

Vestibular Rehab and Falls

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Vestibular Rehab and Falls

Attendees will be able to:

1. Understand the relationship between vestibular disorders and falls.
2. Discuss how dizziness could be a symptom of a vestibular disorder.
3. Identify the benefits of vestibular rehabilitation treatment strategies in preventing falls.

Disclosure

Michael Herrington has no significant financial interest or other relationship with the manufacturer(s) of any commercial product(s) discussed in this educational presentation.

Prevalence of Vestibular Disorders

- 35.4% of adults in the U.S. 40 or older have experienced some sort of vestibular dysfunction
- Those with a vestibular dysfunction and were symptomatic (reported dizziness) were 12x more likely to fall

Agrawal Y, Carey JP, et al. Disorders of balance and vestibular function in US adults: data from the National Health and Nutrition Examination Survey, 2001-2004. Arch Intern Med. 2009;169(10):938-944.

Balance Defined

(Shumway-Cook)



Postural Control: controlling the body's position in space to achieve **orientation** and **stability**.

- ◎ **Orientation:** ability to maintain an appropriate relationship between body segments, between the body and gravity.
- ◎ **Stability:** ability to control the center of mass (COM) relative to the base of support (BOS)

Overview of the Balance System



- ⦿ **Motor**
- ⦿ **Cognitive**
- ⦿ **Sensory**
 - **Vision**
 - **Proprioception**
 - **Vestibular**

What sense in most important for balance?



- Health of the individual
- Age of the individual
- Environmental Context
- Task demands

Falls – Dizziness & Aging

⦿ Misconceptions

- Falls are a normal part of aging
- Dizziness is a part of normal aging & therefore not treatable

❖ The vestibular system seems to age less than all the other systems – vision, CNS, vascular, PNS, etc.

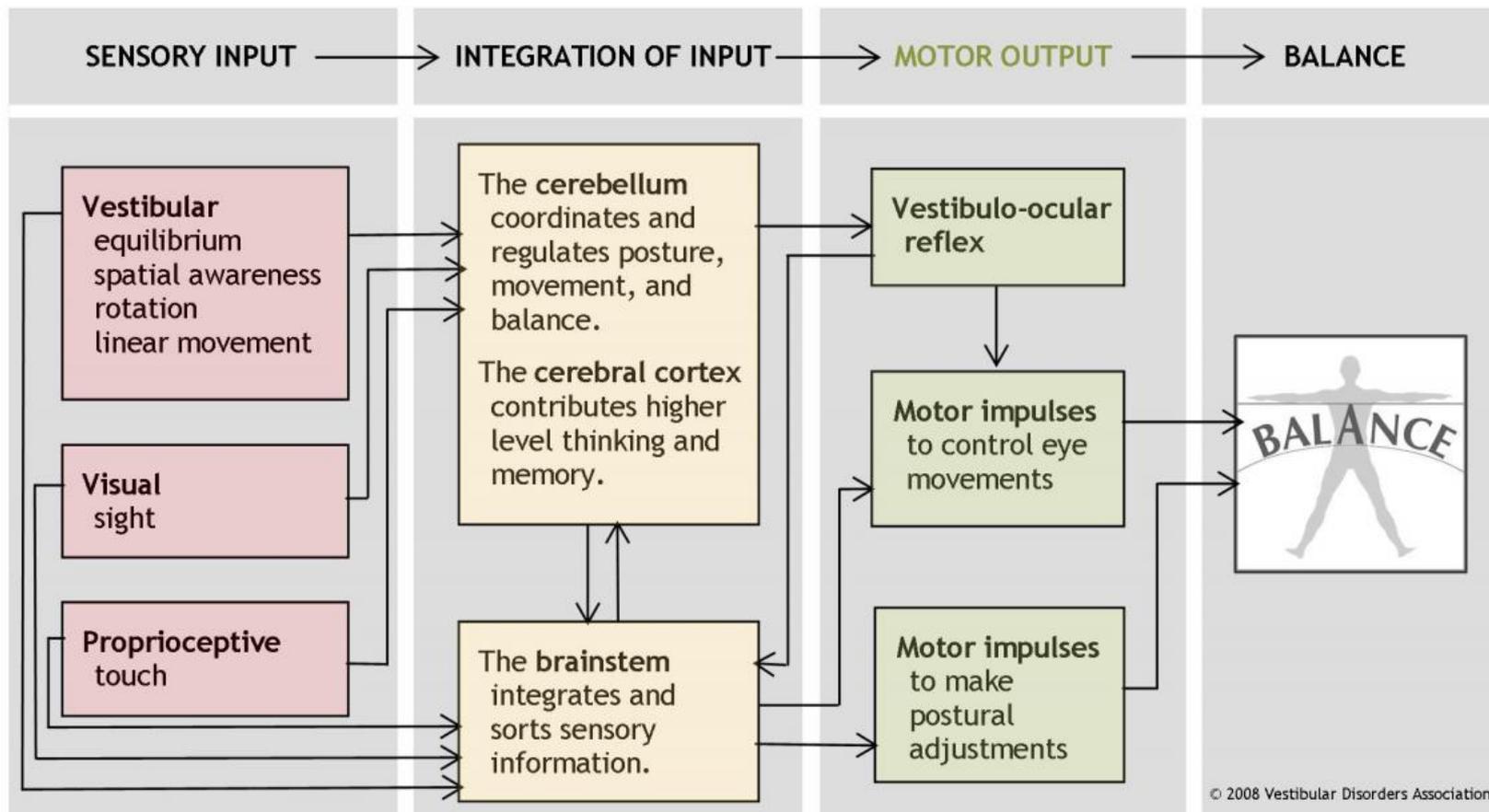
Indications of Vestibular Dysfunction

- Frequent Falling / Imbalance
- Dizziness / Lightheadedness
- Vertigo
- Oscillopsia
- Loss of confidence / Increased Fear
- Decreased walking speed
- Use of a walking aid

