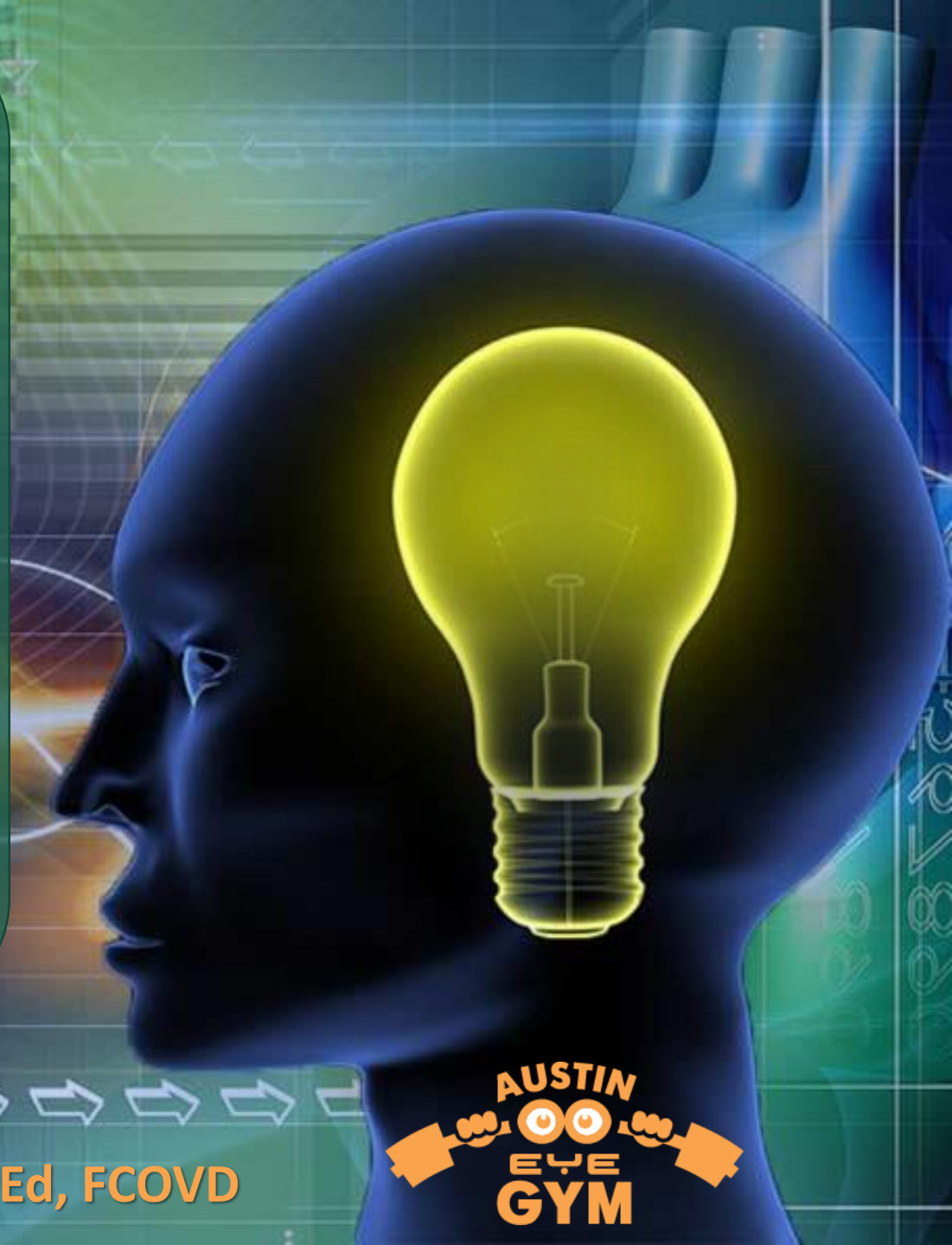
# Visual Dysfunction:

## One of the Most Common Devastating Residual Impairments of Head Injury



Mary McMains Beck, OD, MEd, FCOVD

AUSTIN EYE GYM

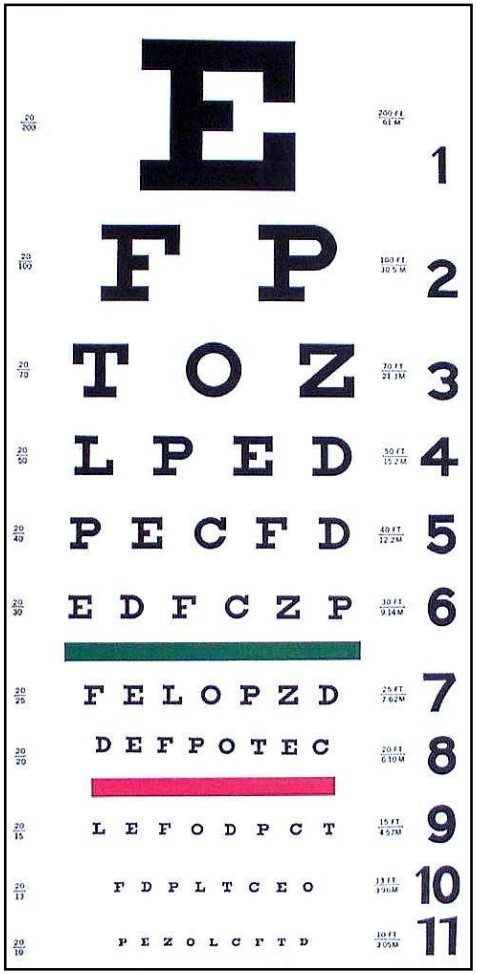
# Dr. Mary Beck

- Neuro-Developmental Optometrist for over 17 years
- Board Certified in Vision Therapy and Vision Development
- Diplomate of the American Board of Optometry
- Master of Education Degree in Visual Function in Learning
- Consultant for the University of Texas Sports Medicine Dept (Austin)
- Owner/Clinical Director of Austin Eye Gym – Cedar Park

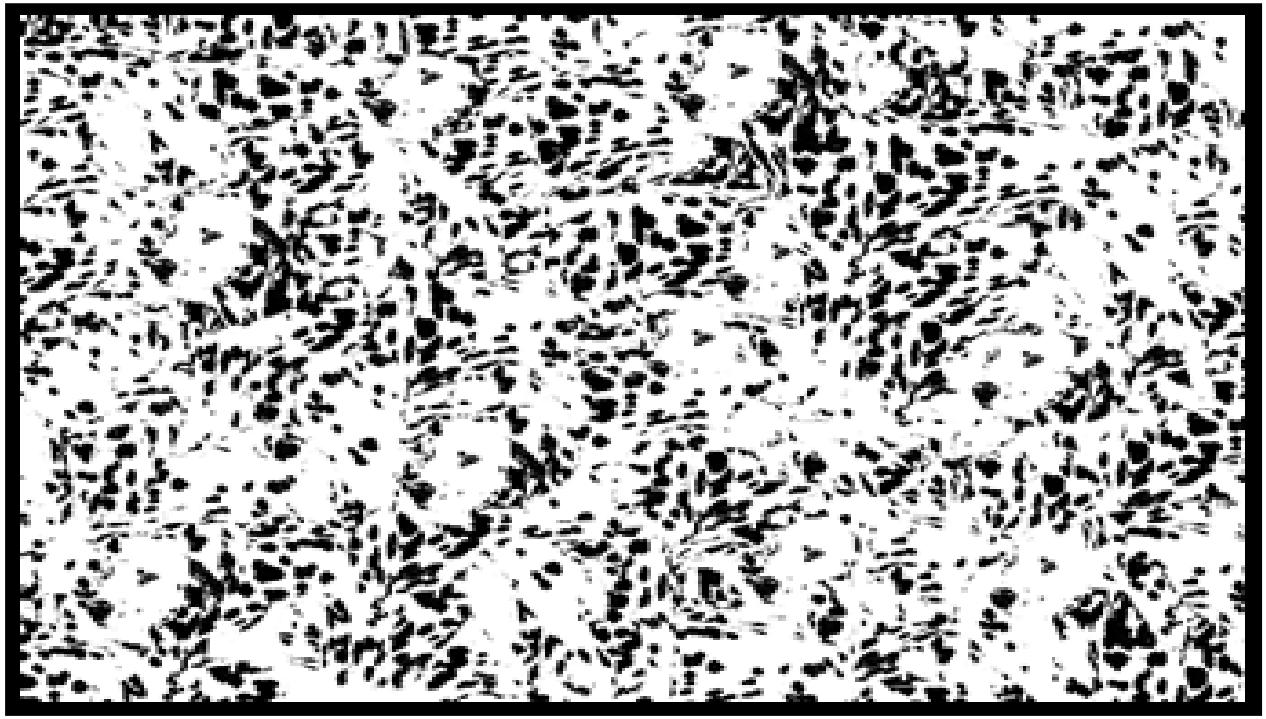
# What is Vision?

