## 1. Glossary

Adaptation = Modification of the VOR gain (slow phase eye velocity/head velocity) up or down induced by repeated stimulus (sinusoidal oscillation, use of lenses or use of prisms) in the light.

Alexander's law = slow phase eye movements of jerk nystagmus is faster when patient looks in the direction of the quick phases. This is due to the presence of gaze-evoked nystagmus superimposed on the vestibular nystagmus.

Ampullae = Widened portion of SCC near the utricle , which contain the sensory hair cells.

Angular acceleration = Change in velocity along one of the planes of the SCC

Arteries = anterior inferior cerebellar artery (AICA), posterior inferior cerebellar artery (PICA) labyrinthine (internal auditory), anterior vestibular artery, posterior vestibular artery

Barany, Nylen-Barany = Position testing maneuver

Barotrauma = Trauma due to change in pressure

Bony labyrinth = Bony shell consisting of three semicircular canals, the cochlea and the vestibule. The bony labyrinth is filled with perilymphatic fluid, which has a chemistry similar to cerebrospinal fluid (high sodium, low potassium).

Brandt-Daroff habituation = Type of treatment for BPPV involving repetitive movement along the planes of the posterior and anterior SCC.

Calcium carbonate crystals = Structure in inner ear. Substance that is in otoconia

Caloric testing = Type of vestibular test in which water or air of cold and warm temperature is infused into ear to elicit nystagmus. Useful in determining if there is a peripheral vestibular hypofanction.

Canalith repositioning maneuver (Epley's) = useful in treating BPPV from canalithiasis

Canalithiasis = type of BPPV in which otoconia are free floating in semicircular canal.

Cochlea = structure in inner ear that senses hearing.

Common crus = section of semicircular canals in which posterior and anterior canal merge together

Contraversive = away from side of lesion or stimulation

Cristae = Sensory structure including hair cells that senses angular movement within the SCC. Cupula surrounds the hair cells.

Cupula = Bulbous, gelatinous mass that surrounds hair cells of cristae within SCC.

Cupulolithiasis = type of BPPV in which otoconia are attached to cupula

Diopter = lens power

Diplopia = double vision

Dix-Hallpike test (Hallpike-Dix) = clinical test for diagnosing peripheral positional vertigo (BPPV) and central positional vertigo.

Dynamic gait index = fall risk assessment designed for patients with vestibular hypofunction

Dynamic visual acuity test = Measures visual acuity during head movements. Good test to assess functional outcome of vestibular rehabilitation.

Dynamic computerized posturography = Laboratory test that measures body sway while sensory input is altered or while floor is perturbed. Can also be used to measure EMG of leg muscles used in the righting reflex.

Electronystagniography (ENG) = Laboratory test that measures eye movements during caloric test, position testing and visual tracking tests.

Electroculography (EOG) = Use of electrodes to record eye movements. Uses comeal-retinal potential.

Endolymph = Fluid of high potassium, low sodium within the membranous labyrinth

Endolymphatic sac = Structure that absorbs endolymph. In Meniere's disease, endolymph is not absorbed well and one surgical treatment is to permanently insert a tube into the sac to facilitate drainage (endolymphatic shunt).

External auditory canal = External hole (entrance into ear).

Ewald's second law = Depolarization (excitation) of the cupula within the inner ear does not saturate whereas hyperpolarization (inhibition) does saturate.

Frenzel glasses = 20 diopter lenses used to block fixation of the patient. Focal length is a few inches.

Fukuda stepping test = Patient marches in place with eyes closed for 50 steps. Rotation of more than 30 degrees or translation of more than 3 feet is considered abnormal (possible vestibulo-spinal abnormality).

Gain = Slow phase eye velocity/head velocity. Normal value is 1.0. Low gain < 1.0, high gain > 1. 0.

Habituation Response decline (e.g. decrease in velocity storage indicated by shorter time constant or larger phase lead) that persist over time induced by a repeated stimulus in darkness (e.g., velocity steps or low frequency sinusoidal stimulation).

Head shaking nystagmus test = clinical test in which patient's head is oscillated horizontally twenty times at 2Hz. If this elicits significant horizontal nystagmus (>3quick phases), or if it clearly increases spontaneous nystagmus, it is considered positive. Its presence suggests vestibular asymmetry (different gain) between the two horizontal SCC.

Head thrust test = clinical test in which patient is told to fixate a stationary target while their head is moved short amplitude but very quickly horizontally. If this elicits a corrective saccade at the end of the head movement, it is considered positive. Its presence suggests a decrease in VOR gain.

Head tilt = One of 3 signs in the ocular tilt reflex.

Hennebert's sign = Nystagmus or slow phase eye movement induced by pressure change in the external auditory canal. Indicates perilymphatic fistula, adhesions in middle ear or Memere's disease.

Hydrops Problem in absorption of endolymph by endolymphatic sac due to previous inner car infection or trauma.

Hyper-tropia = Vertical misalignment of the eyes. The eye that is elevated is called the hypertropic eye.

