Can you see me now? Assessment and Treatment of Visual-Perceptual Deficits Post-Stroke

Kelly F. Ptachick, MS, OTR/L, CSRS, Sentara Clinical Specialist in Neurology
2023 Sentara Stroke Symposium
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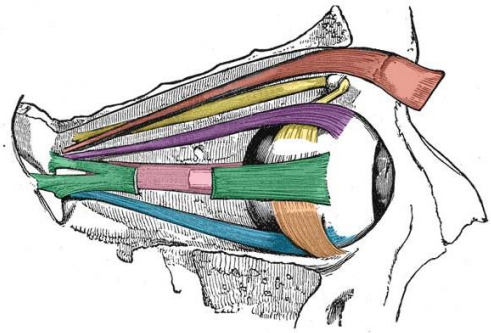
Review of Anatomy



The extraocular muscles are the six pairs of striated muscles that control movement of the eye and one muscle that controls eyelid elevation (levator palpebrae). The rectus muscles have a straight line of pull (ie- the medial rectus pulls the eye medially), while the oblique muscles pull the eye diagonally.

The extraocular muscles are innervated by cranial nerves. See the table below.

Cranial Nerve	Innervates	Resulting Deficit
Oculomotor Nerve (CN 3)	• Medial rectus • Superior rectus • Inferior rectus • Inferior oblique • Levator palpaebrae superioris	• Exotropia (outward position of eye) • Difficulty/unable to make vertical or medial eye movements • Lateral diplopia viewing near objects • Eyelid ptosis
Troclear Nerve (CN 4)	• Superior oblique	• Does not cause significant eye deviation • Vertical diplopia
Aducens Nerve (CN 6)	• Lateral rectus	• Esotropia (inward position of the eye) • Lateral diplopia viewing distant objects

The eye moves in 3 planes.

- Horizontally (ABD, ADD)
- Vertically (Elevation, Depression)
- Diagonally (Intorsion, Extorsion)

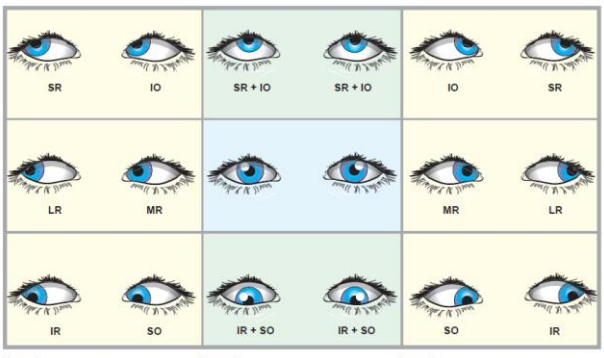


Fig. 18.9 Diagnostic positions of gaze. IO = inferior oblique; IR = inferior rectus; LR = lateral rectus; MR = medial rectus; SO = superior oblique; SR = superior rectus

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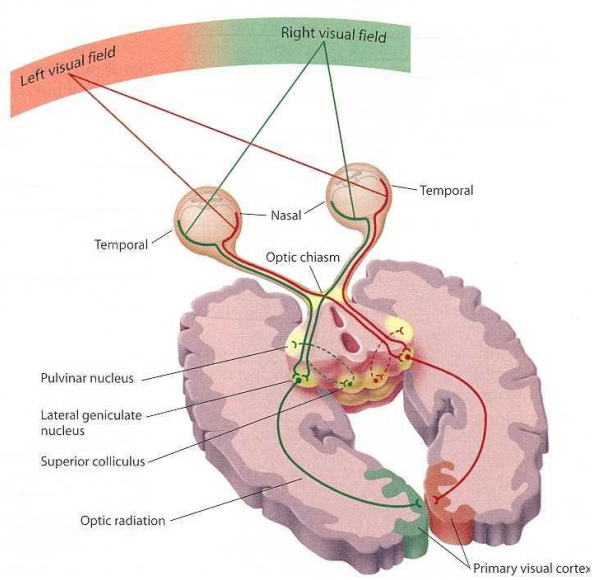
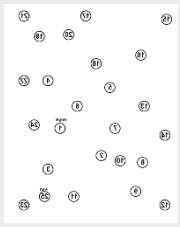
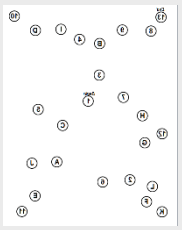


