A person in a white lab coat is interacting with a computer monitor. The monitor displays two side-by-side images of eyes with a crosshair in the center of each. Below the images is a software interface with a 'DONE' button at the top, a play button, and several menu options: 'Add Note', 'Print Screen', 'Delete Video', 'Speed Test', and 'Exit Test'. A 'Left Eye' label is visible below the right eye image. The person's hand is pointing at the 'Add Note' option. The background is a blurred clinical setting.

Update on Assessment and Treatment of BPPV

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Benign Paroxysmal Positional Vertigo (BPPV)

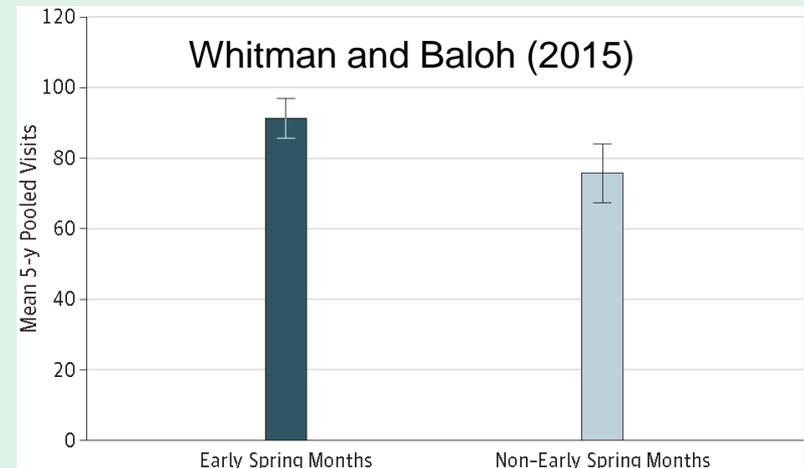
- Characteristics
 - Brief but usually intense episodes of true vertigo following head movements
 - Episodes are most intense during initial head movements (such as rolling in bed in the morning) but intensity may decline after repeated movements
 - Some patients describe imbalance even without head movements
 - Absence of other otologic and neurologic symptoms
- Prevalence – High
 - 20-25% of visits to dizziness clinics and as high as 40% of patients with balance problems
 - Higher in older individuals (peak incidence of first occurrence ~ age 50)
 - High recurrence rate (one-year rate ~30%)

Benign Paroxysmal Positional Vertigo (BPPV)

- Risk factors (50-70% of cases are idiopathic)
 - History of head trauma
 - History of previous inner disease such as vestibular neuritis or Meniere's
 - Age (peak incidence of first episode at 50 years and rising thereafter)
 - Previous bouts of BPPV
 - Osteoporosis (1.8 times higher chance, Chan et al, 2017)
 - Low vitamin D levels (2.1 times higher chance, Ding et al, 2019)
 - Seasonal effect due to lack of sun exposure

Recommendations

- Oral administration of 800 IU of vitamin D and 1,000 mg of calcium as calcium carbonate
- Outdoor activities
- Dietary counselling

