

Learning-Related Vision Problems

You can do more to understand and help your pediatric patients!

Jeffrey J. Lant, OD COEP
UMSL Aug 15, 2026

1

Introduction

Doctor of Optometry

- Southern College of Optometry 2012

Primary Care Optometry

- Clarkson Eyecare 2012-2017

Behavioral Optometrist

- Four Circles Vision Therapy 2017-2025

- Regional Eyecare 2025-Present

Adjunct Assistant Clinical Professor

- UMSL 2023-Present

Chair of Clinical Curriculum Faculty

- Optometric Extension Program Foundation 2021-Present



2



3

Learning-Related Vision Problems

- What is Vision?
- What is Reading?
- How do we learn to Read?
- What is Reading Dysfunction?
- What is a Learning-Related Vision Problem?
- How can we help Learning-Related Vision Problem?
 - Testing
 - Treatments
- What is Dyslexia?
- Primitive Reflexes and Vision

4

What is "Vision"?

- "Vision is the **deriving of meaning** and **direction of action** as triggered by light."
 - Optometric Extension Program Foundation (OEFP)
- The primary purpose of the visual process is to **direct action**."

5

What is "Vision"?

- Visual Information Acquisition
 - Eyesight
 - Oculomotor function–
 - Fixation, saccades, and pursuits
 - Accommodation
 - Binocularity
 - Stereopsis, fusional ranges
 - Central/Peripheral Integration

6

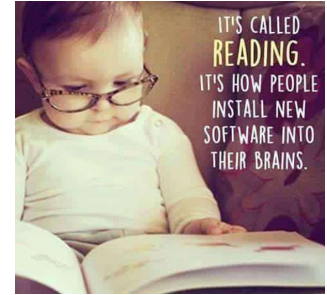
What is "Vision"?

- Visual Information Processing
 - Visual Motor
 - Visual Spatial
 - Laterality/Directionality
 - Visual Perception
 - Discrimination, figure ground, visual closure, form constancy, visual memory etc
- Eidetic Pattern Recognition

7

What is reading?

- "To look at and comprehend the meaning of written or printed matter by mentally interpreting the characters or symbols of which it is composed"
 - Oxford Dictionary
- Absorbing language through vision

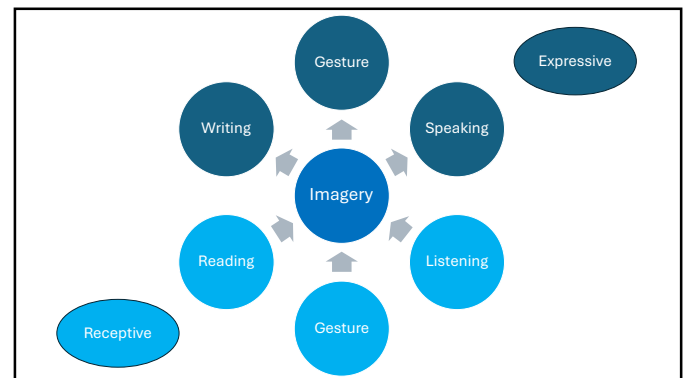


8

What is Language?

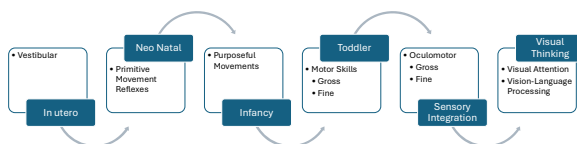
- The process by which we communicate
- Receptive Language
 - Gesture
 - Listening
 - Reading
- Expressive Language
 - Gesture
 - Speaking
 - Writing

9



10

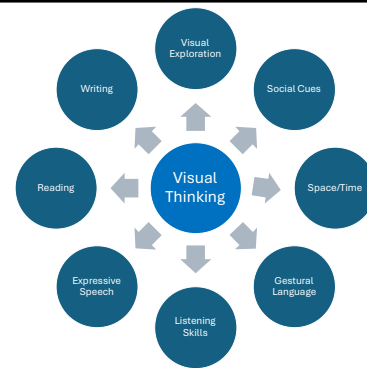
How to we learn to read?



Early stages of visual process maturation

11

Later stages of the visual process maturation



12

How do we learn to read?

