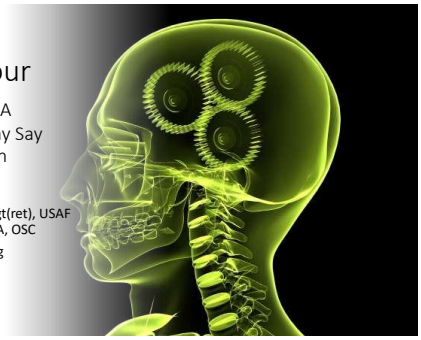
It's All In Your Head!: What A Stroke Patient May Say About Their Vision



Lynn E. Lawrence, CMSgt(ret), USAF
MSOL, CPOT, ABOC, COA, OSC
See The Light Consulting

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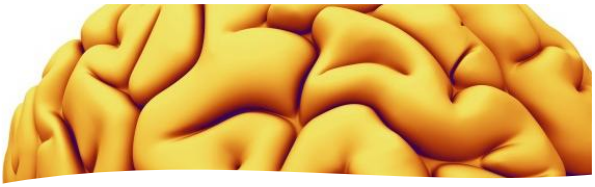

Overview

- The Eye: How amazing!
- How are strokes defined? "B.E.F.A.S.T."
- A stroke's impact on the eye
- Clinic presentations (what to look for!)
- Six Classic Signs of Strokes
- Testing/Therapy

2

CDC Facts on Strokes

- In the United States in 2022, **1 in 6 deaths** (17.5%) from cardiovascular disease was due to stroke.
- The death rate for stroke decreased from 41.1 per 100,000 in 2021 to 39.5 per 100,000 in 2022.
- Every 40 seconds, someone in the United States has a stroke. Every 9 minutes and 11 seconds, someone dies of stroke in this country.
- Every year, more than **795,000 people** in the United States have a stroke.
- About 610,000 of these are first or new strokes.
- About 185,000 strokes—**nearly 1 in 4**—are in people who have had a previous stroke.
- About **87%** of all strokes are ischemic strokes, in which blood flow to the brain is blocked.
- Stroke-related costs in the United States came to nearly **$56.2 billion** between 2019 and 2020. Costs include the cost of health care services, medicines to treat stroke, and missed days of work.
- Stroke is a leading cause of serious long-term disability.
- Stroke reduces mobility in more than half of stroke survivors age 65 and older.

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I AM NOT A DOCTOR!

I cannot make a medical diagnosis!

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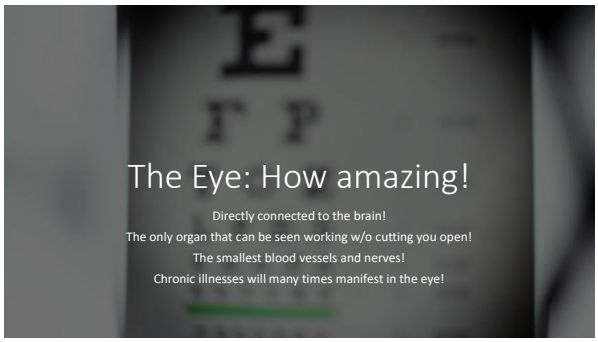


The Eye: How amazing!

Directly connected to the brain!
The only organ that can be seen working w/o cutting you open!
The smallest blood vessels and nerves!
Chronic illnesses will many times manifest in the eye!

5

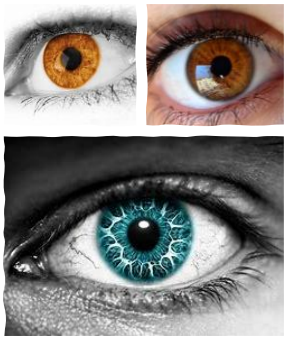
The only organ…

- Takes approximately 20 years for your vision to fully develop
- We can see inside of you while it is in its normal state, without cutting you open
- One of the few organs connected directly to the brain
- Chronic diseases can manifest in the eye, and many can be discovered during an eye exam.

6

Eyes Don't Lie

- Internal warning system!
- Listen to your body
- When there is a sudden change in your vision, please go immediately to your eye doctor or the emergency room
- Do not delay!



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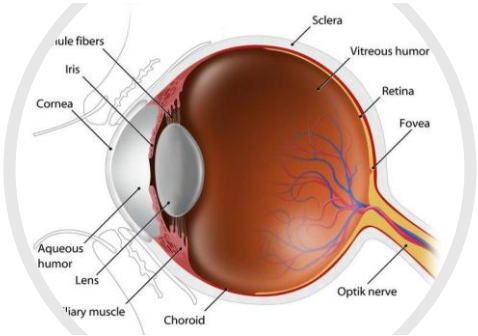

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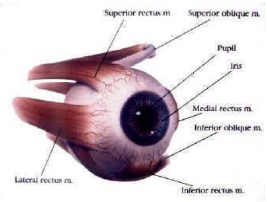
Vision – an important part of your health

- Vision is an early warning sign for many diseases
- Routine eye exams are truly necessary
- Many of the diseases of the body will have some type of manifestation in the eye

9

Anatomy and Physiology of the extraocular muscles

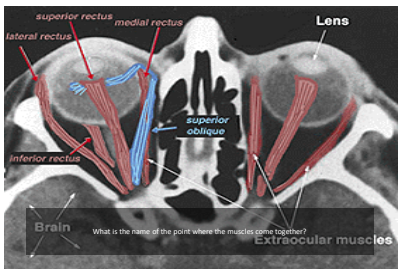
- The Extra-ocular Muscles (EOM)
  - Organized into an umbrella-like bundle amon the orbital fat, orbital blood vessels and nerves
  - Six muscles associated with eye movements
    - **Superior rectus (S.R.)**
    - **Inferior rectus (I.R.)**
    - **Medial rectus (M.R.)**
    - **Lateral rectus (L.R.)**
    - **Superior oblique (S.O.)**
    - **Inferior oblique (I.O.)**



How many cranial nerves control these 6 muscles?