The Vestibular System & Balance

“courtesy of the Vestibular Disorders Association”

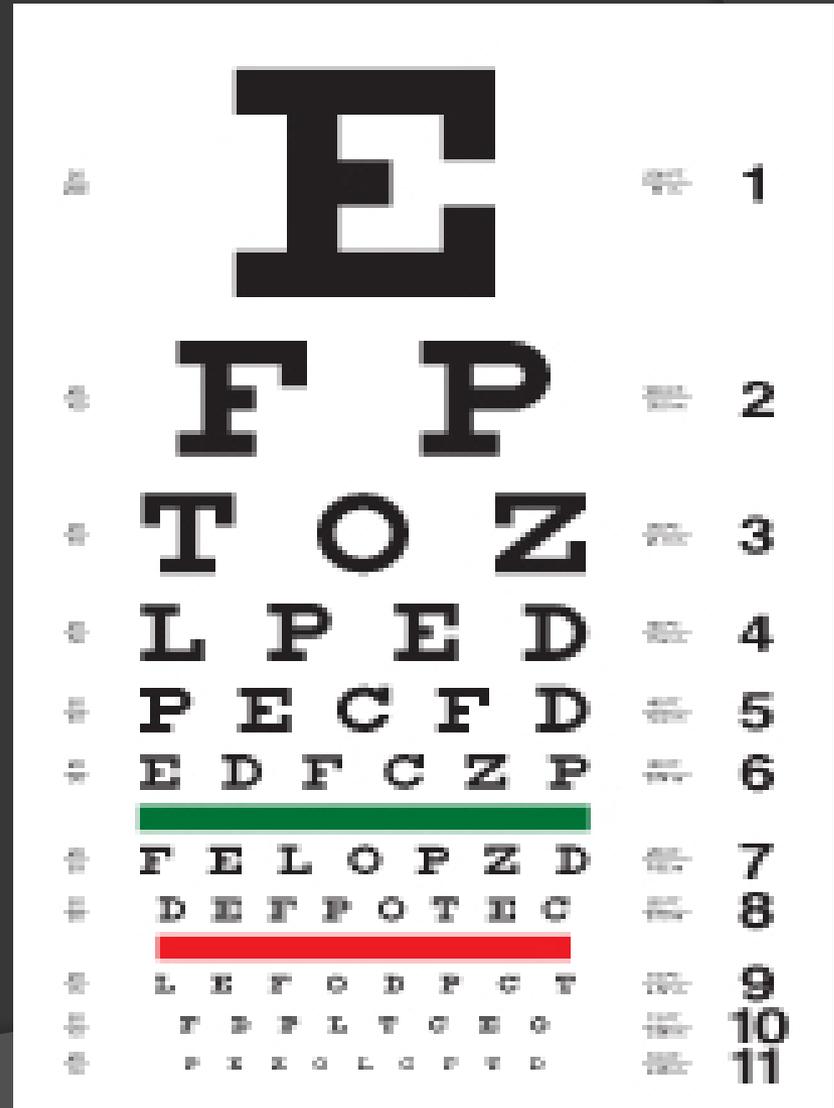
vestibular.org



Vestibular Ocular Reflex (VOR)

