



NEUROSENSORY MISA “LYME” MENT

FUNCTIONAL VISION ASSESSMENT AND REHABILITATION IN NEUROLOGICAL LYME DISEASE

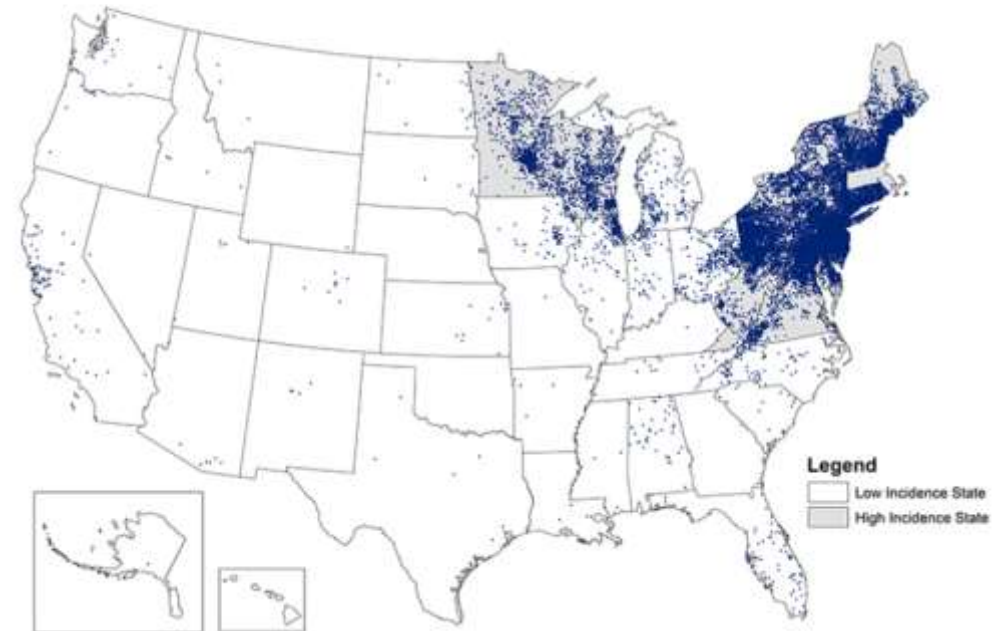
KRASKIN INVITATIONAL SKEFFINGTON SYMPOSIUM
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JENNIFER ZHANG, OD

LYME DISEASE

- Systemic infection caused by *Borrelia burgdorferi*
- 30,000 reported cases per year (USA)
- Estimated 476,000 cases per year (USA)
- Early signs and symptoms:
 - Fever, chills, flu-like symptoms
 - “Bullseye” rash
- Treated with systemic antibiotics
 - Penicillin/Amoxicillin
 - Doxycycline
 - Ceftriaxone

Reported Cases of Lyme Disease — United States, 2019



<https://www.cdc.gov/lyme/datasurveillance/maps-recent.html>

NEUROLOGIC LYME DISEASE

- Chronic systemic inflammation
- Affects 15% of patients
- Affects vision and sensory processing
- Ineffectively managed by antibiotics

VISUAL SYMPTOMS

- Blur
- Diplopia
- Visual fatigue
- Headaches
- Photophobia
- Losing place when reading
- Overwhelmed by busy visual environments

SENSORY SYMPTOMS

- Disequilibrium
- Poor spatial orientation
- Poor memory
- Decreased comprehension/cognition

CASE 1: PATIENT EE

- 47 y.o. female
- Chief complaints:
 - OD vision “feels off” x several months
 - Vague “fog in the middle of my right eye”, worse with headlights
 - Disorientation, “I don’t know where I am in space”
- Diagnosed with Lyme disease 1.5 years ago
 - Ceftriaxone Tx for 6 months; d/c 2’2 liver and kidney toxicity
- Hx environmental mold exposure – elevated blood mycotoxin

CONCUSSION SYMPTOM CHECKLIST

VISUAL SYMPTOMS	SENSORY SYMPTOMS
<ul style="list-style-type: none">- Blur OD>OS- Closing or covering an eye when reading- Poor reading comprehension or declining comprehension as the day goes on- Visual work getting harder at the end of the day- Dizziness or nausea after 30-45 minutes of near work	<ul style="list-style-type: none">- Light and sound sensitivity- Poor ability to judge distances - worsening- Poor eye-hand coordination- Clumsiness/prone to knocking things over- Car/motion sickness when riding as a passenger- History of vertigo/disorientation (improved s/p Lyme treatment)

REFRACTIVE FINDINGS

TEST	FINDING
Entering distance acuity (sc)	OD: 20/20-I OS: 20/25 OU: 20/20-I
Subjective refraction (distance)	OD: -0.50 sph (20/20) OS: -0.50 -0.75 x045 (20/20)
Binocular balance	OD: pl sph OS: pl sph
Subjective refraction (near)	OD: +0.75 sph (20/20) OS: +0.75 sph (20/20) OU: 20/20

REFRACTIVE FINDINGS

TEST	FINDING	SUBJECTIVE RESPONSE
Entering distance acuity (sc)	OD: 20/20-I OS: 20/25 OU: 20/20-I	Slow, strenuous
Subjective refraction (distance)	OD: -0.50 sph (20/20) OS: -0.50 -0.75 x045 (20/20)	Feels like “eyes are being squeezed”
Binocular balance	OD: pl sph OS: pl sph	“Blurry but calmed”
Subjective refraction (near)	OD: +0.75 sph (20/20) OS: +0.75 sph (20/20) OU: 20/20	OD: “hazy” OS: “feels like eyes are squeezing”