10

Extra Ocular Muscles



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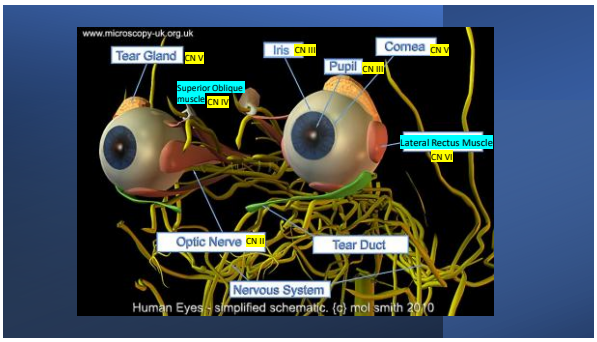

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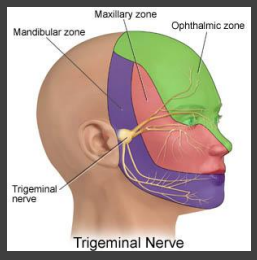
5th Cranial Nerve - Trigeminal

- Corneal sensitivity
- Lacrimal gland innovation



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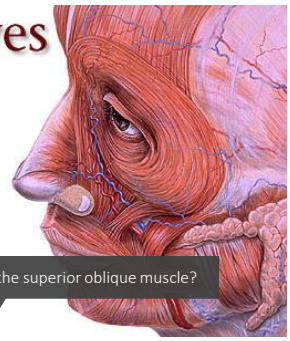
Cranial Nerves

I Olfactory
II Optic
III Oculomotor
IV Trochlear
V Trigeminal
VI Abducens
VII Facial
VIII Vestibulocochlear
IX Glossopharyngeal
X
XI
XII Hypoglossal



Which cranial nerve controls the superior oblique muscle?

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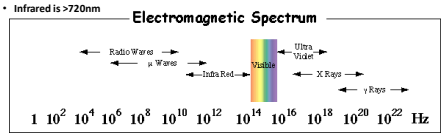
What we can see with the normal eye

Properties of Light

So, what is light?

- **Visible light** is a small portion of the overall spectrum of light (**380-760**)
- EM surrounding the visible spectrum is hazardous
  - **Ultra-Violet is <390nm**
  - **Infrared is >720nm**



What part of the spectrum is most visible to the eye?

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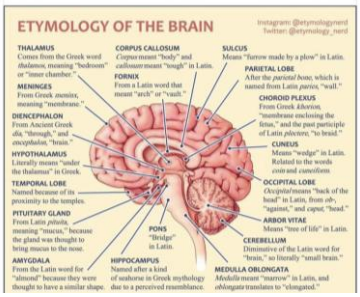
The Neuron System is complex

- 12 Cranial nerves
- 6 of them have a significant impact on the ocular system
- CN #2 is the optic nerve
- Vision occurs in the occipital lobe of the brain

How parts of the brain got their names:
...see more



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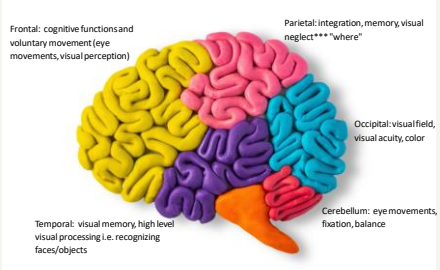
PARTS OF BRAIN: VISUAL SKILLS



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Brain Function

Different parts of the brain control different activities. For example, the brain has language, vision and movement centers. The left side of the brain controls the right side of the body, and the right side of the brain controls the left. A stroke could cause one or more of the following symptoms:

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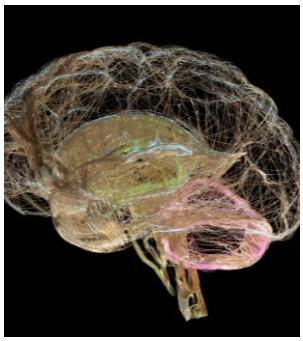
How many cranial nerves operate the eye?

- Six cranial nerves
  - 2nd Optic Nerve
  - 3rd Oculomotor Nerve
  - 4th Trochlear Nerve
  - 5th Trigeminal Nerve
  - 6th Abducens Nerve
  - 7th Facial Nerve



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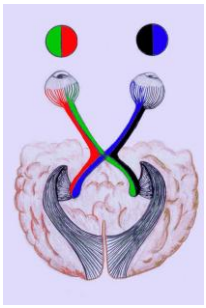
Visual Pathway

- Physical
- Physiological
- Psychological

What causes your physiological blind spot?