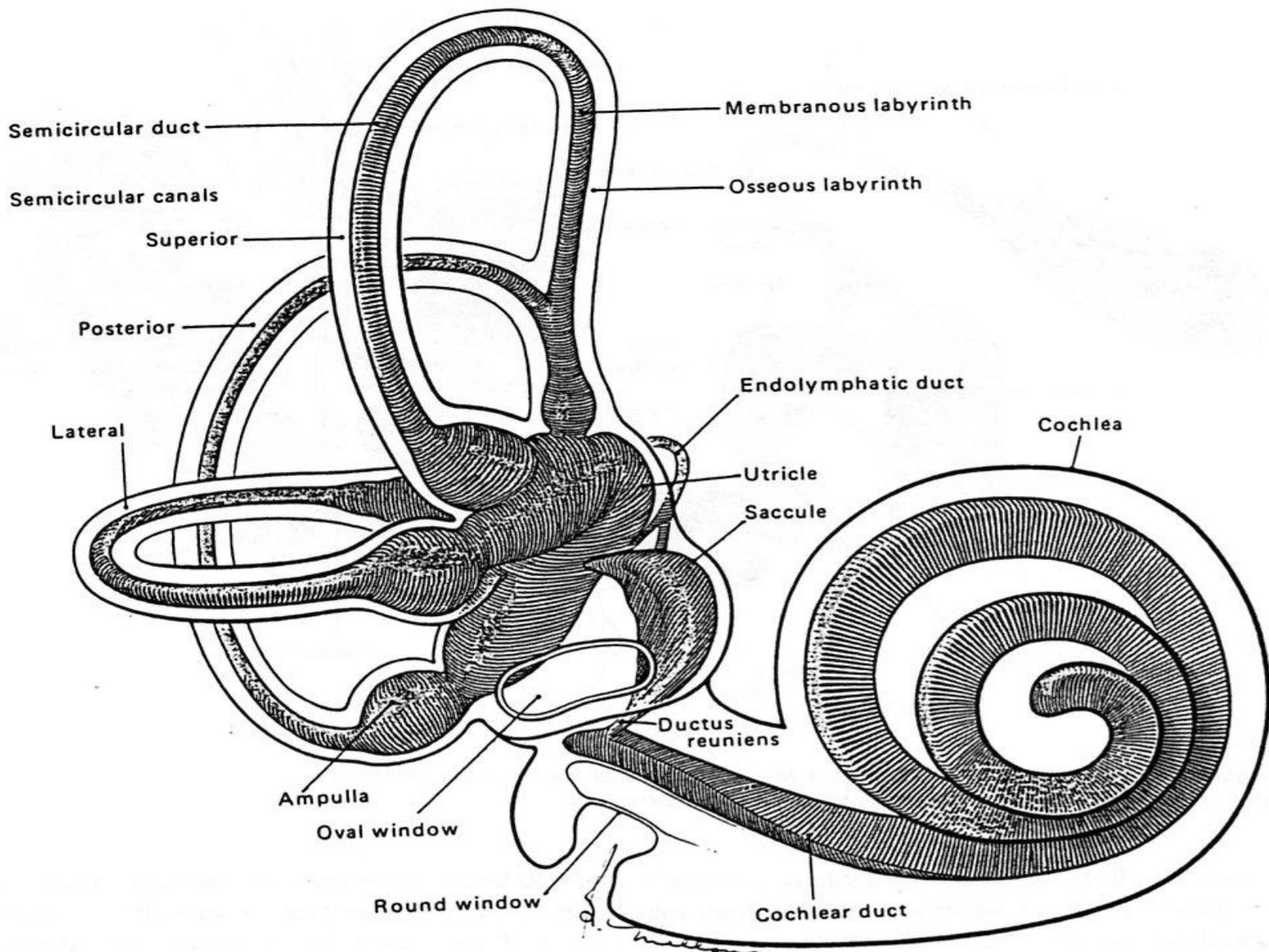
- Static acuity
- Dynamic acuity
 - Head moving at 1 Hz or 60 cycles/sec
 - Head moving at 2 Hz or 120 cycles/sec

More than 2 lines of change = VOR weakness



Testing Vestibular Dysfunction

- Infrared Goggles / Frenzel Lenses
- ENG/VNG
- Rotation tests
- Video Head Impulse Testing (vHIT)
- Vestibular Evoked Myogenic Potential (VEMP)
- Computerized Dynamic Posturography
- Audiometric Hearing tests



Dizziness Clarified

Perception of

- Lightheadedness?

- Vertigo?

- Imbalance?

Further Clarify

- Provoked by?
- Constant
- Duration of Symptoms
- Pace and tempo of symptoms
- Difficulty walking?