- The brain uses the visual process for pattern recognition to compare what we are/will/might experience with that which we've had previous experience
 - Is what I am experiencing similar or dissimilar to anything I have experienced before?
 - Yes, easier to build off prior experience
 - No, harder to start from scratch

13

How to we learn to read?

- Early life experiences build the framework of visual learning which sets the stage for complex abilities such as reading
- "The timing of reading specific instruction is the key to preventing maladaptive epigenetic misalignments or defective learning patterns"
- We first learn language in real space and then begin to apply it to abstract forms such as written text (letters/words)

14

How to we learn to read?

- Prior to reading instruction, an individual needs establish these skills for language to produce imagery
 - Visual Motor Integration
 - Visual Attention
 - Visual Perception
 - Visual Memory
 - Visualization
 - Figure Ground

15

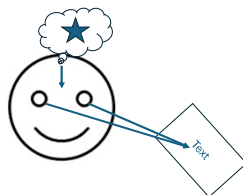
How to we learn to read?

- The brain is genetically predisposed to form a network that allows for language recognition
- We connect what we see with what we know with the goal of imagery/understanding
 - Part-to-Whole (phonologic)-
 - Whole-to-Part (eidetic)
- We learn and execute an organized pattern of fixation-saccade-fixation

16

Reading Strategies

- Visual Dominant Reading
 - Eidetic pattern recognition
 - Whole-to-Part
 - Predictive imagery
 - Fixations confirm imagery
 - Few
 - Quick
 - Organized
 - Sees imagery in the "mind's eye"



17

Reading Strategies

- "Dear Son: I have ever had the pleasure in obtaining any little anecdotes of my ancestors. You may remember the inquiries I made among the remains of my relations where you were with me in England, and the journey I took for that purpose..."
- "Daer Son: I hveee eevr had teh plsauere ni otabninig any ltltle adcoetnes of my asncseorts. You may rmmeeebrr the iqnuieris I mdaeaomngthe raemnisof my rlttaenoswrehe you wree wtihme in Elagnnd, and the jenuory I took for taht prpo purpose..."

18

Reading Strategies

- Count all the letters "F" below

FINISHED FILES ARE THE
RESULT OF SCIENTIFIC STUDY
COMBINED WITH THE
EXPERIENCE OF MANY YEARS
OF EXPERTS

19

Reading Strategies

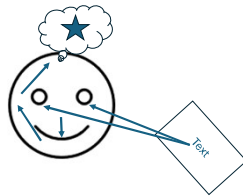
Mchf wht s prcvd s appldb the prcvr
rre fact that you are able to read these lines
shws ho mch nfrmtn yr cpbl s sppng whnvr
an incoming message is distorted
n sm wy.

"It is not what the eyes see but what the mind completes"

20

Reading Strategies

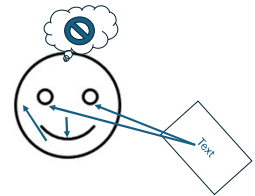
- Speech/Auditory Dominant Reading
 - Vision to Speech
 - Subvocalized/Vocalized
 - Speech to Listening
 - Listening to Imagery
- All words fixated
 - Moderate duration
 - Mixed Attention
 - Whole-to-Part/Part-to-Whole
- Hears words in their mind



21

Reading Strategies

- Imagery Absent Reading
 - Vision to speech
 - Speech to Auditory
 - STOPS at Auditory
 - Fixations
 - Syllabic based decoding
 - Long duration
 - Unable to convert text to imagery



22

How Do We Learn to Read?

- If formal reading instruction is introduced prior to visual competence...



23

What is Reading Dysfunction?

- General reading dysfunction" can be attributed to:
 - Low intelligence
 - Educational deprivation
 - Sociocultural deprivation
 - Primary emotional or mental health problems
 - Vision problems
 - Auditory problems
 - Sensory-integration problems
 - ADD/ADHD
 - Health problems

24

What is Reading Dysfunction?

- Principal vision problems causing general reading dysfunction
 - Uncompensated refractive problems
 - Double vision
 - Vergence problems
 - Accommodation problems
 - Oculomotor problems
 - Information processing problems
 - Visual-auditory integration problems

25

What is Reading Dysfunction?

- Labeling and diagnosing learning problems are confirmations of what is most likely already observed and known
- They are used to qualify for remedial services and accommodations
- Unfortunately, they do little to help determine the cause of the learning struggles

26

How can we identify Learning-Related Vision Problems?