20/20 only tells you how clearly you see, but not how you function.

Did you know most children with vision dysfunction see 20/20 or better?



# Where is the Dalmation?



# Definition of Vision

- Vision is a dynamic process of identifying, organizing, interpreting and understanding what is seen to derive meaning and direct action, thinking, organization, as well as listening.
- Vision is learned.  The foundation of the brain pathways formed between the eyes, the brain and the body is laid down during the prenatal and first years of life.
- We rely on the visual system for input, cognition, memory, accurate motor response and balance.
- Visual function can be rehabilitated thanks to neuroplasticity at any age.

The majority of sensory information received by the human cortex is through the visual system (~65%!)

# It's Really a Brain Thing!

- Vision is integrated and interlinked with all the other senses (especially auditory and balance).
- Every lobe of the cerebral cortex is involved in visual information processing.
- Basically, anywhere you poke in the brain!
- The good and the bad:  the pervasiveness of vision allows for great variance in how an individual compensates for visual functional problems caused by poor development or injury.

# Routine Eye Exams

It is important to ensure that the eyes and pathways are healthy inside and out so we can rule out organic issues affecting visual function.

AOA recommends the first comprehensive vision exam should occur between 6 months and 1 year of age.  Again at 3 years, 5 years and annually thereafter.

- 1 in 30 will develop amblyopia (lazy eye)
- 1 in 25 will develop strabismus (eye turn)
- 1 in 33 will show significant refractive error (glasses)
- 1 in 100 will have eye diseases (treatment needed)
- 1 in 20,000 will have Retinoblastoma (cancer)

# Traditional School/Pediatric Screenings are Not Enough

- Did you know that only **5%** of visual problems are actually caught on school & pediatric vision screenings?
- **51%** of visual problems detected in school-age children that impact learning are **NOT** detected by typical school vision screenings.
- Yet it is estimated that **85%** of classroom learning comes through the visual system.
- According to the National PTA Resolution, **1 in 4** school-age children (10 million children) suffer from undiagnosed vision problems found to interfere with learning.
- In the reading disabled children, it is as high as **3 in 4**!!!

# Not all Eye Professionals are the Same

- Optometrists (Primary Care) are eye doctors trained to diagnose, treat and manage eye conditions, emergencies, infections and diseases, as well as prescribe glasses and contact lenses.

- Ophthalmologists are medical doctors that also provide primary care exams, but they are trained mainly as surgeons.

# What if Your Eyes Jumped Around Like This?

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# Signs & Symptoms of Poor Eye Movements (Oculomotor)

- Loss of place
- Use finger as marker
- Difficulty copying from board
- Skip small words when reading
- Re-reading
- Difficulty hitting or catching a ball

