

## Vestibular Tests & Measures: Study Guide

Nystagmus is described by the direction of the quick phase. Rotary / Torsional N. is described by the direction that the superior pole of the iris moves, L or R.		<b>Directions to perform TEST</b>	<b>Positive sign demonstrated by</b>	<b>Central vs. Peripheral</b>
<b>Eye Movement Range</b>		Take your finger out past 18-24" to examine if the patient has full ocular range of motion. Ask the patient to follow moving target that is held several feet in front of the patient's face (to avoid convergence of eyes.)		Combination: ocular muscles
<b>Smooth Pursuit</b>	Maintains gaze stabilization when rate of eye movement is $\leq 60$ d/sec, i.e. slower than VOR Gain testing	Hold the patient's head stationary. Have the patient follow your slowly moving finger horizontally (from center to 30° right and then to 30° left), and then vertically (center to 30° up to 30° down). Can use an "H" pattern. The test can be repeated; you may have to hold the eyelids up in order to see the downward eye movement clearly.	Eyes do not move synchronously or symmetrically.	Central
<b>End Point Nystagmus</b> (physiological response)		During maintenance of an extreme eye position. Head fixed. Eyes follow my finger and then held at the end point.	1-2 beats is normal.	Central
<b>Gaze evoked Nystagmus</b> (abnormal response)	Observe direction of nystagmus in each test position.	Hold the patient's head stationary. Have the patient follow your finger so she/he is looking 30° to the right, left, up, down. Pause for 20 seconds in each of those positions to observe for nystagmus. Note the direction of the nystagmus in each position. Be sure to keep your finger 18-24 inches away from the patient's face throughout the entire test.	Persistent nystagmus	Central
<b>Saccades</b>	Extra involuntary eye movements during horizontal and vertical tracking.	Normal saccadic movement: hold the patient's head stationary. Hold your finger about 15 degrees to one side of your nose. Ask the patient to look at your nose, then at your finger, repeating several times. Do this from the right, left, up, and down. You are looking for the number of eye movements it takes for the patient's eyes to reach the target. Normal is $< 2$ .		Central
<b>Near Point Convergence</b> (c/s glasses)	Normal: diplopia at $\leq 5$ cm from nose; observe for symmetrical eye movement	Hold target at nose level, arm's length away. Focus on the target as you move it toward your nose. Stop when target turns double. Measure distance from nose to target. Repeat 2-3 times.	$\geq 6$ cm = "Convergence insufficiency"	Central
<b>Diplopia</b>		Patient report of double vision. Test both near and far field of vision.		Central
<b>Oscillopsia:</b> visual blurring with head movement	Decreased VOR gaze stability with head motion	Patient report of environment moving or oscillating, as they walk through it. May also be reported as "seaweed" movement without head mvmt.		Peripheral or Central