Visual information travels from the eye to the brain via the visual pathway. Vision is generated by photoreceptors in the **retina**, a layer of cells at the back of the eye. The information leaves the eye by way of the **optic nerve**, and there is a partial crossing of axons at the **optic chiasm**. After the chiasm, the axons are called the **optic tract**. The optic tract wraps around the midbrain to get to the **lateral geniculate nucleus** (LGN), where all the axons must synapse. From there, the LGN axons fan out through the deep white matter of the brain as the **optic radiations**, which will ultimately travel to **primary visual cortex**, at the back of the brain.

Mechanical Visual Impairments

Impairment	Assessment	Intervention

Visual Field Deficit	**Confrontation Test**
	Equipment- occluder or eye patch, object with a contrasting color at end or a finger
	Set-up- The patient is seated facing the examiner
	Test- Patient occludes one eye and looks at the nose of the examiner. The examiner slowly brings the object from behind and from the side of the patient and asks the patient to say "now" when the end of the object is detected
		Medical Management
		• Prisms- shift the peripheral image towards the central area of the retina (requires consultation to optometrist/ophthalmologist)
		Therapeutic Management
		• Overall Goal- improve the patient's ability to participate in meaningful activities
		• Compensatory in nature- Learning oculomotor compensatory strategies of increasing attention to the blind hemi-field and improve ability to explore the visual field
		  • Computerized Light Boards (document speed in responding to visual field deficit
		  • Scan Course
		  • Scan Tabletop/Sink
		  • Pre-Reading and Pre-Writing Tasks
		  • Be sure to include dynamic environments

	(presented at ~16 inches away from patient). Continue randomly testing different sections of the visual field in 45 degree intervals around the visual field. Repeat with other eye occluded and with both eyes open.	
Pursuits Deficits	**Ocular ROM Testing** Test- Patient follows object 12 inches away from face (without moving head) in a large "H" and "O" pattern to the extremes of gaze. Eye movement should be smooth and precise. Observe if the patient looks away, loses the target, squints or blinks excessively, or reports double vision	• Line tangles • Mazes (www.printablemazes.com) • Connect the dots/trailmaking • Flashlight tag (follow the leader) • Pencil pursuits • www.eyecanlearn.com  

Saccades Deficits	**Saccades Screening**
	Equipment- two different colored objects
	Set-up- Patient should sit with head vertical and be positioned in front of the examiner
	Test- Hold two objects 16 inches from patient's face about 4 inches from midline (between the two objects). Give the following instructions "When I say (red), look
		• Hart Chart
		  • Activity 1-Read line by line
		  • Activity 2
		  – Read aloud first and last letter of each line
		  – Read the 2nd and 2nd to last letter of each line
		  – Read the 3rd and 3rd to last letter of each line
		  – So on and so forth until the patient is finished reading the middle two letters of each line
		  – Goal- 30-45 seconds
		  • Activity 3- Name only vowels
		  • Activity 4- Read diagonal lines

	at the (red) target. When I say (green), look at the (green) target. Do not look until I tell you." Have the client look from one target to the other 5 x each. Functional Implications- Adults without visual impairment should perform perfectly. Any mistake denotes problems with saccadic function and the patient will require further evaluation.	 O F N P V D T C H E Y B A K O E Z L R X E T H W F M B K A P B X F R T O S M V C R A D V S X P E T O M P O E A N C B K F C R G D B K E P M A F X P S M A R D L G T M U A X S O G P B H O S N C T K U Z L • Word Weave (over/under letter tracking) • Flashlight tag • Letter/number cancellation in word search • Pre-Reading and Pre-Writing Activities (Mary Warren) • www.eyecanlearn.com
Convergence Insufficiency/Diplopia	**Convergence Screening Test-** Slowly bring an object closer to a patient at eye level and between eyes. Ask the patient to keep their eyes on the object and report when 2 are seen (this should occur within 2-4 inches). Now slowly bring the object away from the patient. Ask him/her to keep their eyes on the object and report when a single image is seen (this should occur within 4-6 inches). Observe to see if both eyes are working together or if one eye drifts outward.	**Medical Management** • Prism • Patching within lens • Eye Exercises • Surgical Intervention **Therapeutic Management** • Patching during activities – Full occlusion patching – Partial occlusion patching • Goal- To reduce visual stress! Does not restore binocular function and does not strengthen the eye! • Modify Environment – Increase visibility – Structure environment • Modify Task – Increase visibility of task components – Enlarge print – Decrease number of visual steps – Structure task