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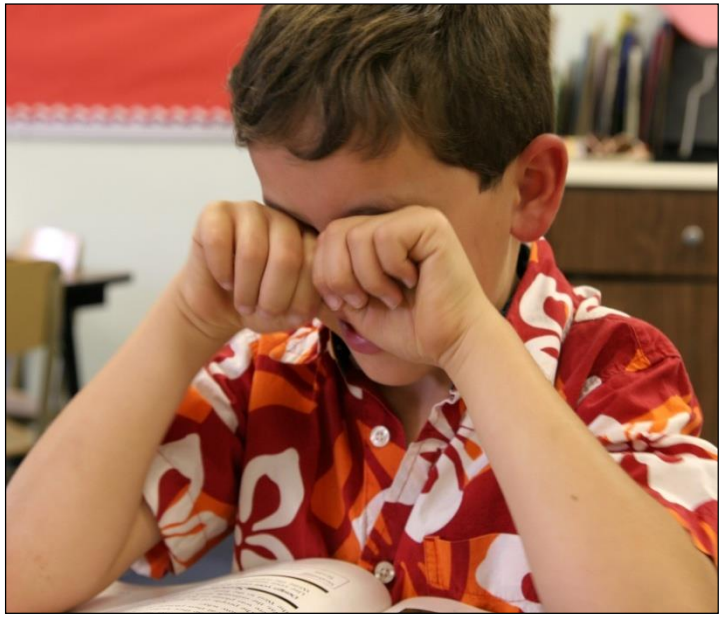
# Signs & Symptoms of Poor Focusing (Accommodation)



- Blinking or rubbing eyes
- Blurred print
- Reduced comprehension
- Task avoidance
- Headaches
- Eyes “hurt” or “tired”
- Reading slowly
- Short attention span
- Excessive time completing assignments or copying from board
- Daydreaming
- Fatigue

# What if Print Doubled or Moved Like This?

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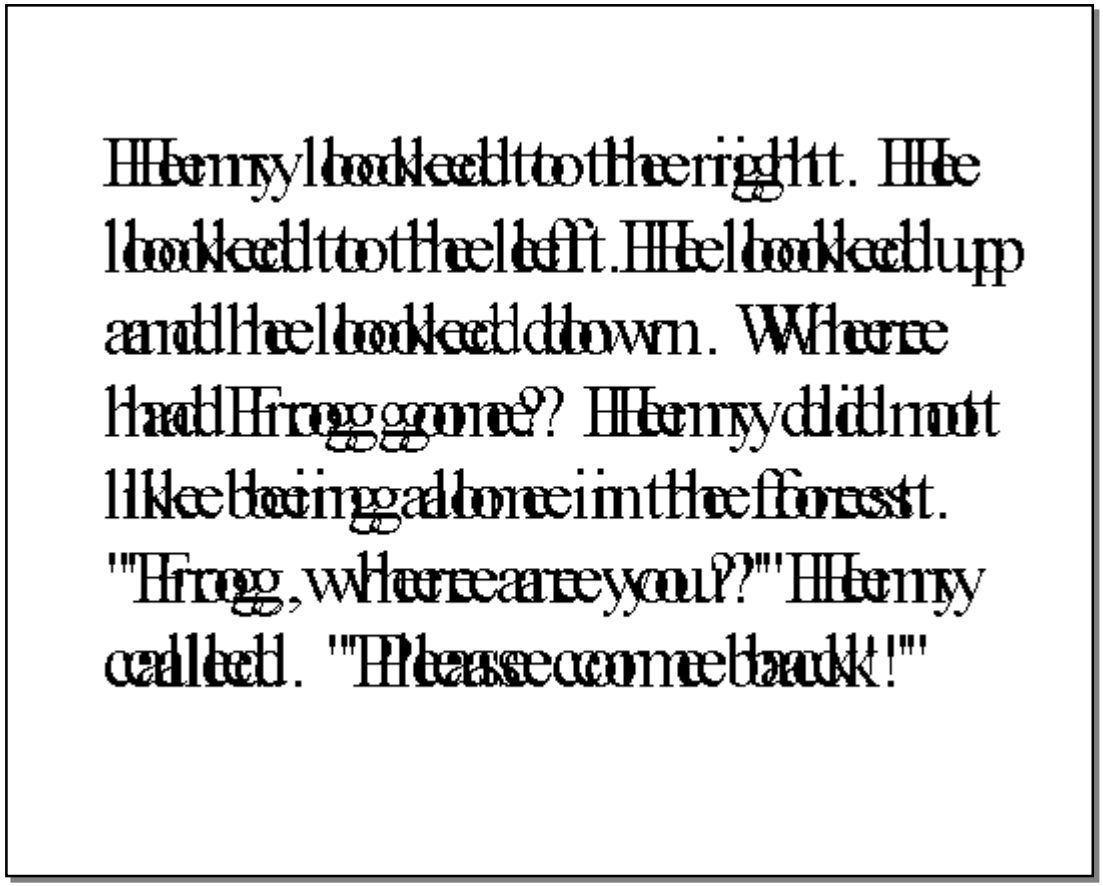