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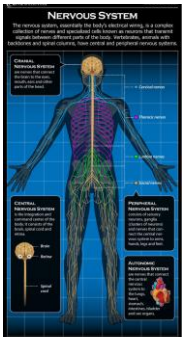
Our electrical system – must be plugged in

The nervous system is a complex collection of nerves and specialized cells known as neurons that transmit signals between different parts of the body. It is essentially the body's electrical wiring.

http://www.livescience.com/27975-human-body-system-the-nervous-system-infographic.html



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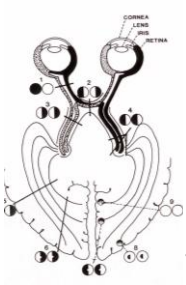

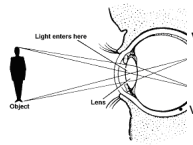

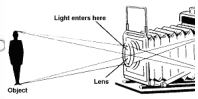

Visual Pathway

Visual pathway has seven structures

- Retina
- Optic Nerve – light super-highway information
- Optic Chiasm
- Optic Tract
- Lateral Geniculate Body (LGB)
- Optic Radiations
- Visual Cortex …where vision occurs

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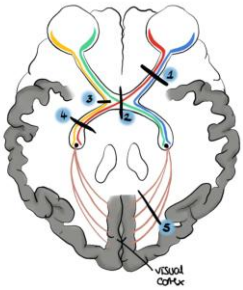

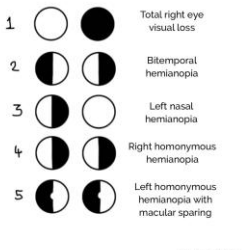

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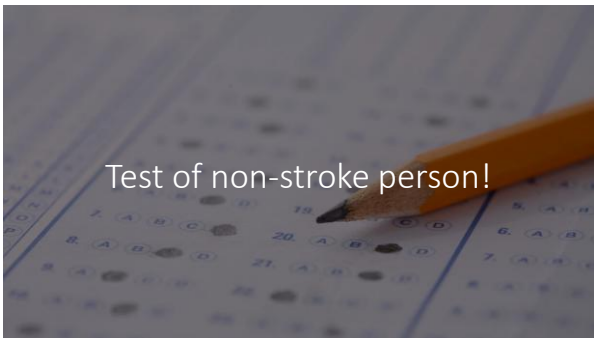

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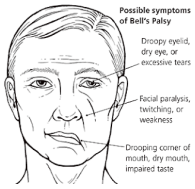
7th Cranial Nerve

- Brow
- Lid: can't blink
- Face
- Mouth



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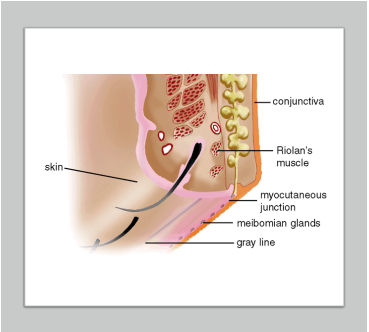
Anatomy Cont....

- Muscle function
- Nerve innervation 3rd CN
- Lid Position
  - Asymmetry
  - Brow appearance



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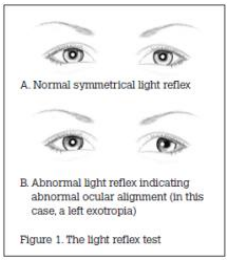

Advantages of Binocular Vision

- The advantages of a Binocular vision are:
  - The first and the foremost advantage of a binocular vision is single vision.
  - In addition to single vision, it results in stereopsis – the most precise kind of depth perception
  - Enlargement of the field of vision
  - Compensation for blind spot and other differences

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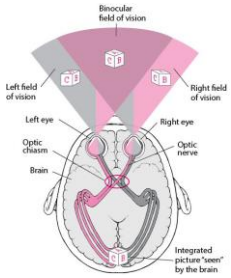
What is Binocular Vision?

Binocular Single Vision may be defined as the state of **simultaneous vision**, which is achieved by the coordinated use of both eyes, so that separate and slightly dissimilar images arising in each eye are appreciated as a single image by the process of fusion. Stereopsis is the highest degree of fusion.



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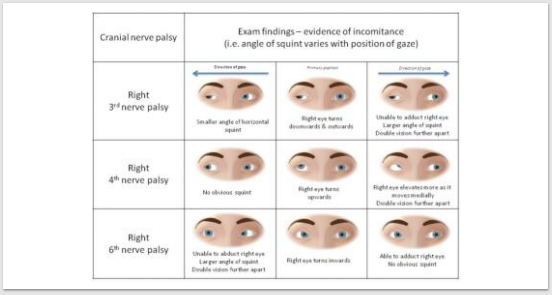

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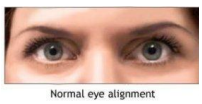
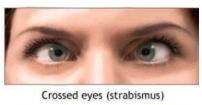
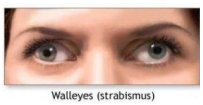
Sensory Aspects of Binocular vision

The objects in space are localized by us in two ways – one is relative to one another and is called relative localization and the other is in relation to ourselves and is called egocentric localization. Objective (Physical) & Subjective (Visual) space Location of an object point in physical space was separated from its localization in visual space. The objective lines of direction determine which retinal area will be stimulated, their subjective counterpart, the visual direction determines the direction in which the object will be seen in visual space.