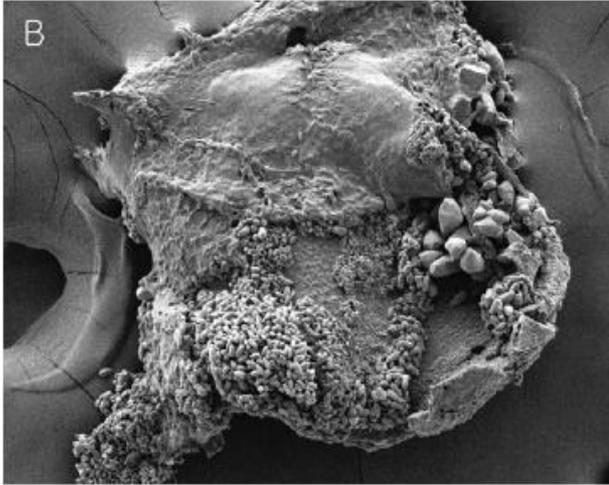


Mechanism of BPPV

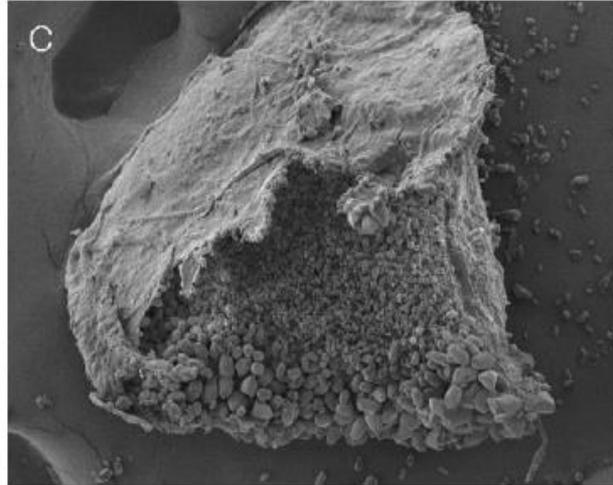
- Original view
 - Particles, most likely otoconia, adhering to the cupula of posterior semicircular canal (Schuknecht 1969)
- Current view
 - Presence of particles with higher density than cupula/endolymph in the semicircular canals (most likely otoconia from utricles)
 - > 90% of cases are caused by particles floating in the canal (canalithiasis)
 - < 10% of cases are caused by particles adhering to the cupula (cupulolithiasis)
 - Explains higher incidence with aging and secondary to inner diseases (deterioration of macula)
 - Also explains high recurrence rate (likelihood of further particle detachment)