27

Testing for Learning-Related Vision Problems

- Case History!!!
- Comprehensive vision evaluation (beyond basic refraction)
- Piaget Right-Left Awareness
- Wold Sentence Copy
- Developmental Eye Movement Test (DEM)
- Jordan Left-Right Test
- Reading Samples
- Dyslexia Screening tests
- Primitive Reflex Screening Tests
- Others

28

Testing for Learning-Related Vision Problems

- Practice Management
 - Exam as either routine or medical
 - **92xxx** or **99xxx**
- Developmental Screening
 - **96110**
 - Primitive Reflexes
- Sensorimotor Exam
 - **92060**
 - Required Components
- Developmental Testing (Additional Visit, does not require doctor)
 - **96112** (30-60 min)
 - **96113** for each addition 30 min beyond the first 60
 - Includes grading and reporting time

29

Functional Vision Evaluation

- | | |
|--|---|
| <ul style="list-style-type: none"> • Acuity at near and far • Cover tests at near and far • Extraocular motility (EOMs) • Near Point of Convergence (NPC) • Confrontational Vision Fields • Stereoacuity at near and far • Retinoscopy at near and far • Subjective Refraction | <ul style="list-style-type: none"> • Phoria assessment (e.g. von Graefe or Maddox Rod) • Vergence ranges at near and far (including break and recovery) • Accommodation assessments (NRA/PRA, FCC, amps, and facility) • Worth Four Dot at near and far • Pupils • Ophthalmoscopy |
|--|---|

30

Piaget Right Left Awareness Test

- Do they know their own right from left? **"Laterality"**
- Can they impose right and left on things around them? **"Directionality"**
- Quick and helps determine what tests comes next
- What lead to this?
 - Retained reflexes?

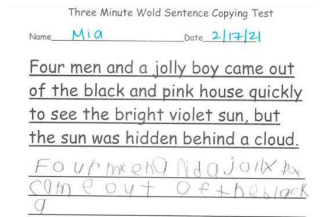
Awareness Test	
Age	Items passed by 75% of children that age
5, 6	A
7	A, C
8, 9, 10	A, B, C, D
11	A, B, C, D, E

Right Left Awareness Test	
Form (R) or Fall (R)	
A. _____	Show me your right hand. Now show me your left hand. Show me your right leg. Now show me your left leg.
B. (SIT OPPOSITE THE CIRCLE)	Show me my right hand. Now show me my left. Show me my right leg. Now my left leg.
C. (PLACE A COIN ON THE TABLE LEFT OF A PENCIL IN RELATION TO THE CIRCLE)	Is the pencil to the right or to the left? (ASK THE CHILD GO AROUND TO THE OPPOSITE SIDE OF THE TABLE) Is the pencil to the right or to the left? And the penny - is it to the right or to the left?
D. (SIT OPPOSITE THE CHILD WITH A COIN IN YOUR RIGHT HAND AND A BRACELET OR WATCH ON YOUR LEFT ARM)	You see the penny. Have I got it in my right hand or in my left? And the bracelet. Is it on my right arm or my left?

31

Wold Sentence Copying Test

- Observations
 - Handwriting
 - Visual-spatial organization
- Better for observational data
 - Posture
 - Number of fixations
 - Spacing
 - Vocalization/Subvocalization
 - Speed
 - Concentration, attention, and fatigue
 - Formation
 - Frustration level



32

Developmental Eye Movement Test (DEM)



- Evaluation left to right saccadic eye movements
- Differentiate normal reading eye movements from oculomotor dysfunction and automatic naming problems
- Quick and revealing about individual's abilities

33

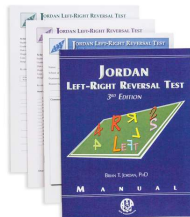
Developmental Eye Movement Test



34

Jordan Left-Right Reversal Test

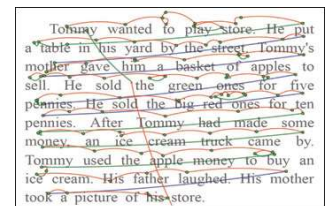
- To assess how well individuals can identify reversed images, letters, and numbers
- Compare to age-appropriate norms
- Quick but not comprehensive