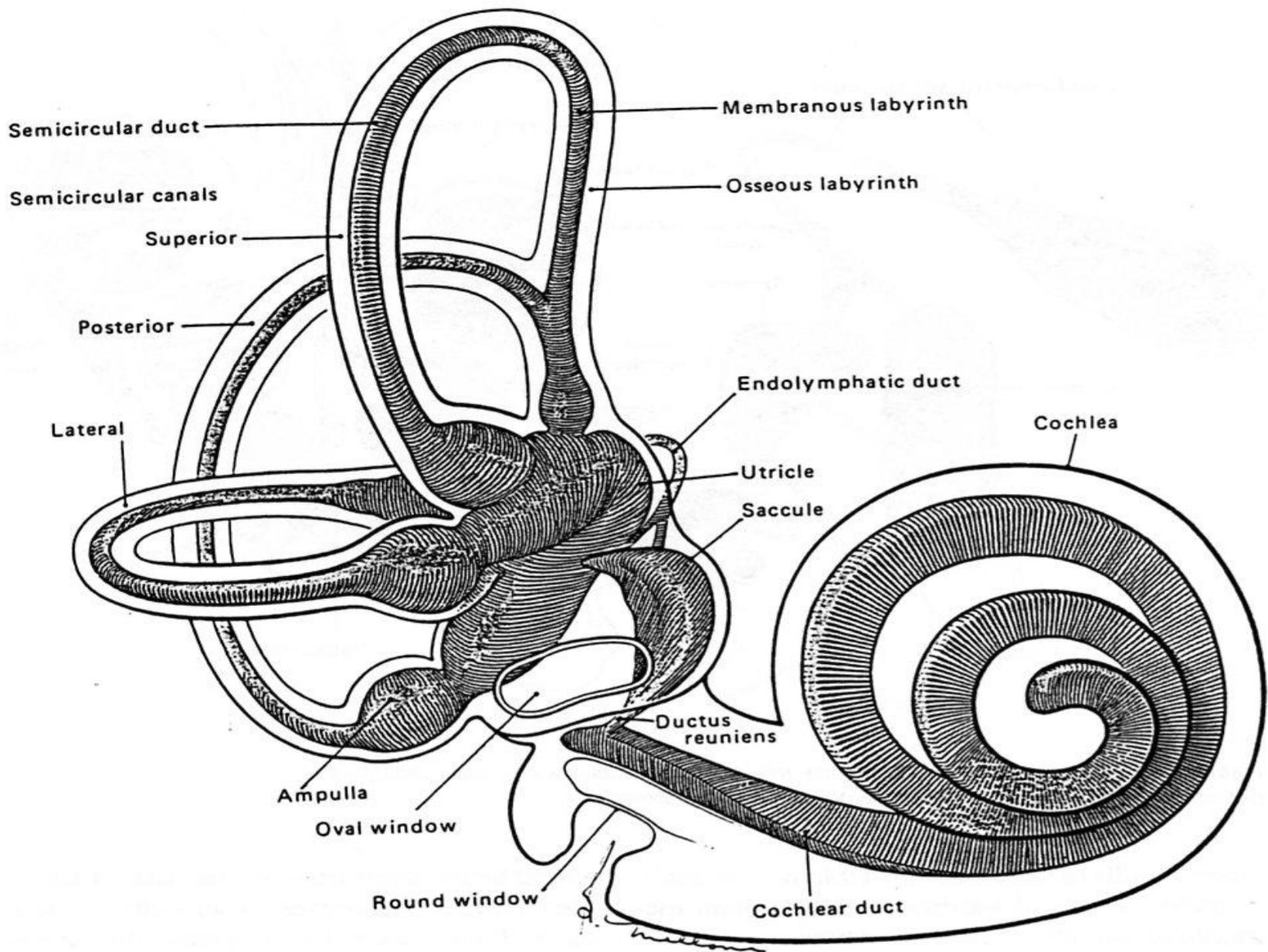
Vestibular disorders categorized

1 - Peripheral Dysfunction

- Unilateral Hypofunction
- Bilateral Hypofunction
- BPPV

2 - Central Dysfunction

- Single Lesion
- Multiple Lesions



Vestibular Diagnoses

- Acoustic Neuroma
- BPPV
- Cervicogenic dizziness
- Labyrinthitis
- Vestibular Neuritis
- Meniere's disease
- Mal de débarquement
- Migraines
- Ototoxicity
- Perilymphatic fistula
- Superior canal dehiscence

BPPV

Benign Paroxysmal Positional Vertigo

Otoconia or calcium crystals disrupt the accurate detection of rotational velocity in a semicircular canal

Incidence in general population

64/100,000

50% of individuals over age 65 (Herdman)

Balance clinic in Pittsburgh, 22% of patients have BPPV^(Whitney)

Most common cause of vertigo due to a peripheral vestibular disorder^(Herdman)

Subjective BPPV Complaints

- Dizziness Handicap Inventory (DHI) – 25 questions patient indicates severity of dizziness. *Yes/No/Sometimes*
- DHI subscale^(Shepherd):
 1. Vertigo with quick head movements
 2. Vertigo when looking up
 3. Vertigo when bending over
 4. Vertigo when turning in bed
 5. Vertigo when sitting up in bed