Utricular macula

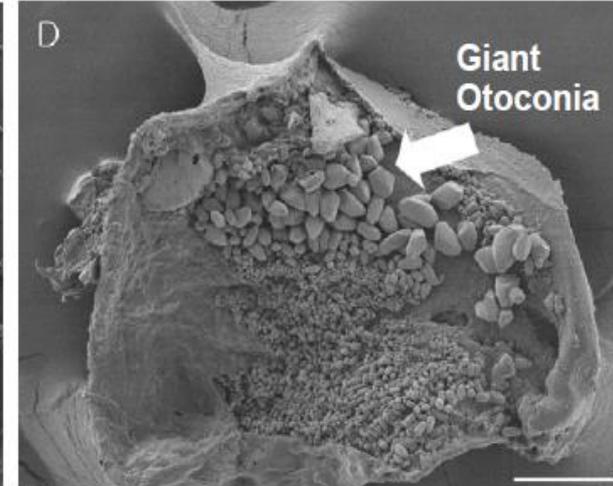
From Kim JS, South Korea



Young rat

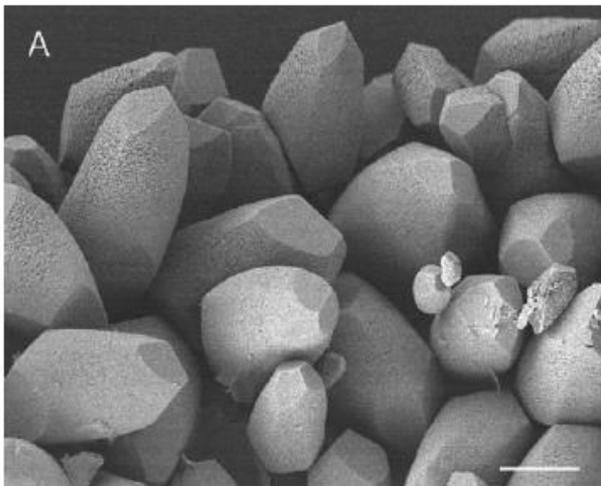


Middle-aged rat

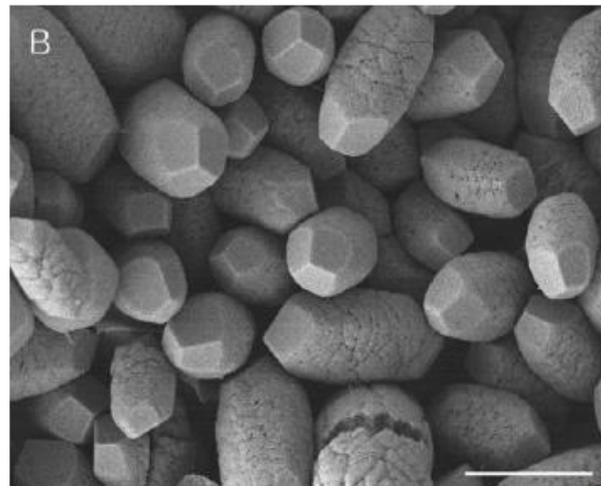


Aged rat

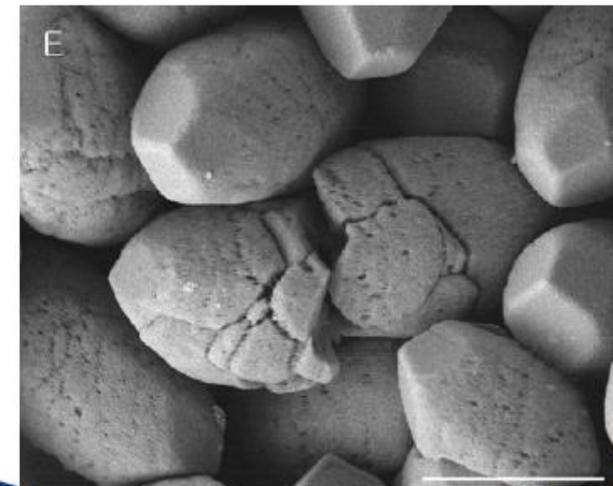
Otoconia



Young rat



Middle-aged rat



Aged rat

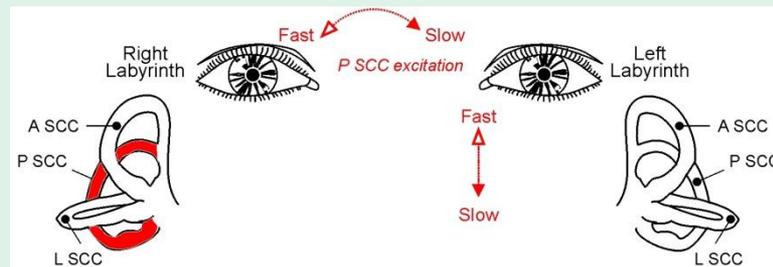
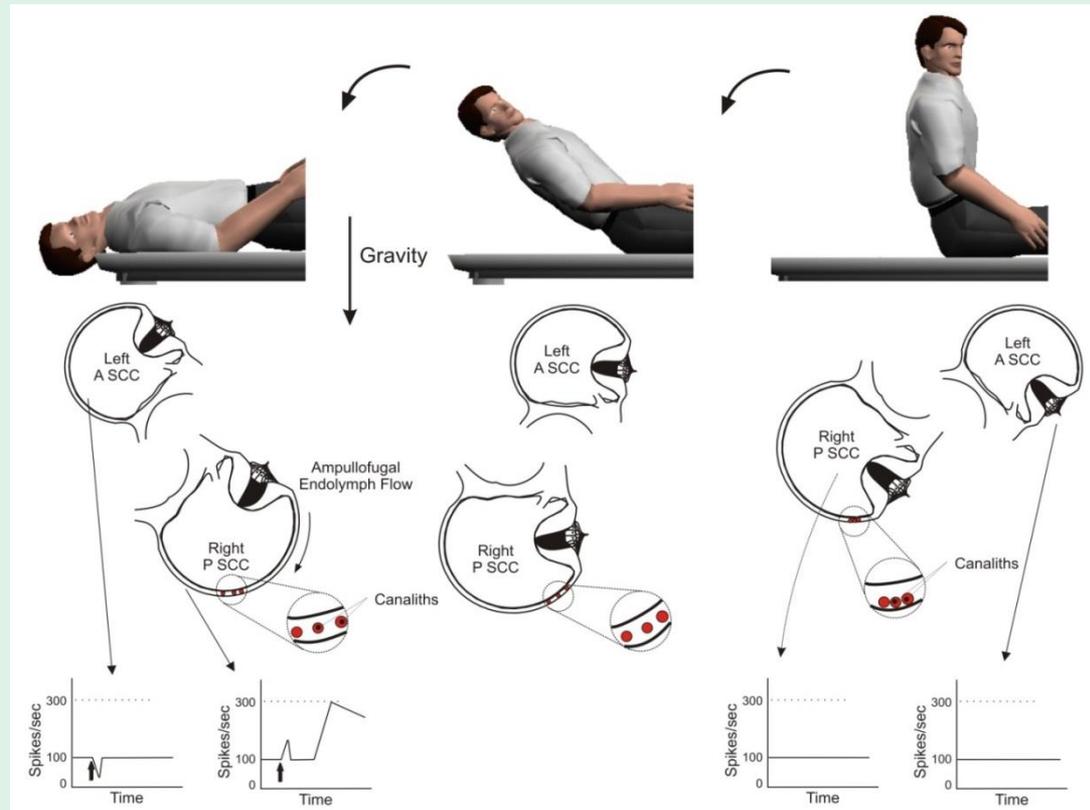
Canal Involvement in BPPV