35

Reading Samples

- Visigraph*
- Readalyzer*
- RightEye
- Lexeplore
- Important observations and metrics
 - Organization
 - Number of fixations
 - Fixation duration
 - Speed (words per minute) Regressions



36

Dyslexia Screening Options

- Dyslexia Determination Test (DDT)
 - Adult Dyslexia Test (ADT)
 - The Dyslexia Screener (TDS)
 - Dyslexia Screener for First Graders (DSF)
 - Pre-dyslexia Letter Coding Test for Kindergartners
- These are SCREENING tests! They are not complete enough for a formal diagnosis
- We can learn a lot about our patients reading, spelling, and writing behaviors/strategies
- These behaviors can be considered "Dyslexic Patterns"

37

Dyslexia Determination Test (DDT)



- **Dysnemiakinsiea:** deficit in the ability to develop motor gestalts for written symbols and write them without reversals
- **Dysphonisia:** deficit in visual- symbol and sound integration, and the inability to develop phonic word analysis synthesis skills
- **Dysidesia:** deficit in the ability to perceive whole words as visual gestalts and match them with auditory gestalts

38

Dyslexia Determination Test (DDT)



- **Dysnemiakinsiea:** Motor
- Difficulty with writing letters and numbers without reversals
- Poor laterality and directionality skills

39

Dyslexia Determination Test (DDT)



- **Dysphonisia:** Auditory
- Difficulty using phonics syllabication and structural analysis in the coding of words.
- Poor phonetic ability to decode words
- Words are not spelled how they sound

40

Dyslexia Determination Test (DDT)



- **Dysidesia:** Visual
- Poor spelling because revisualization of the whole word is difficult, and spelling of many phonetically irregular words will be in a phonetic basis
- They will have a hard time matching the visual configuration of the whole word with the whole sound of the word

41

Dyslexia Determination Test (DDT)



- Do they have a written reversals problem?
- What is their method for decoding (reading)?
 - Do they know it by sight?
 - What happens if not?
- What is their method for encoding (spelling)?
 - Do they spell it how it sounds?
 - Do they remember how it looks?

42

What is Dyslexia?

- "Dyslexia, a disorder that is neurological in origin, characterized by difficulties with accurate and fluent word recognition and poor spelling and decoding abilities that typically result from a deficit in the phonological component of language, often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction, and of which secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."
- Missouri Revisor of Statutes
<https://revisor.mo.gov/main/OneSection.aspx?section=167.950>

43

What is Dyslexia?

- **"Specific Reading Dysfunction/Disability"**
- Problems with single-word decoding due to an impairment in grapheme-phoneme conversion – Sight to Speech connection
- "In most cases, a specific reading disability is synonymous with dyslexia, which is manifest as a deficit in decoding, encoding, and nemkinesia of the symbols of written language caused by a minimum brain dysfunction or differential brain function leading to problems in reading writing and spelling."

44

What is Dyslexia?

- Reversals and Dyslexia
- "Contrary to the accepted idea, these mere inversion errors are not the first signs of dyslexia, but a natural consequence of the organization of our visual brain."
 - Reading in the Brain, Stanislas Dehaene

45

What is Dyslexia?

- Language problem?
- Vision problem?
- Speech problem?
- Auditory problem?
- YES!!!

46

How is dyslexia officially diagnosed?

- Patient history including development, educational problems, and personal and family medical history
- Psychoeducation testing
- Reading testing
- Neurological testing
- Aptitude testing

47

Can we "diagnose" dyslexia?

- In short, we SHOULD NOT "diagnose" dyslexia
- What can we do...
 - Identify learning-related vision problems
 - Identify or rule out visual components of "general reading dysfunction"
 - Identify "dyslexic patterns"
 - Advocate for our patients in learning environments

48

Primitive Reflexes and Vision

- "...the presence of certain PRs can affect visual development and academic performance especially in the area of reading, leading to abnormal functioning of ocular motility and significantly of saccadic movements."
- "The inhibition of the asymmetric tonic neck reflex, symmetric tonic neck reflex, labyrinthine tonic reflex and Moro reflex significantly improve, independently of age and sex, visual fixation, and saccadic movements, favoring tasks with less effort and improving the balance between the values of both eyes. This progress establishes the basis for other more complex processes such as reading. The present research aims to provide valuable information that will help vision professionals and physiological therapists, among others, to obtain new work approaches."