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Visual-Perceptual Impairments

Impairments	Assessments	Interventions
– **Figure Ground** – **Visual Form Recognition/Discrimination** – **Visual Closure** – **Visual Memory** – **Spatial Orientation**	The following assessments have subtests which address all the impairments: • Test of Visual Perception Skills, 4th Edition (TVPS-4) • Motor Free Visual Perception Test (MVPT-4) • Hooper Visual Organization Test • ADL observation • Mobility observation The Beery-Buktenica Developmental Test of Visual-Motor Integration, 6th Edition (BEERY VMI) assess visual-perception with a motor component.	**Figure Ground** • Highlights Hidden pictures • Messy drawer sort **Visual Form Recognition/Discrimination** • Sorting (colors, shapes, socks) • Comparison pictures • "I Spy"- especially shadow version of game **Visual Memory** • Scouting Game- lay out a certain number of objects and have patient remember what was seen • The game "Memory" **Spatial Orientation** • Map activities • Mazes • Clothing orientation activities (find R sleeve, L sleeve, etc.) **Other resources** • Computer Games – www.eyecanlearn.com – Unblock me – Flash Focus (DS) – Luminosity • Other visual perceptual printouts (http://www.ot-mom-learning-activities.com/visual-perceptual-worksheets.html)
Spatial Neglect	**Personal Neglect** • Fluff Test • Comb and Razor Test	**Visual Scanning Training** • Training patient to explore environment in impaired area of neglect • Activities Emphasize

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	Peri-personal Neglect • Line Bi-section test • Cancellation tests • Star Cancellation • Bell's Cancellation • Baking Tray Test **Extra-personal Neglect** • Point to Objects Test • Catherine Bergego Scale	– Initiate search from left side – Execute a symmetrical search pattern – Execute complete search to the left – Anticipate visual input occurring on the left – Shifting search between L and R fields – Observe all visual detail • Verbal cue of "look to your left" and "your missing something" has been found to be ineffective – Give gentle cues/have patience – "Try to take it all in" – "Make sure you look for everything on the table, even to the far edges" **Limb Activation** • Any active movement of the left (affected) side may function as a motor stimulus activating the right hemisphere and thus improving neglect • Applying lotion to the affected arm; placing watch on left arm with alarm **TENS** • Somatosensory stimulation applied to the left posterior neck muscles reduce neglect by causing the patient to detect and identify stimuli in the left field • Adjunct to other therapy interventions • Easy to administer and well tolerated by patients • Parameters:

		– Frequency: 100 Hz, Pulse Duration: 100 us, Intensity: sensory threshold (pleasant tingling), Applied via 2- 2x2 electrodes on posterolateral aspect of the neck (lateral to spine) and upper traps on neglected side, time: 15 minutes

Link to Fluff Test: https://www.academia.edu/3504557/The_Fluff_Test_A_simple_task_to_assess_body_representation_neglect

Link to Comb and Razor Test: http://www.strokengine.ca/indepth/crt_indepth/

Hemianopsia vs. Spatial Neglect

Visual Field Cut Only	Spatial Neglect
• Awareness of left field • Have client turn head contra-lesionally, they can see a stimulus on the wall or in front of them • Attempts to actively compensate • Confined to visual system (should not see signs of personal neglect or motor signs) • Can scan and perform visual tests • Attention demands should not change performance • Abbreviated search pattern- omissions on the left • Pattern is organized • Re-scanning to check accuracy • Ability to sustain attention (measured by completion time) is task appropriate • Improves with cuing	• Demonstrates decreased awareness of one side • Have client turn head contra-lesionally, they cannot see stimulus • Not sure where left is • May be observed across modalities (motor and tactile) • Will not scan during clinical tests • Symptoms change with increased selective attention demands and demands for sustained attention; more complex environment worsens symptoms • Abbreviated search pattern- omission on the left • Pattern is asymmetrical, random, disorganized • Revisiting on right • Reduced ability to sustain attention (short completion time) • Unable to incorporate cue (revisiting)