	Persistent Symptoms
• Dizziness • Headache • Cognitive • Mood	• Only 56% % neck pain • Only 38% % neck stiffness • 28% % neither	• More likely to have cervical involvement and when treated, symptoms improve

Kennedy, Ewan, et al. "Clinical Characteristics and Outcomes of Treatment of the Cervical Spine in Patients with Persistent Post-Concussion Symptoms: A Retrospective Analysis." *Musculoskeletal Science and Practice*, vol. 29, 2017, pp. 91–98.,

Leddy, John J., et al. "Brain or Strain? Symptoms Alone Do Not Distinguish Physiologic Concussion from Cervical/Vestibular Injury." *Clinical Journal of Sport Medicine*, vol. 25, no. 3, 2015, pp. 237–242.,

Slide courtesy of Sara Etheredge DPT

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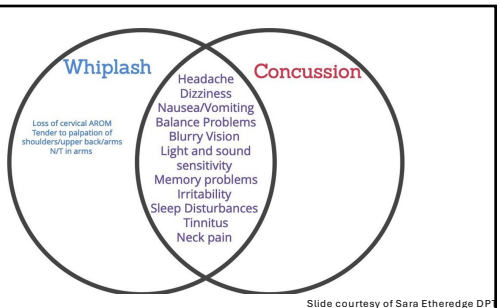

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Prevalence of Cervical Spine Injury + Concussion

- **In Pediatrics:**
  - 32.5% of those referred to a tertiary care center for concussion or suspected concussion also had cervical spine dysfunction
- **In Pediatrics and Adults:**
  - 9-13% of those presenting to the ED also had a neck injury
  - Neck injury was 2.89 times more prevalent in MVC related concussions
  - Neck injury was more prevalent in females 5 - 49 yo for all types of related concussion

Ellis, Michael J., et al. "Cervical Spine Dysfunction Following Pediatric Sports-Related Head Trauma." *Journal of Head Trauma Rehabilitation*, vol. 34, no. 2, 2019, pp. 103–110., https://doi.org/10.1097/htr.0000000000000411.

Sutton, Mitchell, et al. "Neck Injury Comorbidity in Concussion-Related Emergency Department Visits: A Population-Based Study of Sex Differences across the Life Span." *Journal of Women's Health*, vol. 28, no. 4, 2019, pp. 473–482., https://doi.org/10.1089/jwh.2018.7282

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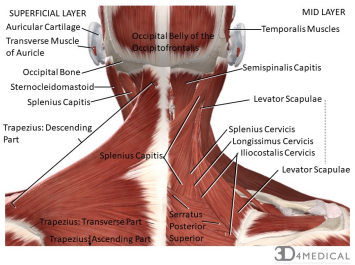
Cervicogenic PT Referrals

Best interventions:
- Dry needling + manipulations (intensity and duration)
- MET + Exercise (intensity)
- Soft Tissue Work + exercise (intensity)
- Dry needling + exercise (frequency)



Jung, A., Carvalho, G. F., Szikszay, T. M., Pawlowsky, V., Gabler, T., Luedtke, K. (2023). Physical Therapist Interventions to Reduce Headache Intensity, Frequency, and Duration in Patients with Cervicogenic Headache: A Systematic Review and Network Meta-Analysis. *Physical Therapy*. https://doi.org/10.1093/ptj/pzad154

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How to Avoid Tech-Neck: Workstation Ergonomics

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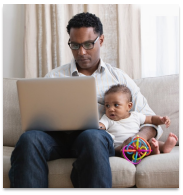
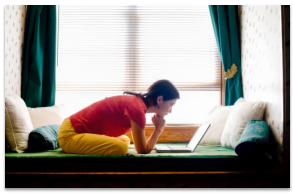
Pandemic Ergonomics





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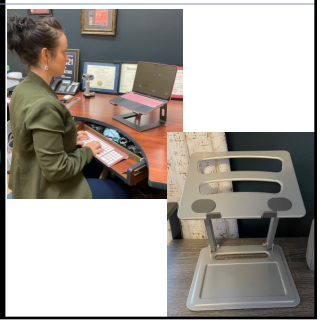
How to Avoid Tech-Neck: Workstation Ergonomics

<u>Seated ergonomics</u>
- Screen height and distance
  - Top edge of screen is at eye level
  - Working distance:
    - 20-40 inches (50-100cm)



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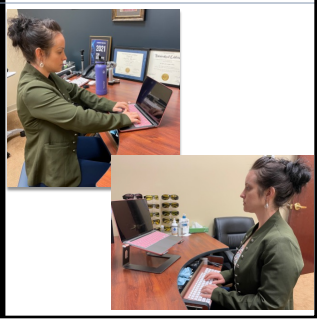
How to Avoid Tech-Neck: Workstation Ergonomics

- Wrists should be slightly below level of elbow when typing
- When acutely flared, recommend take a break every 20 minutes ...from typing
- Chair arm rest should be supporting elbows
  - For smaller/slender body types, most armrests are too wide
  - Get a better chair



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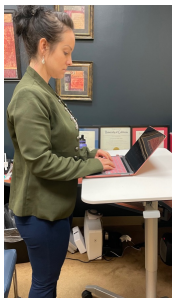
Standing Desks Are Not Perfect Either



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How to Avoid TechNeck: Workstation Ergonomics

Standing Ergonomics

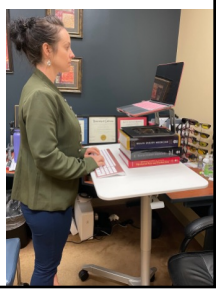
Desk height

- Make sure wrist are not above elbows when typing

Use a stool if issues with low back pain

- Alternate which foot is propped up on stool

https://www.osha.gov/etools/computer-workstations/checklists
https://www.aoa.org/healthy-eyes/eye-and-vision-conditions/computer-vision-syndrome?sso=y



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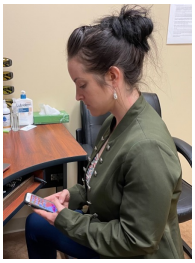
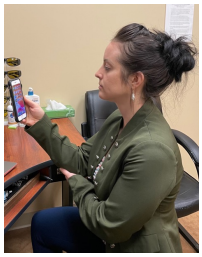
And then of course….





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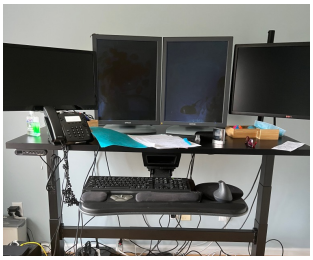
Desk Setup Considerations from the optometric perspective: Bigger Isn't Always Better



Number of screens

- Different setups for laptop vs desktop
- Multiple screens 2 vs 3 vs 4
- Mobility considerations
  - Working space considerations for patients in wheel chairs

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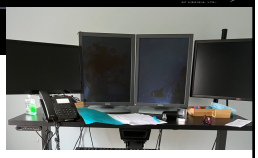
Refractive Considerations



- Progressives
  - Can cause chin tilt up vs down to attain add needed for workstation
  - Forcing reading into downgaze may exacerbate cervicogenic eye pain
- Inappropriate near add and working distance
  - Too low - patient moves head forward for distance magnification effect
  - Too high - patient moves head forward to attain working distance of lens

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Thank you! Questions?

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