Ipsiversive = Towards the side of the lesion or stimulation.

Labyrinth = inner ear divided into membranous and bony parts

Liberatory treatment (brisk, quick or Semont) = useful in treating BPPV from canalithiasis or cupulathiasis.

Linear acceleration = Change in velocity along a straight path (vertical or horizontal) sensed by the otoliths of the inner ear.

Maculae = Sensory structure including hair cells that senses linear movement within utricle and saccule. Otoconia sits on top of the maculae.

Mal de debarquement = Perception of rocking as if on a boat (sea legs) that persists after debarking from prolonged passive transportation (sea cruise, train, plane).

Membranous labyrinth = Structure suspended within bony labyrinth by fluid and supportive connective tissue. Membranous labyrinth contains the membranous portion of the 3 semicircular canals, the utricle and saccule. It is filled with endolymph.

Meniere's disease = Problem in absorption of endolymph into endolymphatic sac of unknown

etiology.

Nystagmus = jerk (ageotropic, geotropic, vestibular, downbeat, upbeat, torsional, periodic alternating, congenital, latent), pendular

Ocular tilt reflex = A righting reflex of the eyes and head sensed by the utricle. Imagine a person steps into a hole with the left foot. This reflex causes 1) torsion of both eyes within head towards the right, 2) tilt of the head to the right, 3) skew eye deviation in which the left eye elevates and right eye is depressed in the orbit.

Oscillopsia = false illusion of movement of environment. Subtypes include head-induced in patients with severe vestibular hypofunction when they move their head, and spontaneous in patients with spontaneous, acquired nystagmus.

Otoconia = Structure in inner ear. Calcium carbonate crystals in utricle and saccule

Otoliths Structures within the inner ear that senses linear acceleration (utricle and saccule).

Oval window = This membrane that separates the middle and inner ear. The oval window surface on the middle ear side comes in contact with the stapes ear bone. The oval window surface on the inner side comes in contact with the cochlea. Allows sound waves to enter into the cochlea.

Perilymph = Type of fluid in inner ear (high sodium, low potassium similar to extracellular fluid in rest of body.

Perilymphatic fistula = Hole between endolymph and perilymph fluid containers of inner ear. Commonly located in round window.

Phase = 1) Description of eye movement (i.e., slow and quick phases). 2) Lab measure of how well sinusoidal eye movements line up with sinusoidal head rotation (timing).

Pitch = movement of head vertically (nod head yes)

Quickphase component of jerk nystagmus generated by saccade system

Roll = movement of head to the side (ear on shoulder)

Rotary chair testing = Lab test used to measure VOR. Slow phase eye movements recorded using EOG, video or infrared. Subject rotated constant velocity (step) or sinusoidally. Quantifies VOR gain and time constant (or phase). Useful in following patients during vestibular rehabilitation and better than caloric test to diagnose bilateral vestibular hypofunction.

Round window = Membrane that separates a portion of the middle and inner ear. Allows sound waves to exit from the cochlea.

Saccadic eye movement = eye movement used to quickly move eye

Saccule otolith structure in inner ear that detects vertical translation motion of head.

Semicircular canals (anterior or superior; posterior or inferior, horizontal or lateral) - structure in inner ear. Fluid filled loops measured angular acceleration.

Sidelying test = Clinical test used for assessing peripheral or central positional vertigo. Subject sits on side of bed, head turned 45d to left and then head and body en block quickly moved to right until lying on bed. Slowly sat up and repeated in other direction.

Skew eye deviation = Clinical sign of vertical ocular misalignment from a peripheral or central otolith abnormality.

Slowphase component of jerk nystagmus generated by vestibular system

Smooth pursuit eye movement = eye movement used to track small moving target

Time constant = Engineering term to describe exponential function (1/e). Can be used to describe charging or discharging of velocity storage system. During discharge, one time constant equals decay down to 37% of original value. Three time constants to decay down

to zero.

Tragus – Ear flap directly in front of external auditory canal.

Tullio's sign = clinical sign consisting of sound-induced slow phase eye movement or nystagmus. Caused by mechanical problem in membranous labyrinth.

Utricle – otolith structure in inner ear that detects horizontal translation and tilt of head.

Utricular-fugal – movement within semicircular canal away from the utricle

Utricular-petal – movement within semicircular canal towards the utricle

Velocity storage = neural circuit in dorsal medulla that stores head velocity neural signal for up To 90 seconds.

Vertigo – sensation of motion of self or environment (rotation, translation or tilt).

Vestibular ocular reflex – movement of eyes opposite to movement of head. Useful during head movements to stabilize gaze.

Vestibule = Inner car that contains the utricle and saccule

VOR cancellation = movement of eyes that suppresses VOR. Useful when trying to follow target that is moving synchronously with head.

Wallenberg's syndrome – Lateral dorsal medulla stroke resulting in lateral pulsion, ocular tilt, Homer's syndrome, nausea, vomiting, nystagmus and sensory loss.

Yaw = movement of head horizontally (move head "no")