

Types of Vision Deficits

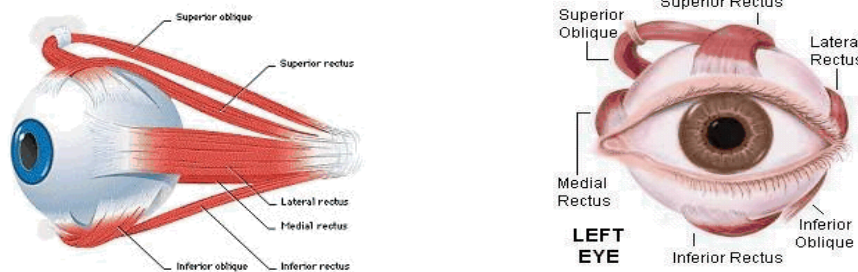
Double Vision

When the muscles are not working due to weakness or injury, many deficits can result in either or both eyes. These include:

- Misalignment
- Decreased movement and coordination
- Decreased speed of movements

When someone is experiencing these deficits, they typically complain of double vision (diplopia).

The following images show the six muscles that control each eye:



Strabismus

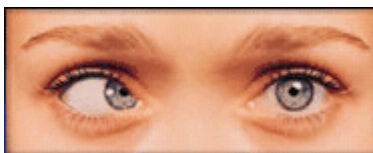
A type of eye movement dysfunction that interferes with vision since it prevents both eyes to appropriately align with each other. Usually caused by result of trauma or increased pressure in the brain.

- Misalignment of the eye can cause:
 - The eye turns in, out, or up.
 - The direction of the eye turn depends on which nerve in the brain has been affected.
- There are two different ways to describe the eye turn.
 - “-*tropia*” indicates paralysis of the eye muscle (the eye cannot move)
 - “-*phoria*” indicates weakness of the eye muscle (the eye muscle is too weak to move)

Eye is turned out (Exotropia)



Eye is turned in (Esotropia)



Eye is turned up (hypertropia)



Signs and Symptoms of Strabismus:

- Misalignment of the eyes
- Complaints of double vision (seeing two images)
- Complaints of blurry vision

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- Complaints of floating images
- Closing/covering of one eye

Impact of Strabismus on Daily Function:

- Poor coordination
- Poor depth perception
- Difficulty walking on changing surfaces (ie. stairs, concrete to grass)

Convergence

Issues related to an eye's ability to convergence and divergence is also known as an accommodative dysfunction which is very common after brain injury or stroke.

- *Convergence* occurs when the eyes simultaneously turn toward each other in order to see an image clearly when close up.
- *Divergence* occurs when the eyes turn away from each other to see images clearly at a distance.
- When an individual's eyes look at near objects and then at distant objects, the eyes must make necessary adjustments in order to focus on both the near and far objects and to see these objects clearly. This process is called *accommodation*.
 - For example, an individual's eyes must turn towards each other (converge) to read clearly from a book on a table or in their lap. Then, if they want to look up to see the time on the clock, their eyes must turn away from each other (diverge) in order to see the clock clearly at a distance.
- The eyes have a tendency to drift outward due to the inability or difficulty to adjust focus during visually demanding, near centered tasks (ie. Reading, writing, tabletop activities).

Signs and Symptoms of Convergence Insufficiency

- Complaints of blurred vision while reading
- Complaints that the letters move while reading
- Complaints of eye strain and discomfort
- Complaints of headaches
- Rubbing eyes
- Fatigue/sleepiness
- Unable to sustain gaze on near objects
- Eyes drift out when used in near vision, but work well at a distance

Impact of Convergence and Accommodative Insufficiency on Daily Function

- Unable to focus on near objects
- Unable to focus when shifting from near to far and then back to near
- Requires frequent rest breaks with tasks requiring sustained attention
- Poor concentration or loss of comprehension over time

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- Increased frustration
- Tires easily

Nystagmus

A type of eye movement dysfunction that can occur following a brain injury referred to as Nystagmus. The cause of nystagmus can at times be unknown and difficult to treat.

- It appears as an involuntary, rhythmical, and repeated movement of one or both eyes in a circular or horizontal pattern. It can occur in any or all fields of gaze (ie. When looking up, down, to the left or right).
- There are different types of nystagmus that can result following a head injury, including:
 - Related to vision loss - *Sensory nystagmus*
 - Related to the control of muscle function- *Motor nystagmus*
 - Related to inner ear problems- *Vestibular nystagmus*
 - Medication can also cause nystagmus

Visual Acuity

The measure of the eye's ability to see small detail clearly, both near and far, is called *visual acuity*.

