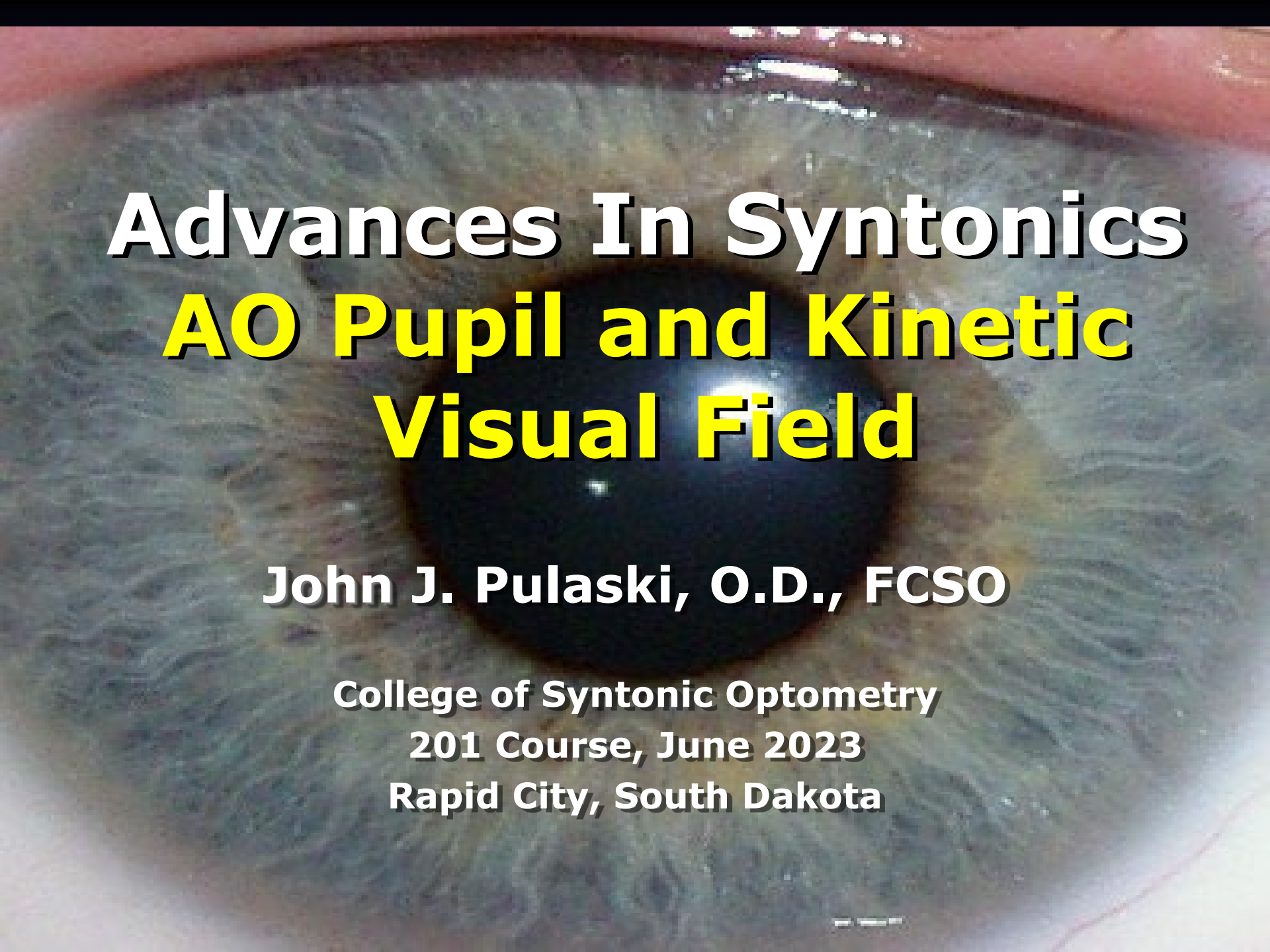


Advances In Syntonics
AO Pupil and Kinetic Visual Field

John J. Pulaski, O.D., FCSO

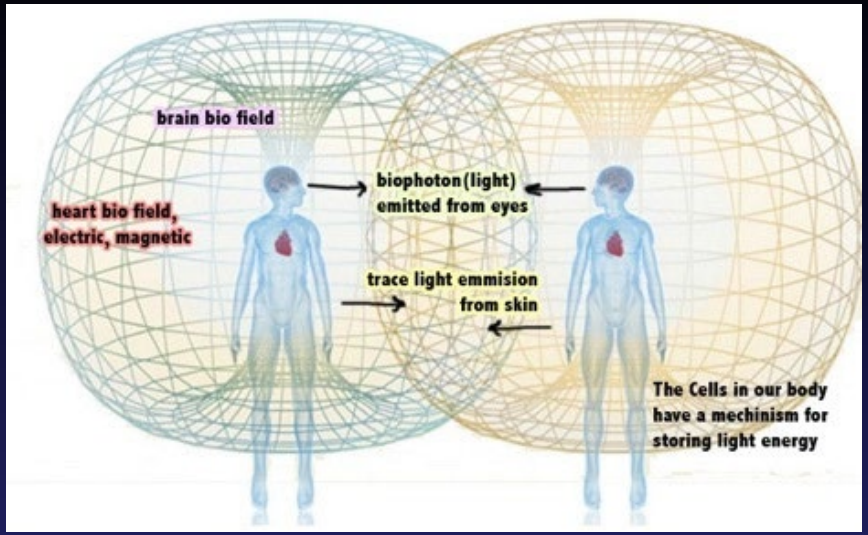
College of Syntonic Optometry

201 Course, June 2023

Rapid City, South Dakota

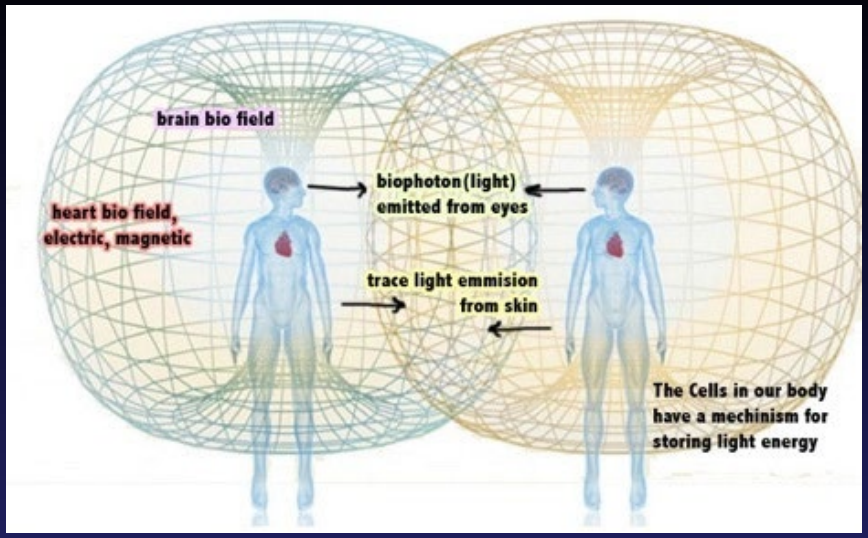
The Kinetic Field
Normal vs Abnormal

The Syntonic Visual Field



Fritz Popp, a German physicist and inventor of the biophoton theory described the biophoton field that surrounds living organisms as being highly complex, self-tuneable, oscillating fields of energy. This ‘field’ regulates and controls all our life processes. When we plot colour visual fields, we are measuring information that the brain receives from the eyes and the eyes receive from the ‘field’. In the same way as we emit a spectrographic pattern of our electromagnetic field, we can plot colour emanation from the brain. This colour visual field then describes the emergent biophoton field of a human being.

The Syntonic Visual Field



In measuring the Kinetic Field several things are unique that require more complex brain processing.

1. We have a moving target – “peripheral tracking”
2. We have to identify a specific aspect or quality of that target.
3. We are asked to identify the color of the moving target.

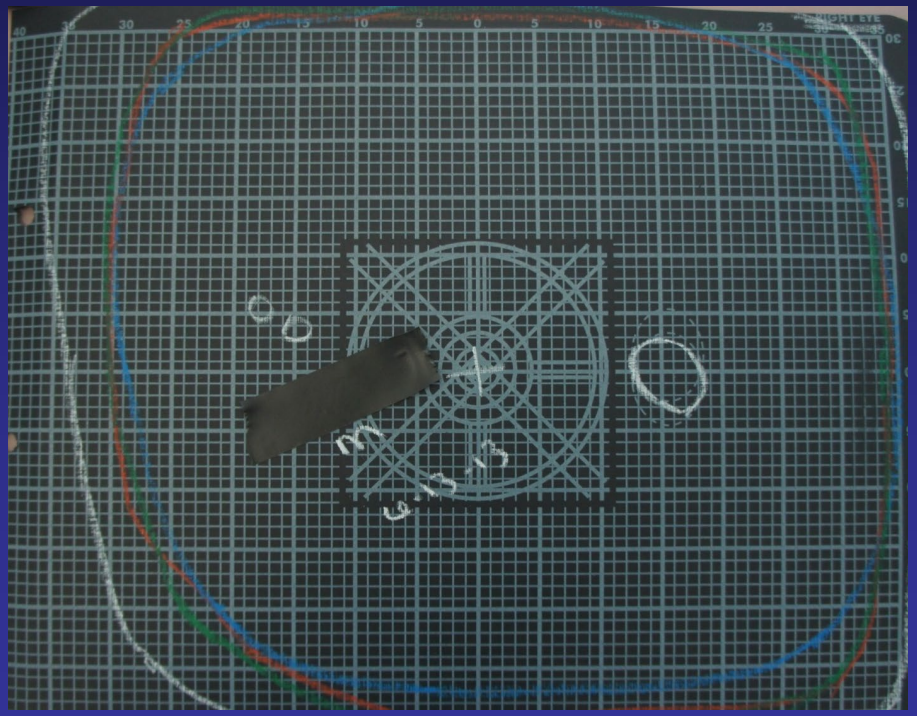
Norms for Kinetic Visual Fields

Campimetric College Unit

Pulaski

White

Superior	**34˚**
Superior Temporal	**42˚**
Temporal	**38˚**
Inferior Temporal	**42˚**
Inferior	**32˚**
Inferior Nasal	**36˚**
Nasal	**38˚**
Superior Nasal	**40**



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Norms for Visual Fields

Borish

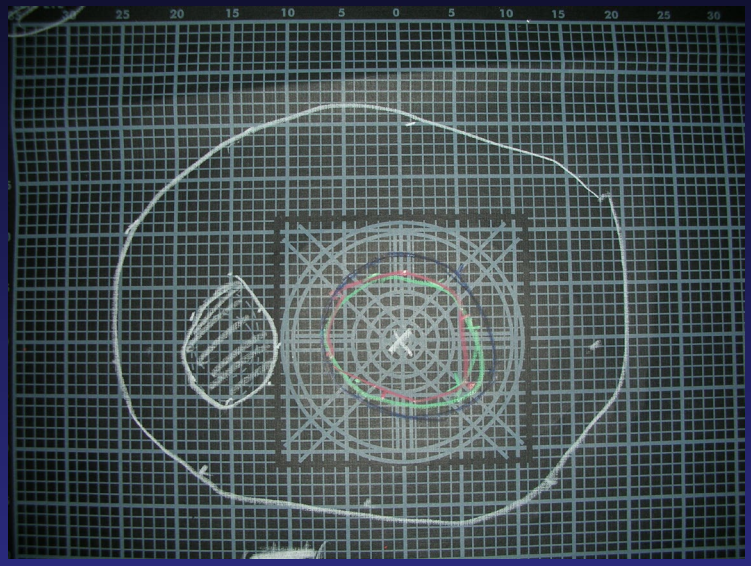
Clinical Refraction 3rd Edition

	White (form)	Blue	Red	Green
Out:	100^0	75^0	41^0	30^0
In:	60^0	38^0	23^0	18^0
Up:	60^0	38^0	26^0	18^0
Down:	80^0	46^0	29^0	24^0

The Kinetic Field

Blind Spot

- The blind spot size is likely the most important indicator of spatial compression that in turn relates to the accuracy of spatial judgments.
- In Syntonic treatment normalizing the blind spot and expanding the field is key to restore optimum visual functioning.
- Normalization is also key in preventing regression.

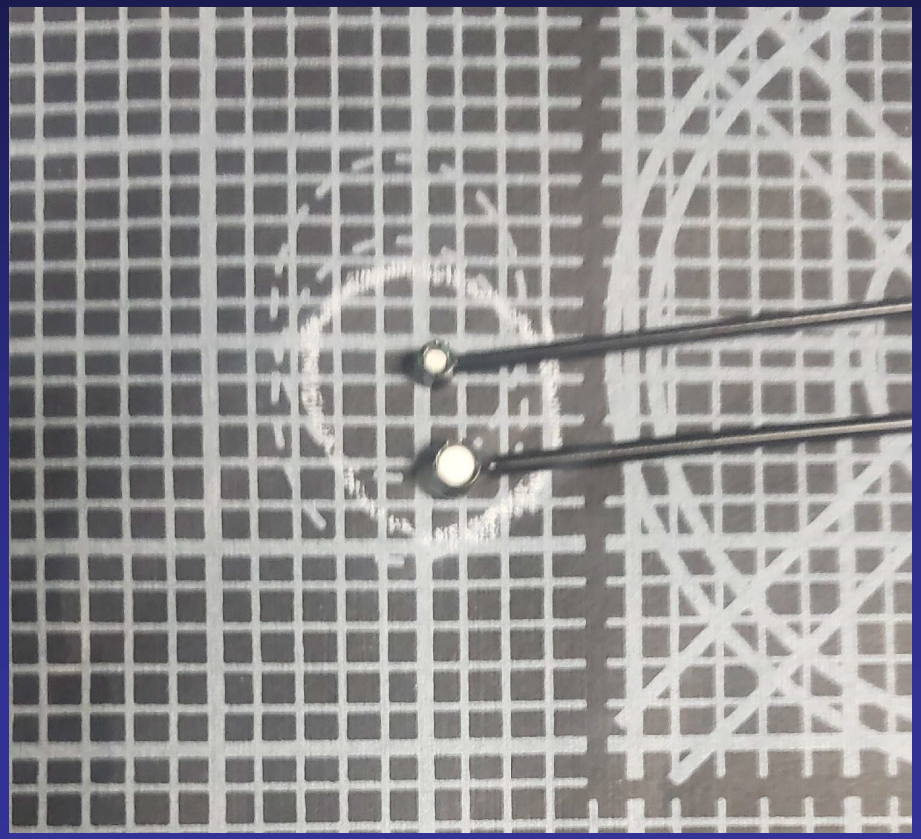


Pulaski AO Pupil

The Kinetic Field

Blind Spot

- Plotting the blind spot should include 8 points and be done slowly and exactly.
- Best done with ½ degree target
- Start target in blind spot without any explanation of what measuring and ask when they see white.

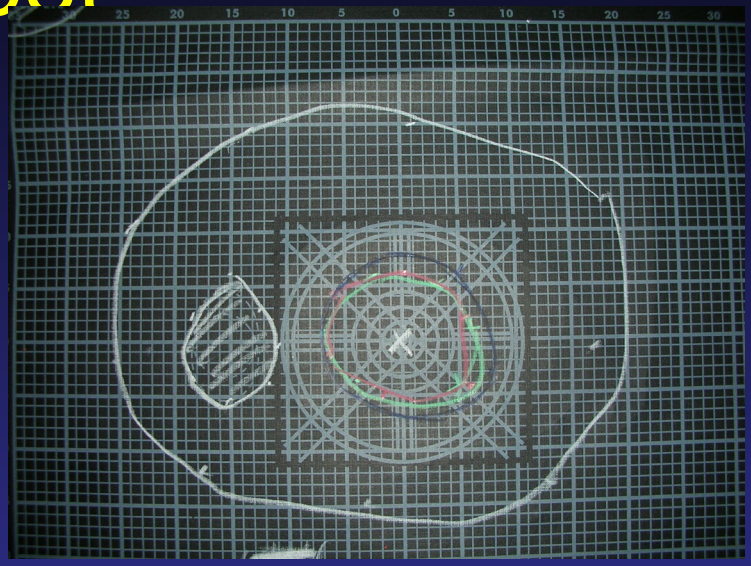


Pulaski AO Pupil

The Kinetic Field

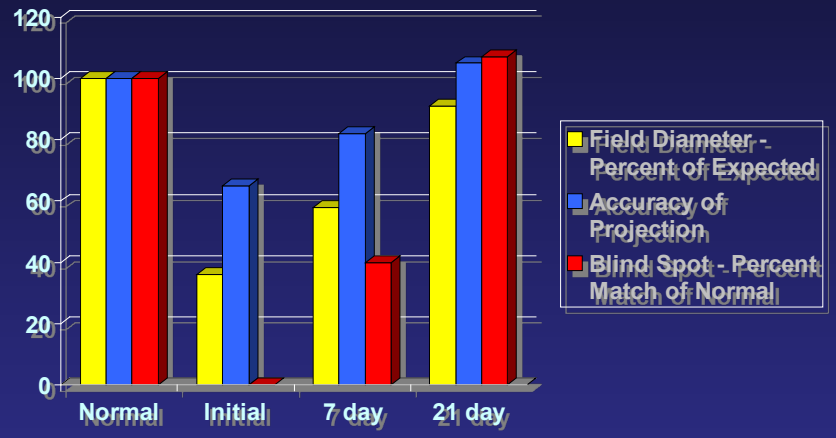
Blind Spot

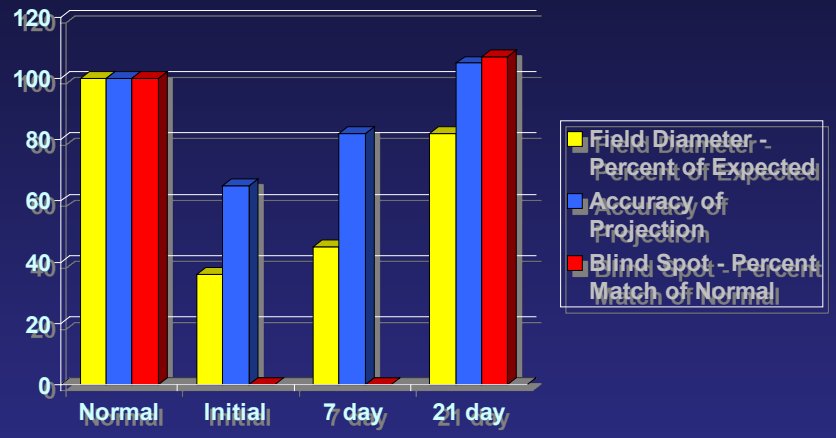
- In fully opened field the blind spot is usually smaller than expected.
- If fields are normal in size but blind spot is enlarged, results will not hold unless the blind spot is normal size.

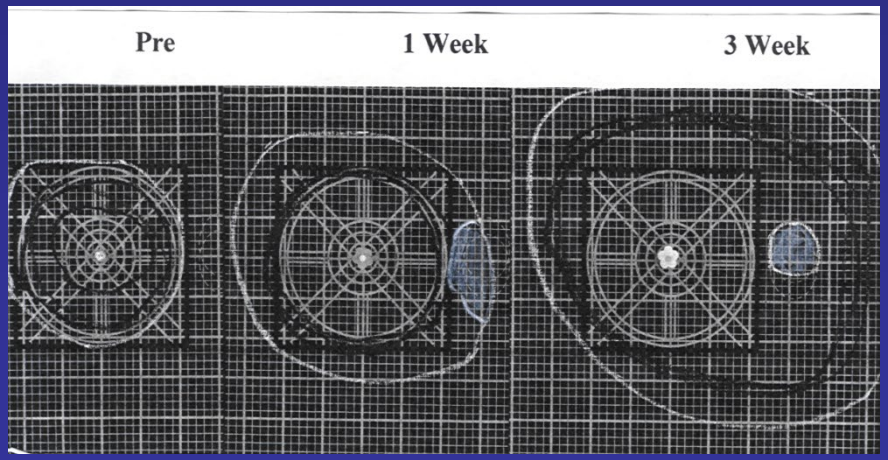


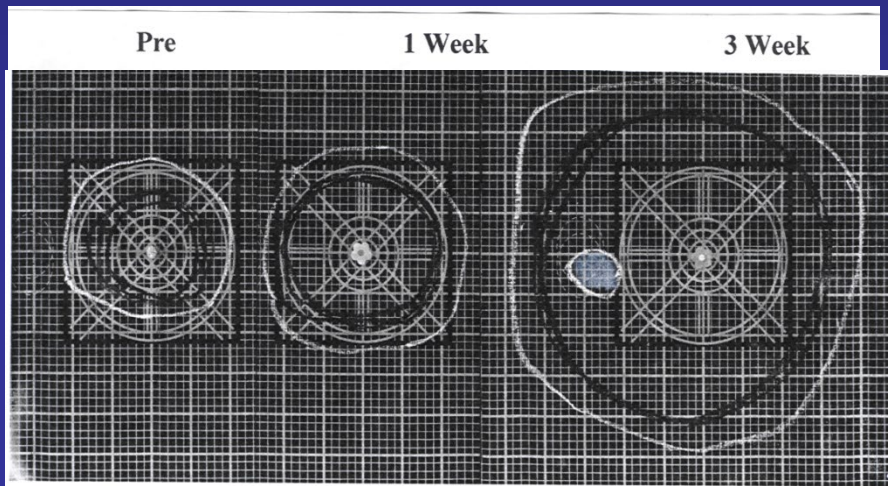
Change in Projection, Field, Blind Spot with Syntonic Light Therapy