Normal eye alignment


Crossed eyes (strabismus)


Walleyes (strabismus)

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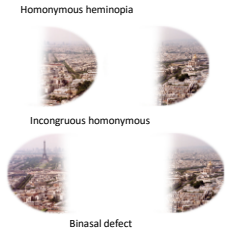
Visual Field Defects

- Common types of field defects
  - Blind spots - Areas of blindness in th visual field
  - Hemianopsia - Blindness in one half of the visual field of one or both eye
    - Homonymous - Involving the nasal half of the visual field of one eye and the temporal half of the visual field of the other eye
    - Incongruous –
  - Superior Field loss



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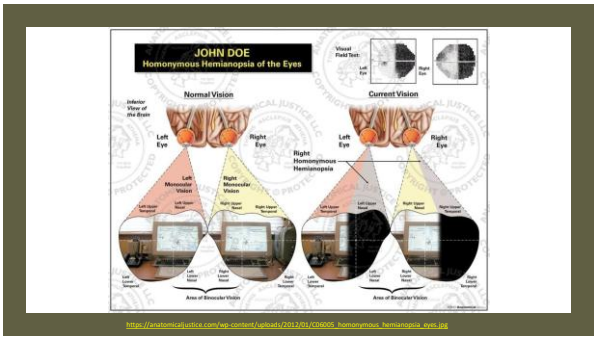

https://anatomicaljustice.com/wp-content/uploads/2012/01/CD6005_homonymous_hemianopsia_eyes.jpg

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Stroke vs Risk of Stroke

- There is a difference between causes of stroke and risk factors for stroke. Causes of stroke are the way a stroke happened, such as a blockage in a blood vessel from a cholesterol plaque. A risk factor for stroke is something that increases the chance of that cause occurring, such as high cholesterol levels in the blood.

The causes of ischemic and hemorrhagic strokes are different, but most of the risk factors are the same.

Common risk factors for stroke may include:

- High blood pressure
- Diabetes with high blood sugar
- High cholesterol
- An irregular heart rhythm called atrial fibrillation

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What are strokes?

Primary classifications of a stroke:

- Blockages and bleeds
- Transient Ischemic Attacks - temporary
- Hemorrhagic – broken vessel
- Subarachnoid Hemorrhage – blockage
- **Can lead to death!**

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Types of Strokes The

We call it a transient ischemic attack, or TIA, if the blockage goes away very quickly, within minutes, and there is no permanent injury. With a TIA, people go back to normal, usually within an hour. The symptoms of ischemic stroke and TIA are the same. The only difference is in how long they last.

When the bursting of a blood vessel causes a stroke, healthcare professionals call it an intracerebral hemorrhage or a hemorrhagic stroke. When a blood vessel to the brain bursts, there is bleeding in the brain or on the surface of the brain. The bleeding causes two problems: loss of blood flow to the brain and pressure on the brain. Depending on how much bleeding there is, symptoms might be mild or very severe, even lethal.

When bleeding is on the surface of the brain, usually from the bursting of an aneurysm, which is a bulge in a blood vessel on the surface of the brain, it's called a subarachnoid hemorrhage.

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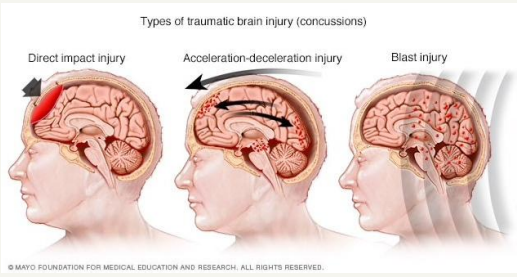

Image from web: Mayo Clinic https://www.mayoclinic.org/diseases-conditions/concussion/symptoms-causes/syc-20355594

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Imaging

The best way to confirm the extent of damage from a stroke

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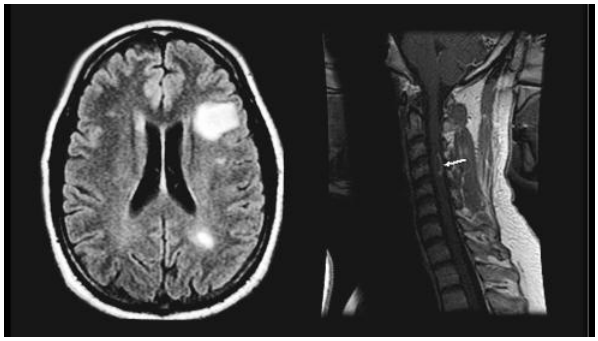

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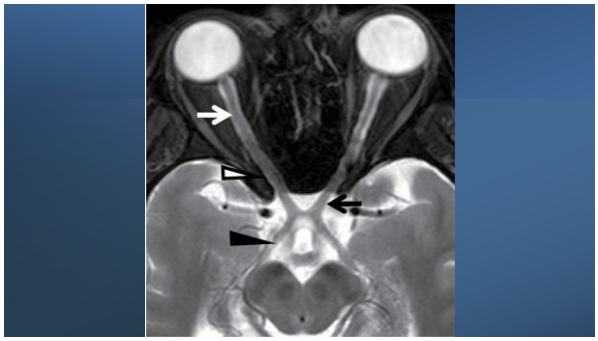

