Is there a difference between sight and vision?
COURSE OBJECTIVES

1. Gain a deeper understanding of the visual system
2. Amblyopia
   a. What is it exactly?
3. Strabismus
   a. Classifications
   b. How is vision affected
4. Treatment and Therapy for Amblyopia and Strabismus
5. Gain a better understanding of how these conditions affect vision, learning and life!
○ **Sight:** ability to clearly see a fixated object

○ **Visual Acuity**
  ○ Example: 20/40
  ○ Athletes: ideally 20/10 or better

○ **Vision:** is understanding what you actually see.
  ○ Past experience (action, movement, etc), oculomotor skills, and visual processing skills affect vision and how you understand what you are viewing.
保持你的眼睛球
Can you see it?
Do you understand it?
Keep your eye on the ball!

Can you see it?
Do you understand it?
Vision is the deriving of meaning and direction of action as triggered by light.
Step 1: Visual Integrity

1. What is 20/20?

○ Measure of sharpness of sight with fixed viewing (not dynamic)
○ Helps provide proper glasses/contact lens prescription
○ Provides no information as to how much effort is needed to see clearly
○ Does not determine whether both eyes are used together as a team
○ Does not measure how much meaning is obtained from visual input
○ Not usually the issue with TBI patients
○ Athletes - better than 20/20 is best
○ Dynamic acuity matters

Example: 20/60 vision means you would need to be 20 feet from an object to see it clearly - while someone with 20/20 vision could easily and clearly see the same object from 60 feet
Step 1: Visual Integrity

Ocular Health Assessment

Ocular structures & Functional Visual Pathway
3. Gross Oculomotor skills

Step 1: Visual Integrity
BINOCULAR VISION: HOW DOES THIS WORK?

Normal Vision (Fusion)
- Two clear images blended into one picture

In normal vision, an image is seen by both eyes and blended into one picture by the brain.

Optic nerve
Optic chiasm
Optic tract
Optic radiations

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Binocular Vision = Stereopsis = Depth Perception = 3D Vision

The ability to see volume: air and space between object

Visual Spatial Awareness:
- Binocular vision tells us very accurately where we are in space
- How do we move to do something
- Where are things in space
- Higher appreciation = improved accuracy with regard to eye-hand (sports)

Example: Thumb test
Binocular VS Monocular

- 60-80% of cells in the visual cortex are ONLY activated binocularly - amblyopia affects binocularity and ultimately overall visual function and performance

Monocular Individuals: use light, shadows, parallax, overlapping object and size to determine where they are in space. Not near as accurate
Amblyopia: What is it?

- Often referred to as “lazy eye”
- Worse than 20/30 acuity with no disease or dysfunction detected
- AOA: atleast 2% of our population experiences effects of amblyopia
- US: ~12 million cases
- Breakdown in neurological processes in the brain not the eye
- Dysfunction of binocularity - the eye is healthy not “lazy”
Amblyopia is not just reduced acuity. It affects your vision and how you derive meaning and direct action.

- Eye control & fixation
- Saccades & Pursuits
- Vergence Ranges: Convergence and Divergence
- Accommodative skills
- Visual Vestibular
- Eye Hand Coordination (Gross and Fine)
- Visual Processing skills
AMBLYOPIA CLASSIFICATIONS:

“Amblyopia is the world’s leading cause of non-disease associated monocular vision loss among those under 40 years of age.” Pilar Vergara Gimenez

1. **Organic**: caused by a disease process

2. **Functional**: reduced acuity not due to disease but disruptions in cortical visual function
   a. Our focus for this lecture.
2 MAIN TYPES OF FUNCTIONAL AMBLYOPIA

1. REFRACTIVE
   a. Prescription related
   b. Asymmetry in prescription
   c. High prescription in both eyes

2. STRABISMIC
   a. Related to Eye Alignment
      i. Esotropia
      ii. Exotropia
      iii. Hypertropia
REFRACTIVE AMBLYOPIA

1. Eyes are typically aligned
   a. Harder to detect -eyes are aligned
   b. Kids typically don’t complain especially if one eye sees well

2. High Prescriptions
   a. OD: +6.00
   b. OS: +6.00
   c. May have reduced acuity in both eyes

3. Anisometropia - unequal prescription
ANISOMETROPIA

1. When the two eyes have unequal refractive error
2. 1 Diopter of power difference creates a 2% difference in retinal image size
3. Example of Hyperopic Anisometropia:
   a. OD: +1.00
   b. OS: +4.00
Unequal Image Size on Retina
Myopic Anisometropia:

Example:
OD: -4.00
OS: Plano

Minification with more minus eye.
Anisometropia

1. Affects image size on retina (unequal size or shape or both)
2. Affects binocular vision
3. Side Effects:
   a. Creates eye strain
   b. Can cause headaches
   c. Aversion to near work
   d. Double vision
   e. Reduced Depth Perception
   f. Suppression
Strabismic Amblyopia

- When both eyes do not properly point to the same point in space
- Eyes typically do not move together as a team
- Eye control is a coordinated, complicated cortical process
Causes of Strabismus:

1. Eye control is a developmental process. Failure to learn to coordinate eye movement during the early stages of development

2. Eye Muscle Problem

3. Disease processes

Dr. A.D. Reudemann states: “The fact of the matter is that seeing is a learning process. No one is born knowing how to see.”
Visual Development

Starts at birth

Continuously develops throughout childhood
Just texting mom that I need more milk!
○ A newborn may have all of the proper wiring for sight; however, he or she has no experiences relating vision with other senses like taste, smell, hearing, touch and body position to understand vision.