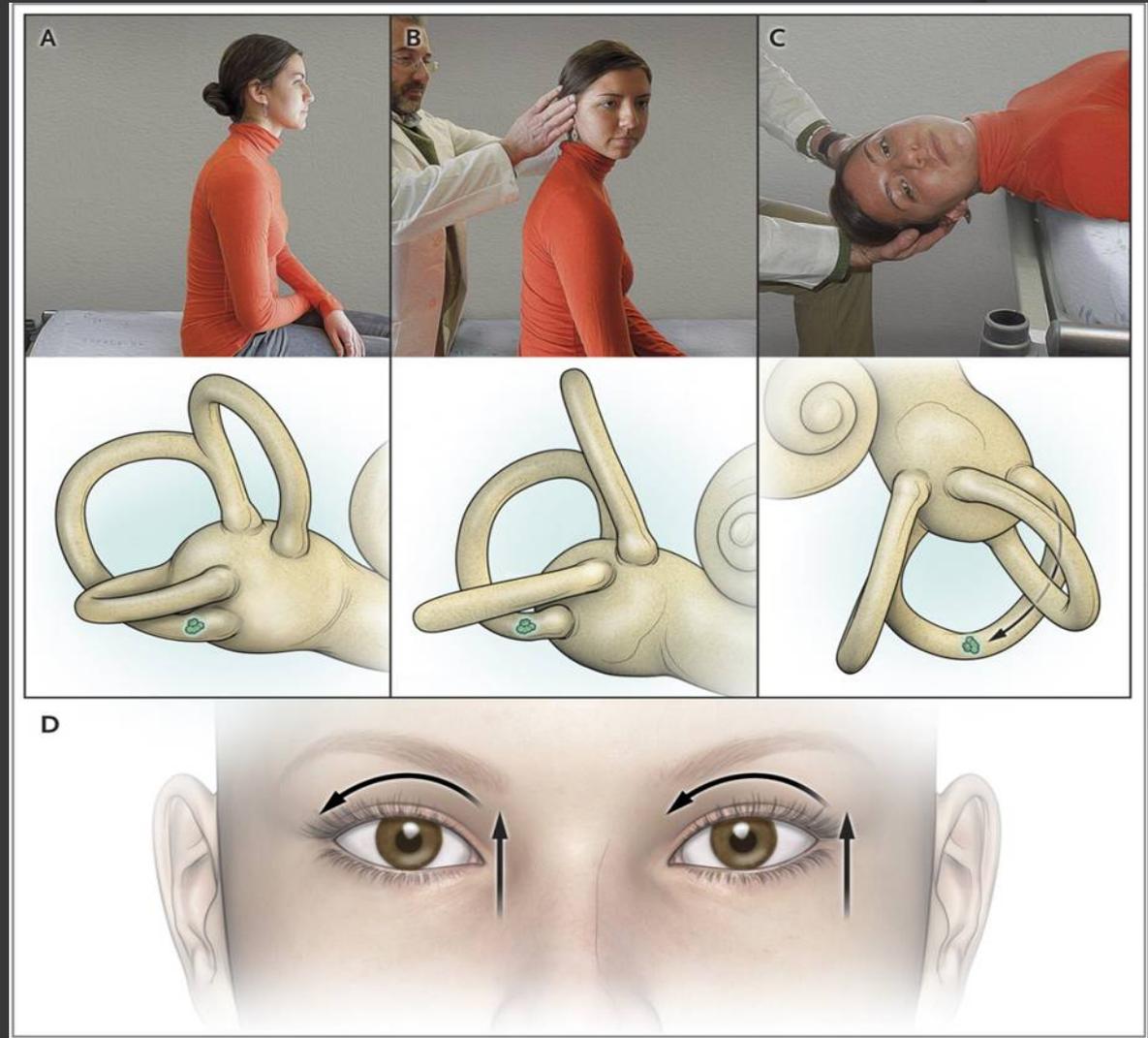
BPPV characteristics

- provoked by head movements,
- Vertigo/spinning
- symptom within 2-20 seconds
- lasts for <60 seconds
- Also report: Imbalance, lightheadedness, sense of tilt, floating, falling, swimming, headache, nausea, vomiting

BPPV Clinical Exam : Dix-Halpike

Assesses Posterior Canal (PC) and Anterior Canal (AC)

- 45 deg cervical rotation
- 20 deg cervical extension
- Watch for Torsional Nystagmus
- Report symptoms of vertigo



BPPV Clinical Exam : Nystagmus

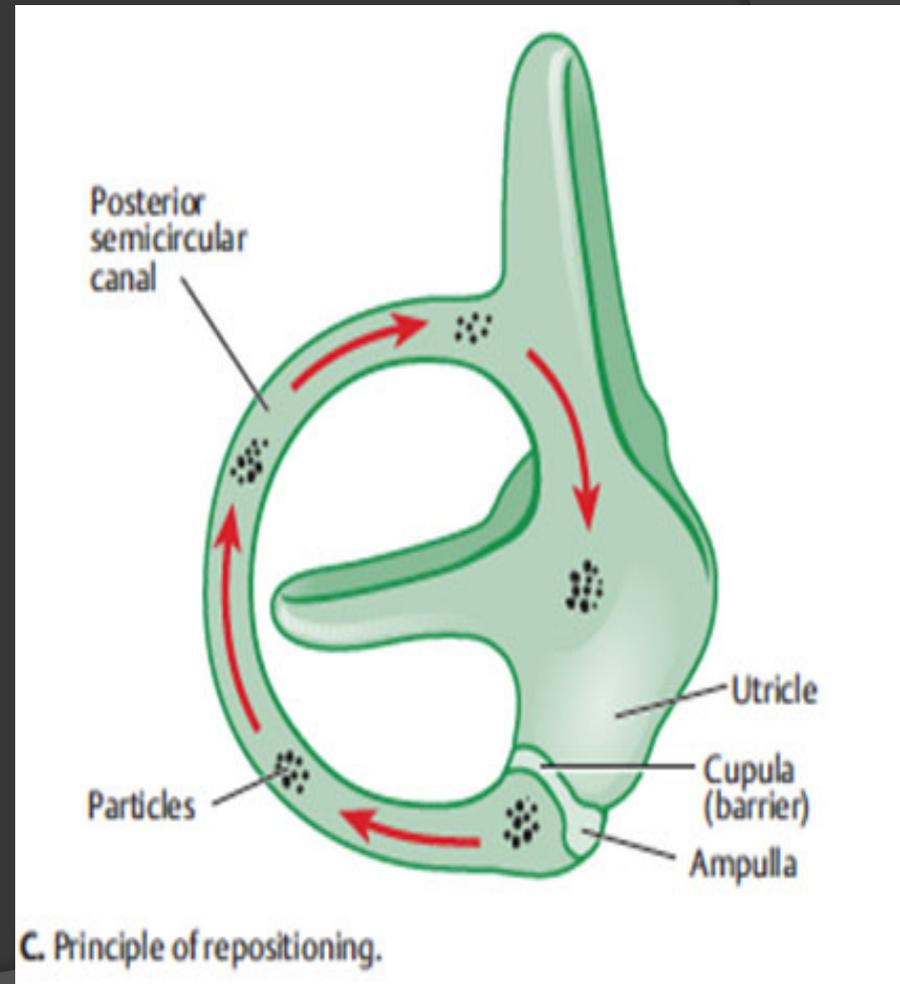
How do you know it is nystagmus from BPPV?