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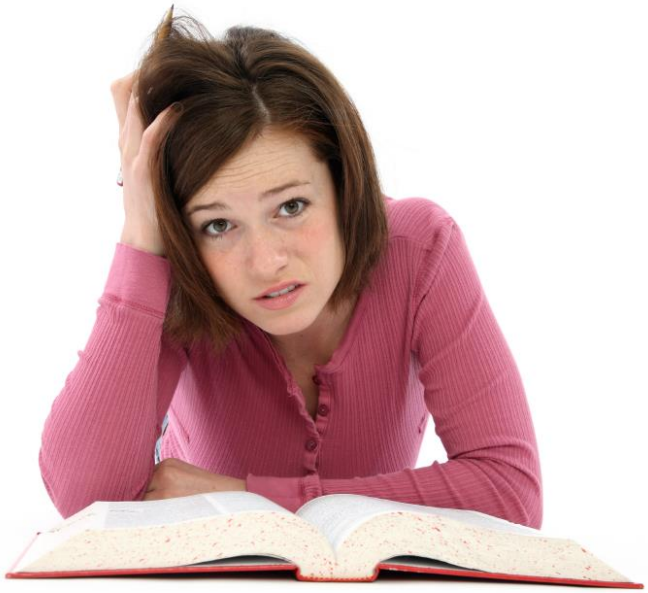
# Signs & Symptoms of Poor Eye Teaming (Phoria & Vergence)



- Double vision
- Words moving around on a page
- Reduced reading comprehension
- Short attention span
- Headaches
- Closing or covering of one eye
- Motion Sickness
- Difficulty catching/hitting a ball
- Slow or inaccurate depth perception
- Excessive blinking
- Holding a book too close
- Poor handwriting

# Neuro-Developmental Optometry

- Neuro-Developmental Optometrists (Behavioral Optometrists/ Developmental Optometrists) are specialized eye doctors that assesses the neurological development and function of the visual system and how it integrates with all the other senses.
- Diagnose and treat visual inefficiencies, brain injuries or delays that often **impact development, learning, academic, work and sports performance.**
- Provide Neuro-Visual Therapy directly or via a Vision Therapist to train the brain in order to remediate, rehabilitate, habilitate or enhance visual function through the use of prescribed exercises, lenses, prisms and/or filters.

# An Ounce of Prevention is Worth a Pound of Cure!

- My Ultimate Goal: To guide and enhance visual function and provide the necessary visual tools to help each individual reach their full potential.
  - Prevent or minimize academic difficulties
  - Prevent or minimize emotional and behavioral difficulties (AD(H)D, fatigue, low self esteem, anxiety, distractibility, frustration)
  - Ensure that the doors to opportunities are open and not closed because of avoidance due to low self-esteem, "it's too hard," "not smart enough," or "not good at that."
  - Help my patients Return to Life after injury.
  - Eliminate eye strain, discomfort and poor performance.

# A Neuro-Visual Analysis – A Deeper Dive Beyond Seeing Clearly and Eye Health

## Visual Skills That May Be Tested:

- Eye Movement Control (tracking)
- Accommodation (focusing)
- Binocularity (eye teaming)
- Depth Perception
- Central-Peripheral Integration
- Sensory-Motor Development
- Spatial Awareness & Localization
- Primitive Reflexes
- Visual Perception
- Visual Memory
- Visual Sequential Memory
- Visual-Auditory Integration
- Visual-Motor Integration
- Graphomotor Control
- Reading Fluency
- Speed of Processing
- Eye-Hand Coordination
- Reaction Time