- It is recorded with a number on top (which is the testing distance) and a number on bottom (the distance that the letters/symbols are being viewed).
 - 20/20 vision is a term to express normal visual acuity, measured at a distance of 20 feet. This means that an individual can see clearly at 20 feet what should normally be seen at 20 feet.
 - For example, if an individual has 20/100 vision, it means that the individual must be as close as 20 feet to see what a person with 20/20 vision can see at 100 feet.
 - Decreased visual acuity often results in blurriness, or blurred vision.
- Having 20/20 vision does not mean that the individual has perfect vision. The term 20/20 only indicates the clarity of an individual's vision at a distance or when close up.
- There are other important visual skills that contribute to an individual's overall vision, including:
 - Visual fields
 - Eye coordination
 - Visual perception
 - Focusing ability
 - Color vision

Signs and symptoms of decreased visual acuity:

- Squinting
- Complaints of print that is too small to read

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- Complaints of fuzzy/blurry vision

Impact of decreased visual acuity on daily function:

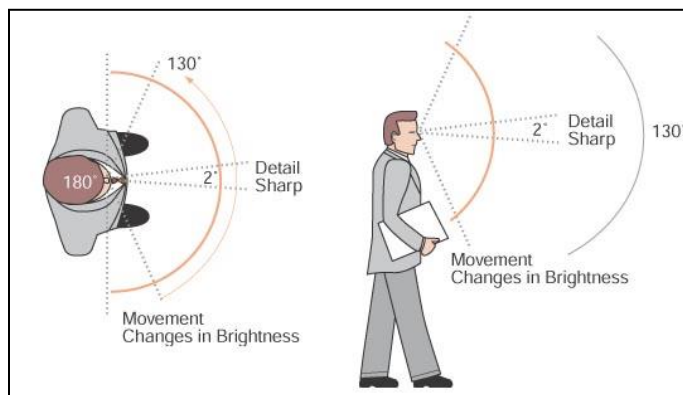
- Decreased facial recognition
- Difficulty finding one's way through a crowded environment
- Difficulty reading daily schedule
- Difficulty with reading

Visual Fields

The eye's visual field is the space you see when you're looking out in to the world. An individual can be looking at an object, but can also see the space around the object's surroundings, known as the *peripheral field*.

- There are four visual fields for each eye:
 - Superior (up)
 - Inferior (down)
 - Temporal (by the ear)
 - Nasal (by the nose)

The following diagram illustrates intact visual fields in each eye.



Visual Field Deficits

Following a brain injury, it is common to observe deficits related to visual field loss because of the complexity of the visual pathways.

- Based on where the injury occurred, different visual deficits may result.
- A health care professional must rule out other visual deficits that can have similar signs and symptoms to ensure that the individual does in fact have a decreased visual field.

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Signs and Symptoms of Decreased Visual Fields

- Changes in gaze preference
- Head turning or tilting to one side
- Missing items during self-care tasks
- Running into people or objects
- Complaints of seeing “blackness” or not seeing

Impact of Visual Field Deficits on Daily Function

- Poor personal hygiene
- Decreased/limited body awareness
- Unsafe mobility
- Poor routing in the environment
- Increased need for caregiver during self-care and/or at all times

The following are examples of common visual field deficits seen after a brain injury with a corresponding picture in attempts to illustrate the individual’s visual deficits:

- *Bitemporal Hemianopsia*
 - Injury where the optic nerve of the left and right eyes cross each other within the brain.
 - Vision is missing in the outer half of each eye (temporal fields) impacting both the right and left visual fields.



- *Left Hemianopia/Right Hemianopia*
 - Injury in the left/right optic tract
 - Vision is missing on the left/right side
 - People might have an abnormal head position
 - Left Hemianopia affects an individual’s mobility because left visual field is restricted, leading to not seeing objects or people on our left side. Left Hemianopia also affects an individual’s ability to read because we read from left to right.
 - When the right side is impacted, activities can still be difficult; however, this type would be preferred over a left hemianopia due to less impact on activity participation and independence.
- A lower or upper hemianopia are also possible. The lower or upper field would be missing, which causes increased difficulty with reading and mobility. Interacting and navigating within

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a person's environment becomes an increased safety risk. Activities such having a conversation and recognizing the persons face, walking in a cluttered room, going up and down stairs, stepping off curbs, and negotiating ramps all pose challenges to an individual with these fields deficits.