- It is torsional – vertical/up or down and with a torsional component
- Typically lasts less than 30 seconds
- Use Frenzel lenses or infrared goggles

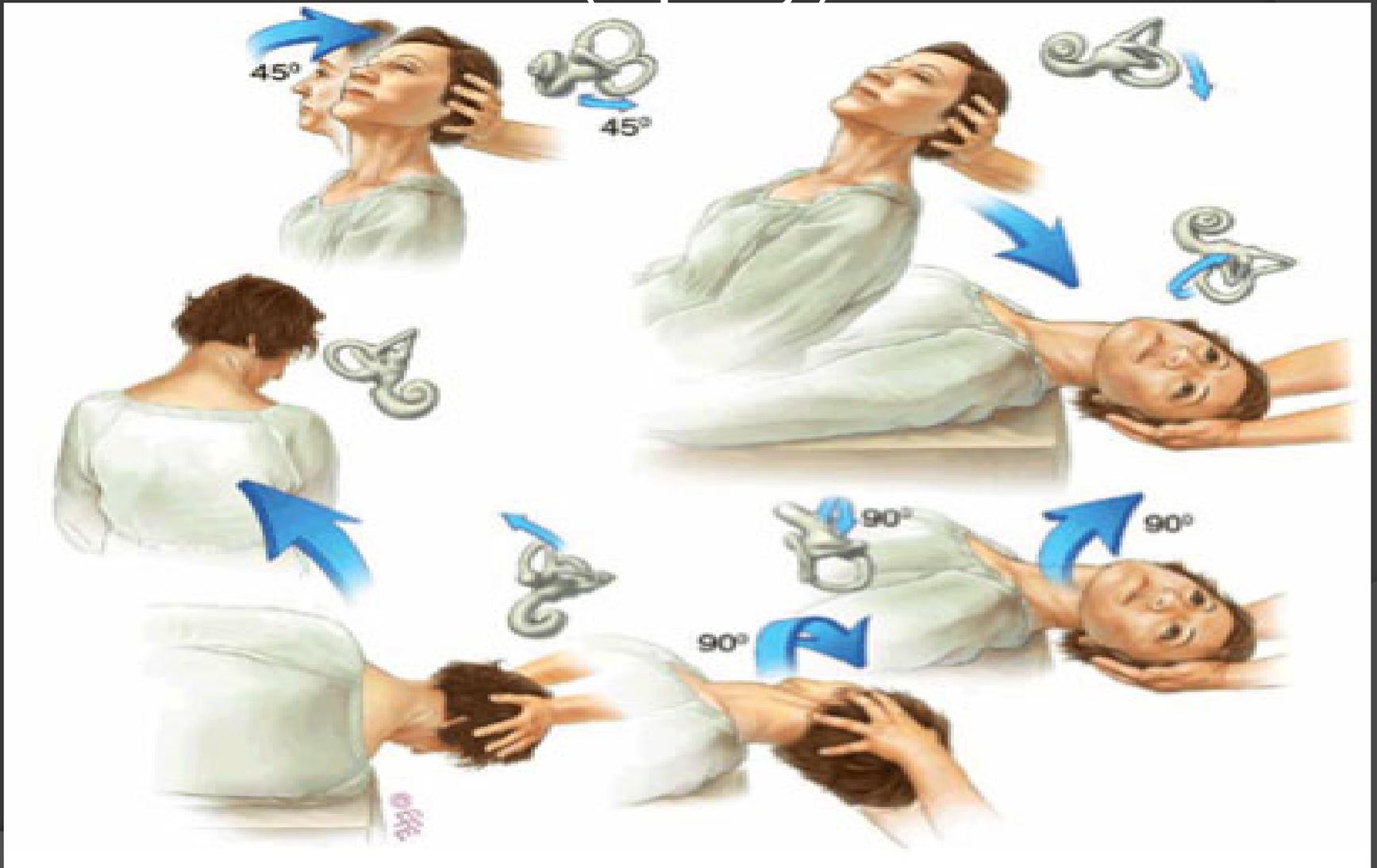
Video Example of BPPV

Types of BPPV

- Canalithiasis –
Otoconia are free in the PC and fall to the lowest point in the canal.
Movement of the otoconia, induces flow of endolymph and deflection of the cupula.
- Cupulolithiasis



Canalith Repositioning Treatment (Epley)



Treatment of BPPV

- ◎ Canalith Repositioning Treatment – CRT
 - Treats canalithiasis of PC and AC
 - Hold each position for twice the length of the nystagmus or length of symptoms.
 - Maintain cervical extension and 45 deg rotation
 - Chin tuck before sitting up
 - Can reassess the same session but finish with the CRT.
 - Post treatment instructions

Risk factors for BPPV

- ⦿ Trauma
- ⦿ Diabetes
- ⦿ Post surgical procedures
- ⦿ Prolonged immobilization
- ⦿ Female (hormonal changes)
- ⦿ Sleeping on one side