○ A baby does not recognize his or her parent’s face when born.

○ Vision is a dynamic process that is much more complex than looking at a stationary object on an eye chart.

Visual experiences – help us write the “mental software” that allows us to use our hardware to make sense of the images the eyes are capturing. Through sight, vision is acquired through life experiences.

Ex: Bike Riding or Learning a second language
Strabismus: What is it?

With Strabismus the eyes either turn in, turn out, or alternate position between eyes.

Typically, when the eye is in the turned position, the brain will ignore any visual information coming from that eye.

This is called Suppression. Suppression helps to manage visual confusion from diplopia (double vision).
Types of Strabismus

Important aspects to observe:

1. Constant vs Intermittent
2. Angle of deviation
3. Changes along Z-axis
4. Degree of Suppression

- Esophoria/Esotropia - eye is turned inward toward the nose
- Exophoria /Exotropia - eye is turned outward toward the ear
Esotropia

- Derived from 2 Greek words: Eso “inward”/ trepo “turn”
- One eye is pointed straight ahead and the other is pointed toward the nose
- Onset
  - First years of life
    - Within 6 months - most often esotropia
  - Adult
    - Unusual and typically a more serious underlying disease
      - Illness, Tumors, Accident
      - Send for neurology work up - could be life threatening
- Most common type of misalignment of the eyes
Exotropia:

1. One eye is pointed toward ear
2. Can be constant or intermittent
3. Onset: 6months - 6years
4. Often noted first at distance
What happens visually with Strabismus?
Suppression: Patient has normal fusion and control if and when eyes are aligned, Under certain conditions fusion is lost & suppression occurs Causes: Fatigue, stress, extended near work, illness
Diplopia:

Common symptoms of double vision include the visual appearance of objects overlapping each other or appearing adjacent to one another.
Suppression: The brain’s response to visual confusion.

The brain is smart and double vision is intolerable. It can render someone incapacitated. The brain will suppress one eye because visual function is significantly improved.

Examples: Playing the piano
1. Works best if you use 2 hands
2. You can play with one hand
3. What happens if you play with two hands on different tempos

Ear infection: unbalanced hearing
Treatment:

1. Best corrective lens power
2. Glasses
   a. Ensure ideal frame fit
   b. Ensure Optical center is accurate
   c. Consider Seg Height measurement to ensure you are not inducing prismatic power
Proper Frame Centration is key.
Lens Designs:

1. Non-Glare
   a. Reduce any form of visual frustration

2. Bifocals
   a. Know where you should put the bifocal line

Figure 3: Well fitting bifocal.
Contact Lenses:

1. Daily Disposable
2. Reduces Image Size Difference
3. Can’t look over or under
4. Can’t easily remove
5. Parents must be involved in younger years
Vision Therapy?

- Optometric VT has been defined as the art and science of developing visual abilities to achieve optimal visual performance and comfort. It provides the patient with an opportunity for both development and learning experience. *Journal of Behavioral Optometry, Vol. 1, 1990, Number 3, p. 66-67.*
Vision Therapy:

1. Oculo-motor Skills
   a. How to use the eye together as a team.

2. Visual Processing skills
   a. How to make sense of visual information

Example: of twin brother

   Step 1. Best correction
   Step 2. Monocular
   Step 3. Biocular
   Step 4. Binocular
Passive Patching:

1. Can be effective - but follow up regularly
2. Doesn’t train binocular vision
   a. Both eyes must work together
3. Standard therapy:
   a. Patching non-amblyopic eye 2 hours per day
Visual Processing Skills

- Laterality & Directionality
  - Visual spatial awareness
  - Visual motor planning and integration
  - Speed of Processing
  - Visual memory & Visualization skills
  - Reading efficiency skills and comprehension
  - Central and peripheral process: visual search and scan, visual attention
Laterality & Directionality
Visual Spatial Awareness
Visual Motor Integration

3(a) Rama is a good boy
3(b) Rama is a good boy
3(c) Rama is a good boy
3(d) Rama is a good boy
3(e) Rama is a good boy
Signs of Symptoms of reduced visual skills

- Short attention span
- Headaches
- Skipping words or lines
- Holding material closely or too far
- Poor balance / coordination
- Excessive fatigue
- Squinting
- Poor recall
- Using a finger to keep place
- Head turns / tilts
- Poor handwriting
- Many more....
○ 80% of what children learn is through vision – our most utilized sense

○ Vision is one of our most important, most complex, and most incredibly designed of all our senses. Over 70% of our entire brain has connections to the visual system.

It is our responsibility together to ensure that our patients are given the best opportunity to reach their highest visual potential!
○ “How we perceive the visual world around us depends on the visual experiences we had during the first stages of our lives.”

○ Quote by Karlniska awarding assembly regarding eh Nobel Prize in Medicine

THANK YOU!!