# Neuro-Optometric Treatment

Treatment requires specialized optical and sensory treatment modalities including:

- Prescription Lenses
- Contact Lenses
- Tints/Filters
- Prisms
- Occlusion (patching)
- Neuro-Visual Rehab
- Prevention
- Lighting
- Visual Hygiene/Ergonomics
- Compensating Strategies

# What is Optometric Neuro-Visual Rehab/Therapy (VT)?

- A prescribed progressive program of vision procedures to habilitate or rehabilitate visual function
- Performed under **doctor supervision**
- Individualized to fit the visual needs of each patient
- Helps patients develop or improve fundamental visual skills and abilities
- Improves visual comfort, ease, and efficiency to perform daily tasks
- Change how a patient processes or interprets visual information to improve their quality of life.

# Vision and Acquired Brain Injury

- Due to the pervasive nature of vision, visual problems that can accompany head injury can be quite varied.
- Visual dysfunctions are often "hidden" in that they may not be obvious to the caregiver.
- Visual dysfunctions may not be understood or adequately described by the patient.
- The abruptness of visual performance deficits resulting from ABI makes compensation difficult.
- Many times the injury is diffuse and minute, but no less devastating.
- Most often the injury will not show up on x-ray, CT scan or MRI.

# As Related to Head Trauma…

- 90% of individuals with ABI need visual care

  (Gianutsos, 2001)

- Of most commonly reported symptoms…
  - Dizziness = 55%
  - Visual disturbances = 49%
  - Balance problems = 43% (Lovell et al, 2004)
- Visual Disturbances - 11th most commonly reported symptom in high school & college athletes 1-7 days post concussion (Kontos et al, 2012)

# Consider the Impact of Injury

Impairments may result in a variety of symptoms that can impede or delay “return to life” performance.

- Double Vision
- Headaches
- Difficulty Concentrating on Nearpoint Tasks
  - Reading
  - Computer
- Light Sensitivity
- Difficulty with Memory
- Car or Motion Sickness
- Fatigue
- Visual Motion Sensitivity - Getting overwhelmed in crowds/stores

# Most Common Visual Disorders in Head Injury

TBI Sample Size of 160 patients reveals that the prevalence of visual dysfunction (not including visual-cognitive dysfunction) is high.

The most common visual dysfunctions are the following:

- 41% Accommodation - Accommodative Insufficiency
- 51% Versional (eye movements) - Saccadic Dysfunction
- 56% Vergence - Convergence Insufficiency
- 25.6% Strabismus (eye misalignments) - Strabismus at near
- 6.9% Cranial Nerve Palsy - CN III *(my clinical experience CN IV)*

(Cockerham et al, 2009)

# Head Trauma in School

Some visual functional difficulties secondary to injury:

- Reading: Poor reading comprehension, fluency problems, loss of place, transposing words, words moving on the page, blur, double.
- Writing: Spacing errors, visual-motor mistakes, spelling errors, reversals and transpositions
- Testing & Homework: Difficulty remembering, visualizing, slow speed of processing, decreased time on task, poor organizational skills, not able to multi/dual task, reduced concentration, distractibility, inattention, fatigue

# POST TRAUMATIC VISION SYNDROME (PTVS)

Padula's Theory:

- The insult to the cortex produced from a TBI causes stress in the central and autonomic nervous systems
- The disruption occurs at the level of the midbrain where vision is matched with kinesthetic, proprioceptive and vestibular processes
- Primarily affects depth perception in the periphery & spatial organization

# POST TRAUMATIC VISION SYNDROME (PTVS)

Symptoms:

- Diplopia
- Blurred vision
- Asthenopia (eye strain/discomfort) – typically out of proportion to findings
- Photophobia
- Poor concentration and attention
- Objects appear to move
- Associated neuromuscular difficulties with balance, coordination and posture
- Motion Sickness
- Difficulty/discomfort working under fluorescent lights