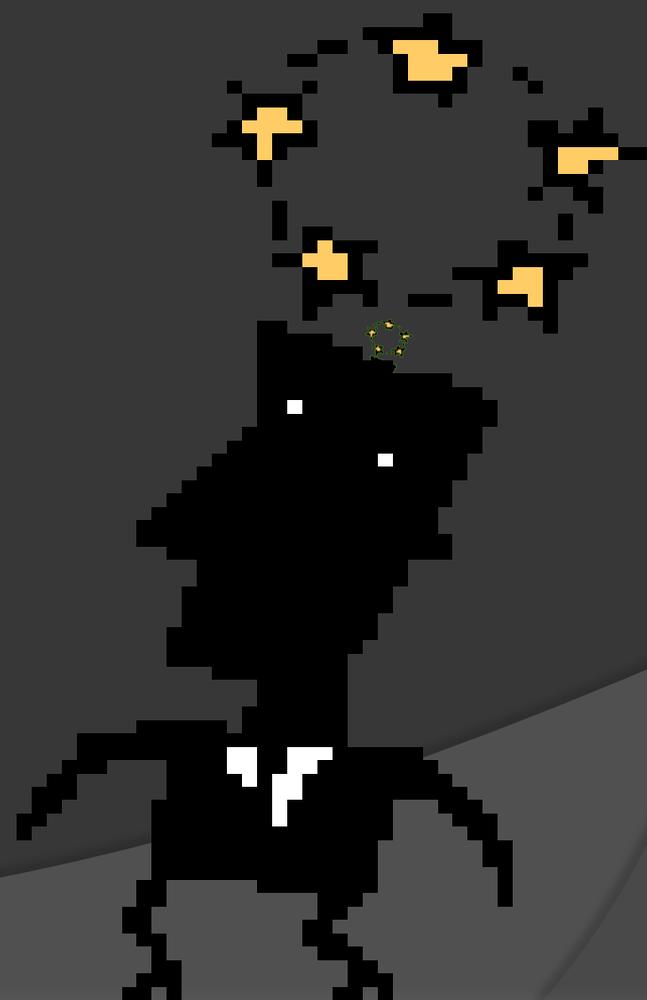
Shigeno K, et al. Benign paroxysmal positional vertigo and head position during sleep. J Vestib Res. 2012; Jan 1;22(4):197

Does BPPV cause falls?

- Especially in the elderly
- Medically fragile
- CRT decreases fall risk

Gananca, FF, et al, Braz J Otorhioloaryngol, 2010

VRT needed to
ameliorate postural
instability



II. Other Peripheral Vestibular Pathologies

- ⦿ Vestibular Neuronitis
- ⦿ Vestibular Labrinthitis
- ⦿ Acoustic Neuroma
- ⦿ Meniere's Disease
- ⦿ Perilymphatic Fistulas
- ⦿ Ototoxicity

Vestibular Neuronitis

- Vestibular nerve and system are impacted by virus
- Hearing is not usually affected
- Acute spontaneous nystagmus for 24-72 hours

Vestibular Neuronitis

- The fast beats towards the neurologically active (intact) side.
- Gradual return to normal balance usually takes 6 weeks
- Recovery depends on the amount of vestibular loss experienced.

Vestibular Labyrinthitis

- Symptoms are similar to neuronitis, but area affected is larger
- Hearing usually diminished

Acoustic Neuroma

- Characterized by hearing and/or vestibular difficulties subsequent balance impairments
- Other cranial nerves may be affected such as facial muscles and sensation
- Onset will be gradual due to growing non-malignant tumor and therefore some vestibular compensation can occur
- Surgical removal or laser radiation are treatment options

Meniere's Disease

- ⦿ Caused by endolymphatic hydrops – malabsorption of endolymph in the endolymphatic duct and sac
- ⦿ multiple vertigo attacks lasting >30min to 24 hrs.
- ⦿ unilateral fluctuating hearing loss of low frequency
- ⦿ ipsilateral tinnitus and/or aural fullness
- ⦿ VRT is not beneficial without medical management

Perilymphatic Fistula

- vertigo or disequilibrium with auditory stimuli-Tullio phenomenon
- high frequency hearing loss
- usually spontaneous healing with initial bed rest with head elevated and symptom management with medications
- if symptoms persist > 4 weeks, surgical exploration and packing of round window and stapes to mitigate the fluctuating pressures
- diagnose with valsalva initiation of nystagmus and vertigo

Ototoxicity

- Often results in bilateral vestibular hypofunction
- Most commonly caused by ototoxic drugs such as gentamycin and streptomycin. Chemotherapeutic drugs and some ear drops with antibiotics are ototoxic
- Cupula hair cell destruction can begin after 12 days of continuous antibiotic use
- Presents with oscillopsia or blurred vision with head movement
- Dynamic visual acuity and balance testing are best for physical exam

III. Possible Causes of Central Vestibular Disorders

1. Vestibular Neuropathy
2. TBI
3. Cerebellar Degeneration
4. Migraine
5. Ocular Malalignment

Central/Peripheral Comparison

Central

- Pure Vertical Nystagmus
- Vertigo Uncommon
- Motion Sensitivity
- Imbalance
- Diplopia
- Infrequent Hearing Loss
- Abnormal Smooth Pursuits or Saccades

Peripheral

- Mixed nystagmus and suppresses with fixation
- Vertigo common
- Hearing loss
- Tinnitus
- Normal smooth pursuit and saccades

Functional Indications for VRT

- Someone who avoids head and body movements and walks slower than normal because of increased complaints of vertigo and dizziness.
- Staggering gait, increased symptoms turning around and bending over.
- Someone who stays inside the house because of visual over-stimulation including moving traffic, shopping and car riding.
- Unable to read, watch TV, or use the computer for extended periods of time.
- Unable to perform basic and higher level ADL's
- DHI greater than 30%