<b>Alternate Cover Test</b>		Therapist alternately covers and uncovers each eye, while patient keeps their eyes open, focused on therapist's nose.	Covered eye has moved from midline; phoria	Utricle hypofunction, or brainstem pathways
<b>Cover Test</b>		Patient looks at therapist's nose. Cover one eye at a time for 2 sec. Observe the uncovered eye for movement.	Ocular misalignment; eye readjusts when opposite eye covered; tropia / strabismus	Ocular muscle dysfunction
<b>Ocular Tilt Reaction (OTR)</b> (can accompany Wallenberg syndrome)		Observation: Triad = head tilt + skew deviation + torsion See illustration of OTR in: O'Sullivan 6th ed. p.980, Fig. 21.15 (O'Sullivan 5 <sup>th</sup> ed. p.1013, Fig. 24.14)		Unilateral brainstem e.g., Medullary infarct
<b>Subjective Visual Vertical (SVV); Subjective Visual Horizontal (SVH)</b>		Equipment: 5 gallon bucket with a straight line drawn across the bottom of the bucket (inside and outside); inclinometer on outside Task: with their head "inside" the bucket, therapist turns the bucket until patient perceives the line to be vertical; repeat twice. Test horizontal direction	Abnormal if > 2 degrees off	Peripheral or Central: Otoliths to vestibular cortex
<b>Spontaneous Nystagmus</b> (not movement or position related)	May indicate an acute vestibular dysfunction	Holding the patient's head with one hand. Have the patient look straight ahead without focusing, observe for nystagmus. <b>Horizontal Nystagmus that stops w gaze fixation = Peripheral Nystagmus that does NOT stop with gaze fixation = Central</b>		
<b>Optokinetic Nystagmus</b> (normal physiological occurrence of nystagmus under these conditions)	Nystagmus should beat in opposite direction to the target's movement	Using a vertical bar chart, tell the patient to "stare at the line that is in front of you", while you <b>slowly</b> move the chart in one direction. Repeat this procedure to the opposite direction. Observe for nystagmus.	No response, or atypical eye movement.	Central
<b>VOR Gain</b> 1. Maintained Fixation	Maintains fixed gaze with head movement (eyes move opposite to head).	"Keep your eyes on my finger." "Move your head quickly side to side; repeat up & down" Done at a rate of $\geq 60^\circ / \text{sec}$ . (faster than smooth pursuit) e.g. VOR x 1	Dizziness, nausea, headache. Not able to maintain focus on target.	Vestibular hypofunction
2. Head <b>Impulse</b> Test. aka Head Thrust Test (eyes open: <b>EO</b> )		The patient will need to understand what will be done so their neck is relaxed during the test. If you noted that the patient had pain or significant restriction in cervical spine mobility, this test should be performed with extreme caution or should be deferred. Grasp the patient's head with both hands on the side of their head. <u>Flex neck down <math>30^\circ</math></u> so that horizontal semi-circular canals are level in the horizontal plane. Instruct the patient to look at your nose. Move the patient's head slowly back and forth being sure the patient is	Saccade (to catch up) is a positive sign.  A positive head thrust to the L side indicates a L lesion	Peripheral dysfunction with corrective saccades.

		<p>relaxed. Then, suddenly move the patient's head in one direction and stop. The horizontal head movement should be moved through a small amplitude with the position held at the end. Observe for the patient's ability to maintain visual fixation. You should note if the patient makes corrective saccades to re-fixate on your nose and the direction of head movement that caused the re-fixation saccades, <i>e.g. if a thrust to the L yields a saccade to re-fixate on your nose a <b>Left peripheral lesion</b> is indicated.</i></p> <p>Note: If you are uncomfortable moving the person's head from center to an eccentric position, try moving the person's head from an eccentric position to center</p>	This test helps differentiate between L or R or bilateral lesion.	
3. Head <b>Shake</b> Test. (eyes closed: EC)	Velocity storage integration; dynamic balance of labyrinths	Eyes are closed and with <u>30° neck flexion</u> (horizontal SCC position). Therapist shakes their head side to side at 2 Hz (200-240 bpm) for 20 cycles. Stop and <u>then</u> they open their eyes. Observe for nystagmus.	Nystagmus; fast phase to intact side	Peripheral UVL
4. <b>VOR Cancellation (VOR Suppression)</b> Cerebellum inhibits VOR Gain during VOR Cancellation	Maintain fixation with head movement	Therapist holds target in front of subject at eye level. Ask subject to move <u>head and eyes</u> to follow the target as the therapist moves the target slowly side to side, up and down, and in diagonals. Cue: "Pretend there is a string from your nose to my finger/target". The arc of movement should be within 30° of the midline in all directions.	Saccades, Nystagmus, Difficulty crossing midline.	Central: Cerebellar
5. <b>Dynamic Visual Acuity Test (DVA)</b>	Test of functional VOR.	<p>STATIC TEST: Have the patient wear their glasses if they need distance correction. Depending on the type of acuity chart being used, have the patient sit the appropriate distance from the chart. (The ETDRS charts are designed to be viewed from a distance of 10 feet to provide Snellen equivalent acuity ratios or LogMAR values as noted on the chart). Have the patient read the lowest line that they can until they cannot correctly identify all the letters on a given line. Note the line where this occurs and/or the number of optotypes the patient incorrectly identifies.</p> <p>DYNAMIC TEST: Now, standing behind the patient, grasp the patient's head with both hands on the side of their head, <u>tilt their head forward 30°</u> so that horizontal semi-circular canals are level in the horizontal plane. While moving their head side to side at a frequency of 2 Hz (2 complete side to side cycles per second – use metronome set at 200-240 bpm) have the patient read the lowest line that they can until they cannot correctly identify all the letters on a given line. Then go up a line and repeat. Keep the range of motion of the head movements small so as to not restrict the visual field, which may occur with patients who wear glasses.</p>	<p>If "lose" &gt;2 lines compared to static test = oscillopsia.</p> <p>If lose &gt;3 lines = vestibular hypofunction.</p>	Horizontal SCC
<b>Positional Testing Maneuvers</b>				
<b>Positional Testing:</b> <b>1. Dix-Hallpike Test</b>  (test the unaffected side first, if obvious from history)	Test of <b>Posterior</b> and <b>Anterior</b> SCC	<p style="text-align: center;"><i>(example is for a R side lesion)</i></p> Turn head 45 degrees to <b>R</b> side; quickly lie back with head supported & extended 30° in a hanging position. Observe eyes for latency, duration & direction of nystagmus.  Criteria for positive DHP sign: <i>(example is for a R side lesion)</i>	Vertigo. + Post. SCC sign will be upbeat torsional and linear (cranial) nystagmus (63%) (torsion is toward lesion)	Peripheral (BPPV)