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Possible symptoms of post stroke

- Weakness on one side of the body
- Numbness on one side of the body
- Loss of vision on one side
- Involuntary eye movements
- Loss of balance or coordination, difficulty walking
- Difficulty speaking or thinking of words
- Difficulty understanding speech
- Slurred speech
- Severe headache

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A Stroke's Impact On The Visual System

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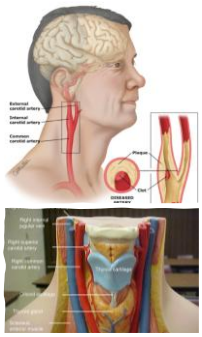
Sudden Tempory Vision Loss Uni or Bilateral

Amaurosis fugax is a temporary loss of vision in one or both eyes, lasting from a few seconds to several minutes. This condition is often caused by a lack of blood flow to the retina or optic nerve, typically due to a blockage in the carotid arteries. Amaurosis fugax is considered a warning sign of an impending stroke, especially in individuals with risk factors such as high blood pressure, high cholesterol, or heart disease.



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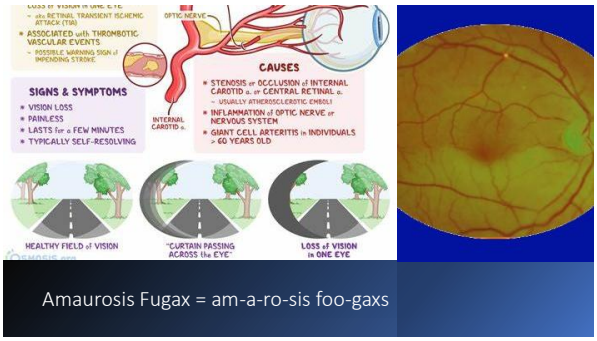

Amaurosis Fugax = am-a-ro-sis foo-gaxs

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Vision complications

- Vision complications due to stroke depend on where in the brain the stroke took place. Areas of your brain that affect visual processing include:
- **Occipital lobe** — Most visual processing happens in this area in the back of the brain. It's the main vision center in the brain, but all of the brain lobes get visual information.
- **Brain stem** — Located at the base of the brain, this area controls eye movements, sensations related to balance and stability, and your ability to recognize and understand objects.

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Continued…

- **Neglect (spatial inattention)** — People with neglect don't respond to and aren't aware of things on their stroke-affected side. This problem isn't related to vision, but results from damage to parts of the brain that perceive and interpret vision.
- **Eye movement disorders** — This happens when the nerves or muscles that make your eyes move are damaged. Examples in stroke survivors include rhythmic eye movements (nystagmus), misaligned eyes (strabismus), eye tracking control issues (oculomotor dysfunction) and double vision (diplopia). Your depth perception, balance, coordination and overall vision may be affected.
- **Dry eyes — Some survivors have trouble blinking or fully closing their eyes, and the eyes don't stay moist enough. When this happens, dry eyes can develop, causing irritation, burning or blurry vision.**

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Did you know?

- About 65% of stroke survivors have vision problems.
- Most people who experience vision loss due to stroke don't fully regain their vision. But at least some recovery is possible.
- Proper diagnosis and vision rehabilitation can help with recovery and improve daily activities.

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What to look for when screening

The responsibility for the technician is to pay attention to the patient and if you suspect that your patient is in crisis, notify another staff member to notify the provider, DONOT leave your patient! B.E.F.A.S.T.

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Common vision problems related to a stroke include[1][2][3][4][5]:

- Visual field loss
- Double vision (diplopia)
- Reduced visual acuity
- Blurred vision
- Eye movement problems
- Visual processing problems – blurred - kaleidoscope
- Poor visual memory
- Decreased balance and depth perception
- Reading problems
- Rhythmic eye movements (nystagmus)
- Misaligned eyes (strabismus)
- Eye tracking control issues (oculomotor dysfunction).
- Pain around the eye

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Patient Presentations

- **B – Balance** (recent falls?)
- **E – Eyes** (Eye alignment?)
- **F – Face** (face symmetry)
- **A – Arm** (arm strength)
- **S – Speech** (change in speech*)
- **T – Time** (know the emergency protocols for office, do not delay!)

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WHAT DO YOU THINK ABOUT THESE PUPILS?

CN III Oculomotor

PUPILLARY ASSESSMENT (cont.)

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Vision Problems After A Stroke

During and after a stroke, you could experience involuntary eye movements and issues with your vision in general. According to the ophthalmology department at Sheffield Teaching Hospitals, up to 68% of stroke victims suffer visual abnormalities, such as misalignment of one eye, nystagmus, and eyelid issues. If you've had a stroke, you could also experience blurry vision and a lack of depth perception. Pain around the eye.

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Ptosis associated with Stroke

Neurogenic ptosis: This acquired type arises due to nerve damage in the levator muscle and can accompany other conditions, such as multiple sclerosis, Horner syndrome, third nerve palsy, and strokes among others.