Case 1 Stephanie - OU









The Kinetic Field
Normal

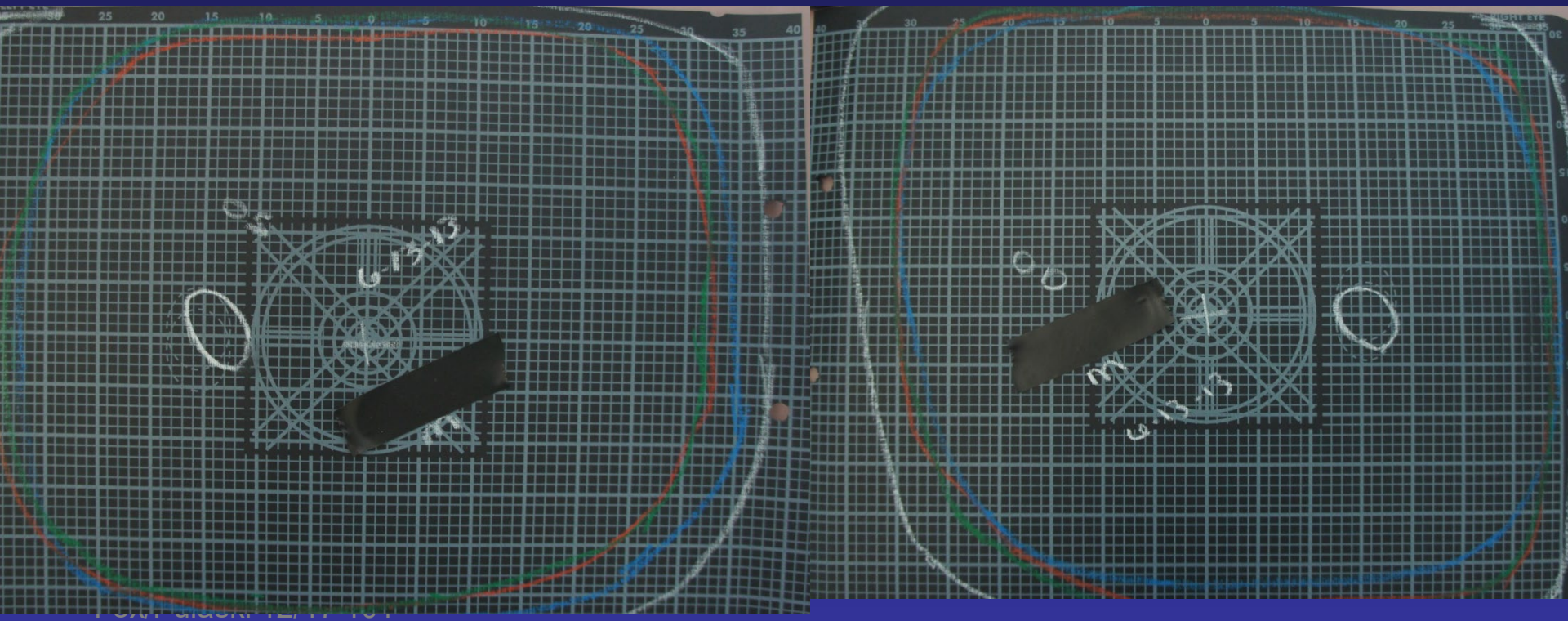
The Largest Fields in general

1. Hockey Players
2. Skaters
3. Pilots
4. Excellent Athletes

The Kinetic Field

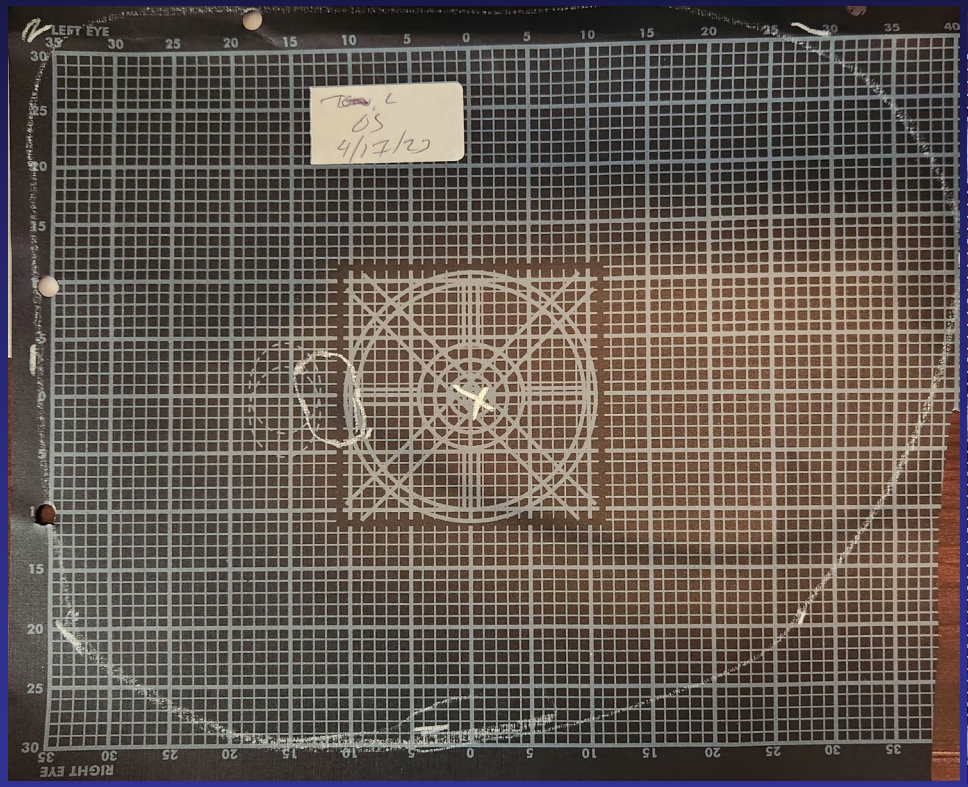
The Nomal Field

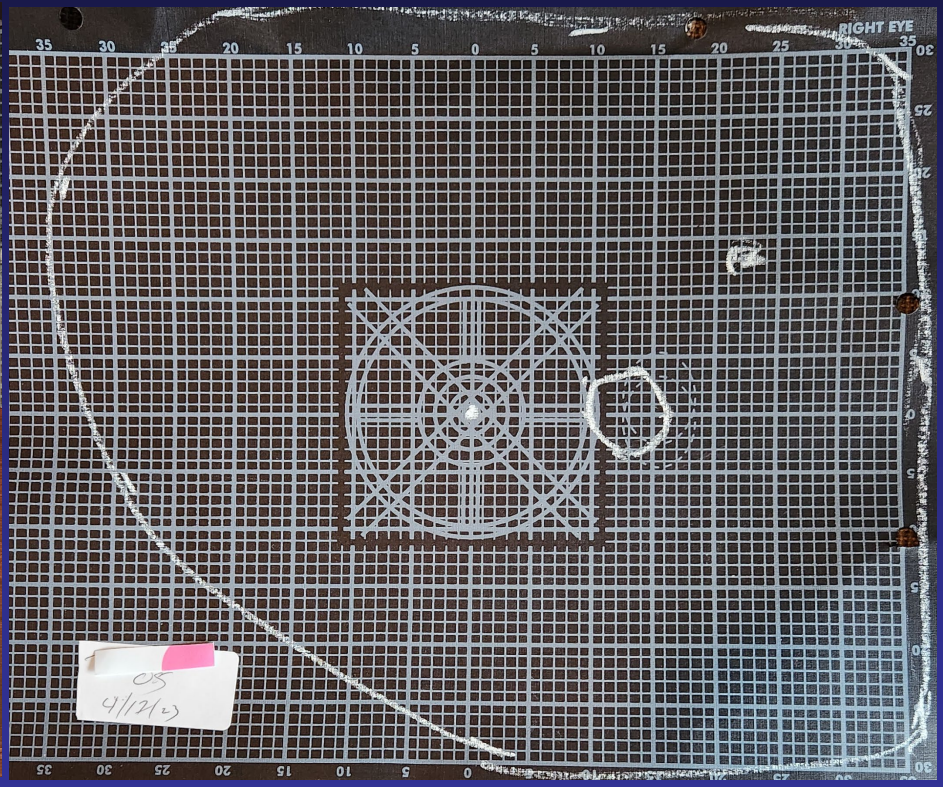
22 y.o. College Hockey Player



The Kinetic Field - The Nomal Field

24 yo Competitive Speed Skater – Short Track

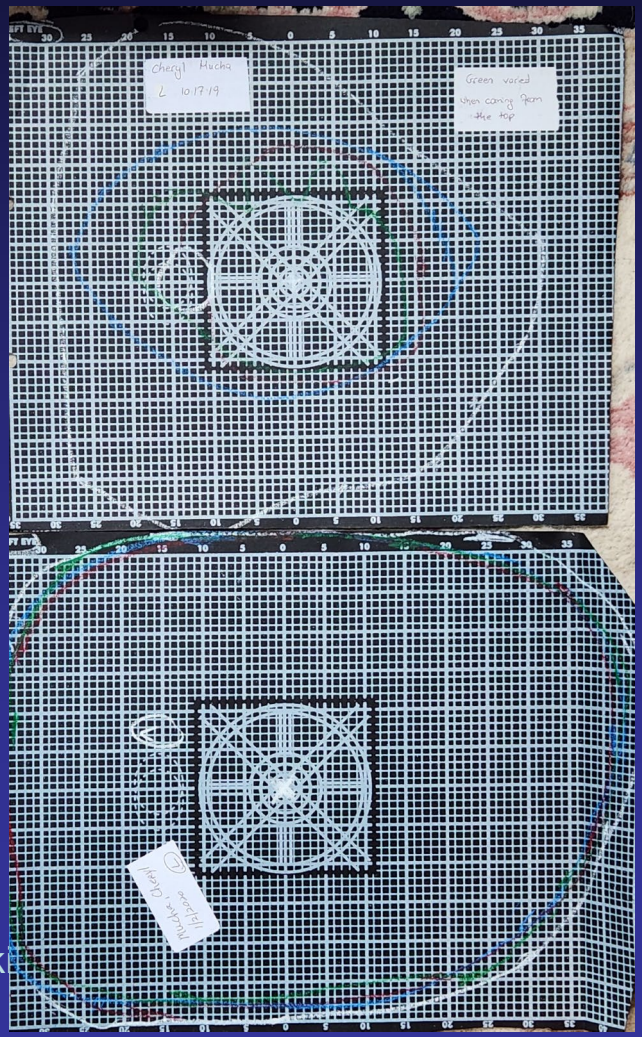


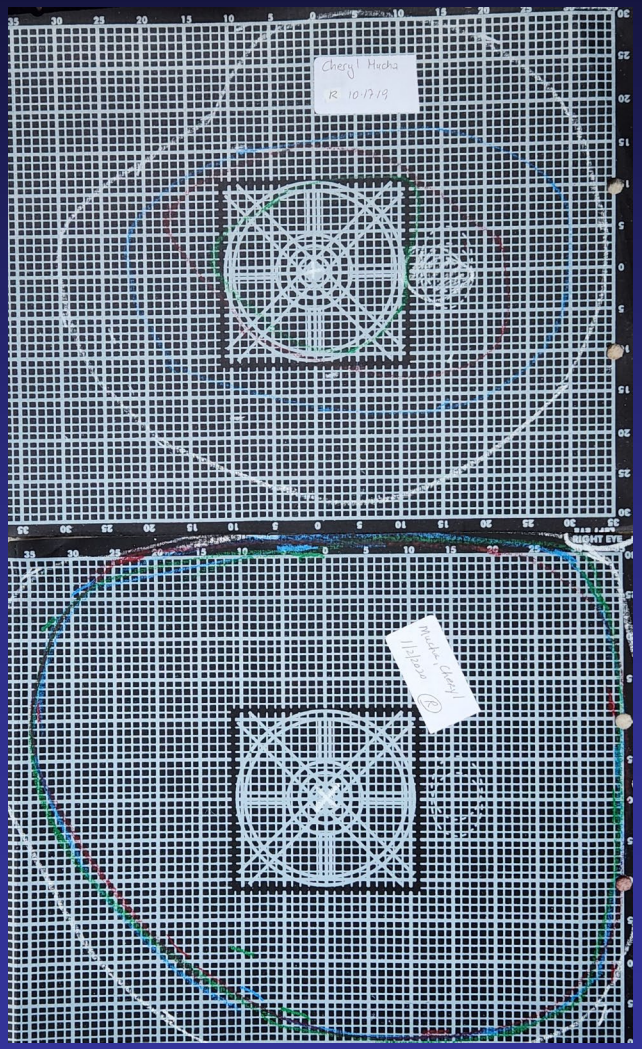


Pulaski 102 2023

The Kinetic Field - The Nomal Field

39 y.o. female PE teacher, former College Softball, Concussion with Tx



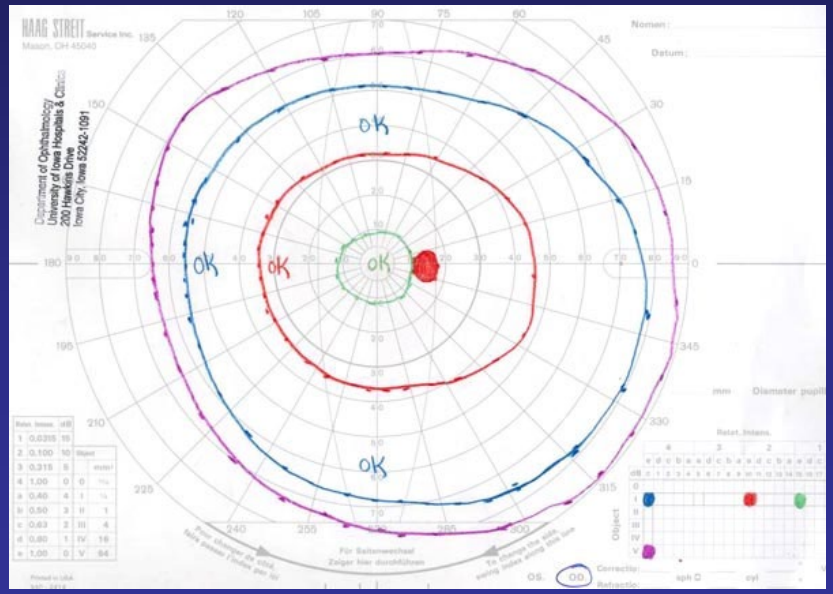


The Kinetic Field
Profoundly Complex and Unique

The Kinetic Field
Why do it?

"Colour visual field analysis is among the most important biological visual tests known to science."

