Visual and Perceptual Problems after a Brain Injury

Although vision problems may not be the most noticeable barrier after a brain injury, they do affect your ability to move and complete your daily tasks. For example, our eyes notice that we are about to step on ice in the parking lot. Our visual system processes this information. We change the speed and direction of our feet to avoid the ice. Or, if we want to pick up a glass of water, our eyes move to locate the glass and focus on it. The brain processes this information. It moves your open hand to the glass. It grasps it and picks it up so you can take a drink.

- The Visual System includes the following:
  - Eyes
  - Nerves that connect the eyes to the brain
  - Parts of the brain that process and interpret what we see

- The Brain functions by:
  - Coordinating the eyes to move together
  - Storing what we see in our memory
  - Allowing us to adjust how we move based on what we see

The primary area for vision is in the lower, back portion of the brain called the occipital lobe.

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**Vision Changes after a Brain Injury**

Vision starts when the eyes see an object and the image travels through the brain to the occipital lobe. The location of the brain injury and its damage will determine the different visual changes. The potential for damage of the visual system is so great that the body has a "back up" system.

Each eye receives some of the information from the left half of what we see in our environment and some from the right half. The information or image from each eye is combined, crosses over in the middle of the brain, and is then carried to the back of the brain (occipital lobes). So, if you have a brain injury on the right side of your brain, it primarily affects the vision on the left. A brain injury on the left side of the brain affects the vision on the right.

A person as seen by someone with normal vision.

The image is turned upside down when it reaches the eye.

The image from each eye is combined here.

The image of the person becomes upright and is processed in the occipital lobe.

**Vision Involves Two Processes**

1. Eye movement and taking in visual information into the brain
2. Processing and interpreting what you see

A brain injury can cause problems with one or both processes.
Eye Movement and Taking in Visual Information

The first step in how vision occurs involves how the eyes move and the amount of information they take in. Problems may include:

- **Muscle Weakness:**
  
The lower part of the brain is called the brainstem. It helps control eye movement. It directs the six muscles that keep the eyes moving together as you look up, down, right, and left. If a brain injury affects these muscles, it may be hard to see things move (such as watching a sporting event) or it may be hard to read.

- **Visual Field Cut (Hemianopsia):**

  When both eyes are open, everything you see is called the **Visual Field**. The field can be divided into 4 areas. The inability to see part of the visual field is called a **Visual Field Cut (Hemianopsia)**.

  The most common loss of vision is the ability to see on one side (peripheral vision) or loss of half the visual field of each eye. This is similar to a "blind spot" when driving, which is an area where you cannot see unless you turn your head. Visual field loss may take a long time to improve or may be permanent.

- **Double Vision (Diplopia):**

  If the brain injury affects the cerebellum or brainstem, you will most likely have double vision or diplopia. This occurs because the muscles that control the eyes are not able to keep them evenly aligned. A person with double vision has trouble walking because he or she cannot see the floor. Spills may occur at meals because there are "two" of every item.

  Sometimes, a prism or vision therapy may be used to create single vision after a brain injury. Taping over one eye or the use of a patch minimizes the double vision. The problem with taping one eye is that it also causes a loss of depth perception. Depth perception is the ability to determine how much distance is between objects.
Processing and Interpreting What is Seen

The second part of vision is processing and interpreting what we see. This is where the true "seeing" takes place. Interpreting what we see allows the brain to distinguish colors, follow patterns, remember what is seen, discriminate details, and determine directions and spatial relationships. This is called perception or visual processing.

- Visual Neglect or Inattention:
  - This is a common perceptual problem after a brain injury. It is caused by an inability to correctly process or pay attention to visual information on one side of the body. It is not a problem in seeing the information.
  - This deficit is more common in a right brain injury that affects the left side of the body. A person with neglect may hold their head or eyes to the right and may not look at you if you stand to their left. They may not be able to locate items on the left side of the meal tray and may run into objects on their left side.
  - You may also see neglect or inattention in a left brain injury that affects the right side of the body. With this brain injury, the inattention and neglect are less obvious.
  - Visual neglect can often be improved by increasing the person's awareness of the neglected side.

Who can help the patient with these visual problems?

Usually, a team of these health care providers provides the most effective treatment for visual problems after a brain injury.

- An Occupational Therapist (OT) will do a vision screening to identify the above problems. This screening may include visual tests and watching the patient do daily tasks such as dressing, eating, and moving in a wheelchair. Once a problem is identified, your OT may teach you ways to help compensate or retrain your vision. If the eye muscles need to be strengthened, exercises may help align them.

- A Neuro-opthalmologist is a medical doctor who specializes in diseases of the eye and eye surgery.

- An Optometrist specializes in vision development and can diagnose and treat eye disease. They look at a person's vision as it relates to their ability to do activities at work, play, school, or sports. Treatment may include the use of lenses, prisms, low vision devices, and vision therapy.

Talk to your doctor or others on your health care team if you have questions. You may request more written information from the Library for Health Information at (614) 293-3707 or email: health-info@osu.edu.