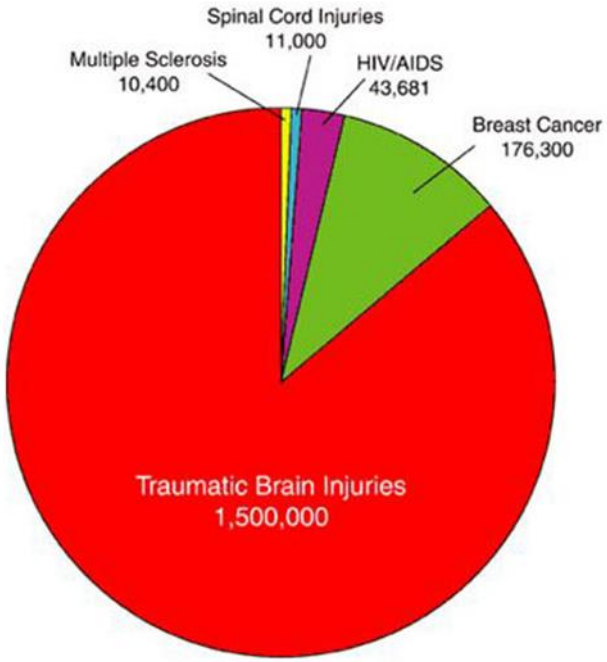
# POST TRAUMATIC VISION SYNDROME (PTVS)

Symptoms:

- Visual Perceptual-Motor Dysfunction
  -- One of the most common and devastating residual impairments resulting form TBI
  -- Recovery of visual information processing deficits can take much longer than physical recovery

# Let's Talk about Concussion

- An estimated 3.8 million sports-related concussions in the United States every year.
- Keep in mind the above statistic is based on reported loss of consciousness (LOC)…and, it is estimated that LOC occurs <10% of the time.
- A head injury occurs every 15 seconds and is the leading cause of death worldwide.



# Why the Increasing Concern with Adolescents?

- In 12-17 yo, a concussion with < 15 min of symptoms at time of injury required 7 days for cognition to return to baseline and symptoms to resolve
- High school athletes have more prolonged neuro-cognitive impairment than college athletes
- 41% of athletes were returned to play too early
- Head trauma leads to altered cerebral blood flow…in adolescents may be up to 1 month[17]

All 50 states now have a Return to Play Law

# Who is Most at Risk for Protracted Recovery?

- Collision and Contact Sports
  - Football, Soccer, Lacrosse

    (Lincoln 2011; Gessel 2007, Marar 2012)
- Previous Concussions
  - 4-6 fold increase risk for future injury

    (Guskiewicz, , McCrea et all, JAMA 2003)
- Younger Age
  - High School Athletes have more prolonged neuro-cognitive impairment than College Athletes

    (Field, et. al. J. Ped 142 (5), 2003)
- Female Gender
  - Females have higher frequency, worse symptoms and signs, and longer recovery time than males
  - Nearly 2x risk in similar sports

    (Lovell et. al., Clinics in Sports Med. 28(1), Jan, 2009)

# Clinical Value: Vision

- We rely on the visual system for input, cognition, memory, accurate motor response and balance.
- 90% of those needing visual rehabilitation do not receive it, yet small studies suggest that at least 90% can be rehabilitated (more large studies are needed)
- Vision -- Vestibular -- Cognition. Not only is it important to diagnose, it is important to rehabilitate the visual system directly.

# Seek out a Neuro-Developmental Optometrist for your Rehab Team

- If visual disturbances are suspected, a referral to a Neuro-Developmental Optometrist for a full neuro-visual assessment is recommended.
- However, you do not need a direct referral to seek out a Neuro-Developmental Optometrist to be part of your Rehabilitation Team.

# Neuro-Visual Rehabilitation can be the Missing link in Recovery

- Optometric Neuro-Visual Therapy can greatly improve not only specific visual skills, but enhance learning, performance and the overall quality of life.

- However, the prescribing of optical lenses, filters, prisms and other optical devices can have an IMMEDIATE and positive effect on an individual's performance.

- Visual disturbances are one of the most commonly reported symptoms in head injury (49% Lovell), yet most go untreated.

- Improving Vision can help individuals with brain injuries return to life.