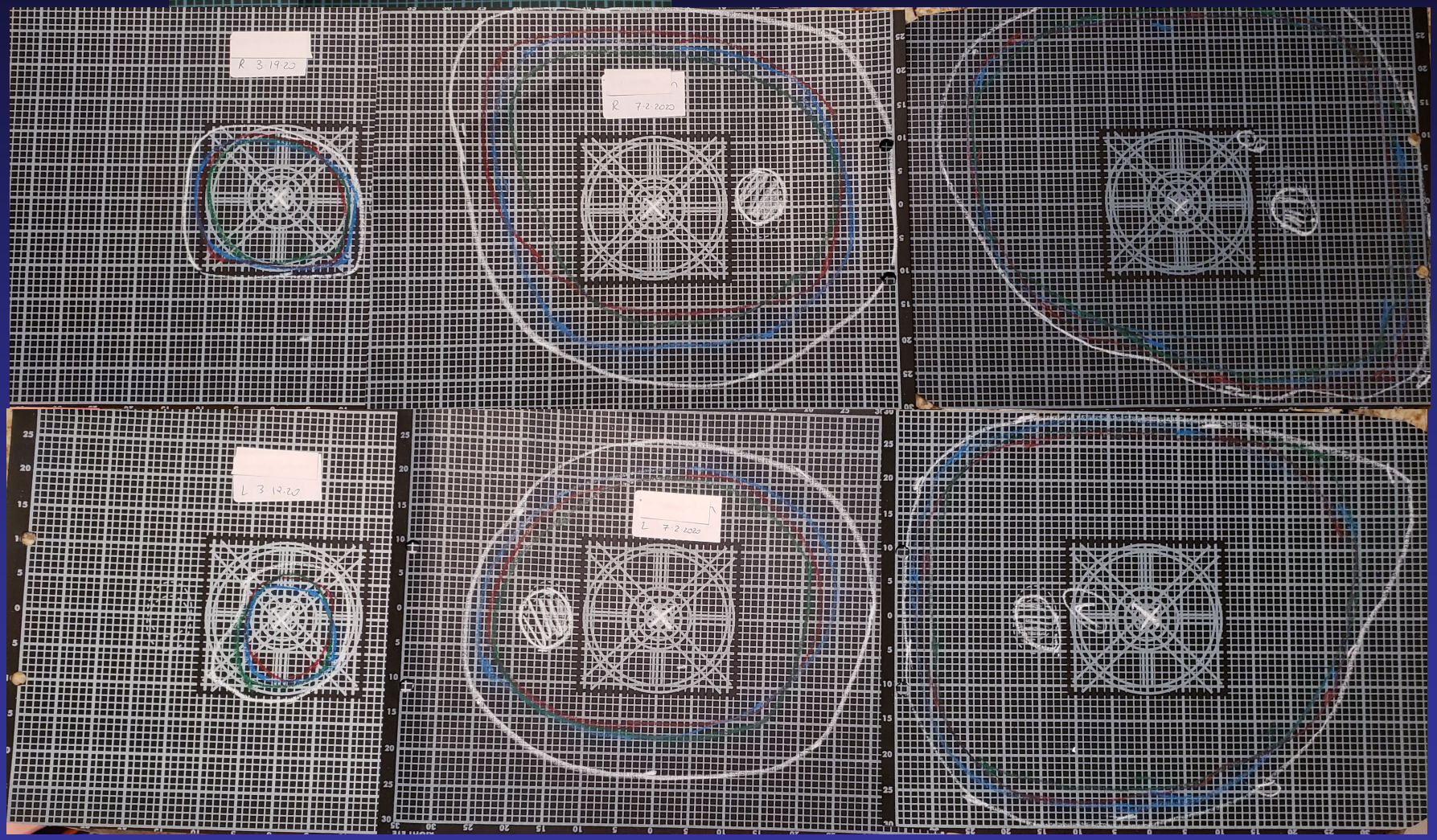
T.A.Brombach, 1936



The Kinetic, Functional Field

Abnormal Fields

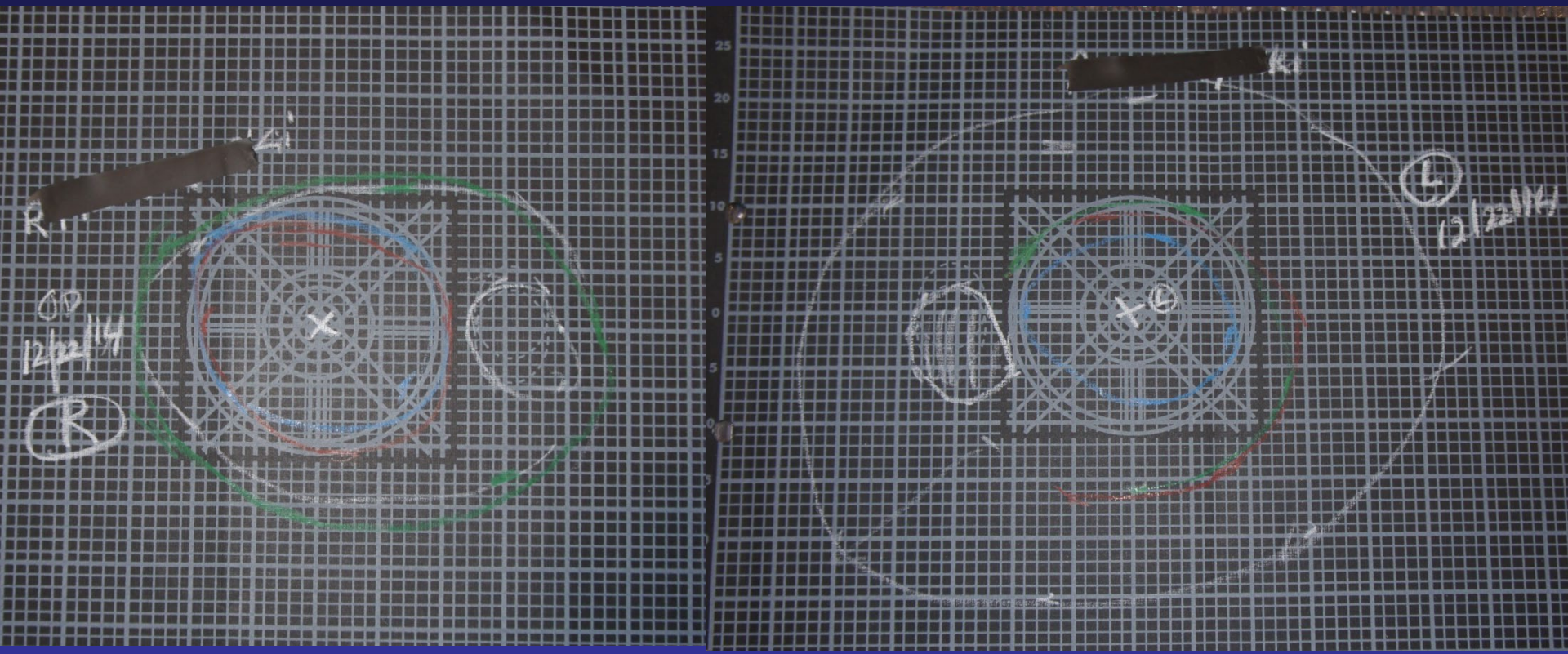
Learning Problem – AO/MD



The Kinetic, Functional Field

Abnormal Fields

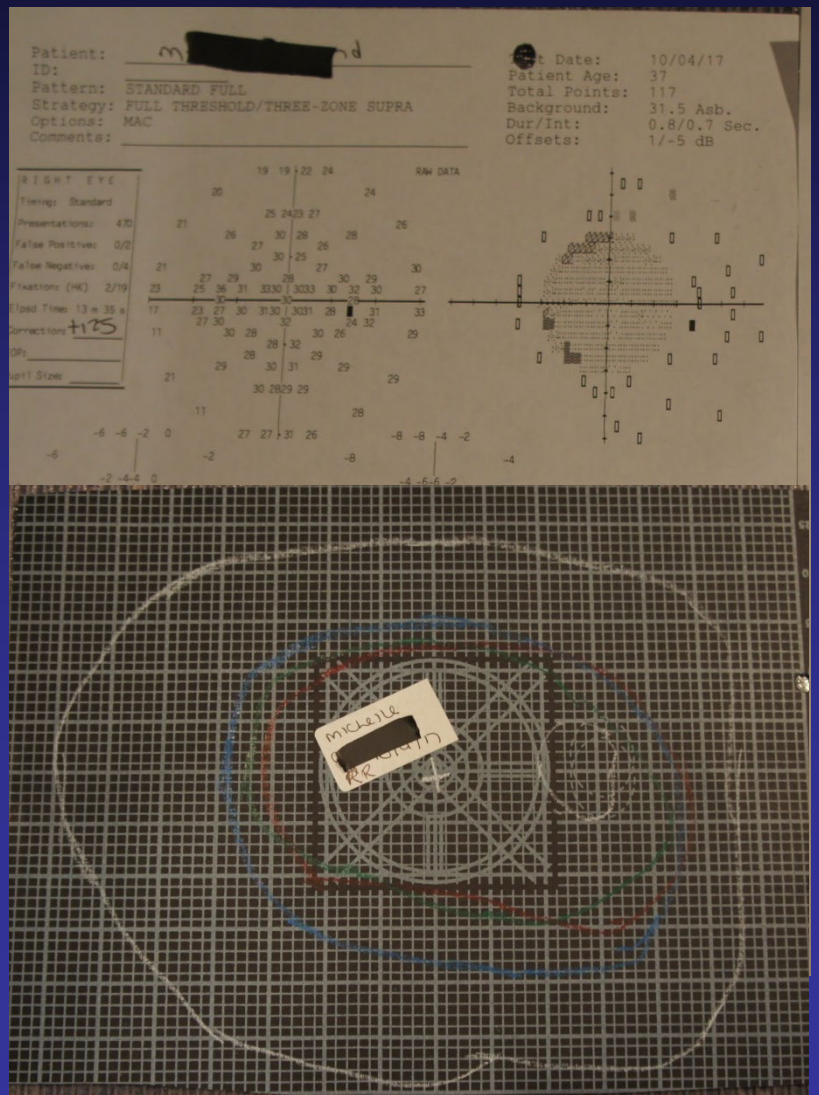
TBI Concussion

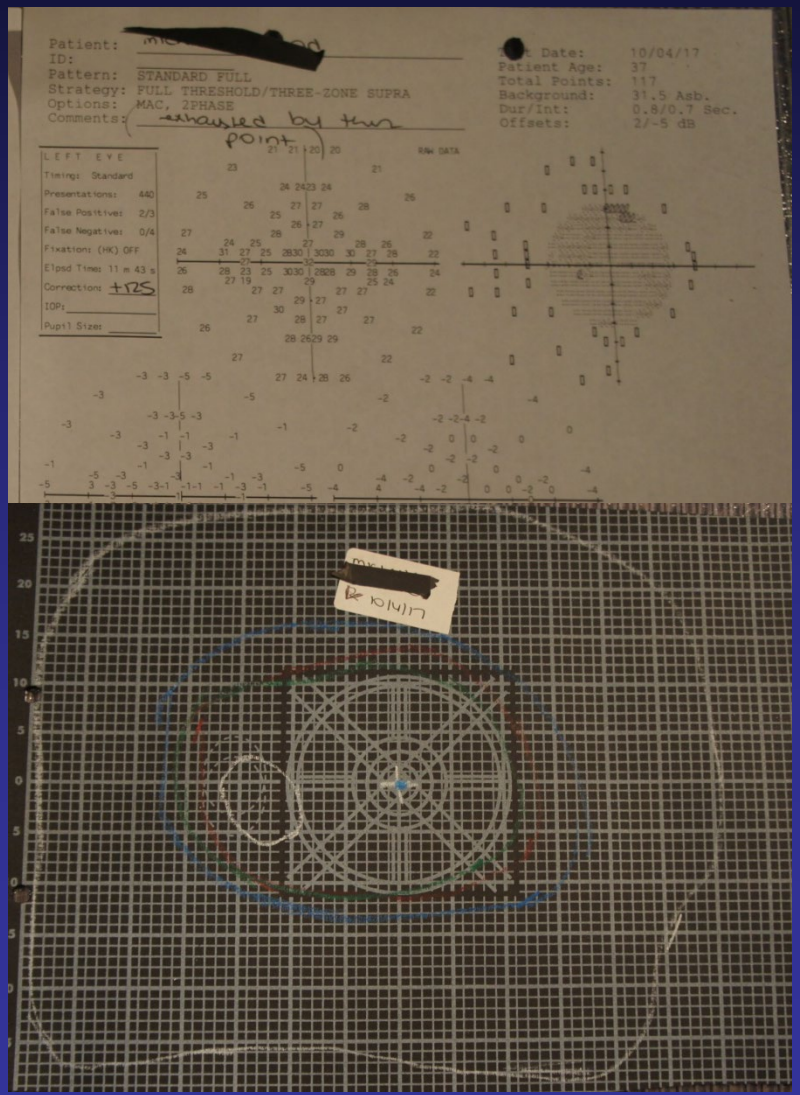


The Kinetic, Functional Field

Abnormal Fields

TBI Concussion

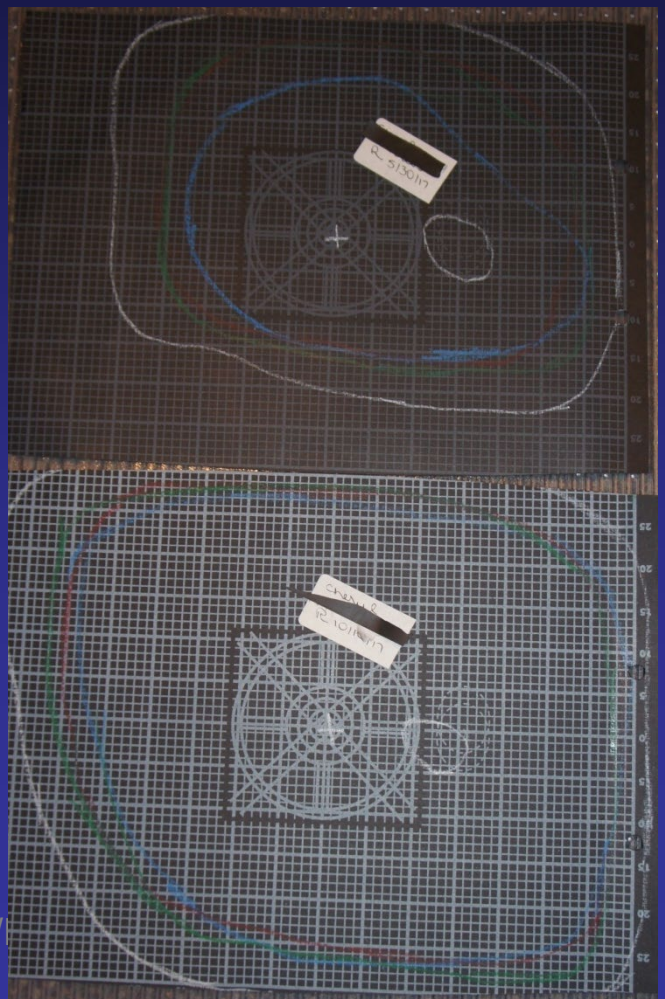


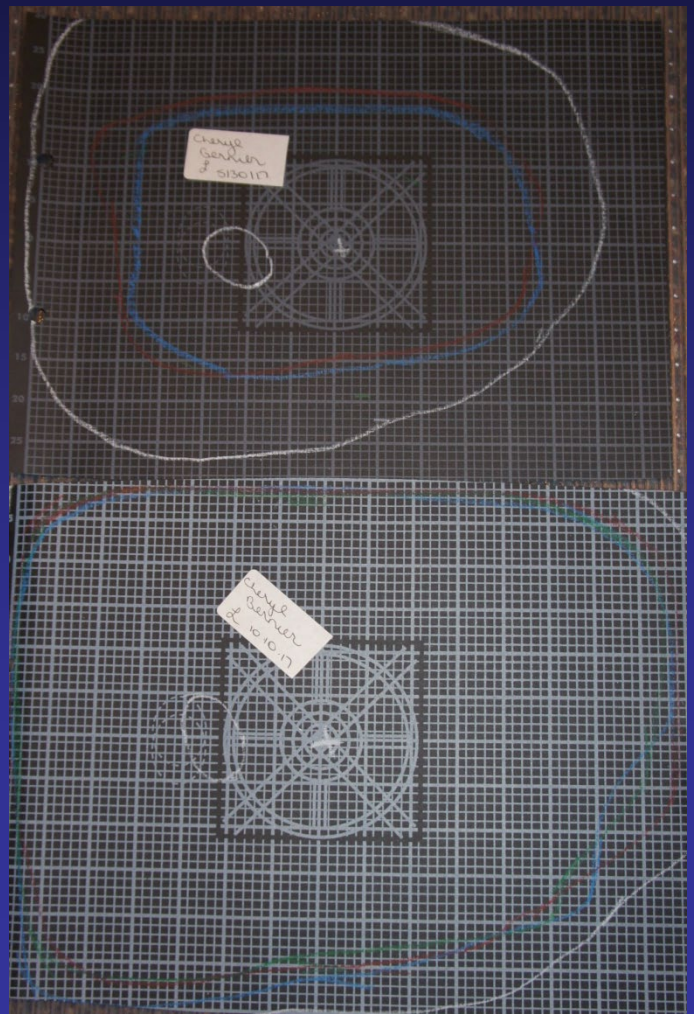


The Kinetic, Functional Field

Abnormal Fields

TBI Concussion – Start w/ MU

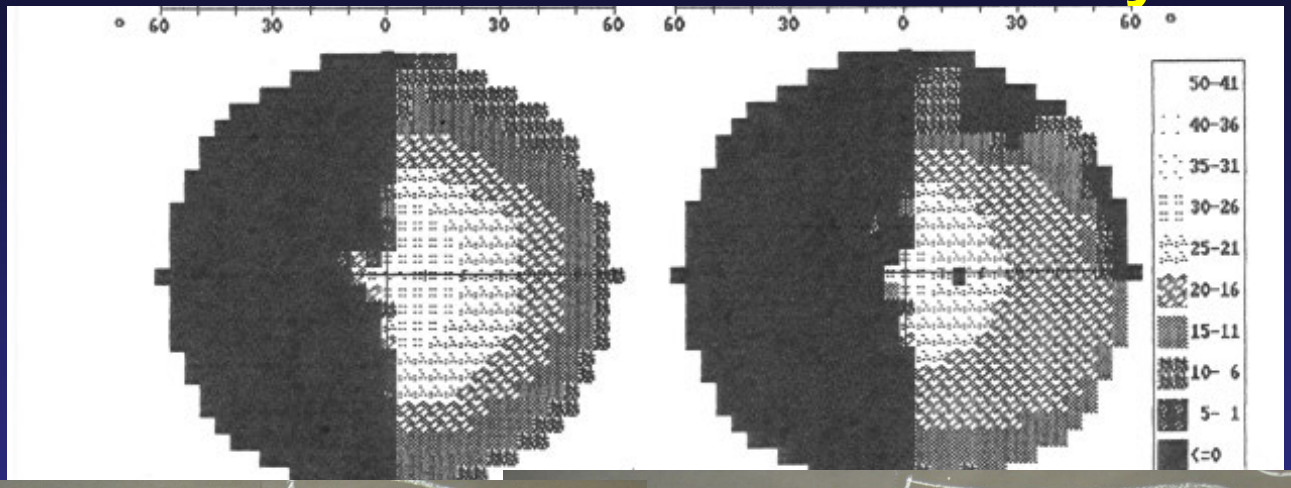


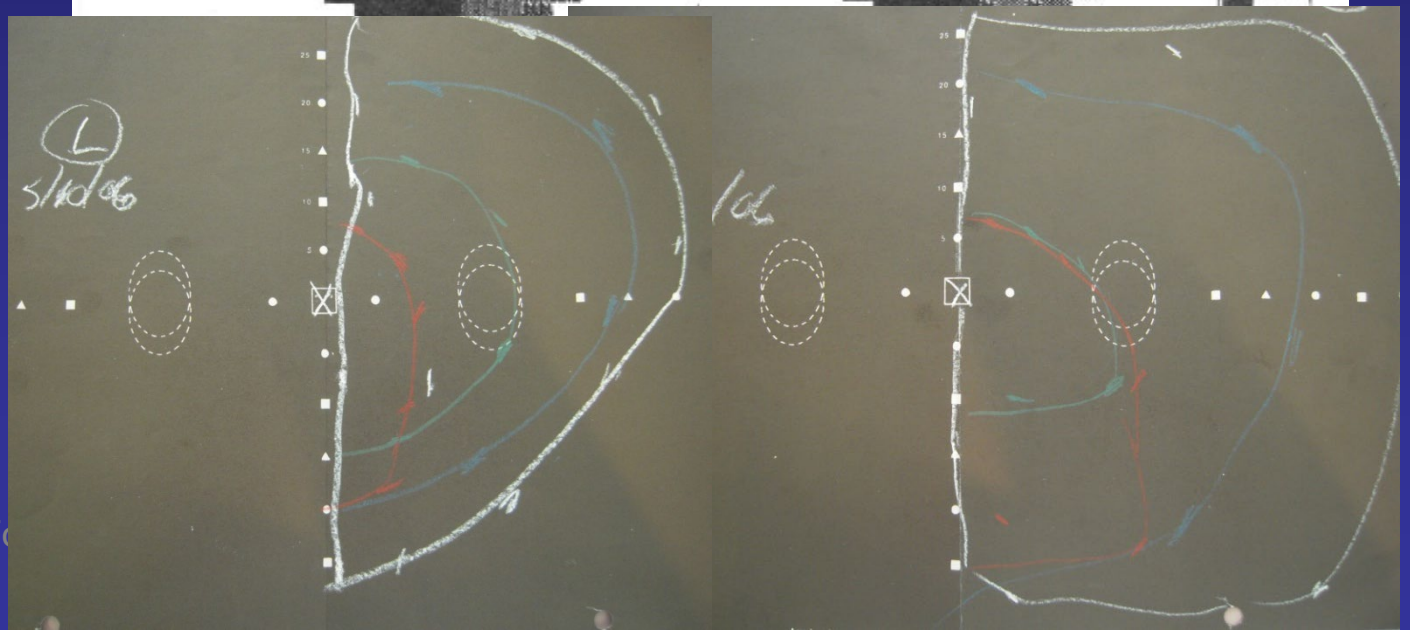


The Kinetic, Functional Field

Abnormal Fields

Stroke – Initial normally MU

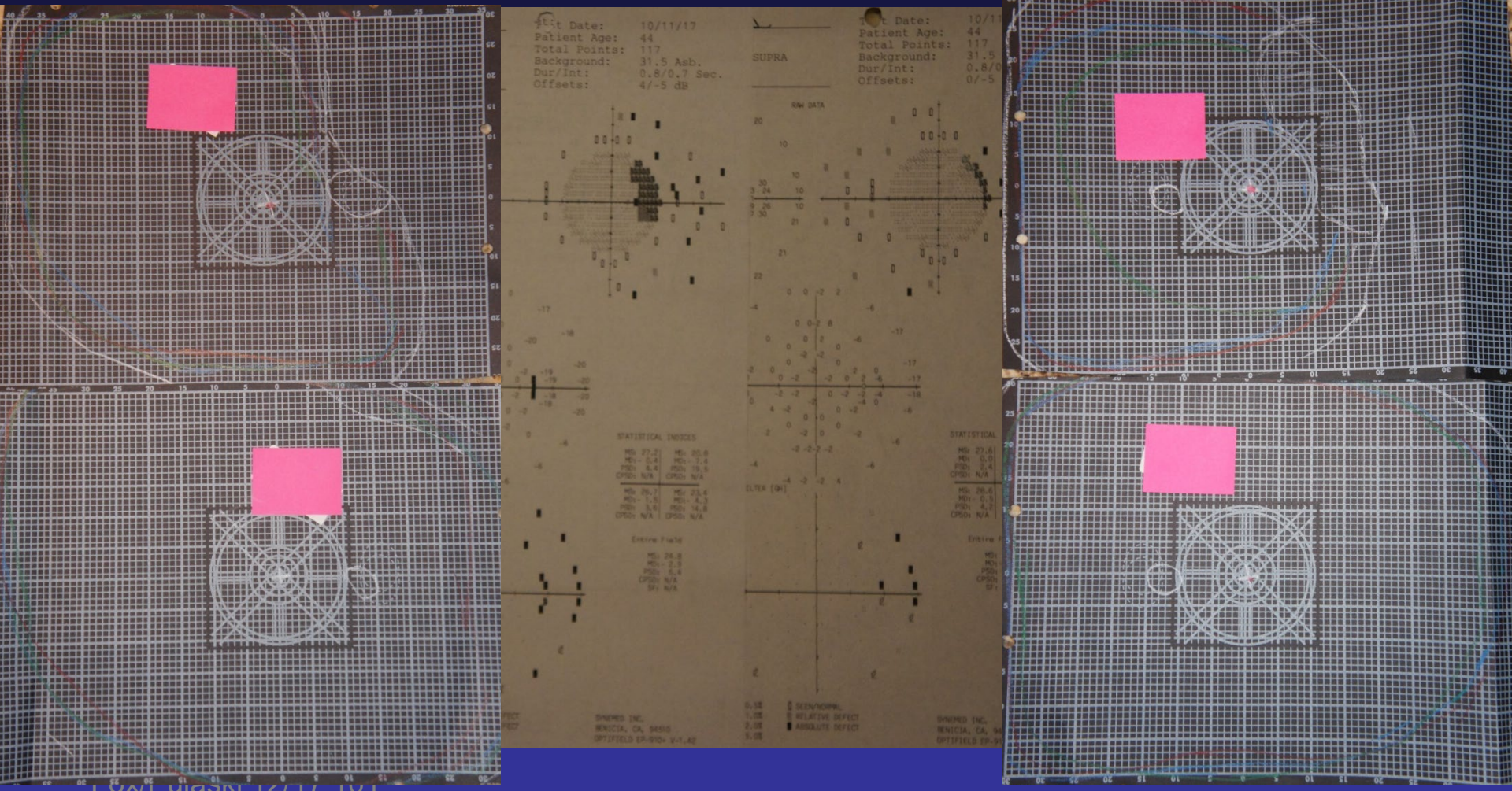




The Kinetic, Functional Field

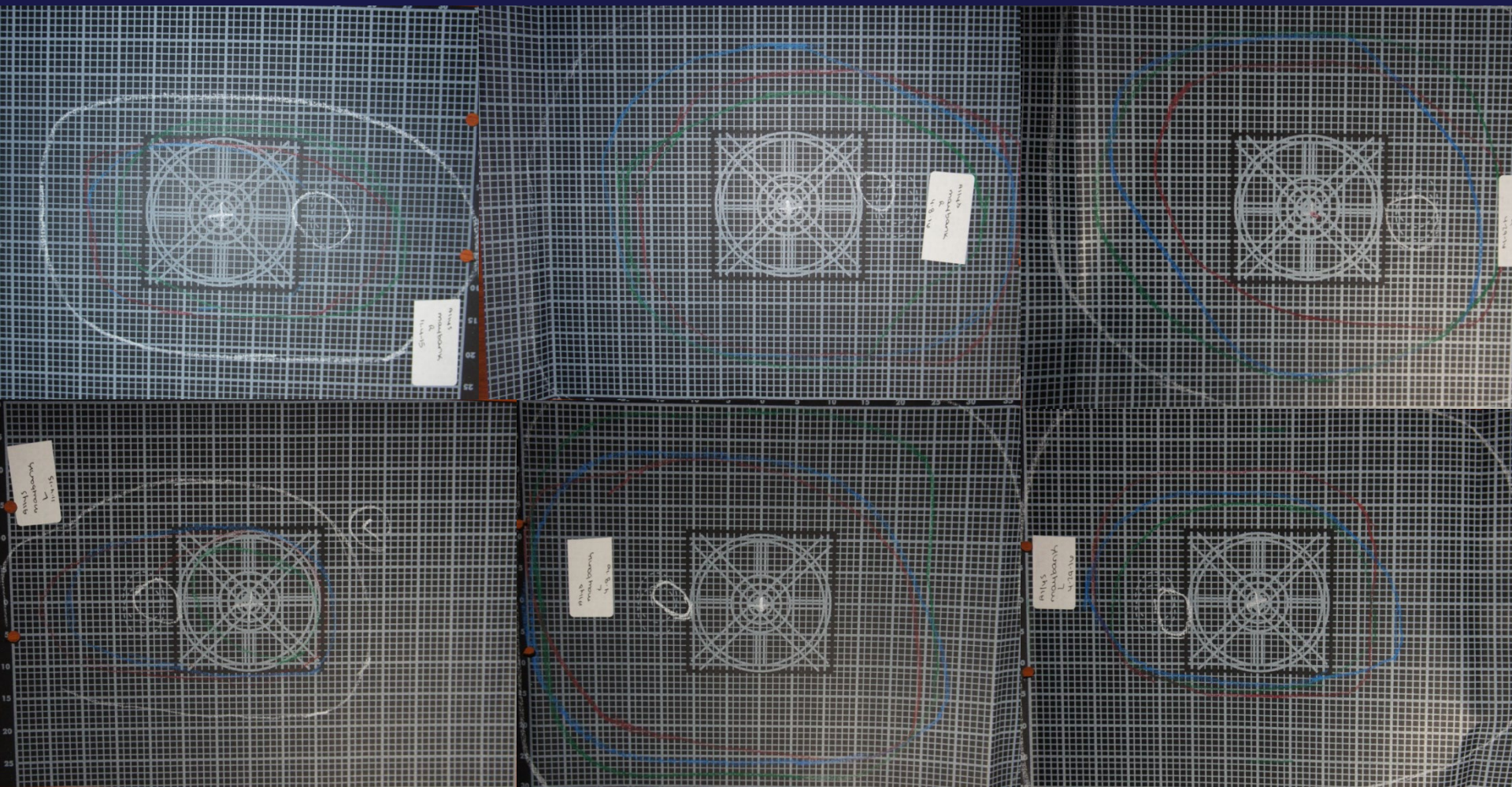
Abnormal Fields

Stroke



The Kinetic Field - Abnormal

Lyme

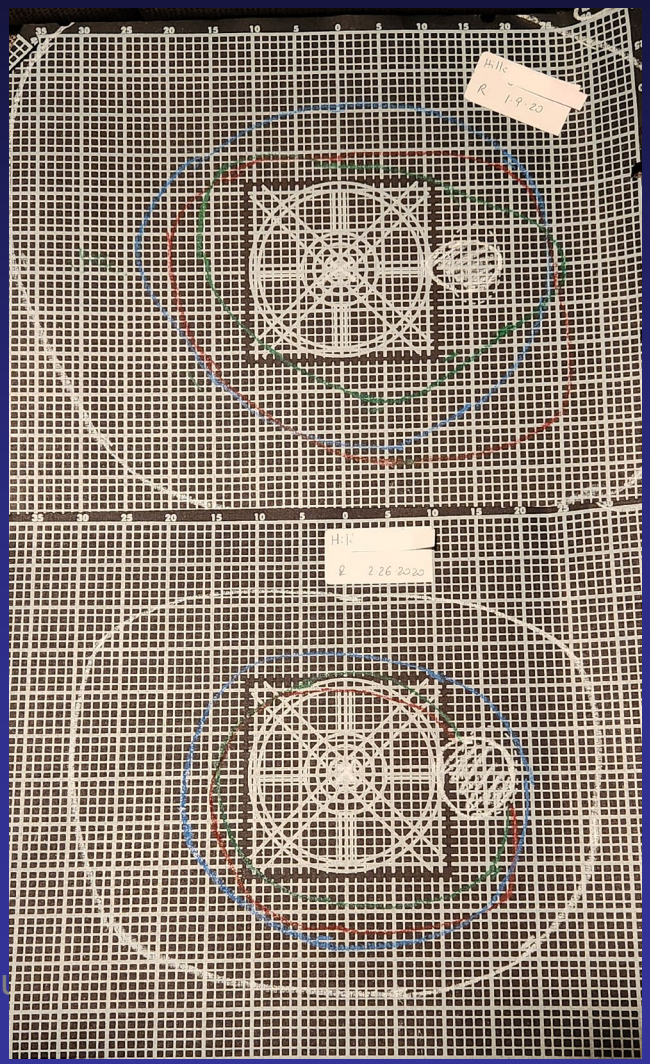


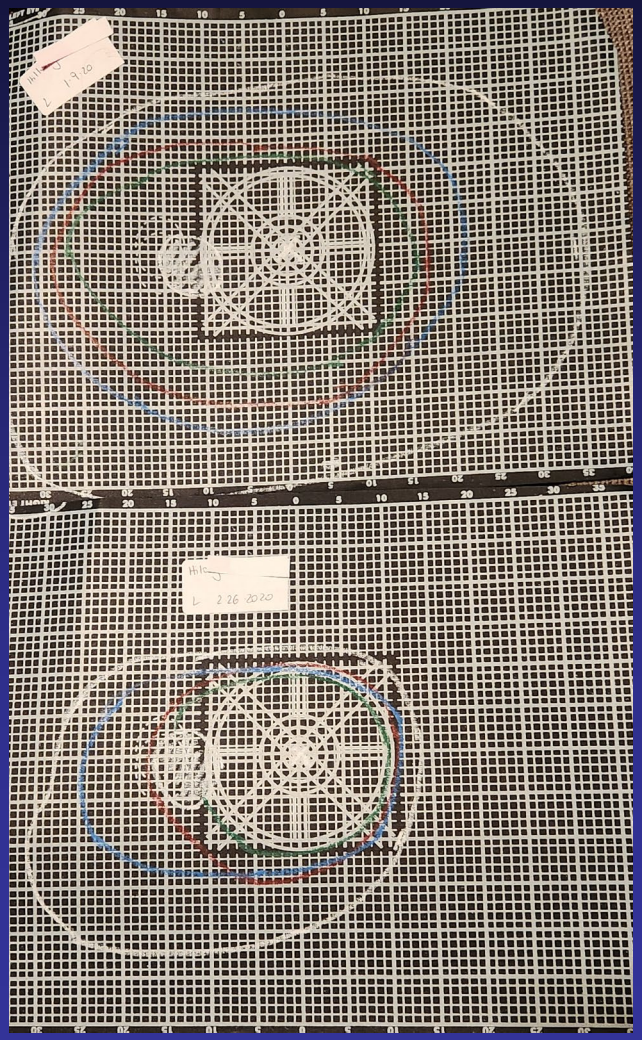
The Kinetic Field - Abnormal Lyme - HM

- 40 y.o female, mother of 5, pianist
- Referred by neuro-chiropractor due to persistent vertigo, balance issues and reading issues.
- Persistent Lyme since 2016.
- Examination remarkable for high myopia, normal convergence, anisocoria, asymmetric localization, right hyperphoria (1D), asymmetric kinetic fields. RightEye showed pursuit deficits, poor fixation stability OS, decreased reaction times and speeds.
- Very complicated HX working closely in conjunction with Lyme specialists.