V. Vestibular Rehab Therapy - VRT

- ⦿ Adaptation Exercises
- ⦿ Habituation Exercises
- ⦿ Substitution Exercises

Adaptation Exercises

- For patients with Unilateral Hypofunction and some patient's with Bilateral Hypofunction.
- To improve VOR Gain
- Retinal slip required to induce change in gain.
- Neuroplasticity
- Like tuning a piano

Adaptation Exercise - X1 Viewing

- Target is seen clearly
- Head movement about 30 deg
- Smooth
- Continuous
- Push the upper limit – just about to go out of focus

A

Progression of X 1 Viewing

- ⦿ Duration – 30-60sec to 1-2min
- ⦿ Frequency – BID to 10x/day
- ⦿ Target size – 2 inches to 20 font
- ⦿ Background – blank wall to full field
- ⦿ Position – sitting to standing to walking
- ⦿ Target distance – 5 feet to arms length
- ⦿ Head speed – push the upper limits and work up to 2 Hz cycles/sec

Adaptation Exercise - X2 Viewing

- Hold a card with a single letter on it at arms length.
- Move head and card from side to side in opposite directions keeping the word in focus.
- Head only moves as fast as the target stays in focus.
- Speed of movement slower than X1.

Neuroplasticity and vestibular compensation

- Induce slippage of the image on the retina
- During active head movement there is a substitution of a saccade (adjustment of the eye)

Habituation Exercises

- Beneficial for motion sensitivity
- Motion sensitivity is a result of asymmetrical sensory information which leads to a sensory mismatch.
- To decrease the symptoms you must systematically provoke the symptom.
- Sensory reweighting
- Motion Sensitivity Quotient – MSQ, rates the intensity and duration of 16 head/ body movements.
- Treatment begins with 2-3 of the mildly provoking movements

Substitution Exercises

Substitution of alternative strategies to replace the lost or compromised function.

Good for patients with Bilateral Vestibular Hypofunction (BVH) or Central Dysfunction

Rationale: Gaze Stability

- cervical ocular reflex COR
- central pre-programming of eye movements
- behavioral modification

Substitution Treatment Options

1. Remembered Targets- look at target directly in front. Close eyes and turn head. Imagine eyes still on target then open eyes to see if eyes are still on target.

Vary pace, number of head turns, angle of head motion.

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Treatment Options

2. Active eye-Head movements between targets

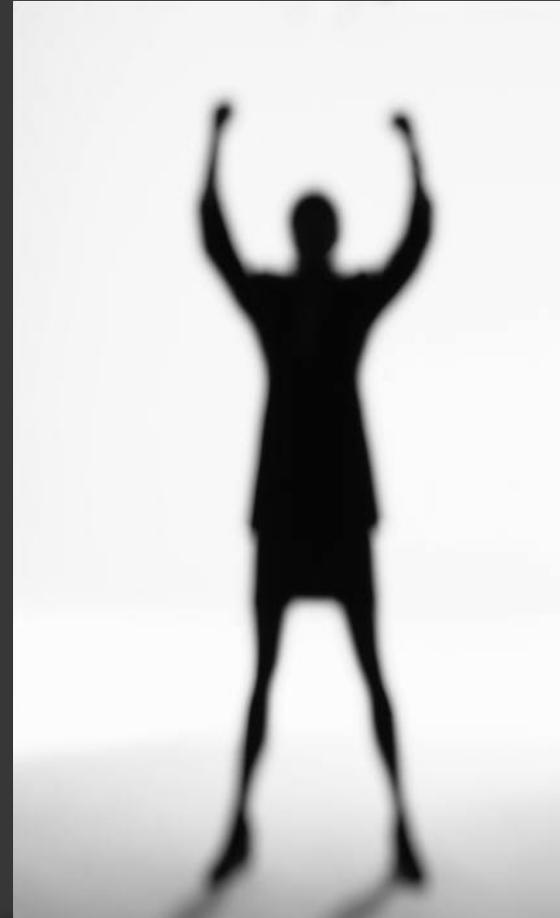
- Place two letters apart on a wall about 2 feet apart (X,Z). Look directly at the X then look with eyes only at the Z. Then look with the nose at the Z. Keep the target in focus and vary the speed of head movement.
- Vary Pace and angle of head turn

X

Z

Recommendations for Recovery

- Get the head moving
- Frequent Dosing
- Manage anxiety
- Monitor Gait Speed and other fall predictors



Case Study - 1

- ⦿ 55 y.o 2 weeks post cerebellar/brainstem stroke
- ⦿ Truncal ataxia, leans to left. Decreased static and dynamic balance
- ⦿ Impaired oculomotor control with incr dizziness with head turns, impaired VOR
- ⦿ Strength is 4/5 throughout, Impaired proprioception in the LEs
- ⦿ Stands with wide BOS and walks 50 ft with walker and mod assist

Case Study - 2

- ⦿ 45 y.o s/p cervical decompression
- ⦿ Absent proprioception, no c/o dizziness
- ⦿ Walks without AD, narrow base and scissoring steps, gaze down.
- ⦿ DGI = 12/24
- ⦿ Fell last week making a salad in his kitchen when he turned around to put it in the refrig.

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www.vestibular.org

Thank you for your time!!



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