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Double Vision: Alternate Name

Diplopia is double vision

- Images are up and down
- Images are side by side

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Diplopia

- **Diplopia**, commonly known as **double vision**, is the simultaneous perception of two images of a single object that may be displaced horizontally, vertically, or diagonally (i.e. both vertically and horizontally) in relation to each other.[1] It is usually the result of impaired function of the extraocular muscles (EOMs), where both eyes are still functional but they cannot converge to target the desired object.[1] Problems with EOMs may be due to mechanical problems, disorders of the neuromuscular junction, disorders of the cranial nerves (III, IV, and VI) that stimulate the muscles, and occasionally disorders involving the supranuclear oculomotor pathways or ingestion of toxins.[2]
- Diplopia is often one of the first signs of a systemic disease, particularly to a muscular or neurological process,[3] and it may disrupt a person's balance, movement, and/or reading abilities.[1][4]

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Other Signs

- Not everyone having a stroke will have the same ocular symptoms:
- Sudden vision loss
- Blurred vision
- Dark spots or shadows in field of vision
- Floaters or sudden increase in floaters
- Flashes of light
- Zigzag lines in vision
- Double vision
- Difficulty moving eyes

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Headaches Could Be A Significant Sign!

- Most common headache is a tension HA
- If a patient has a headache:
  - Location (localized, diffused, radiating)
  - Quality (dull sharp throbbing, etc…)
  - Intensity
  - Frequency
  - Duration
  - Associated symptoms (nausea, noise/light sensitivity)
- Medications (OCT too!)
- Hypertension – **check pts BP!**

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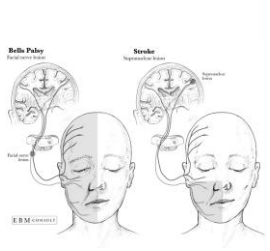
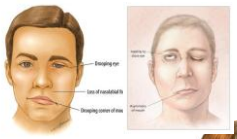
Aging - Bell's Palsy vs Stroke





5th and 7th Cranial nerves

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True Life-threatening Suspected Stroke

- Please be aware that emergencies other than ocular emergencies can find their way into your office
- If you notice a change in the patient's facial expression, behavior or speech, they could be experiencing a true life-threatening emergency
- **Inform your provider immediately, do not leave the patient!**

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Testing For Suspected Stroke Patients

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Proper Clinic Testing

- Visual testing
- IOP (eye pressure)
- Pupil Testing
- Muscle testing
- Cover Testing
  - Test speed is critical
- Color Vision Testing
  - Redcap saturation test
- Amsler Grid*
- Confrontation Fields

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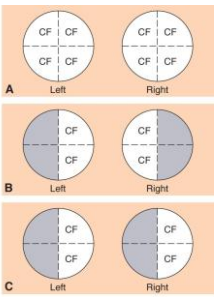
Purpose of Confrontation Field Test

- Visual field tests used to identify in the screening process to locate gross field defects
- This does not replace other visual field test, this is a screening test



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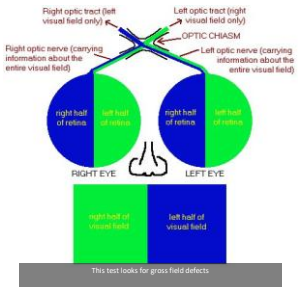
Confrontation Fields

- Confront Fields
  - Pt instructions
  - Proper distance
  - Cardinal positions
  - Recording accuracy

Why are confrontation fields necessary?



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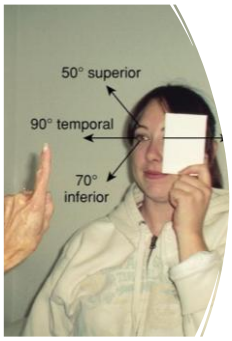

Performing confrontation fields:

1. Have the patient remove their hat or anything that could interfere with their peripheral vision.
2. Sit approximately three to four feet away and directly in front of the patient. If possible, adjust your seat height until you are at eye level with the patient.
3. Ask the patient to gently cover their left eye with their left hand and instruct the patient to fix their gaze directly on your left eye throughout the test.
4. While the patient is focusing on your eye, close your right eye and maintain fixation on the patients open eye. Raise your hand to the inferior temporal edge of your peripheral vision halfway between yourself and the patient, while holding up 1, 2, or 5 fingers. Using only 1, 2, and 5 fingers helps to make the number more easily distinguished by the patient. Ask the patient how many fingers are seen.
5. Repeat step 4, testing all four visual quadrants of the left eye: Inferior temporal, inferior nasal, superior temporal, and superior nasal.
6. Repeat steps 3, 4, and 5 for the patient's right eye

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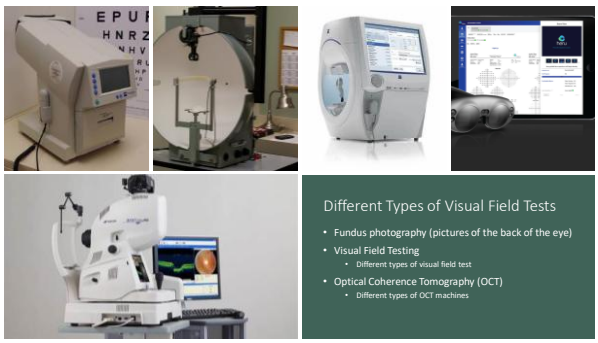