Lyme - HM

Had significant flu and diagnosed with variant of Lyme between initial visit and Tx initiation. 01/09/20, 02/26/20

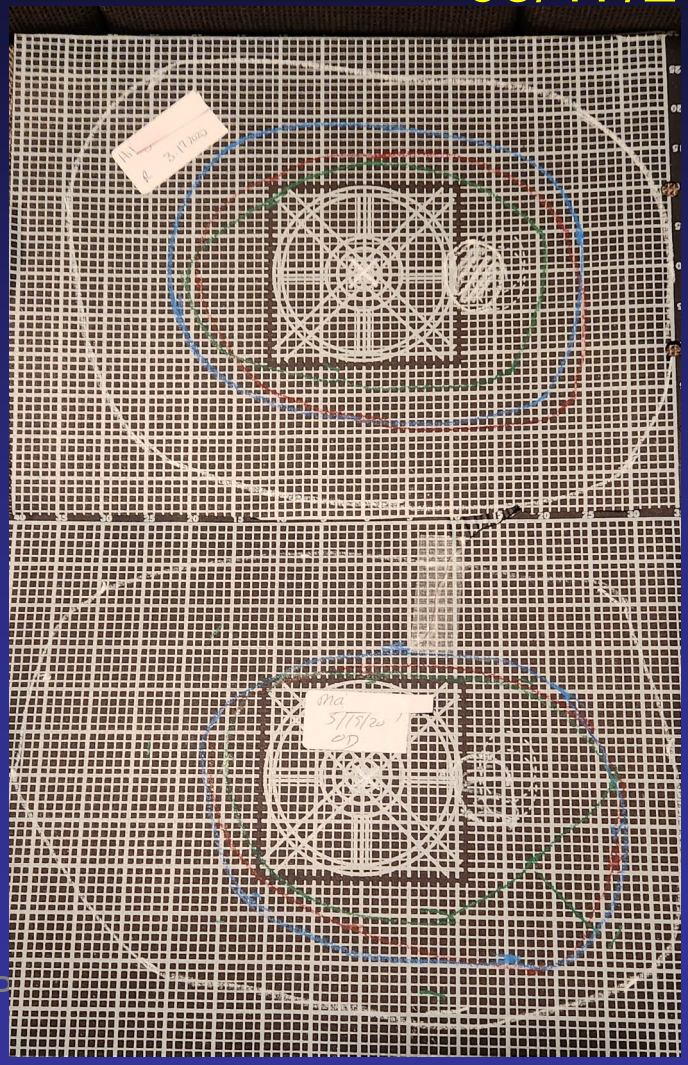


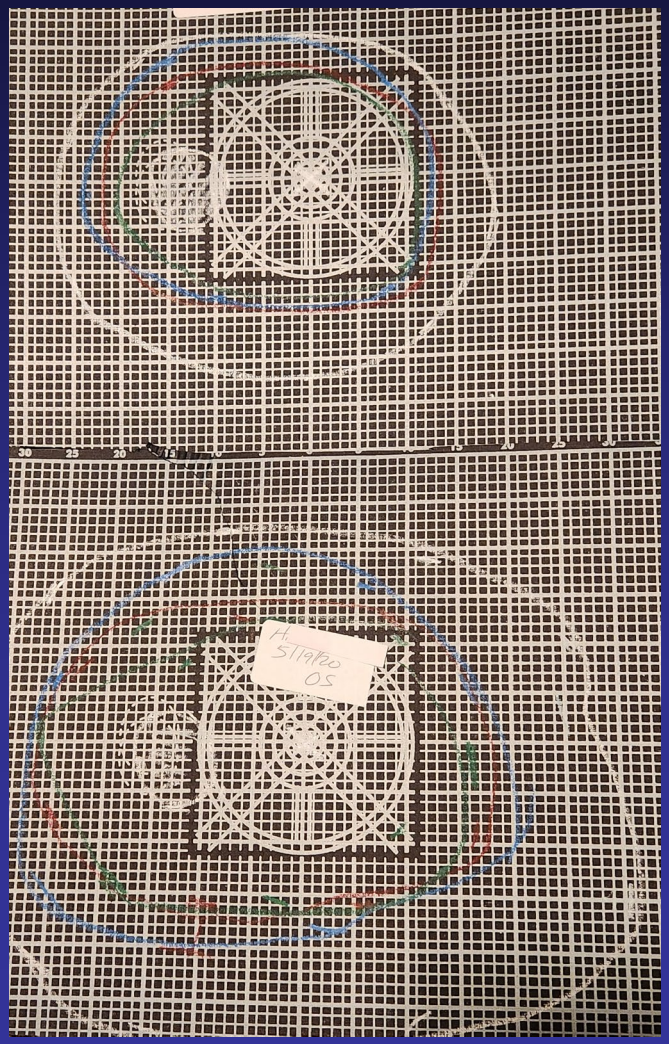


Lyme - HM

MU 20

03/17/20, 05/19/20



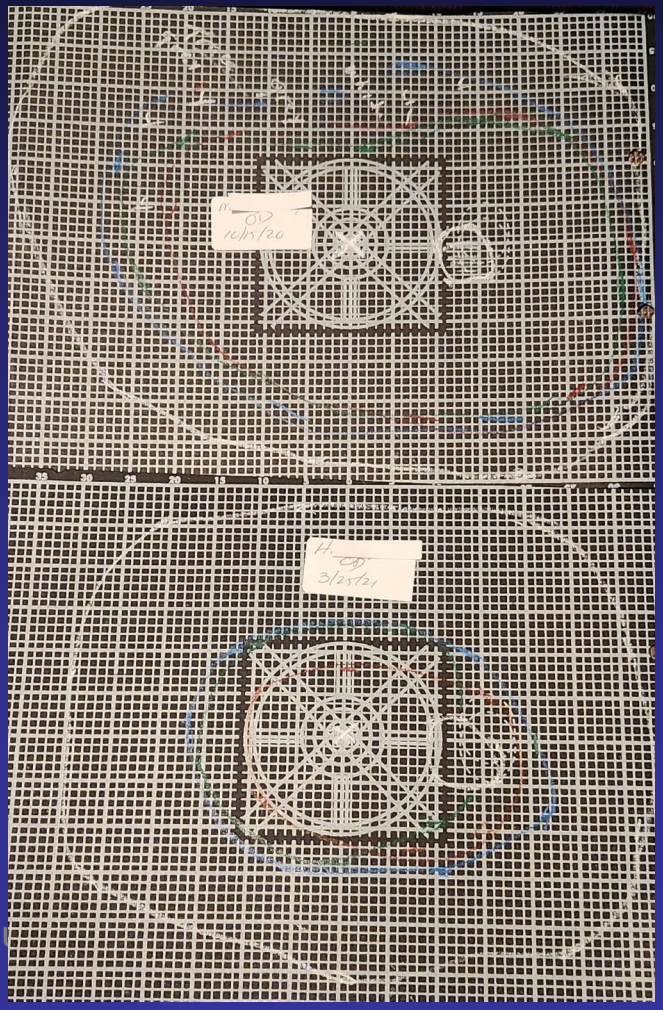


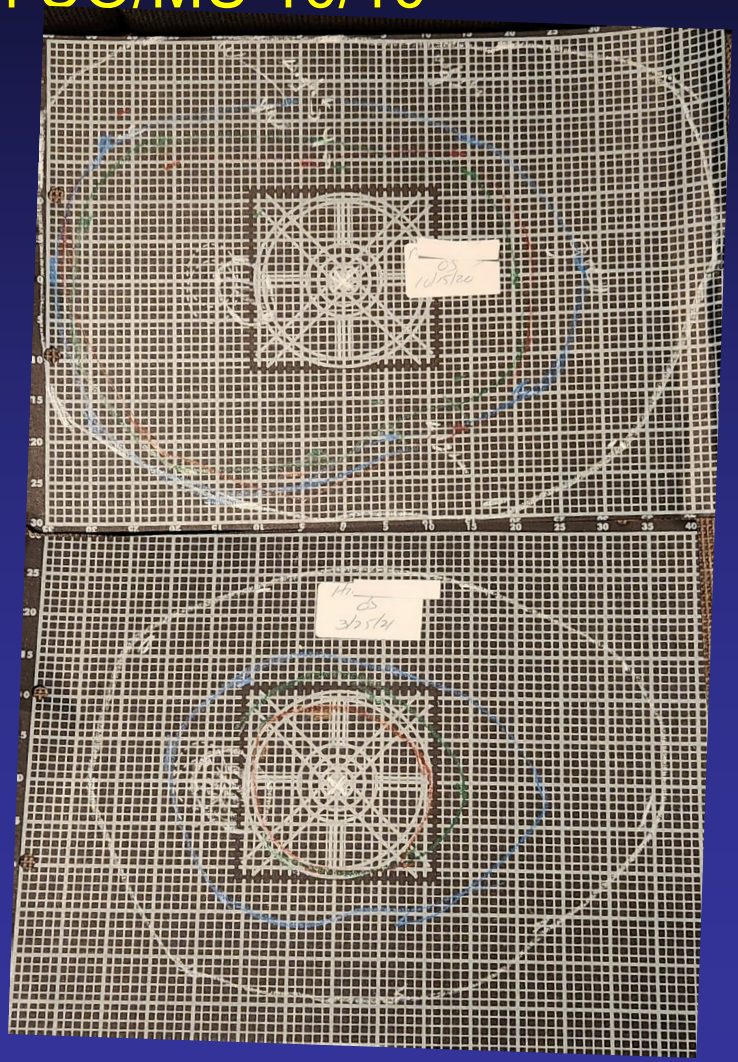
Lyme - HM

Changed to MU/UO June then AO/MD August – Oct 2020

Then another tic bite and co-infection Epstein Barr March 2021

Changed MU 20, then UO/MU 10/10



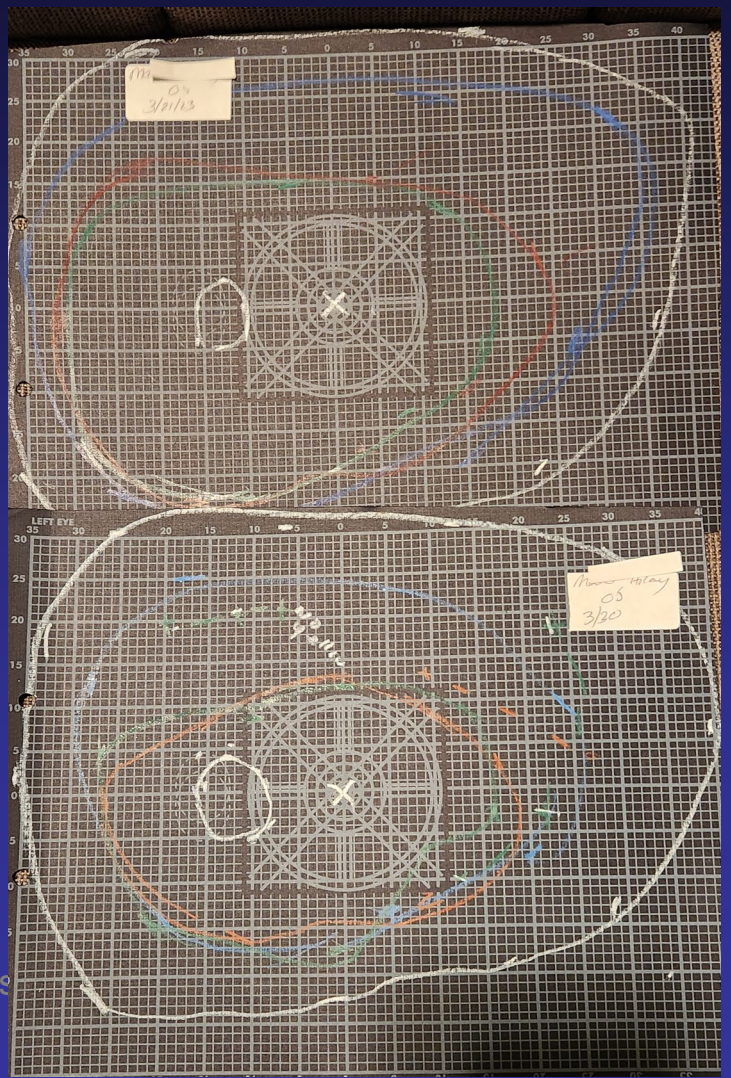


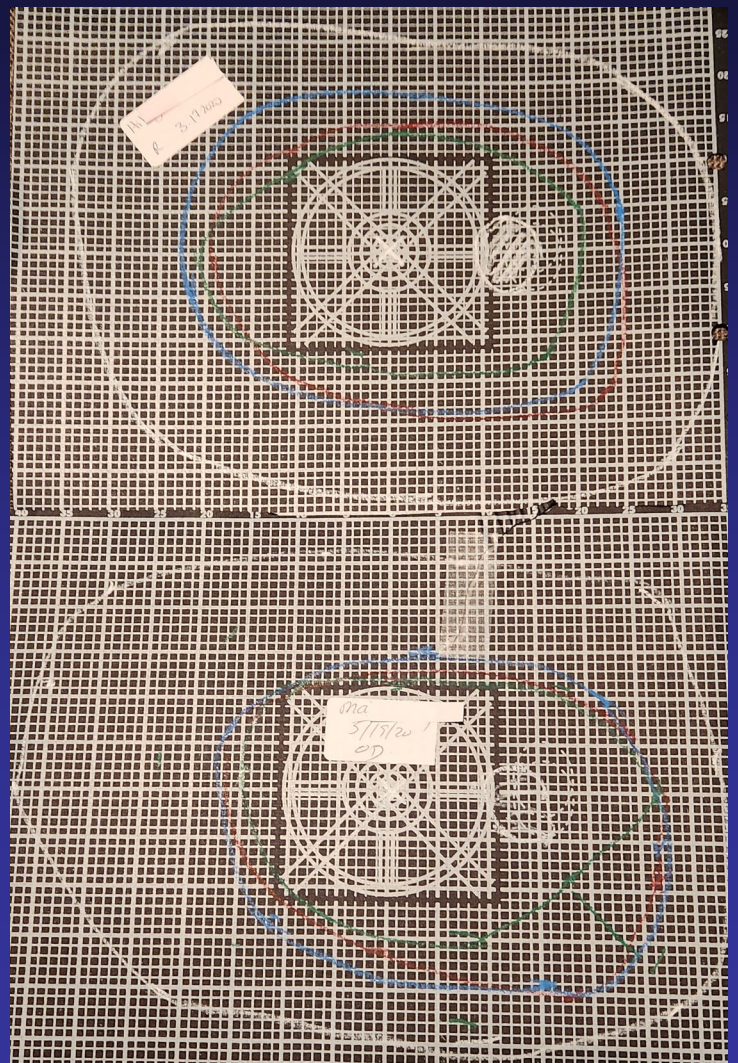
Lyme - HM

Treated Acute until March 2022, then AO/MD and MD combinations until final in March 2023. 30 Fields

2023

2022





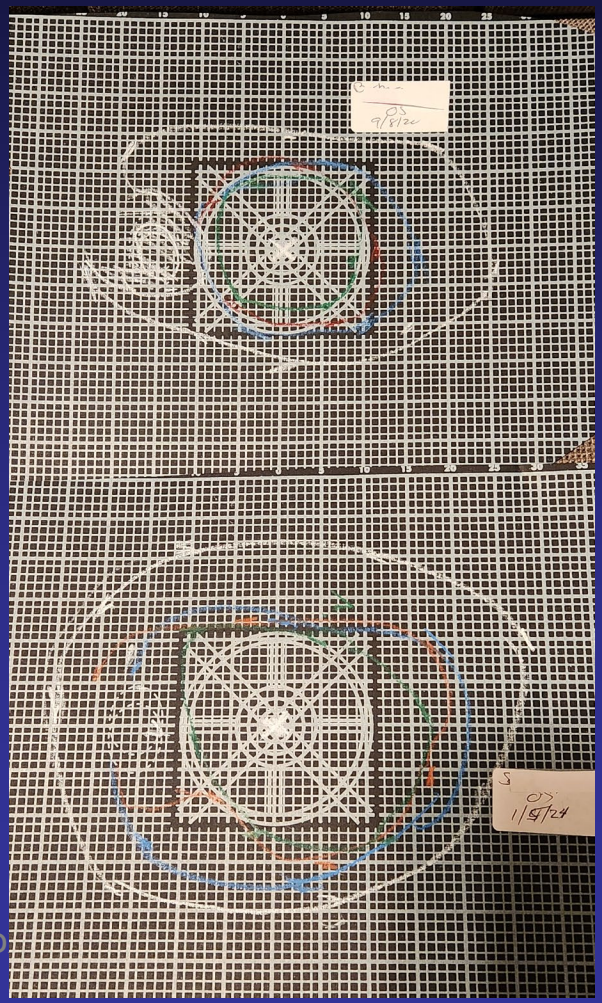
The Kinetic Field - Abnormal Mold Toxicity - BS

- 65 y.o. female diagnosed -2 years prior with MCI (Major Cognitive Impairment) secondary to Mold Toxicity.
- Referred by therapist in New Hampshire
- Examination remarkable for decreased corrected visual acuity of 20/30 with no ocular pathology, moderate CI, severe oculomotor dysfunction especially in saccadic eye movements with 80% limitation in upgaze. Localization extremely poor – cannot reach for objects accurately. Significant gait issues/narrow stepping. Severe kinetic field compression.
- Yoked Base Down (2D) showed significant improvement in walking and localization.

The Kinetic Field - Abnormal

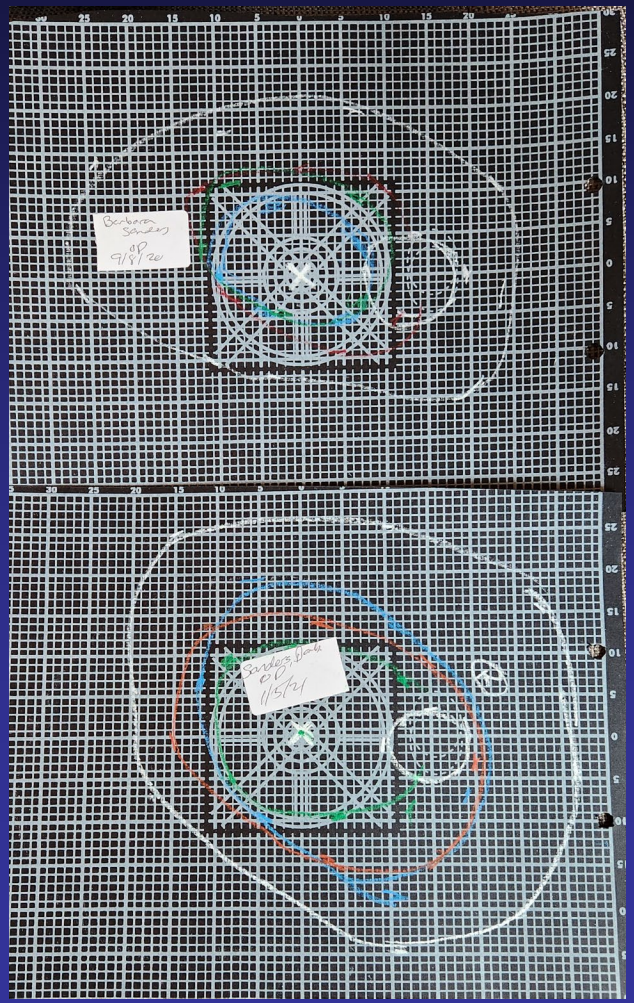
Mold Toxicity - BS

Initial 09/08/20. Tx AO/MD 10/10.