# Internet Resources

- www.covd.org – College of Optometrists in Vision Development
- www.aoa.org – American Optometric Association
- www.nora.cc – Neuro-Optometric Rehabilitation Association
- www.austineyegym.com

# Thank You!

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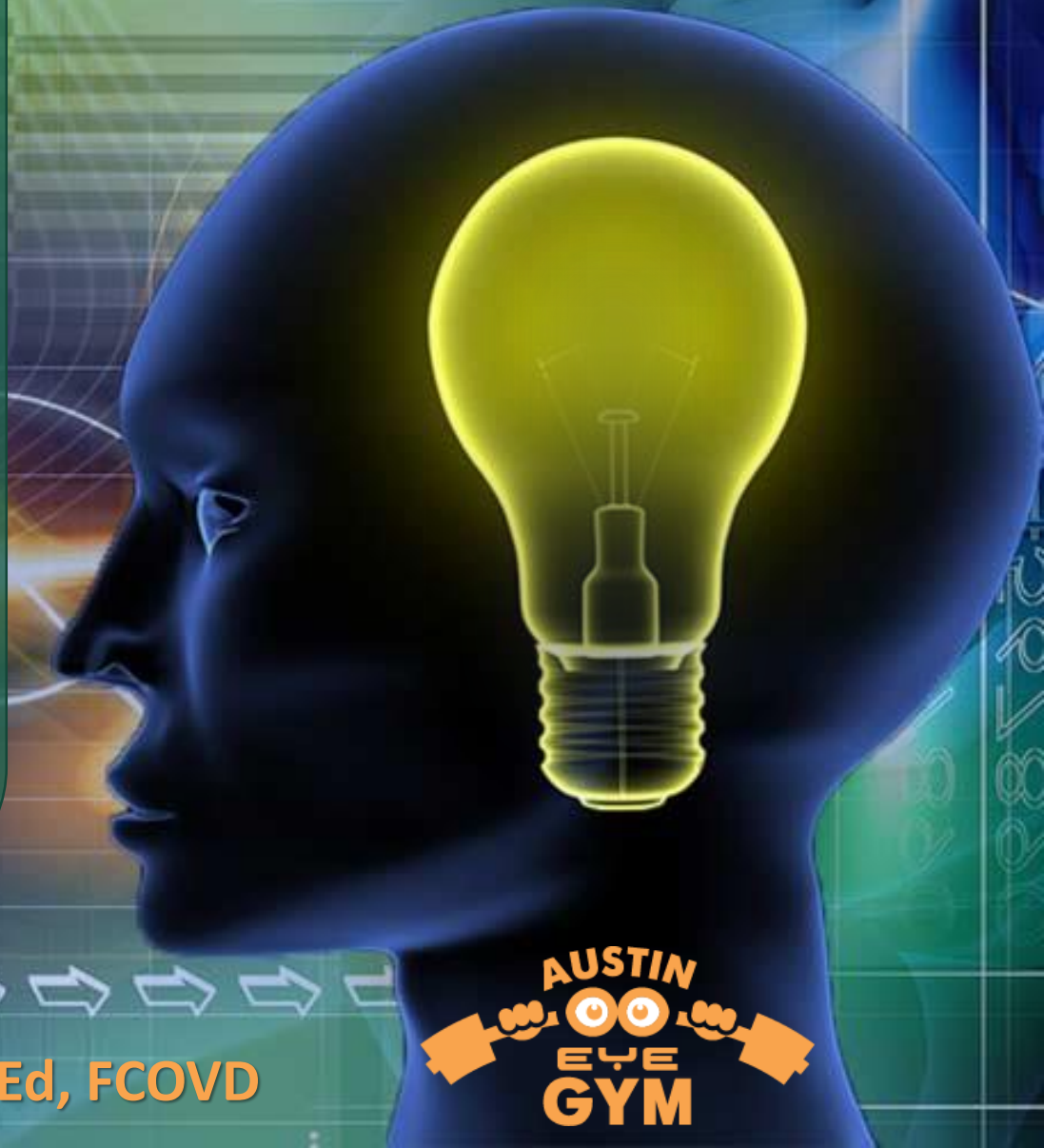

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