		<ol style="list-style-type: none"> <li>1. Torsional &amp; linear-rotary nystagmus; reproduced by provocative positioning with <u>affected R ear down</u></li> <li>2. brief <b>latency</b> of 5-15 seconds before the start of nystagmus.</li> <li>3. nystagmus of <b>brief</b> duration <math>\leq 60</math> sec, (<i>toward the lesion</i> i.e. <b>R</b> torsional &amp; linear nystagmus)</li> <li>4. <b>reversal</b> of nystagmus direction on return to upright position (<i>away from lesion</i>)</li> <li>5. response diminishes with repetition of maneuver (fatigability)</li> </ol>	<p>+ Ant. SCC sign will be downbeating (caudal) with a possible transient torsional nystagmus (torsion is toward lesion). May be positive to both testing positions.</p> <p><b>Nystagmus duration</b>  <math>&lt; 60</math>s Canalithiasis  <math>&gt; 60</math>s: Cupulolithiasis (no latency with cupulolithiasis)</p>	
<b>2. Supine Roll Test</b>  O'Sullivan 6 <sup>th</sup> ed. p.976 (O'Sullivan 5 <sup>th</sup> ed. p.1010)	Test of <b>Horizontal SCC</b> (15%)	Supine, position head in 20° of flexion. Quickly turn head 90° to one side. Maintain for 1 min. Return head to midline. Repeat to opposite side. Will be positive to both sides, with one side being worse. <ul style="list-style-type: none"> <li>• Geotropic Nystagmus = Canalithiasis</li> <li>• Ageotropic Nystagmus = Cupulolithiasis</li> </ul>		Peripheral
<b>3. Vertebral Artery Screen</b>		Maneuver: Sit with elbows on knees and chin in hands. Look up for 30 seconds.	Vertigo, nystagmus, headache, visual disturbance central signs.	Vascular
<b>Functional Tests</b>				
<b>Motion Sensitivity:</b> <b>1. Motion Sensitivity Quotient (MSQ)</b>		Quantifies symptom duration and intensity with position changes.		
<b>2. Visual Motion Sensitivity Test</b>	Part of concussion screening (VOMS)			Onset or exacerbation of symptoms
<b>Functional Tests:</b> Balance & Mobility		<b>Instruments:</b> <ul style="list-style-type: none"> <li>• <i>Functional Reach, Multidimensional Reach</i></li> <li>• <i>Berg Balance</i></li> <li>• <i>Tinetti Balance &amp; Gait</i></li> <li>• <i>TUG, and the Five-Times Sit to Stand</i></li> <li>• <i>Preferred Gait Speed</i></li> <li>• <i>Functional Gait Assessment, and Dynamic Gait Index</i></li> <li>• <i>Fukuda</i></li> <li>• <i>Perturbation Tests (Mini-BEST items)</i></li> <li>• <i>Clinical Test of Sensory Integration and Balance (CTSIB)</i></li> <li>• <i>Sensory Organization Test (SOT)</i></li> </ul>	<b>Questionnaires:</b> <ul style="list-style-type: none"> <li>• <i>Dizziness Handicap Inventory (DHI)</i></li> <li>• <i>Modified Falls Efficacy Scale</i></li> <li>• <i>Activities-specific Balance Confidence Scale (ABC)</i></li> <li>• <i>Physical Activity Scale for the Elderly (PASE)</i></li> <li>• <i>Cognition:</i> <ul style="list-style-type: none"> <li>○ <i>Mini Mental State Exam</i></li> <li>○ <i>Blessed Orientation-Memory-Concentration Test</i></li> </ul> </li> <li>• <i>Geriatric Depression Scale (GDS)</i></li> </ul>	