09/08/20

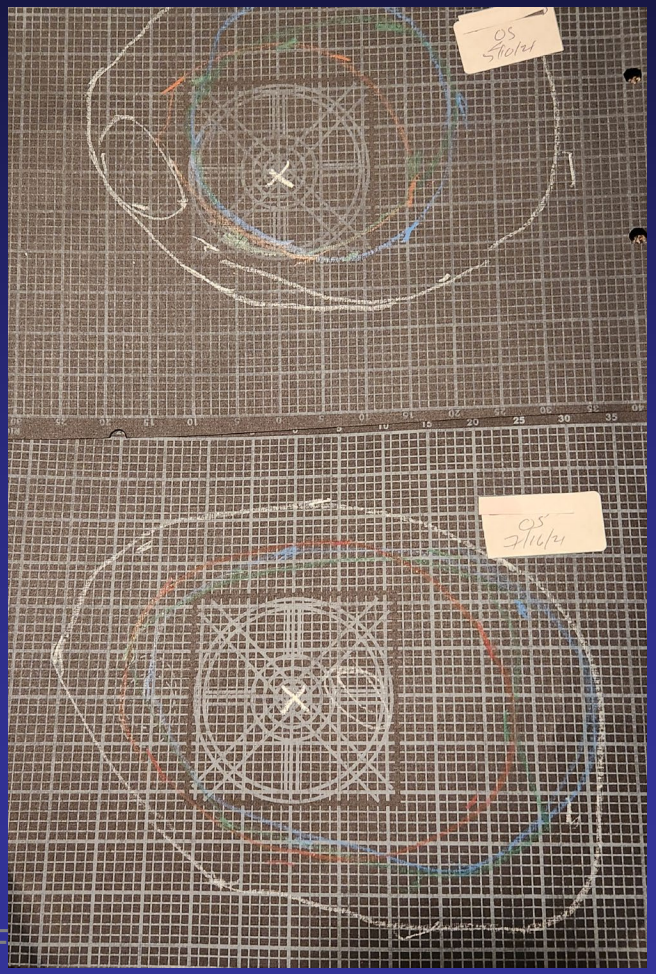
01/05/21



The Kinetic Field - Abnormal

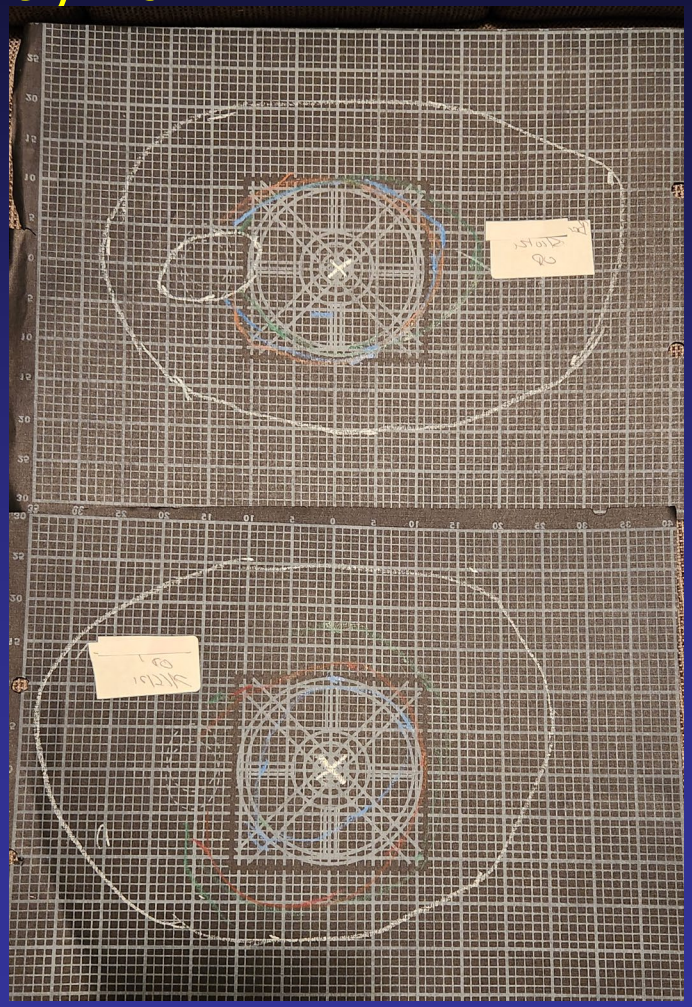
Mold Toxicity - BS

Changed to MU 20 in May 2021



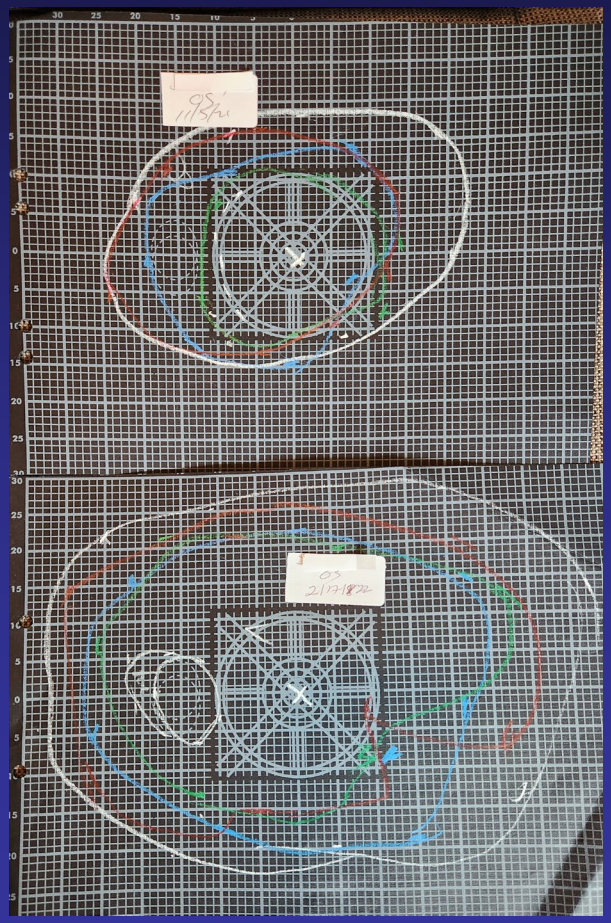
05/10/21

07/06/21



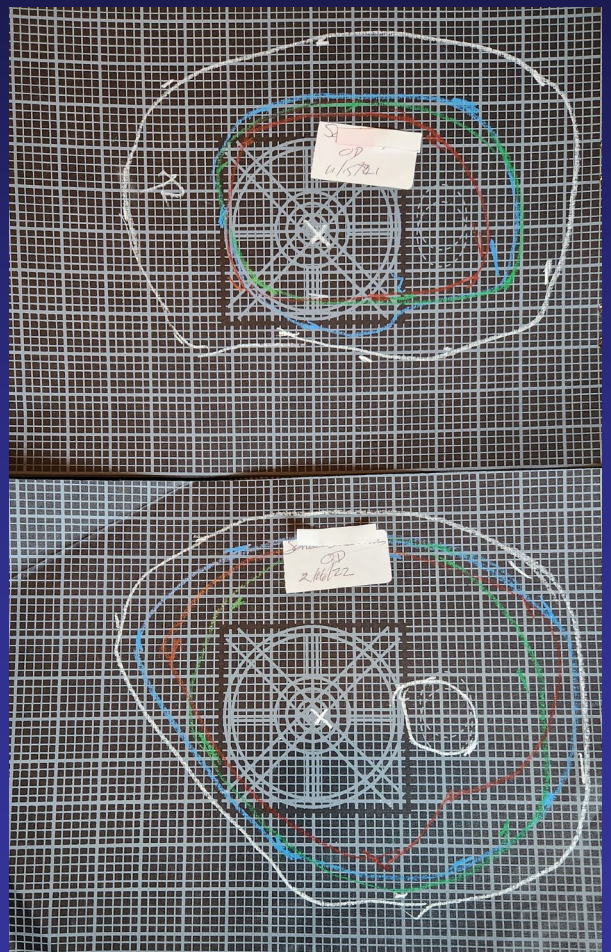
Mold Toxicity - BS

Stopped Tx 11/2021 – Complex Mold Tx was ongoing. Was showing L visual neglect. In January Dx with "Chronic Inflammatory Response" specifically mold related.



11/05/21

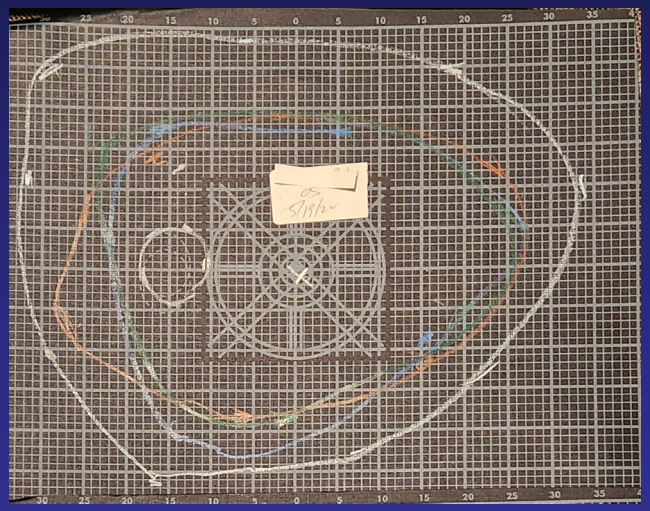
02/17/22



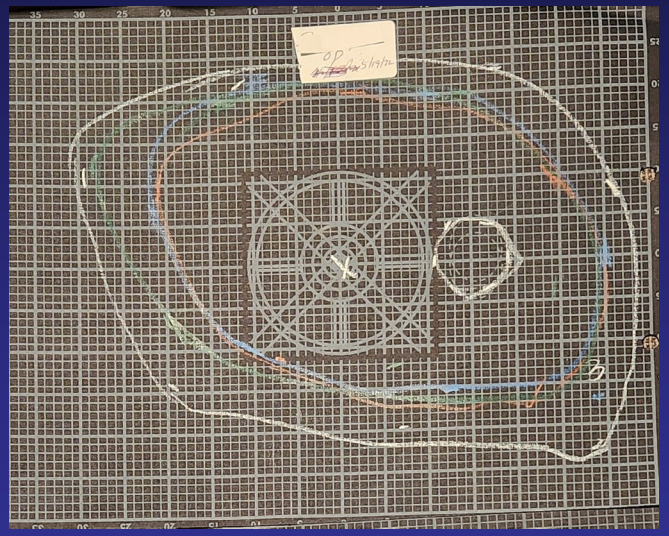
The Kinetic Field - Abnormal

Mold Toxicity - BS

Blood makers all improving but still walking, grasp and speech are issues. CI worse. Home VT cont.



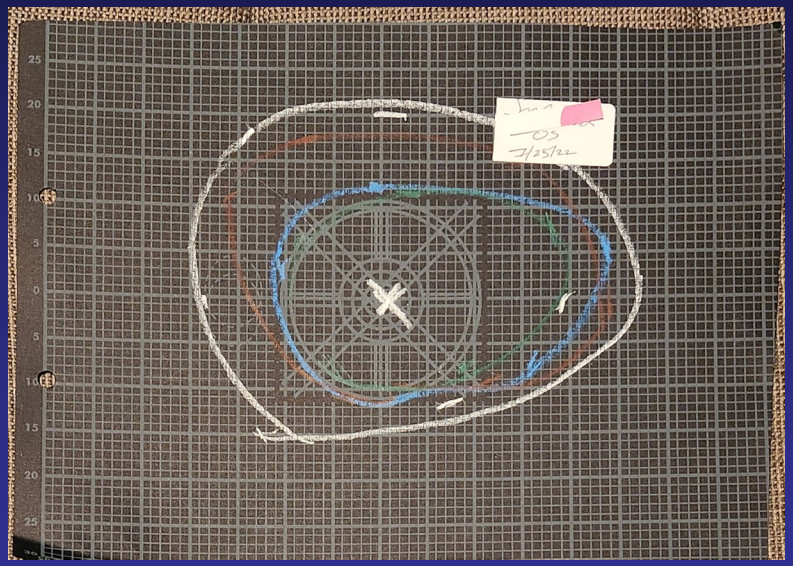
05/19/22



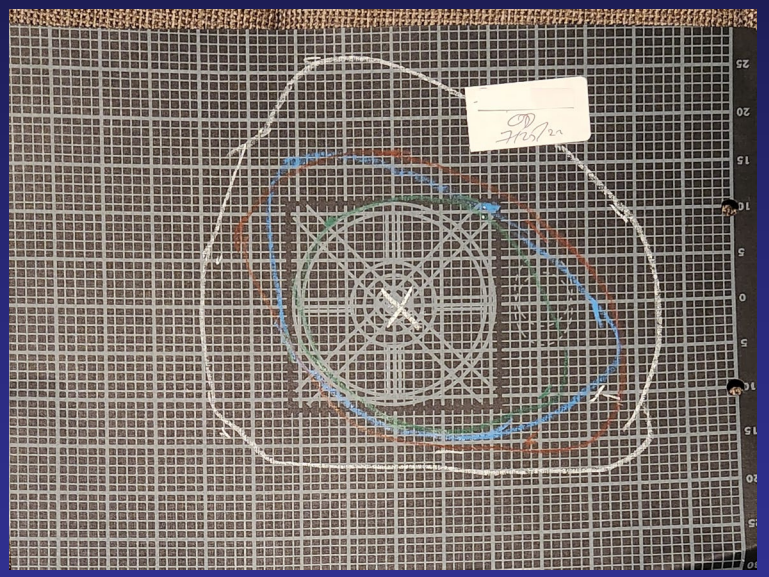
The Kinetic Field - Abnormal

Mold Toxicity - BS

Another mold exposure, high bacteria count in house.

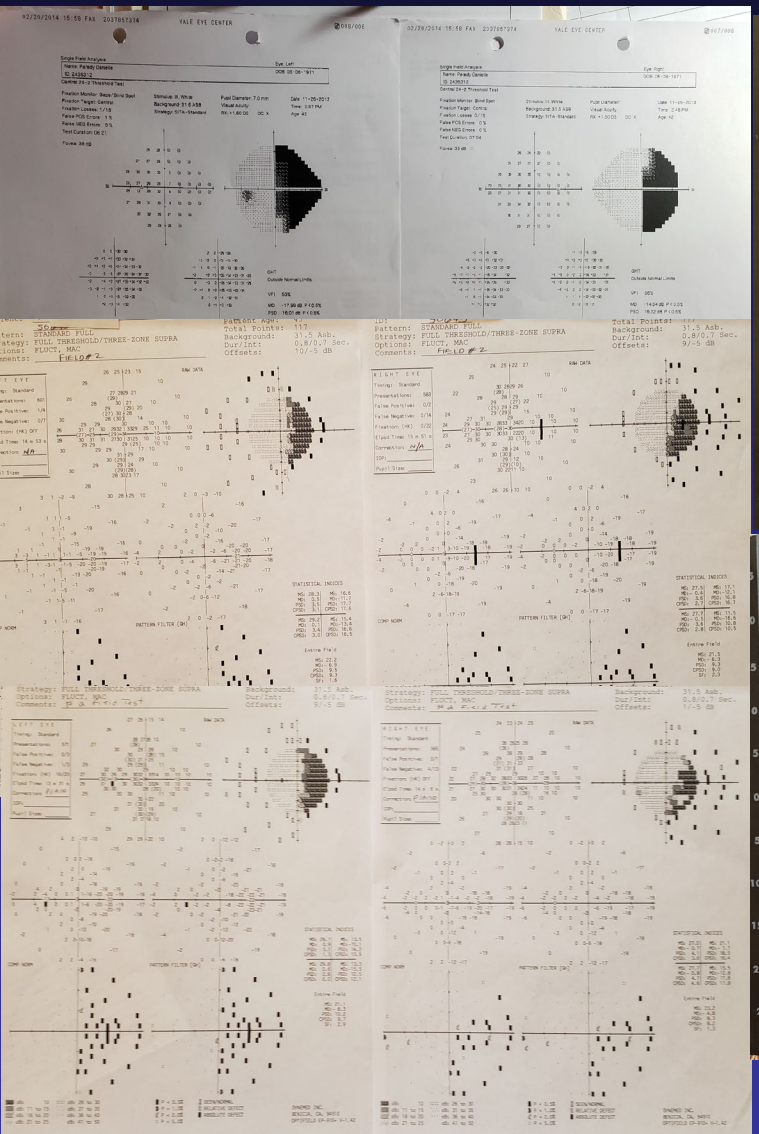


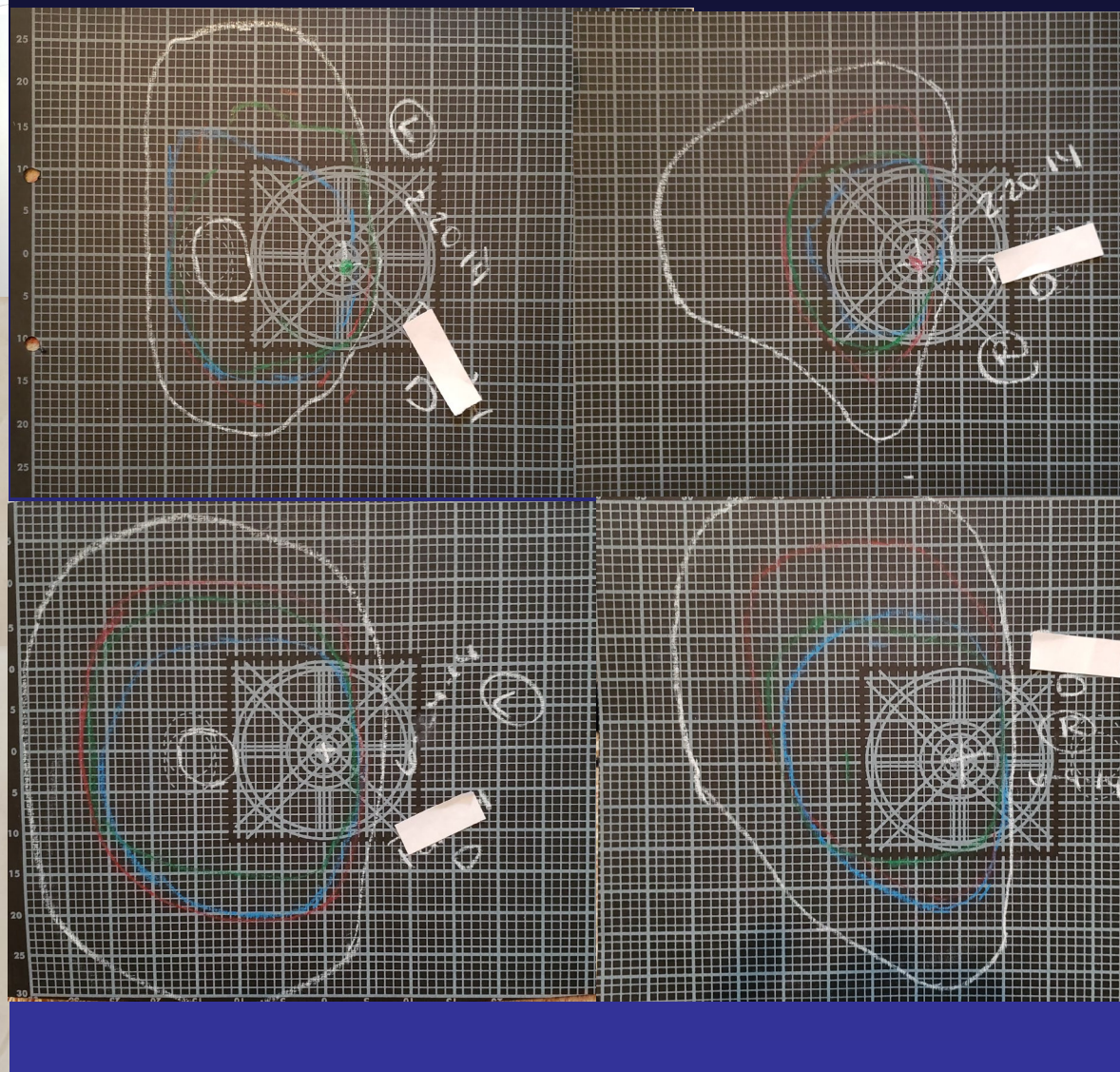
07/25/22



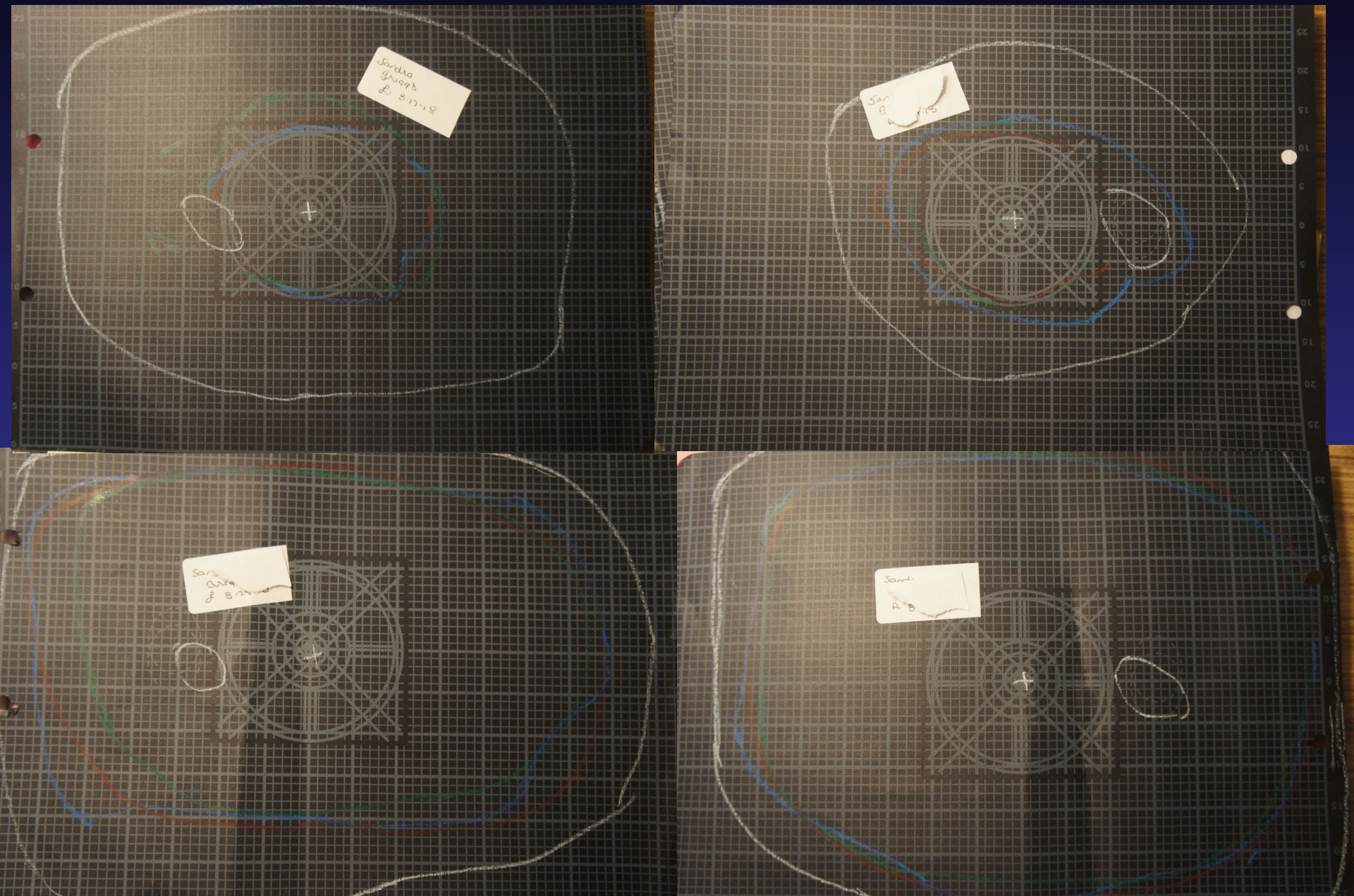
Was seen in September/December 2023. Gave Pi-Omega and MU with minimal change due to condition. Told to stop and TX.