Different Types of Visual Field Tests

- Fundus photography (pictures of the back of the eye)
- Visual Field Testing
  - Different types of visual field test
- Optical Coherence Tomography (OCT)
  - Different types of OCT machines

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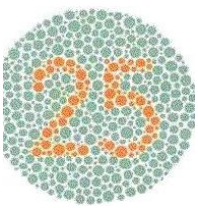
Testing for Strokes

- One quick test to rule out optic neuritis is a monocular color vision test (color vision testing)
- MRI
- Carotid ultrasound



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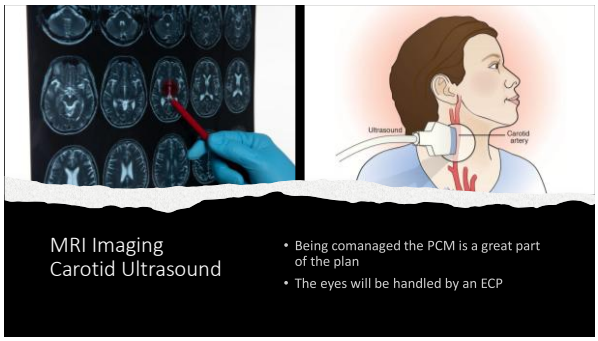

MRI Imaging
Carotid Ultrasound

- Being comanaged the PCM is a great part of the plan
- The eyes will be handled by an ECP

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Visual Therapy Associated With Stroke Patients

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The visual system involves up to 70% of the brain; either directly or indirectly

Vision takes place in the BRAIN not in the eye

Vision is about spatial information

69

Studies show that 90 percent of TBI patients suffer from visual dysfunctions.

70

8 out of 12 cranial nerves are directly or indirectly involved in the process of vision:

II: Optic
III: Oculomotor
IV: Trochlear
V: Trigeminal
VI: Abducens
VII: Facial
VIII: Vestibulocochlear
XI: Accessory

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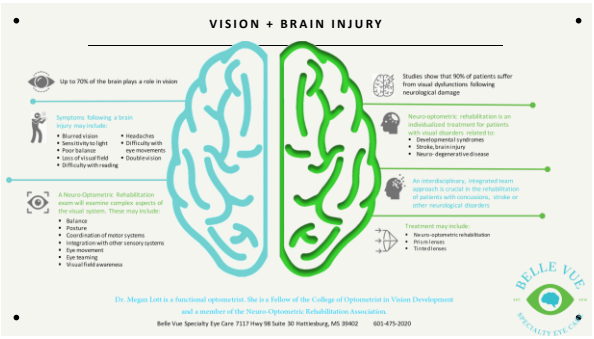

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How do I know if my patient/family/friend has a visual problem?

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Subjective COVD checklist

Although this questionnaire is often used to detect Visual Related Learning Disorders, it is also used in identifying brain injury, specifically in children.

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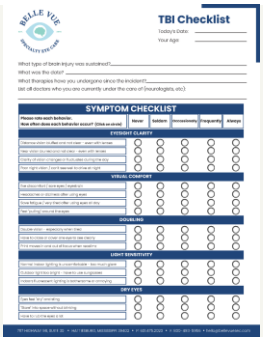
Subjective: TBI checklist



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Visual aspects are often overlooked as a necessity of rehabilitation.

Neuro-visual rehabilitation can be an integral part of the rehabilitation team.

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TRY AND LEARN

ACTIVITY

Vision and Balance

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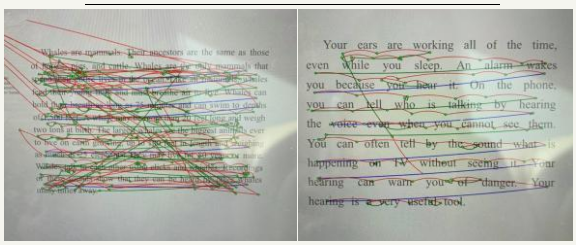
OCULARMOTOR ASSESSMENT



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Perceptual/Cognitive

- Confusion of Left Right
- Visual Fields Deficits
- Visual Neglect
- Memory
  - Short Term
  - Long Term
- Executive Function
  - Decreased Ability
  - Increased Time to Process
  - Fatigue

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Visual neglect
vs.
Visual field loss

Aren't they the same thing?
How do you know which it is????

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New Advance Testing

- Surveys of occupational therapists show there is a need for a standardized tool and training in visual perception screening.
- The new test, called the Oxford Visual Perception Screen (OxVPS), is a simple paper-based set of 10 tasks which checks for a wide range of visual perception problems after brain injury.