Domínguez-Saura VA. Persistence of primitive reflexes associated with asymmetries in fixation and ocular motility values. J Eye Mov Res. 2024 Aug;10:172310.10010/jemr.17.2.5. doi: 10.10010/jemr.17.2.5. PMID: 39246715; PMCID: PMC11279514.

49

Primitive Reflexes

- Primitive Reflexes are involuntary movement patterns that are present at birth and should become dormant, or "integrated" before the child reaches 12 months of age
- Most reflexes become integrated into a pattern of movement after infancy, so more mature and voluntary movements can emerge
- Unintegrated, or retained, reflexes interfere with a child's ability to develop an appropriate foundation for stability and mobility

50

Moro Reflex

- Preceded by the "Fear Paralysis Reflex", response to stress
- Beginning of "fight-or-flight" response
- A sudden change to the vestibular system drives a sympathetic response
- Responsible for the first breath

The moro reflex



51

Moro Reflex

- Residual MR activity can be associated with...
 - Poorly coordinated vestibular function
 - Hypersensitivity to sensory stimuli
 - Underdeveloped oculomotor skills
 - Significant anxiety
 - Poorly regulated emotions
 - Visual-perception delays

The moro reflex



52

Moro Reflex

- A retained MR can interfere with the development of basic fundamental vision skills
 - Oculomotor skills
 - Visual-perceptual skills
 - Pupillary responses to light

The moro reflex



53

Tonic Labyrinthine Reflex (TLR)

- Major function is the help an infant stretch out after birth
- Helps develop musculature for interaction with gravity and forming the sense of proprioception
- Coordinated action between upper and lower body stimulates muscular development



54

Tonic Labyrinthine Reflex (TLR)



- A retained TLR can lead to...
 - Postural instability caused by abnormal regulation of muscle tone
 - Poor internal awareness of body position
 - Often have slumped or sluggish appearance
 - Become easily fatigued and have little endurance dealing with stressors

55

Tonic Labyrinthine Reflex (TLR)



- Lack of internal tonic awareness including eyes
 - May not "feel" their eyes moving
 - Difficulty with endurance on vergence and accommodative tasks (e.g. near/far or maintaining stereopsis)
 - Impacts early vestibular functions preventing oculomotor/vestibular integration

56

Spinal Galant Reflex (SGR)

- Tactile stimulation to the sides of the spine cause a fetus to wiggle its body
 - Helps them move through the birth canal
- When presents, the individual will curl sideways towards the stimulation
- Primary conductor of sound in utero, they "feel" sound
 - Plays a role in developing auditory processing and rhythm skills



57

Spinal Galant Reflex (SGR)

- Residual SGR activity can be associated with...
 - Tactile hypersensitivity
 - Distractibility and difficulty controlling and maintaining visual attention
 - Poor sense of spatial and timing connections
 - Delayed toiletry skills (Pulgar Marx Reflex)



58

Asymmetric Tonic Neck Reflex (ATNR)

- When the head is turned to one side the arm on that side extends and the other goes into flexion
- Helps establish division between right and left sides of the body and internal sense of a midline
- Helps develop early eye-hand coordination



59

Asymmetric Tonic Neck Reflex (ATNR)

- Residual ATNR activity can be associated with...
 - Physical and visual midline confusion
 - Difficulty knowing right vs left
 - Difficulty with bilateral tasks
 - Eye-teaming problems including strabismus
 - Academic performance related reading eye-movements



60

Symmetric Tonic Neck Reflex (STNR)



- Not a true "Primitive Reflex" because it emerges after birth
- When an infant flexes or extends their head, the arms follow the head and the legs do the opposite
- Integration leads to crawling and creeping

61

Symmetric Tonic Neck Reflex (STNR)



- Residual STNR activity can be associated with...
 - Difficulty with near/far focus changes and binocular alignment
 - Poorly developed saccadic eye movements
 - Poor handwriting, posture, balance, and overall coordination

62

Moro Reflex Testing

- Vestibular Moro Reflex (VMR)
 - Supine
 - Standing
 - Observe reaction and sympathetic responses
- Duck and Pigeon Walk
 - Walk with feet turned out or in
 - Observe body posture, positioning of hands, and balance