	Posterior	Lateral	Anterior
Incidence	81-89%	8-17%	1-3%
Diagnostic Maneuver	Dix-Hallpike Side-lying	Roll	Dix-Hallpike Side-lying
Nystagmus Direction	Up-beating & torsion toward the undermost ear	Horizontal (geotropic or ageotropic)	Down-beating & torsion toward the uppermost ear
Treatment Maneuver	<u>Single treatment</u> <ul style="list-style-type: none"> Epley's canalith repositioning Semont's liberatory <u>Multiple treatment</u> <ul style="list-style-type: none"> Brandt-Daroff exercises Other home exercises 	<u>Single treatment</u> <ul style="list-style-type: none"> Gufani Log-roll <u>Multiple treatment</u> <ul style="list-style-type: none"> Forced prolonged positioning Modified Brandt-Daroff exercises Other home exercises 	<u>Single treatment</u> <ul style="list-style-type: none"> Deep Dix-Hallpike Epley's canalith repositioning Semont's liberatory <u>Multiple treatment</u> <ul style="list-style-type: none"> Brandt-Daroff exercises Other home exercises

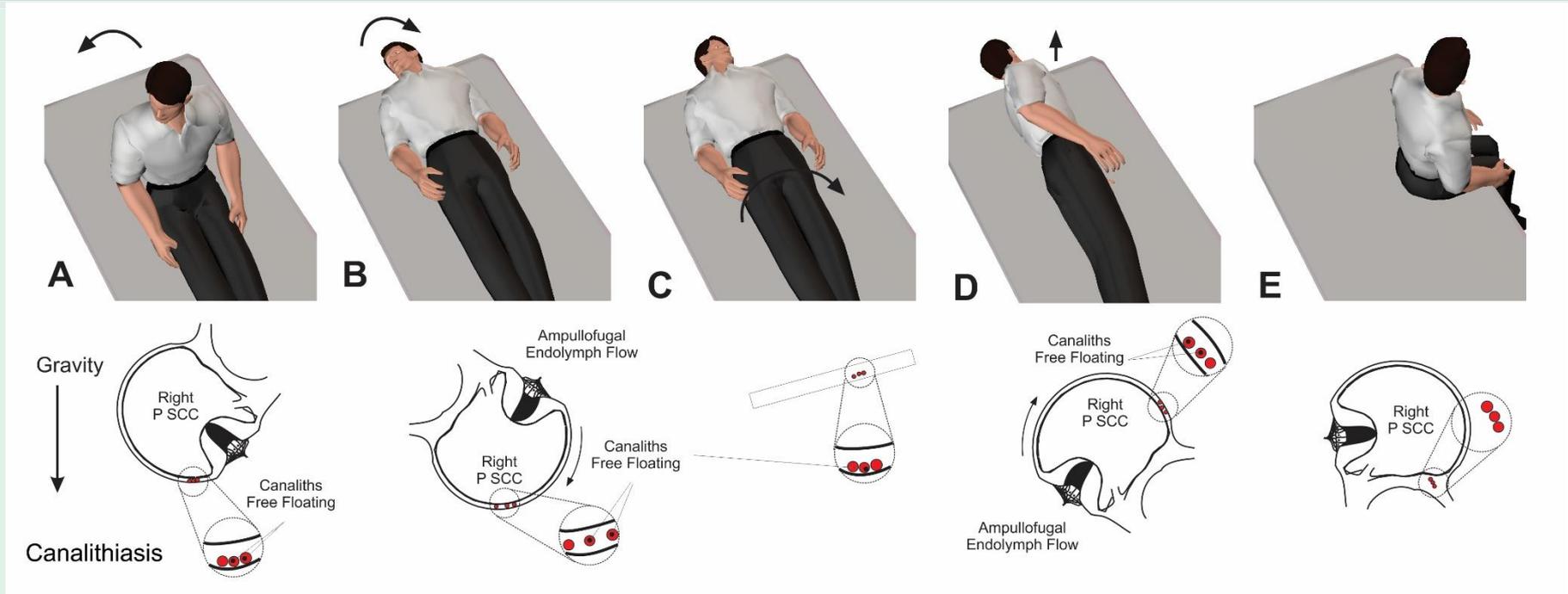
- The current AAO guidelines recommends against radiographic imaging and full vestibular testing in patients with BPPV unless there are other symptoms or signs