Rx - **Epley Maneuver: Canalith Repositioning Maneuver for Canalithiasis** (example below is to treat a **Right** side lesion)

1. Patient is positioned in long sitting, with head turned 45d toward the affected ear (positive HPD side) e.g. to the right.
2. Rapidly bring the person back into supine with head hanging over the end of table in to a 30° head hanging position.
3. Wait for S&S to subside, and then wait an additional 30 sec.
4. Slowly rotate head to the opposite side (left), while keeping the neck in extension. Wait 30 seconds.
5. Ask the person to log roll onto their (left) side, (their head will now be turned nearly face down). Wait 30 seconds.
6. Then have the person push up to sitting, while still keeping their head turned to the left.

Rx - **Brandt Daroff** (home treatment example to treat a **Right-sided persistent positional vertigo**)

"This treatment requires the patient to move into the provoking position repeatedly, one or more times a day. The patient turns the head away from the side on which he or she is going to lie down." In our example of right BPPV ... "the patient turns her head 45° to the left and lies down quickly on the right side ... She then stays in that position until the vertigo stops plus an additional 30 seconds. The patient then slowly sits up. Moving to the sitting position may also result in vertigo. The patient should again wait until the vertigo stops before moving into the next position. Head is turned to the right, patient lies on opposite side. If vertigo is provoked, the patient stays in that position until the vertigo stops and again sits up. Repeat 10-20 reps, 3x/day, until patient has no vertigo for 2 days.

Herdman, S.J. (2007). Vestibular Rehabilitation - Contemporary Perspectives in Rehabilitation. (3rd ed.). Philadelphia: F.A. Davis.

Rx - **270° Roll** for Horizontal Canalithiasis (example below is to treat a lesion that is symptomatic on **R > L**)

1. Patient is positioned in supine, therapist holds neck flexed at 20d.
2. Quickly rotate head to the right (prior testing showed that the right side was more symptomatic than the left) and hold 60 sec.
3. Return head to midline, wait 60 sec.
4. Quickly rotate head to the left and hold 60 sec.
5. While keeping chin tucked, patient rolls to the left into the prone on elbows position. Remind patient to keep chin tucked throughout. Hold 60 sec.
6. Assist the person to move their lower body off the plinth to get their feet onto the floor (keeping chin tucked). Then transfer to full standing.

Rx - **Semont/Liberatory Maneuver** for Cupulolithiasis (example below is to treat a **Right PC side lesion**)

1. Patient is positioned in sitting on the side of the plinth.
2. Rotate head to the contralateral side of the lesion (for a right side lesion, head is rotated to the left)
3. Therapist assists the person to quickly come down into right sidelying position (legs can remain off the table) being sure to maintain left neck rotation. Wait 60 sec.
4. Therapist assists the person to quickly move all the way over to left sidelying (neck is still rotated to the left; looking down towards floor). Wait 60 sec.
5. Therapist assists the person to return to sitting (neck is still rotated to the left while coming up). Person looks straight ahead.