DP, 42 yo, Metastatic Melanoma to Brain

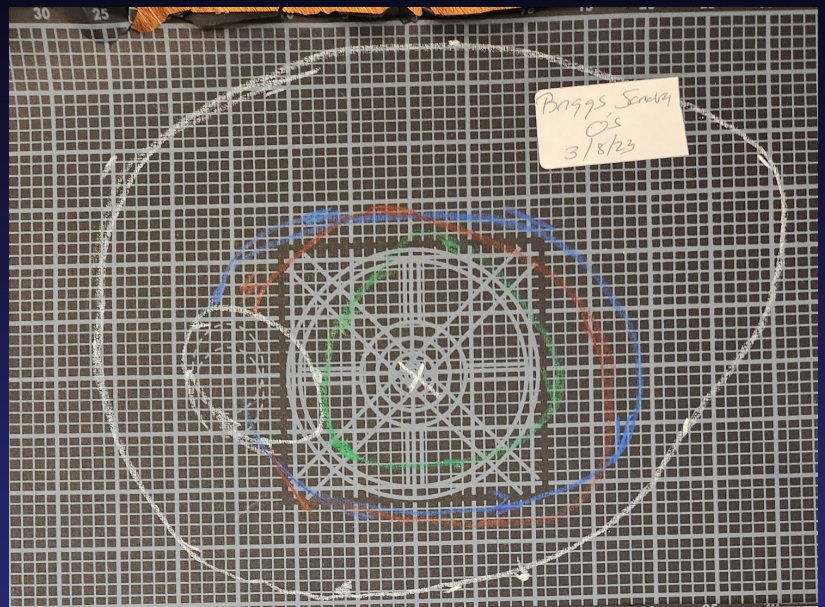


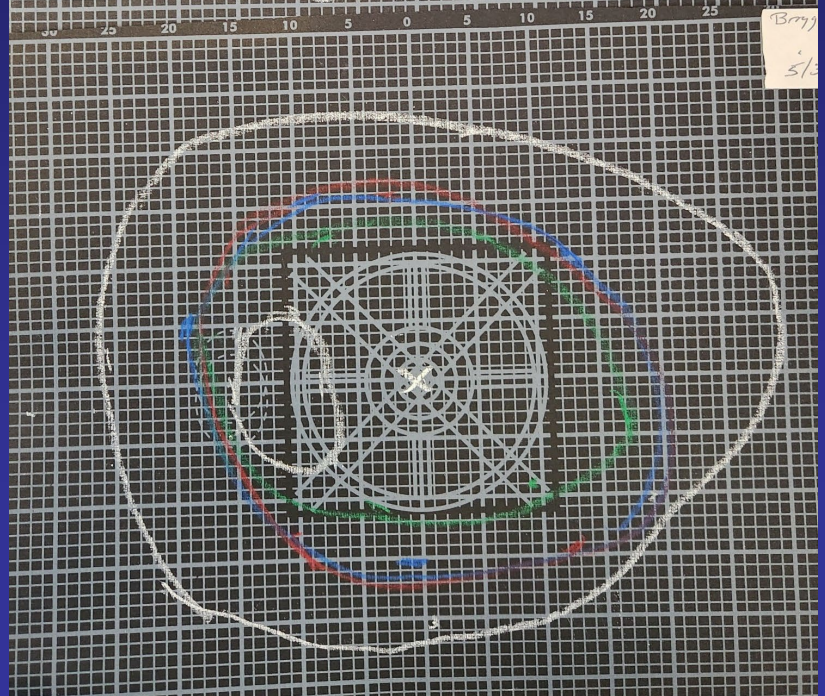


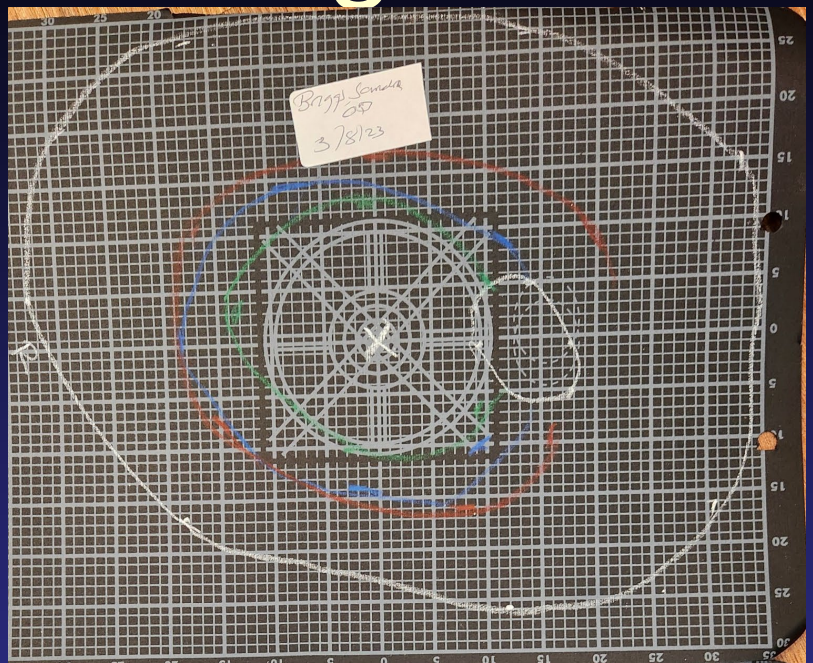
Sandra B Bee Sting

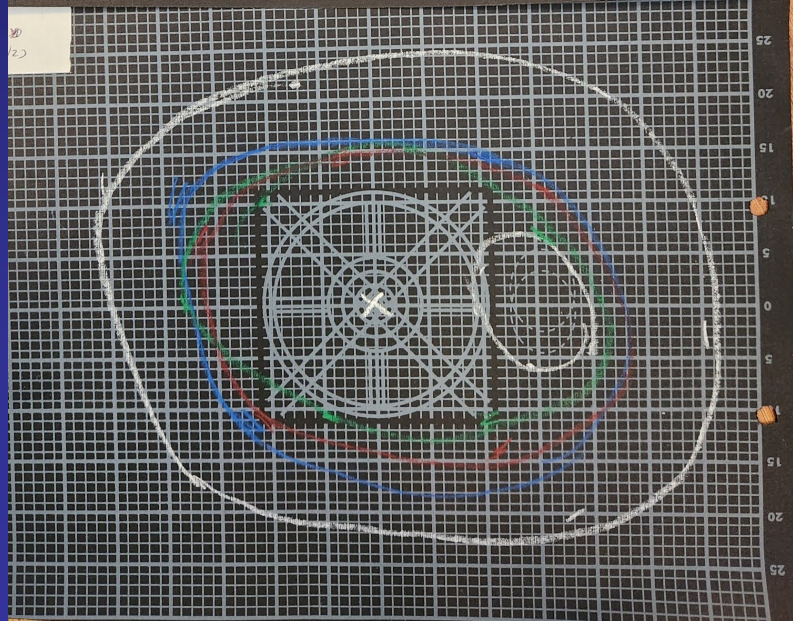


Sandra B Bee Sting 2023

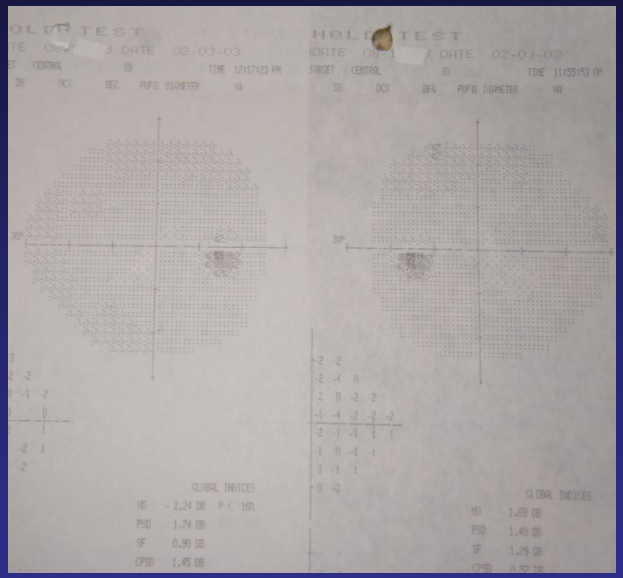


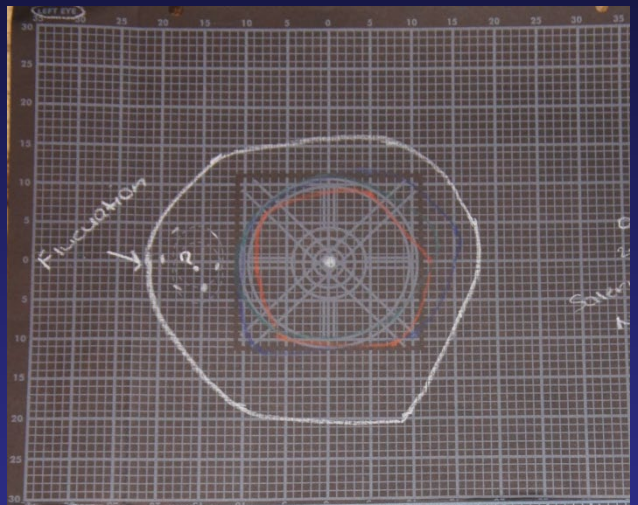


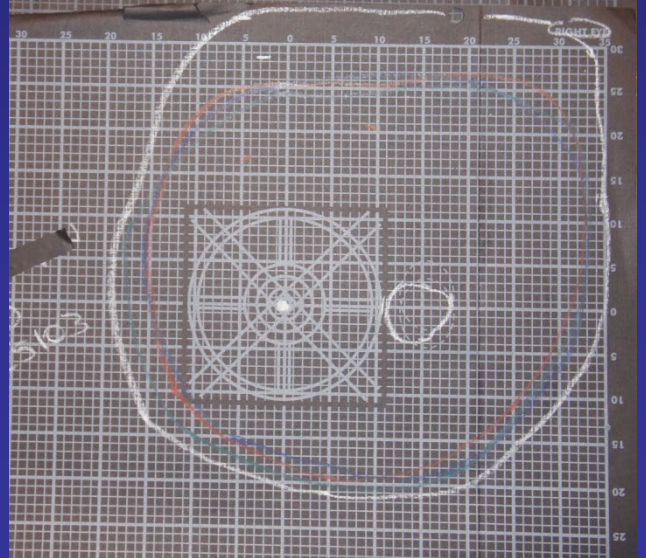


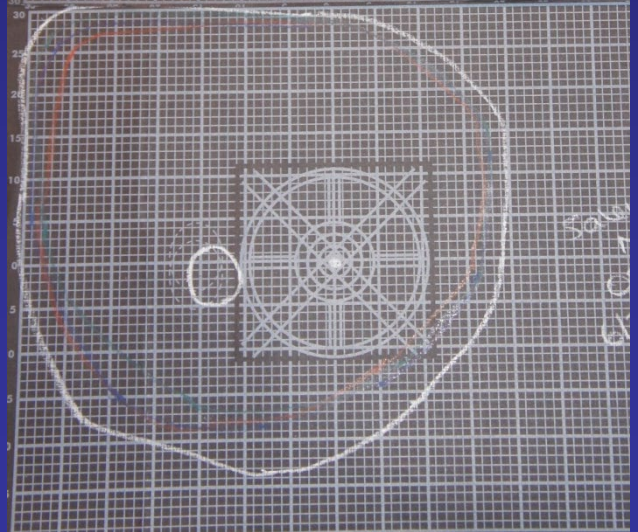


Kinetic, Functional Field - Abnormal Stress



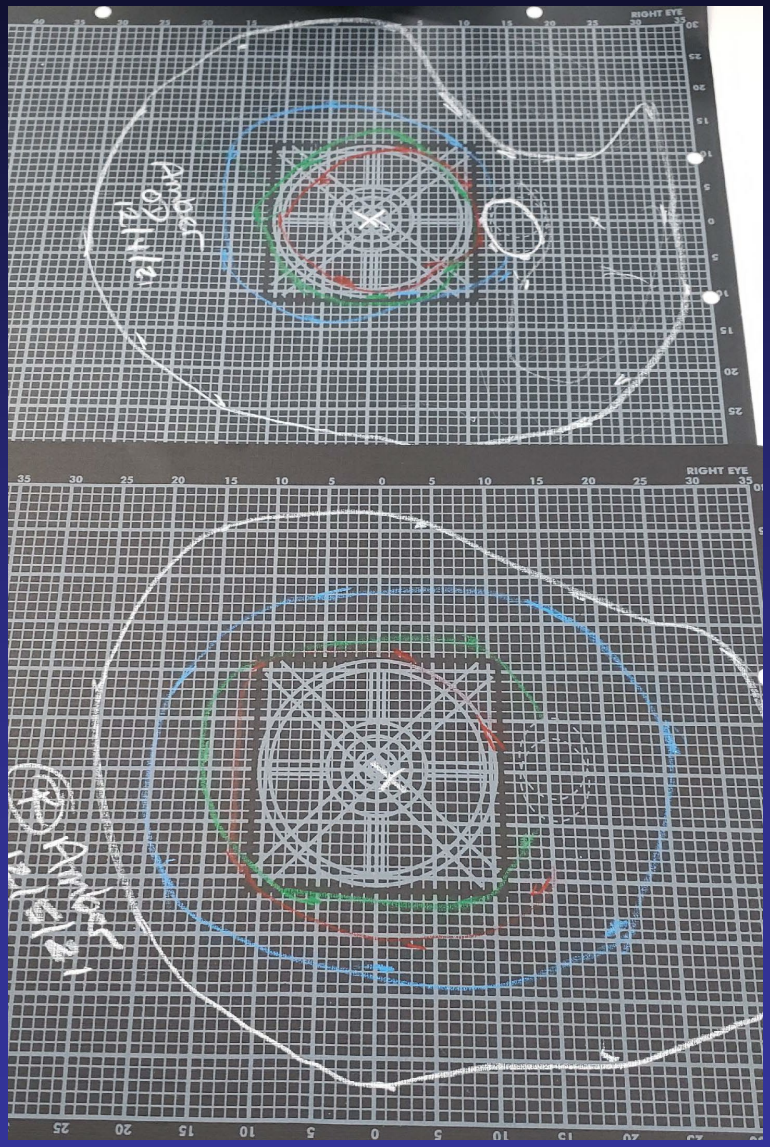


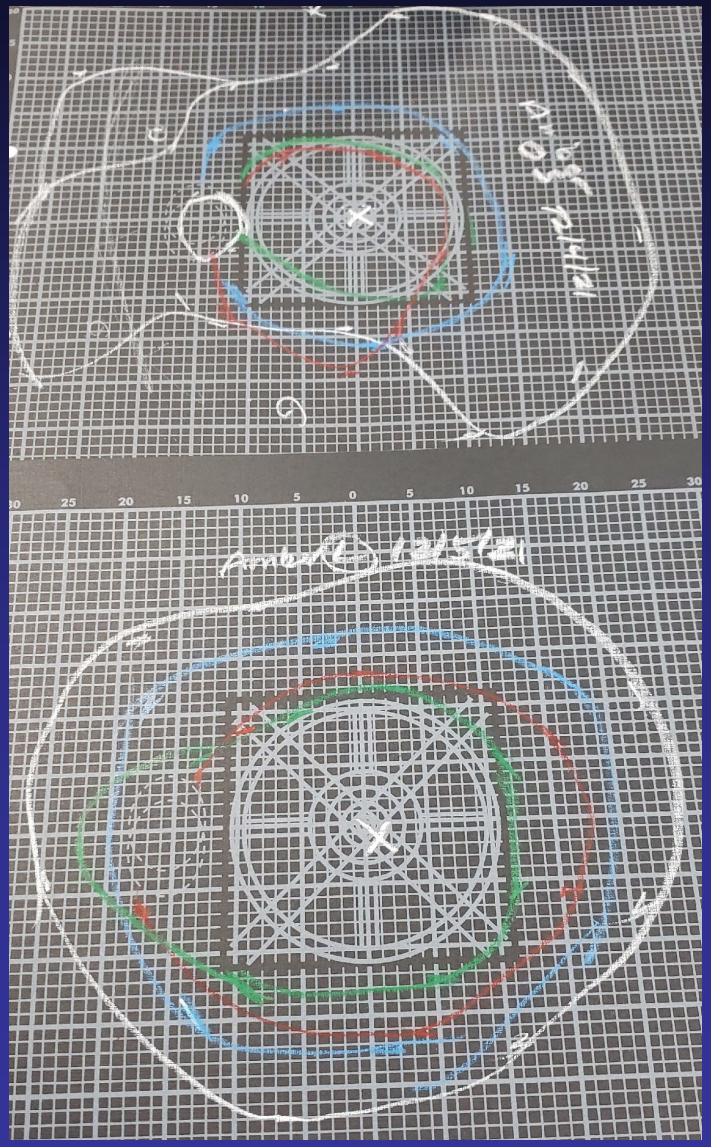




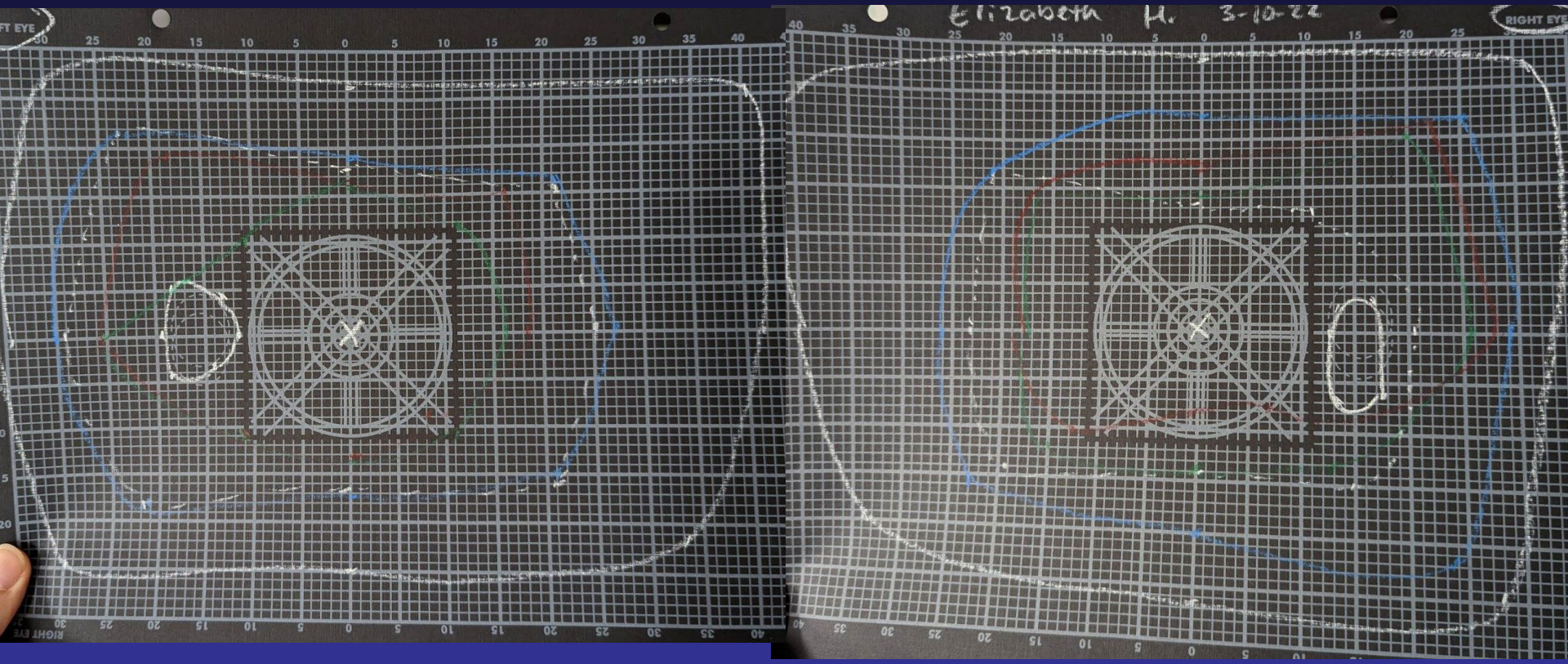
Kinetic, Functional Field - Abnormal

Vaccnines – Covid 19 Booster



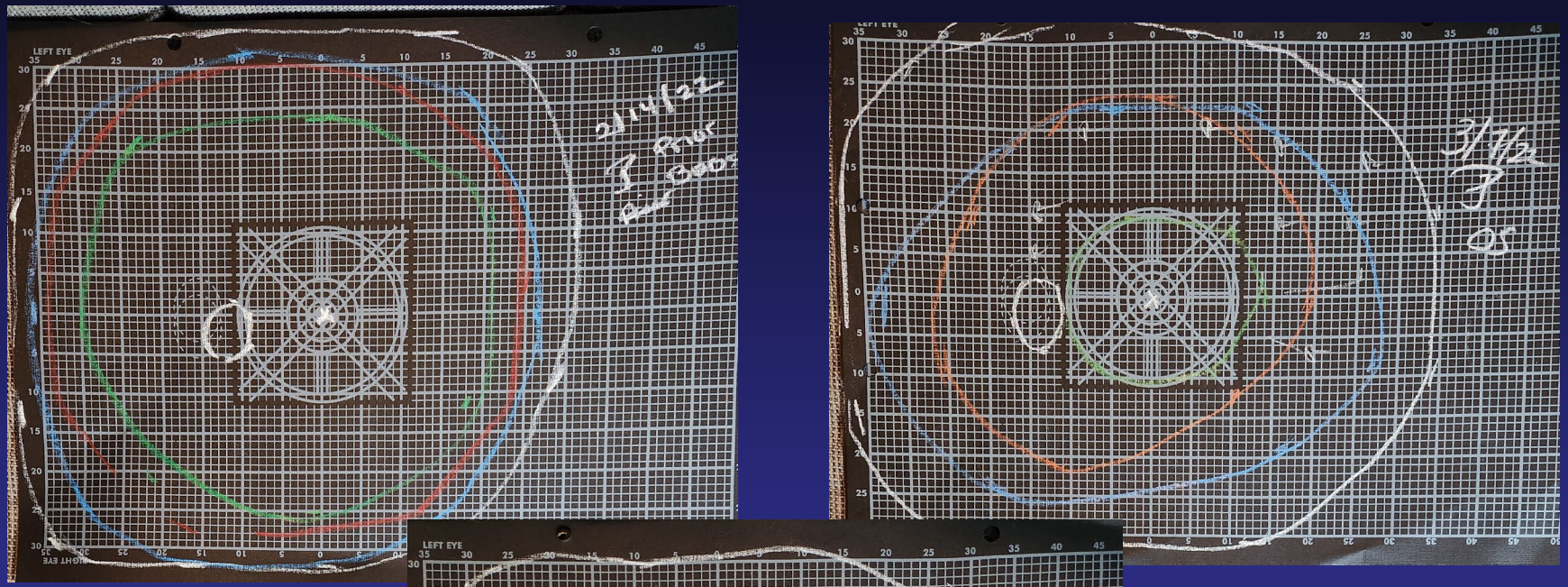


COVID Booster – 6 Days Post



Kinetic, Functional Field - Abnormal

Vaccnines – Covid 19 Booster



Preliminary Evaluation of BITS Touchscreen Technology in Improving Visual Field Awareness Related to Neurological Injury in the LTACH Setting

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Connecticut Community Foundation Timeless Impact

Abstract

Purpose: Many patients admitted to inpatient rehabilitation after acute neurological injury have some degree of a visual field deficit. Occupational Therapists (OTs) are trained to screen, assess, and treat these deficits. Many of the current interventions are either compensatory or restorative, however, there is conflicting evidence on what the current best practice is to improve visual field loss. The purpose of this study is to determine if the integration of touch screen technology into an OT regimen positively impacts visual field awareness. Specifically, our goal is to determine if the use of Bioness Integrated Therapy System (BITS) touch screen technology is more effective in improving visual field awareness than conventional vision interventions involving table-top and pen and pencil activities.