Dix-Hallpike in Posterior Canal Canalithiasis

- Causes strong excitation of ipsilateral posterior canal and results in up-beating and torsional nystagmus beating toward the undermost ear
- Nystagmus usually has a delayed onset because it takes time for gravity to move the particles through the canal
- Nystagmus is transient because the particles settle at the lowest part of the canal with respect to gravity



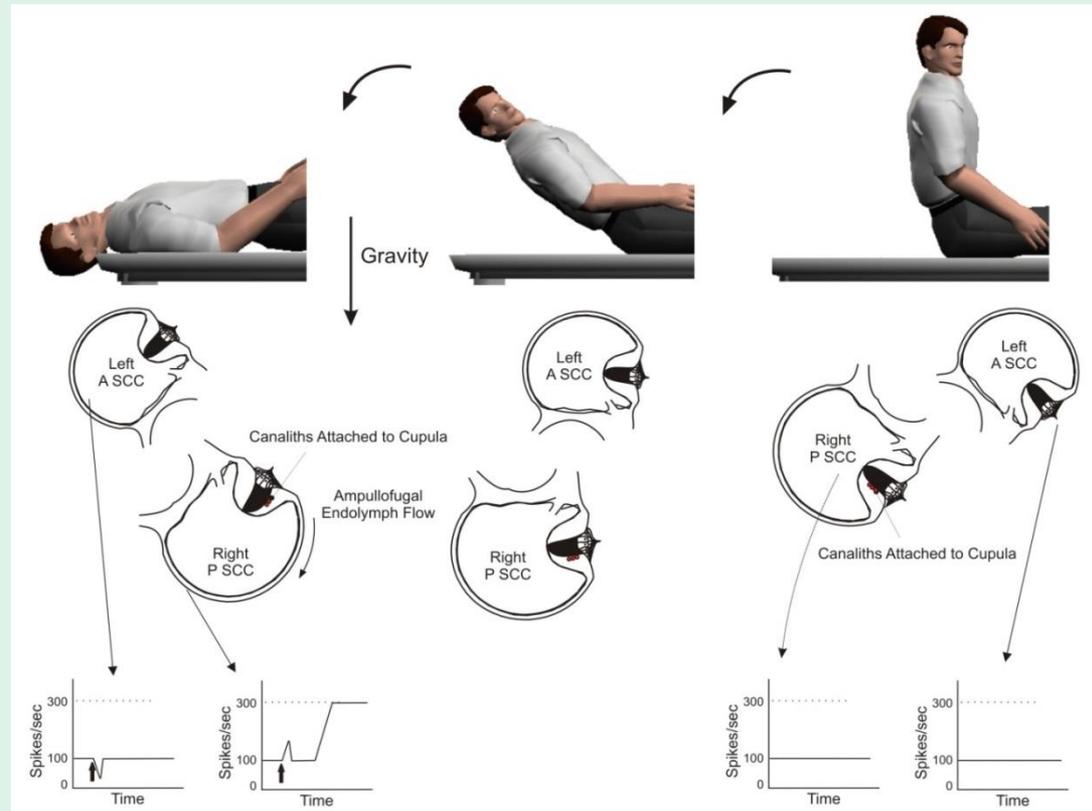
Posterior Canal BPPV Treatment



- Canalith repositioning (Epley) maneuver
 - After completing Dix-Hallpike (A and B), rotate the head/body away from the involved ear (toward the uppermost ear) in two 90-degree turns (C and D)
 - Watch for secondary nystagmus in the same direction
 - Head rotations can be performed slowly (reduces severity of symptoms) or rapidly (shortens treatment duration)
 - Bring the patient to the sitting position (E) after responses subside (> 60 sec)