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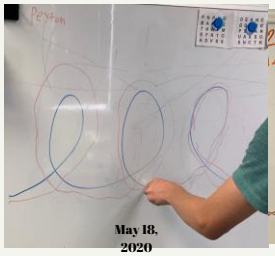

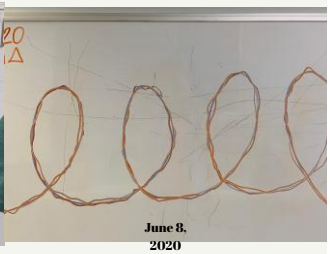

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Eye Care Specialist That Can Help

- Eye doctors (ophthalmologists and optometrists), brain doctors (neurologists) and brain-eye doctor specialists (neuro-ophthalmologists and neuro-optometrists) can diagnose vision problems and develop a treatment plan. These plans may involve a variety of rehabilitation therapies and often have a goal of helping survivors compensate for losses and regain as much function as possible. Examples of therapies include:
- **Scanning** — One of the most common types of visual therapies, it helps train the eyes to better scan toward and away from areas of vision loss.
- **Prisms** — They can be added to your glasses to change the way you perceive certain objects in space by changing the direction of incoming light.
- **Relaxation and breathing techniques**.
- **Spatial awareness and balance activities**.

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RESOURCES

Brain Injury Association

Neuro-Optometric Rehabilitation Association
noravisionrehab.org

OVDRA
COVD.org

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CONCLUSION

A patient with a brain injury can almost always tell you the day and time of their injury. They may not remember anything else, but they know the **moment** their life was changed. They have a "before" and "after" point of reference.

Do not ever tell a person who has sustained a brain injury "But you look great!" Brain injuries will alter **everything** about life as you know it; it is a hidden disability. Yes, they may look "normal" on the outside, but they often feel broken. **Listen** to their needs and assist from there.

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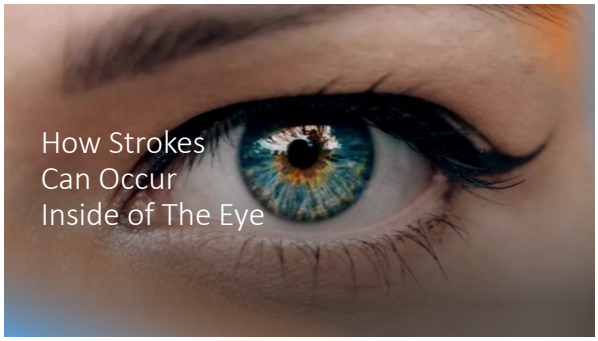

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Eye Strokes Happen Too

A retinal artery occlusion may have different names based on the location of the blockage. The terms for these can also apply to blockages in veins. Types of retinal artery occlusions include:

- **A central retinal artery occlusion (CRAO):** This term describes a blockage in the main artery in your eye, which would be like the trunk of a tree. The effects of the stroke can be seen throughout the eye.
- **A branch retinal artery occlusion (BRAO):** This term refers to a blockage in one of the smaller arteries in your eye, like a branch connected to the trunk of a tree. The effects of the blockage can be seen in a smaller area of the eye.
- **A twig retinal artery occlusion:** This term describes a blockage in an even smaller blood vessel, like a twig that is part of a branch connected to the trunk of a tree.

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Causes of Eye Strokes

An eye stroke is caused by an interruption of blood flow to your retina. The blockage can be caused by something solid like plaque or infection that breaks off from another part of your body, like the inside of your heart or another artery. This type of blockage is called an embolism.

The blockage can also be caused by blood getting thicker and clotting. This type of blockage is called thrombosis.

- These blockages cause fluid to leak and ocular (a term that refers to your vision or eyes) pressure to increase. This pressure can damage the optic nerve, which happens with glaucoma.

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Risk Factors for Eye Strokes

Most of the risk factors for having a stroke in one of your eyes are similar to the risk factors for having a stroke in general. These things include:

- Having high blood pressure (hypertension).
- Having high cholesterol (hyperlipidemia).
- Having a build-up of plaque in your blood vessels (atherosclerosis).
- Having coronary artery disease.
- Surviving a previous stroke.
- Being older than 60.
- Being male.

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Things To Remember Strokes

- Strokes are not the same for everyone
- Medications can help reduce risks
- Many people function many years after stroke
- **Physical functions** can also be impacted for people that had a stroke

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RECAP OF TODAY'S CLASS

RECAP 01	RECAP 02	RECAP 03	RECAP 04
Vision is more than 20/20 eyesight.	Vision occurs in every part of the brain, not just the occipital lobe.	Quality of life can be dramatically improved wtih neuro-optometric therapy.	Be sensitive to those who have suffered a brain injury and help them find support. It takes a team.

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How to order a consult....

- Call (601.475.2020). An interview/history will be performed with the therapist/patient/etc to determine what evaluation will be needed.
- All evaluations are conducted in Hattiesburg.
- Therapy can be performed in Hattiesburg (main office) or Jackson (Highland Village).

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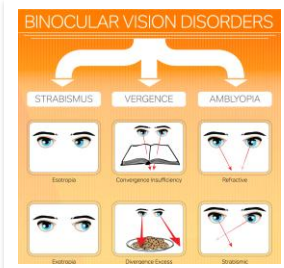
Training Your Staff

- Tests results are vital to achieving the correct diagnosis
- Selecting the right staff is critical
- Staff and patient education
- Training Documentation
- Clinical Documentation
- Follow up care



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- Neuro-ophthalmology
- Neurology
- COVD Optometrist

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Vision Loss After Stroke: Why It Happens and How It's Treated

Eye Stroke: Types, Symptoms & Causes

Let's Talk About Stroke and Vision Changes | American Stroke Association

Stroke: What It Is, Types, Symptoms, Causes, Risk Factors, Treatment & Prevention

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Thank you

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