Design: Subjects were recruited from adult patients currently undergoing inpatient rehabilitation for an acute neurological an acute neurological event, such as a stroke, who also presented with a visual field deficit. Participants were alternately assigned to either the Control or BITS intervention group.

Interventions: The study was conducted at a Long-Term Acute Care Hospital (LTACH). The Control group was prescribed a conventional treatment regimen consisting of various table-top and pen and paper exercises. The BITS group was prescribed a similar treatment regimen using the BITS touch screen technology. Both groups were given 6 treatment sessions by an OT investigator. OTs also delivered pre- and post-intervention Bells testing to each subject; pre- and post-intervention Visual Field testing was delivered by a licensed Neuro-Optometrist.

Results: Preliminary Bells Test data was available for 16 participants, 8 Control and 8 BITS. data was analyzed using multiple t-tests. All pre-intervention Bells Test metrics were similar between groups, indicating subjects had similar baseline visual deficits independent of group assignment. In the Control group, no parameters were found to be significantly different between pre- and post-assessments. In the BITS group, the mean (SD) number of correct items increased from 18 (12) to 25 (10) ($p=0.002$) following the intervention. Comparing the change in bells correctly identified between groups, the change in bells correctly identified in the BITS group trended towards being significantly greater than the Control [2 (5) vs 7 (4); $p=0.065$]. Kinetic Visual Field Testing data was available for 9-16 eyes in the Control and 14-18 eyes in the BITS Group. Calculating the Percentage of Norm, both groups significantly improved ($p<0.001$). Comparing the change in percentage of norm, the BITS treatment group trended towards being significantly greater than the Control [9.9 (6.1) vs 14.3 (7.3); $p=0.149$].

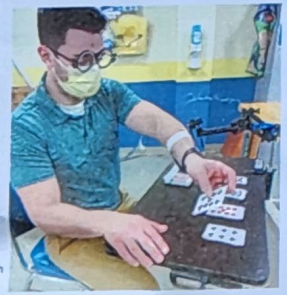
Conclusions: These preliminary data suggest patients with visual field deficits may benefit more from an interactive technology based OT regimen than conventional table-top exercises. We believe this study will help develop best practices in the rehabilitation of visual field deficits.

Objective

To determine the effectiveness of a multi-session regimen involving the Bioness Integrated Therapy System (BITS) touch screen technology as a safe, practical, and beneficial means to increase visual field awareness for individuals with neurological visual field deficits.

Background

- Most individuals that experience a neurological event will face visual deficit.
- Visual field deficits hinder patients' ability to see "the whole picture" of their visual field which can impede their ability to perform activities of daily living, instrumental activities of daily living, and safe mobility.
- There is conflicting evidence on the current best practice to improve visual field loss.
- The BITS is a touchscreen technology designed to challenge, assess, and track vision, cognitive, motor and balance deficiencies.
- It can be can be customized for patients of all functional and mobility levels.
- BITS motivates patients by providing immediate visual and auditory stimulation and feedback.
- The overall goal is to determine if using the BITS touch screen technology in a treatment program more effectively improves visual field awareness than conventional table-top and pen and paper interventions.



Participant completing tabletop tasks with arm support.

Methods

- Population: Patient's admitted for an acute neurological event and present with an acute neurological visual field impairment
- Research Design: Participants were alternately assigned to either the table-top exercise control or the BITS experimental group. Both groups completed six, 20-minute, sessions over a 3 week period.
- Outcome measures: a standardized paper Bells Test assessments; Kinetic Field Testing performed by a Neuro optometrist. Pre- and post-intervention assessments were collected.

Participant using the BITS screen

Participant undergoing kinetic field testing

Inclusion criteria

- Be 18 years or older and able to provide consent or have POA able to consent.
- Have been diagnosed with an acute or subacute neurological diagnosis in the last 3 months.
- Have an accompanying visual field deficit as verified by an OT using confrontation testing.
- Be admitted into Gaylord Specialty Healthcare.
- Able to follow 1 step directions.
- Have sufficient upper extremity strength to utilize BITS touch screen technology.
- Ability to tolerate at least 20 minutes of intervention at a seated wheelchair level.

Exclusion criteria

- Severe cognitive impairments (unable to follow 1 step commands, communicate pain, or stop intervention).
- Past medical history of significant visual impairment impacting visual fields or resulting in legal blindness.
- Re-admitted to ACH without returning in 1 week.
- Currently on a ventilator for respiratory support.
- Quadriparesis.
- Unstable vital signs or deemed inappropriate to participate in therapy per treating RN or physician.
- Uncontrolled or new arrhythmias or deep vein thrombosis.
- Concurrent severe neurological pathology/disease or stroke within 72 hours of admission to LTACH.

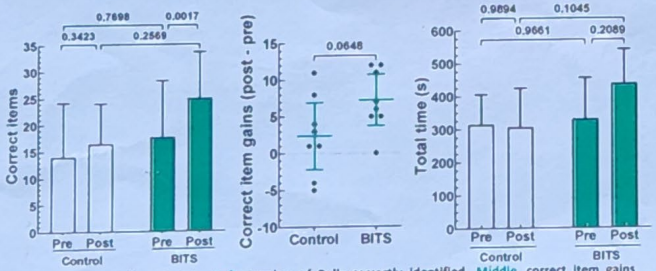


Figure 1. Bells test data. Left, number of Bells correctly identified. Middle, correct item gains between pre and post assessments. Right, total time to complete assessment. n=8; graphs show mean with 95% confidence interval

Acknowledgements and Financial Disclosures

This work is supported, in part, by the Earl and Shirley Herbst Fund for Eye Research at Connecticut Community Foundation.

Kinetic field testing, Percent of Norm[a], Both eyes pooled

	Control			BITS		
Meridian	Pre-exam (n=16 eyes)	Post-exam (n=9 eyes)	p-value[b]	Pre-exam (n=18 eyes)	Post-exam (n=14 eyes)	p-value[b]
Superior, mean (SD)	62% (18%)	73% (15%)	0.077	61% (23%)	83% (8%)	0.001
Superior temporal, mean (SD)	37% (36%)	57% (38%)	0.008	45% (40%)	55% (40%)	0.001
Temporal, mean (SD)	40% (39%)	59% (40%)	0.015	39% (37%)	55% (39%)	0.001
Inferior temporal, mean (SD)	37% (34%)	56% (38%)	0.041	32% (31%)	48% (36%)	0.001
Inferior, mean (SD)	57% (30%)	72% (21%)	0.122	56% (22%)	73% (14%)	0.006
Inferior nasal, mean (SD)	31% (27%)	40% (34%)	0.134	31% (26%)	41% (29%)	0.008
Nasal, mean (SD)	30% (31%)	40% (40%)	0.096	32% (28%)	48% (34%)	0.002
Superior nasal, mean (SD)	30% (31%)	43% (42%)	0.070	38% (35%)	53% (38%)	0.017
Mean (SD)	41% (17%)	55% (20%)	0.001	41% (17%)[c]	57% (12%)[c]	<0.001

[a] Percent of norm calculation = [(Kinetic Field Measurement) / (Normative value)] x 100%
[b] Calculated using multiple paired t-tests
[c] Not significantly different to control pre-exam, p=0.9857
[c] Not significantly different to control post-exam, p=0.6398

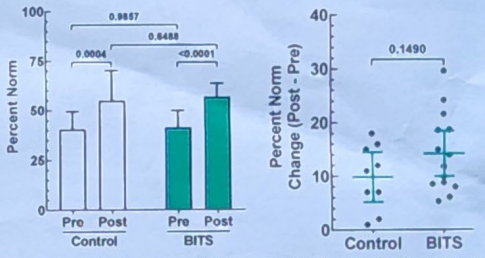


Figure 2. Kinetic field assessment. Left, Percent norm. The ratio of each measurement and their normative value was calculated. Right, Percent norm change between pre and post assessments. n = 9-16 eyes control; n = 14-18 eyes BITS; graphs show mean with 95% confidence interval.

Interpretation and Discussion

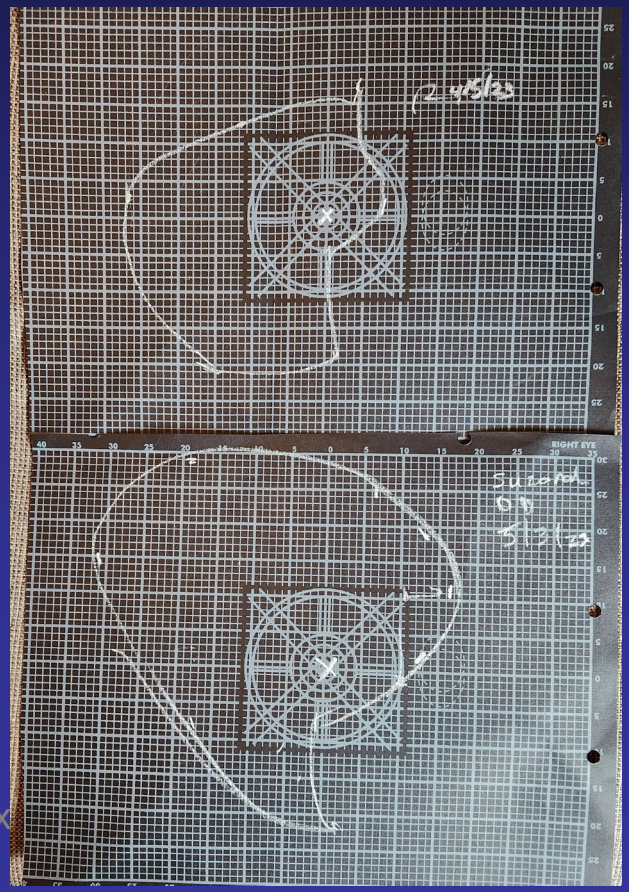
- Participants in the BITS group showed improved Bells Test scores, and the control group did not; both groups showed improved Kinetic Field test scores, pre to post.
- Because BITS technology is more engaging, and challenges patients to perform visual scanning more efficiently, it is possible BITS may have led to this score improvement.
- In the BITS group, Bells and Kinetic Field test gains also trended towards an increase.
- The preliminary data supports our hypothesis that interactive touchscreen technology may be a superior treatment intervention for improving visual field awareness.
- We can further hypothesize that the use of internal and external feedback and tactile localization may improve visual field awareness, and that touchscreen technology may have a place in vision therapy and future visual field deficit studies.
- Whereas the BITS group were provided with the ability to make errors and get immediate feedback, the control group only received external feedback from a therapist with verbal cues to locate items in the impaired visual field.
- In summary, a person's own interpretation of a task gathered from their sensory, visual, and proprioceptive fields, may have a greater impact on learning for carryover of compensatory vision strategies.

Improvements for the Future

- In addition to the BITS training, require prisms to be worn set number of hours per day.
- Compare outcomes of: participants wearing prisms versus no prisms; participants with right versus left field deficit; participants with full hemianopsia versus quadrant field deficits; and participants with CVA versus TBI.
- Determine effect of BITS on dense versus non-dense hemianopsia.
- Evaluate effect of BITS on the functional mobility status of participants.

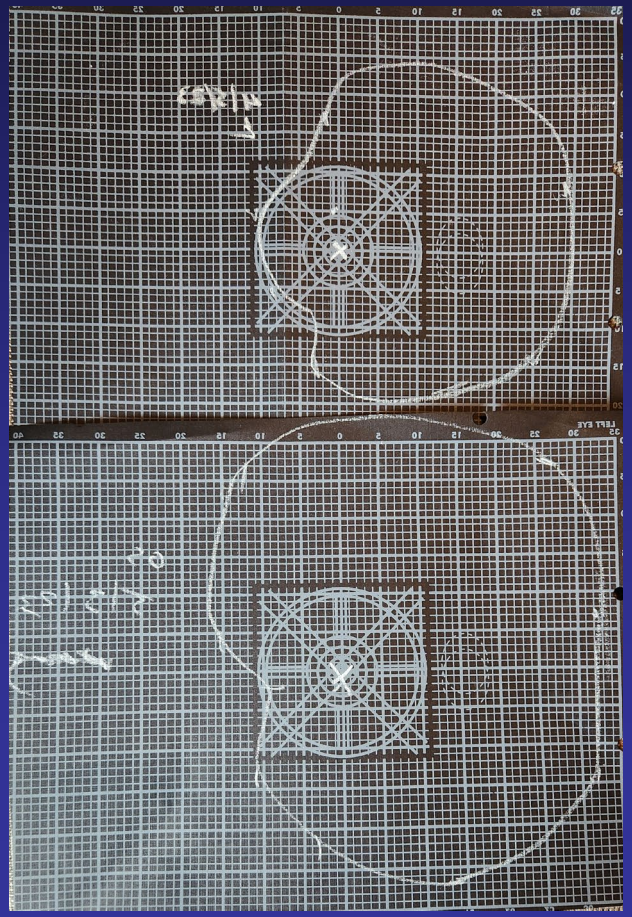
Kinetic, Functional Field - Abnormal Effects of Rehabilitative Intensive Therapy

31 y.o female, Left intraparenchymal hemorrhage on 12/12/2022 s/p left decompressive craniotomy. Booster 12/07/22. Found small but intact AVM left MCA.



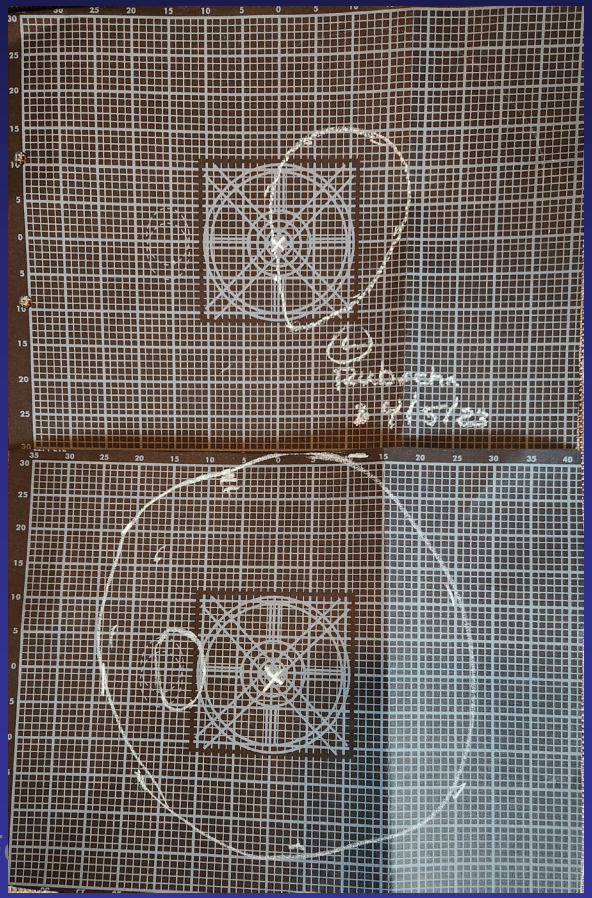
04/05/23

05/03/23



Kinetic, Functional Field - Abnormal Effects of Rehabilitative Intensive Therapy

54 y.o male, R MCA with hemorrhagic transformation suffered 02/06/23.



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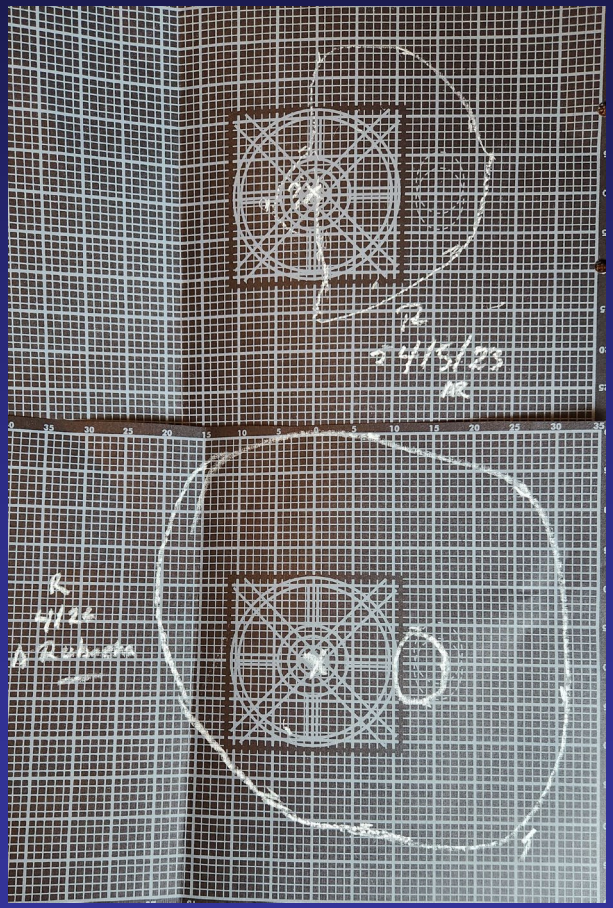
04/26/23



The Pupil
Automated Testing – BrightLamp Reflex

The Pupillary Light Reflex as a Biomarker of Concussion

Frederick Robert Carrick,[1,2,3,4,5,*] Sergio F. Azzolino,[5] Melissa Hunfalvay,[5] Guido Pagnacco,[5,6] Elena Oggero,[5,6] Ryan C. N. D'Arcy,[7,8,9] Mahera Abdulrahman,[10] and Kiminobu Sugaya[1,2]
Gary Peh, Academic Editor

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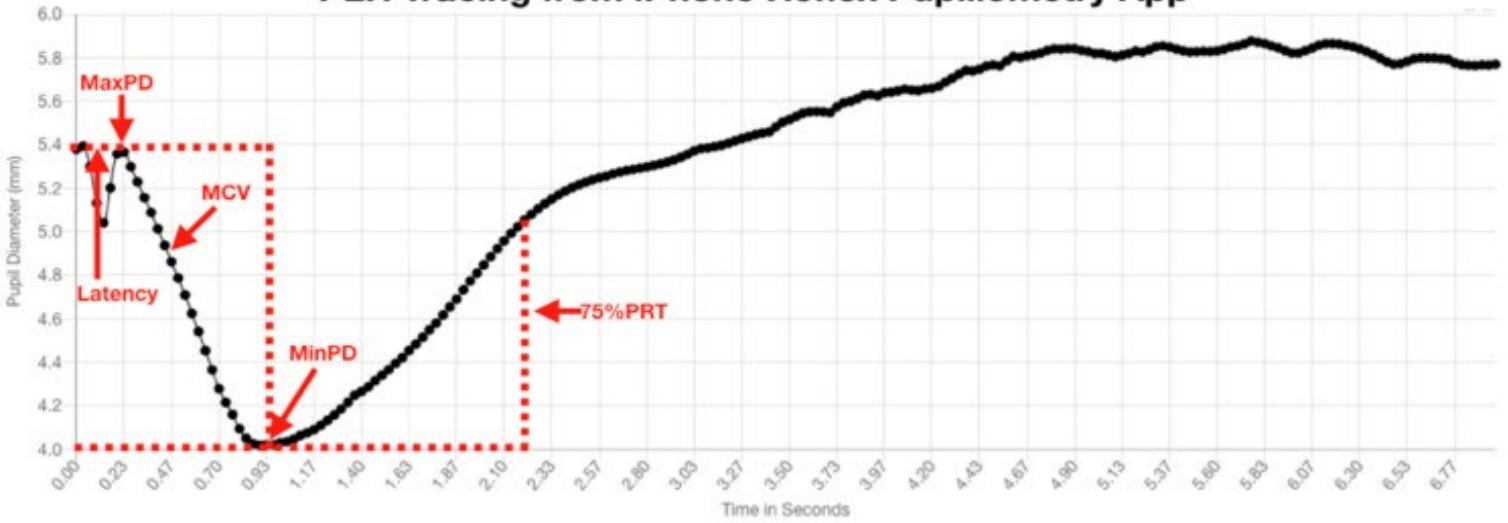
PMCID: PMC8537991
PMID: 34685475

Pupillary Reactions

Bright Lamp

Carrick et al Life (Basel). 2021 Oct; 11(10): doi: 10.3390/life11101104



Latency	Time from light flash to pupil constriction
MaxPD	The maximum diameter of pupil before light flash
MinPD	The minimum diameter of pupil after light flash
MCV	The maximum constriction velocity of pupil constriction after light flash
75% PRT	The time for redilation of pupil to 75% of its previous maximum diameter after light flash

The Pupillary Light Reflex as a Biomarker of Concussion

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- Looked at the parameters of the PLR in concussed versus non-concussed patients, presence of concussion symptoms, age and gender.
- Large Retrospective Study reviewing their clinical patient records – 01/2019 to 01/2020. Over 20,000 patients.
- Used of new automated pupillary testing – BrightLamp Reflex iPhone App. Reproducible diagnostic test.

The Pupillary Light Reflex as a Biomarker of Concussion

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Parameters of the PLR studied

- Maximum Pupillary Diameter (MPD)
- Minimum Pupillary Diameter (MinPD)
- 75% Pupillary Recovery Time (75% PRT)
- Maximum Constriction Velocity (MCV)
- Latency of PLR

.