The moro reflex



63

Tonic Labyrinthine Reflex (TLR) Testing

- Suspended Prone
 - "Superman" on therapy ball/stool
- Prone on Floor
 - "Superman" on the floor
- Standing
 - Hold knees while looking up or down
- Observe ability to maintain extension in head, arms, and legs



64

Spinal Galant Reflex (SGR) Testing

- Quadruped
 - Run finger or object down each side of the spine from shoulder blade to lumbar area
- Observe movement of torso in direction of stimulation or other reactions to the sensation of touch



65

Asymmetric Tonic Neck Reflex (ATNR) Testing

- Supine (Andrich Test)
 - Arms straight up, turn head
- Quadruped
 - "Tabletop" position, turn head
- Standing
 - Arms straight out, turn head
- Observe movements in arms, shoulders, elbows, back and hips



66

Symmetric Tonic Neck Reflex (STNR)

- Quadruped
 - Move head up and down holding for 2-3 counts
 - Look for movement in the back, hips, arms, and lower extremities



67

Video of Testing

68

How can we help someone prepare to read?

69

Pre-Reading

- Infant:
 - Encourage "Visual Curiosity" leading to directing action and movement
 - Visual targets of interest
 - People
 - Food
 - Sounds
 - "See and get"
 - Reflex integration
 - Movement, Movement, Movement

70

Pre-Reading

- Toddler-Pre-school:
 - Beginning of visualization
 - Predictive vision with figure/ground
 - (e.g. Look and Find)
 - Visual discrimination
 - Real objects vs Abstract (pictures and shapes etc)
 - Visual Closure
 - Imaginative Play

71

Pre-Reading

- Toddler-Pre-school continued:
 - Visual memory
 - Tachistoscopic training
 - Where and What
 - Visualization without sounds
 - Writing on back (shape, numbers, letters, words)
 - Central-Peripheral Integration
 - High fives, counting fingers
 - Reading saccadic practice

72

Early Reading

- Encourage Visualization
- Visual Perception Skills
 - Visual Memory
 - Visual Discrimination
 - Eidetic Pattern Recognition
 - Visual Sequential Memory
- Reading eye movement skills

73



THANK YOU!

74

Works Cited

- Facchin, A. (2021). Spotlight on the Developmental Eye Movement (DEM) Test. *Clinical Optometry*, 13, 73-81.
- Thomas P, Rowan S, Doherty SC, et al. Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. *Brain*. 2003;126(4):841-865. doi:10.1093/brain/awg078
- Garcia RP, Richman JE, Nicholson SB, Gaines CS. A new visual-verbal saccade test: the development eye movement test (DEM). *J Am Optom Assoc*. 1990;61:124-135
- Bellocchi S, Ducrot S, Tallat J, Lucie M, Jover M. Effect of comorbid developmental dyslexia on oculomotor behavior in children with developmental coordination disorder: a study with The Developmental Eye Movement test. *Hum Mov Sci*. 2021;78:doi:10.1016/j.humov.2021.102794
- Maples WC, Ficklin T. Comparison of eye movement skills between above average and below average readers. *J Behav Optom*. 1990;1(4):87-91
- Eden DF, Stein JF, Wood HM, Wood FB. Differences in eye movements and reading problems in dyslexic and normal children. *Vision Res*. 1994;34(10):1345-1358. doi:10.1016/0042-6969(94)90289-7
- Wood PM, MacL AA, Hopkins B, White SL. Vision and academic performance in primary school children. *Ophthalmic Physiol Opt*. 2018;38(5):516-524. doi:10.1111/nap.12582
- Domingo-Bara JA. Persistence of primitive reflexes associated with asymmetries in fixation and ocular motility values. *J Eye Mov Res*. 2024 Aug 19;17(2):10.16910/jemr.17.2.5. doi:10.16910/jemr.17.2.5.PMID: 39248716;PMCID: PMC11379514.
- Murray NP, Harfouj M, Roberts CM, Tsagka A, Whittaker J, Noel C. Oculomotor Training for Poor Saccades Improves Functional Vision Scores and Neurobehavioral Symptoms. *Ann Rehabil Res Clin Transl*. 2023 Mar 25;2(2):100126. doi: 10.1016/j.aenrt.2023.100126;PMID: 34477972;PMCID: PMC92712016.

75