BINOCULAR VISION

TEST	FINDING	SUBJECTIVE RESPONSE
Cover test/Maddox Rod	D: ortho N: 6 ^Δ XP, 1 ^Δ R hyper	
Von Graefe	D: 4 ^Δ XP N: 7 ^Δ XP, 3 ^Δ R hyper	
NPC (break/recovery)	3 ³ / ₄ "	Significant visual discomfort
Smooth vergences (distance)	BO: x/6/2 BI: x/6/4	
Smooth vergences (near)	BO: x/20/2 BI: 16/20/16	
NRA/PRA	+2.00/-2.00	Significant strain, "squeezing feeling"
Stereopsis (Randot I)	125 arcsec	

CLINICAL MANAGEMENT - VT

- Goals:
 - Gain an understanding of visual world and visual symptoms
 - Gain more visual control
 - Integrate vestibular and other sensory system
- Initial part of VT
 - Basic accommodative, vergence, oculomotor skills
 - Visual-spatial activities, yoked prism
- Integrative activities
 - Infinity walk
 - Walking rail
 - Balance board
 - VOR

CASE 2: PATIENT DL

- 37 y.o. female, referred from Wilmer Eye for sensorimotor assessment
- Chief complaints:
 - Distance blur OS>OD
 - Headaches
 - Painful, tired eyes
 - “Misaligned vision”
 - “I have lost confidence in my eyes”; “My eyes make me feel vulnerable”
 - “Out-of-body experience”
- Symptoms x 6 years; no effective treatment
- No diagnosis at time of presentation

CONCUSSION SYMPTOM CHECKLIST

VISUAL SYMPTOMS

- Blur OS>OD
- Closing or covering an eye when reading
- Poor reading attention
- Poor reading comprehension or declining comprehension as the day goes on
- Avoiding near work

SENSORY SYMPTOMS

- Light and sound sensitivity
- Poor ability to judge distances
- Clumsiness/ accident-prone
- Motion sickness
- Poor memory

REFRACTIVE AND BINOCULAR FINDINGS

TEST	FINDINGS
Subjective refraction/ BB(distance)	OD: -4.00 sph (20/20) OS: -4.00 sph (20/20)
Subjective refraction (near)	OD: pl sph (20/20) OS: pl sph (20/20)
Cover test/Maddox Rod	D: 1-2 [^] XP N: 12-14 [^] IAXT
Von Graefe	D: 3 [^] EP, 2 [^] R hyper N: 5 [^] XP, 1 [^] R hyper
NPC (break/recovery)	12"/ 18"
Smooth vergences (distance)	BO: 6/20/8 BI: x/6/-2
Smooth vergences (near)	BO: 12/30/6 BI: x/28/6
NRA/PRA	+0.75/-3.00
Stereopsis (Randot I)	200 arcsec

CLINICAL MANAGEMENT - VT

- Goals:
 - “Have better spatial awareness of my body in space and my relationship to other people/objects”
 - “Feel less out-of-body”
 - “Gain back confidence I have lost at work because navigating visual stimuli is so challenging for me”
- VT activities
 - Accommodative and vergence – strengthen binocularity, central fusion
 - Movement exercises; changing visual environments – central-peripheral integration; vestibular integration

3 MONTHS LATER...

- Improved stereopsis (200" → 25")
- Improved NPC (12"/18" → TTN)
- Improved BI and BO vergence ranges
- Improved automaticity in DEM

- Better able to read road signs while driving
- More confidence with spatial activities

NEXT STEPS

- Continue VT
 - Binocular stability
 - Central-peripheral integration
 - Movement and localization
- Systemic Lyme treatment

LYME DISEASE AS AN ABI

- Acquired Brain Injury (ABI)
 - “Conditions that appear suddenly and result in neurological dysfunction” (Suchoff, Kapoor, and Ciuffreda 2001)
 - External vs Internal
 - Treating neurological Lyme as an internal ABI – functional approach to rehabilitation

VISUAL SEQUELAE OF ABI

- Visual field loss
- Eye movement dysfunctions
- Ocular muscle dysfunctions (ex. strabismus)
- Binocular dysfunctions (ex. CI, exophoria, vertical phoria, fusional instability)
- Accommodative dysfunctions
- Perceptual dysfunctions (ex. contrast sensitivity, body image, spatial relationships, visual disturbances)
- Visually-involved vestibular dysfunctions (ex. vertigo, disequilibrium)

SINGLE, CLEAR, AND COMFORTABLE VISION

- Binocular instability causes visual stress
 - Attention is a limited resource
- Binocular dysfunction reduces fixation speed and visual stability
 - Slower processing
 - Busy visual environments are overwhelming

THE VESTIBULAR SENSE

- Vestibular and visual systems are parallel!
- Vestibular sense = feeling “grounded”; allows body to sense orientation in space
- Spatial processing; central-peripheral integration

UNDERSTANDING AND EMPATHY

- Revisiting patient history:
- Patient EE:
 - “I feel *off*”
 - “I don’t know where I am in space”
- Patient DL:
 - “I have lost confidence in my eyes”
 - “My eyes make me feel vulnerable”
- Vision rehab is not the only treatment, but a core part of the process

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THANK YOU!