The Pupillary Light Reflex as a Biomarker of Concussion

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Other Parameters Considered

- Concussion versus No concussion
- Concussion symptoms present
- Male versus Female
- Age

The Pupillary Light Reflex as a Biomarker of Concussion

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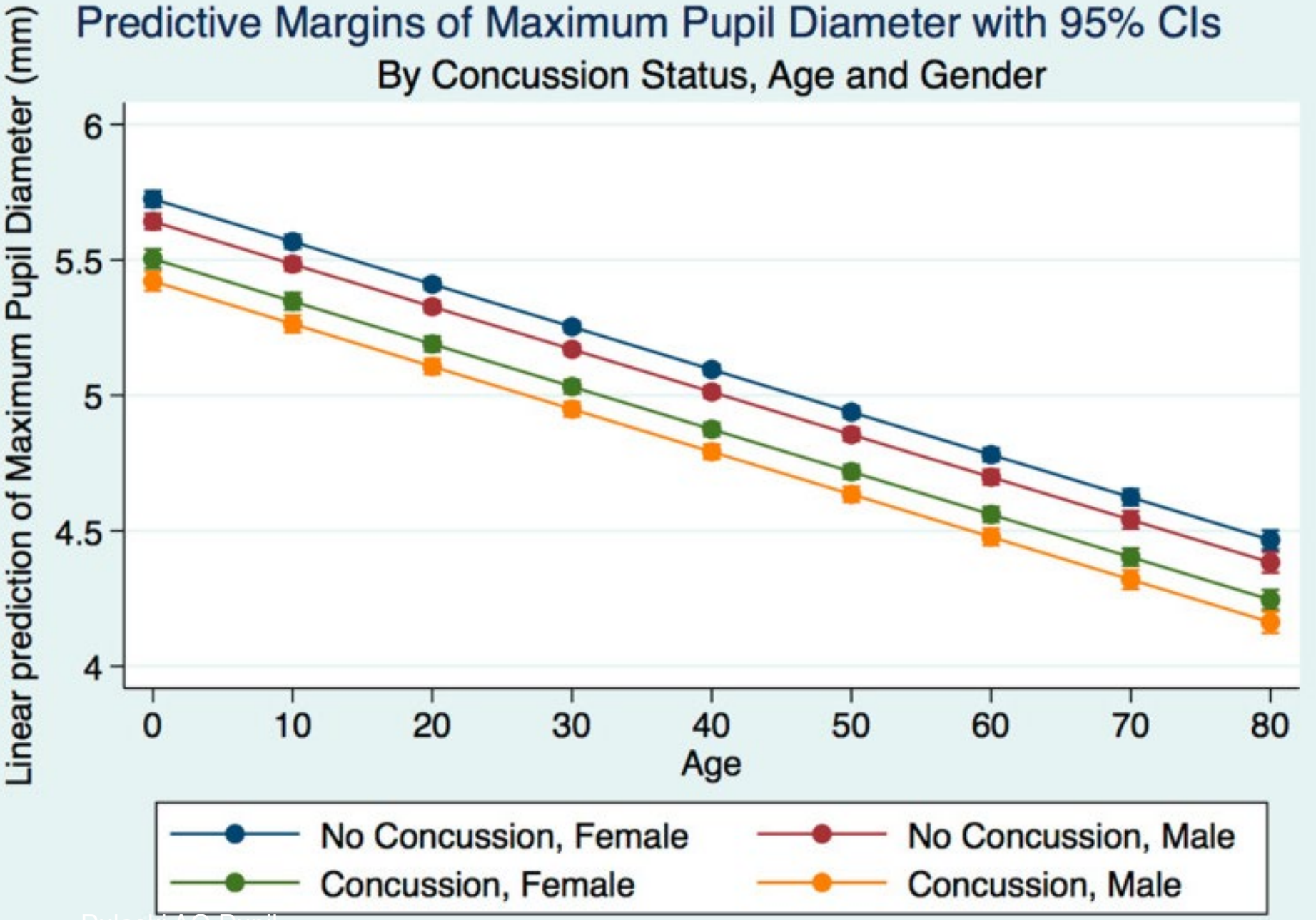
Maximum Pupillary Diameter (MPD)

- No significant difference between MPD in males and females who did not suffer a concussion or had no concussion-like symptoms.
- MPD smaller for both male and female after concussion compared to non-concussion.
- Males had smaller MPD than females in both concussion and non-concussion groups when extrapolated over time.
- As age increased the MPD decreased for all groups.
- Largest MPD was females with symptoms but both males and females with symptoms had a larger MPD than those without symptoms.
- Statistical analysis showed nonsignificant changes in the size of MPD over time.



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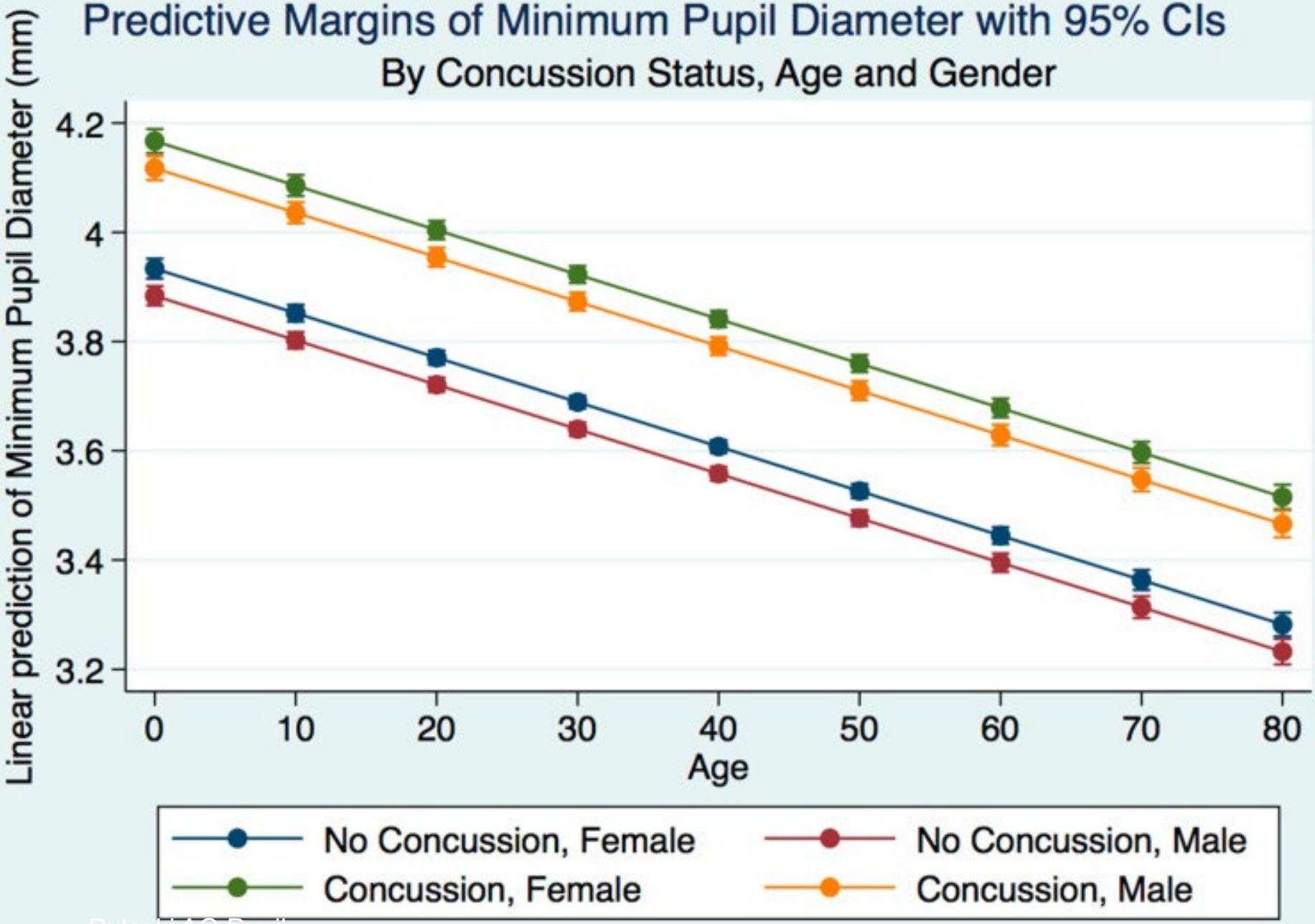
Minimum Pupillary Diameter (MinPD)

- Larger MinPD for both males and females after concussion compared to non concussion.
- Males showed smaller MinPD than females in both groups.
- The MinPD decreased with age.
- There was a decreased range of pupil constriction (MPD-MinPD) in concussion versus non-concussion patients.


Predictive Margins of Minimum Pupil Diameter with 95% CIs
By Concussion Status, Age and Gender
Linear prediction of Minimum Pupil Diameter (mm)
4.2
4
3.8
3.6
3.4
3.2
0
10
20
30
40
50
60
70
80
Age
No Concussion, Female
No Concussion, Male
Concussion, Female
Concussion, Male

The Pupillary Light Reflex as a Biomarker of Concussion

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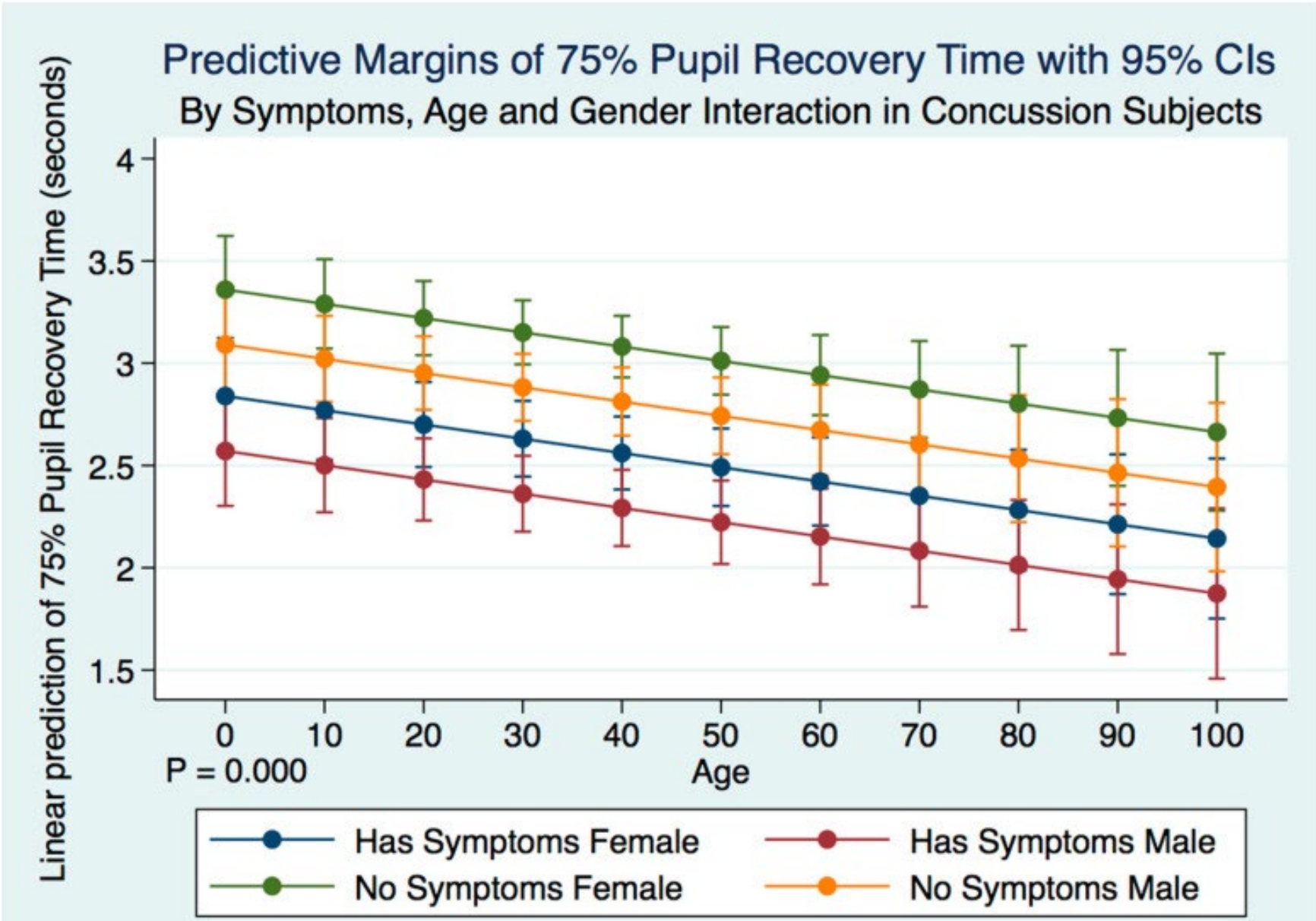
75% Pupillary Recovery Time (75% PRT)

- No statistical difference in 75% PRT between males and females with no concussion.
- Is statistical difference for both genders with faster 75% PRT in concussed groups versus no concussion.
- In concussion group males had a faster 75% PRT than females that increased with age.
- In both the concussion and non-concussion groups the 75% PRT increased faster over their lifespan.
- Symptomatic concussion patients had a slower 75% PRT than the asymptomatic concussion patients.


Predictive Margins of 75% Pupil Recovery Time with 95% CIs
By Symptoms, Age and Gender Interaction in Concussion Subjects
Linear prediction of 75% Pupil Recovery Time (seconds)
4
3.5
3
2.5
2
1.5
0
10
20
30
40
50
60
70
80
90
100
P = 0.000
Age
Has Symptoms Female
Has Symptoms Male
No Symptoms Female
No Symptoms Male

The Pupillary Light Reflex as a Biomarker of Concussion

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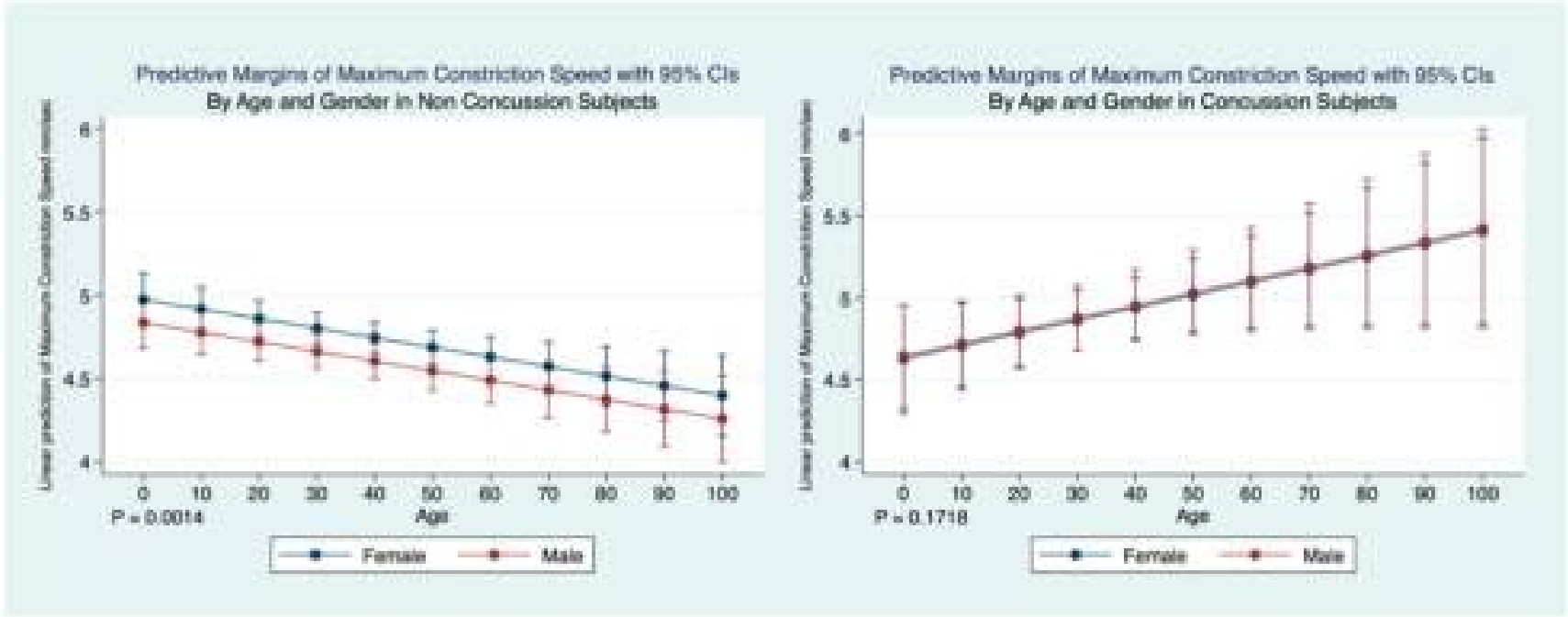
Maximum Constriction Velocity (MCV)

- Is statistical difference with slower MCV in non concussion group except if under the age of 20.
- In non concussion subjects the MCV decreased significantly with age with females having a quicker MCV than males.
- In contrast in concussion subjects the MCV increased with age with no gender difference.
- Females without symptoms after concussion had the fastest MCV.


Predictive Margins of Maximum Constriction Speed with 95% CIs
By Age and Gender in Non Concussion Subjects
Linear predictions of Maximum Constriction Speed mm/sec
6
5.5
5
4.5
4
0
10
20
30
40
50
60
70
80
90
100
Age
P = 0.0014
Female
Male
Predictive Margins of Maximum Constriction Speed with 95% CIs
By Age and Gender in Concussion Subjects
Linear predictions of Maximum Constriction Speed mm/sec
6
5.5
5
4.5
4
0
10
20
30
40
50
60
70
80
90
100
Age
P = 0.1718
Female
Male

The Pupillary Light Reflex as a Biomarker of Concussion

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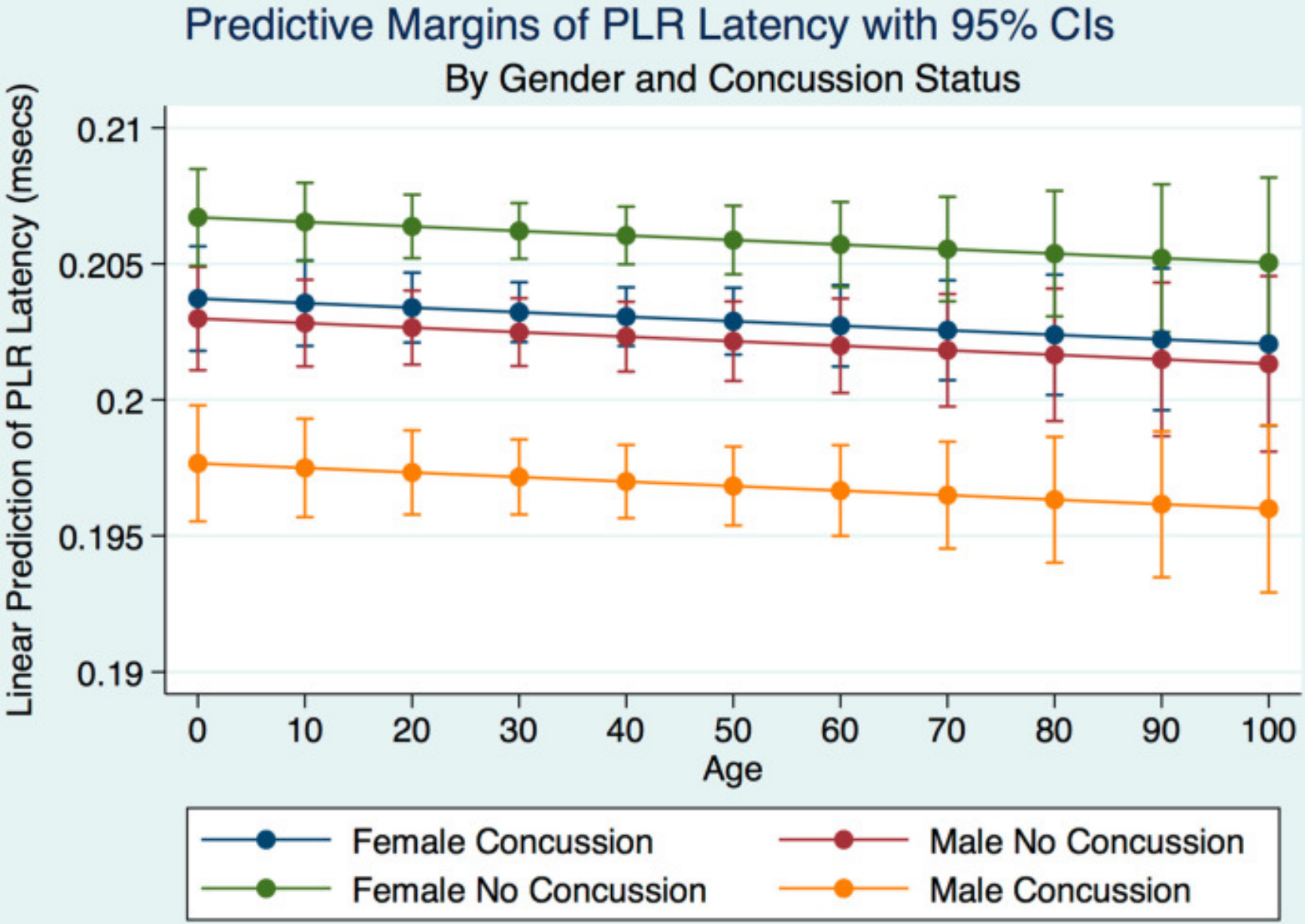
PLR Latency

- Latency of PLR was slower for patients with concussion versus with no concussion.
- Females without concussion had the fastest latencies. Males with concussion had the slowest latencies.
- There was a trend for decreasing latencies over lifespan.


Predictive Margins of PLR Latency with 95% CIs
By Gender and Concussion Status
Linear Prediction of PLR Latency (msecs)
0.21
0.205
0.2
0.195
0.19
0
10
20
30
40
50
60
70
80
90
100
Age
Female Concussion
Female No Concussion
Male No Concussion
Male Concussion

The Pupillary Light Reflex as a Biomarker of Concussion

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Conclusions

- PLR metrics contribute greatly to understanding other functional integration of the brain after TBI.
- Even though symptoms may disappear after a TBI, PLR metrics may not return to normal indicating continued impaired functional brain states.
- The PLR can be a useful diagnostic marker of treatment effectiveness.

The Pupillary Light Reflex as a Biomarker of Concussion

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Conclusions

- Author states that their findings suggest that light is but one of many integration variables governing the size of the pupil and that brain function variables may be more critical than even the light source.
- They further state that the results of this study indicate that the PLR can be used effectively in non- clinical based settings such as in a gym, sporting field or hospital ward.

The Pupillary Light Reflex as a Biomarker of Concussion

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Conclusions

- There exists a gender and age difference in pupillary reactions related to the PLR.
- TBI significantly affects PLR findings and varies depending on the presence of symptoms and across age groups. These include PLR latency, pupil size, velocity of constriction and dilation in recovery times.
- Long-term effects of PCS have been quantified with the permanency of functional changes of the PLR after concussion.

Overall Summaries

Females

- MPD Larger
- MinPD Larger
- 75% Rec Slower
- MCV Faster
- Latency Faster

Concussion

- MPD Smaller
- MinPD Larger
- 75% Rec Faster
- MCV Slower >20 yo
- Latency Slower

The Pupillary Light Reflex as a Biomarker of Concussion

Frederick Robert Carrick et al 2021

Conclusions

- Automated pupillometry such as the portable iPhone medical device (Brightlamp) is a reliable and reproducible instrument that can provide immediate evaluation and management of the TBI patient. The authors opinion is that this should contribute to decreasing the associated morbidity and mortality of brain injury.

Importance to Field of Syntonic Optometry and Neuro-Optometry

- We now have in our possession a device to accurately record not only the reactions of the pupil under sustained light illumination (AO Pupil) but also the additional metrics of the PLR. These are directly related to autonomic nervous system balance and vitality.
- This can allow us to more specifically assess and diagnose our patients and to provide more specific and accurate treatment through our filters.
- These reactions can now serve as additional accurate biomarkers and baselines to assess the effectiveness of our treatment.

Importance to Field of Syntonic Optometry and Neuro-Optometry

- Results from objective test important supporting clinical data in Medical/Legal cases
- Biomarkers for determining effectiveness of other modalities of rehabilitative care.
- Research Studies

Questions or Comments?

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