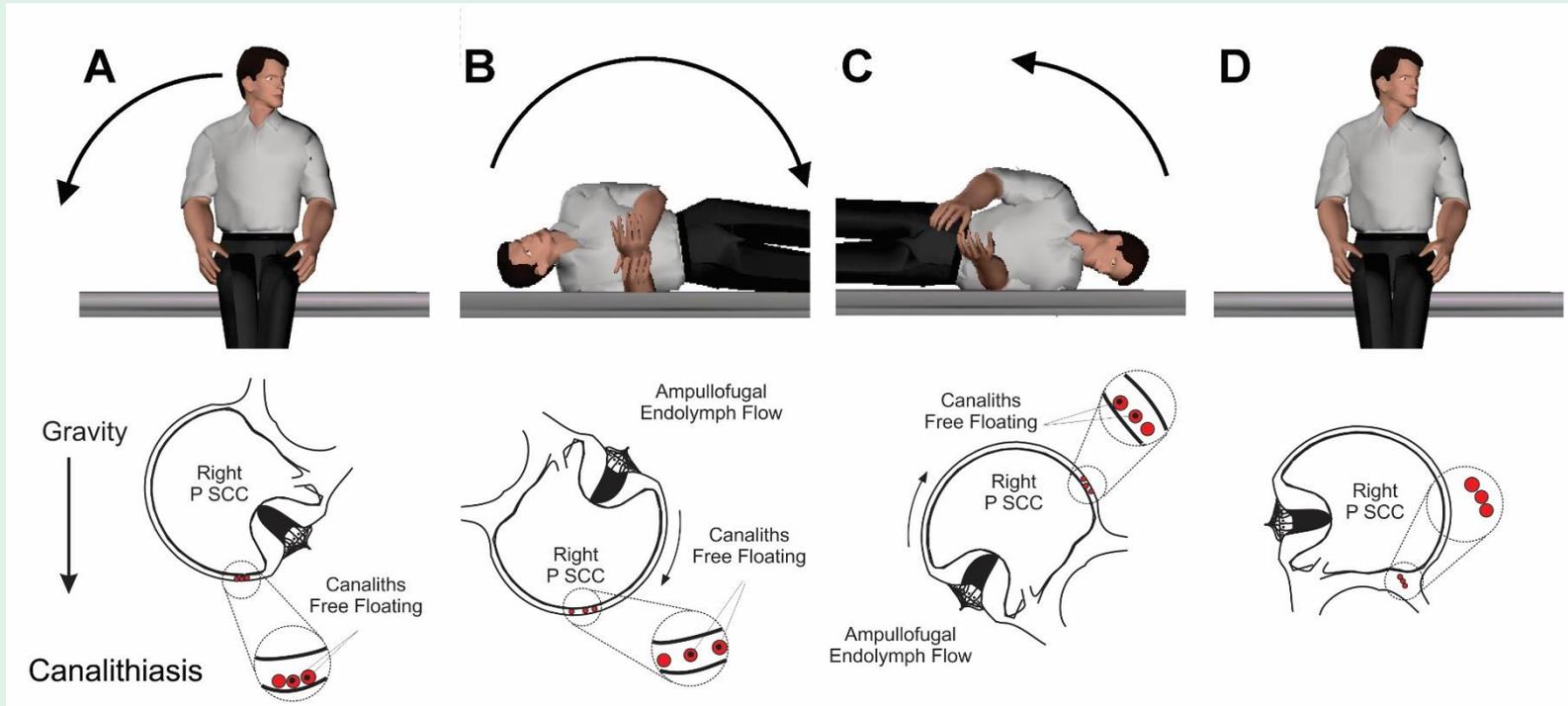
Dix-Hallpike in Posterior Canal Cupulolithiasis

- The responses for cupulolithiasis are similar to those for canalithiasis except:
 - Onset delay is much shorter for cupulolithiasis
 - Duration is much longer (over a minute) for cupulolithiasis
 - The response may not fatigue as readily for cupulolithiasis
- There is no easy way to distinguish between canalithiasis and cupulolithiasis of posterior canal
 - The best strategy is treat for canalithiasis and if not successful, treat for cupulolithiasis



Sitting to Supine with Left Ear Down

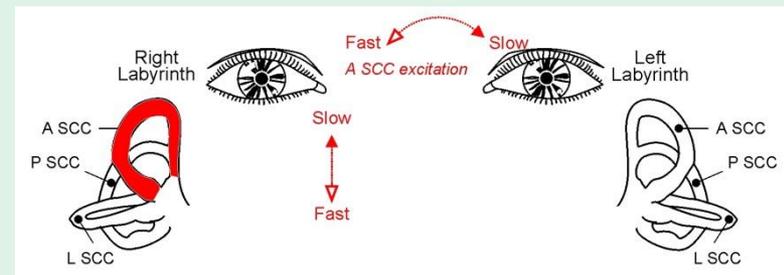
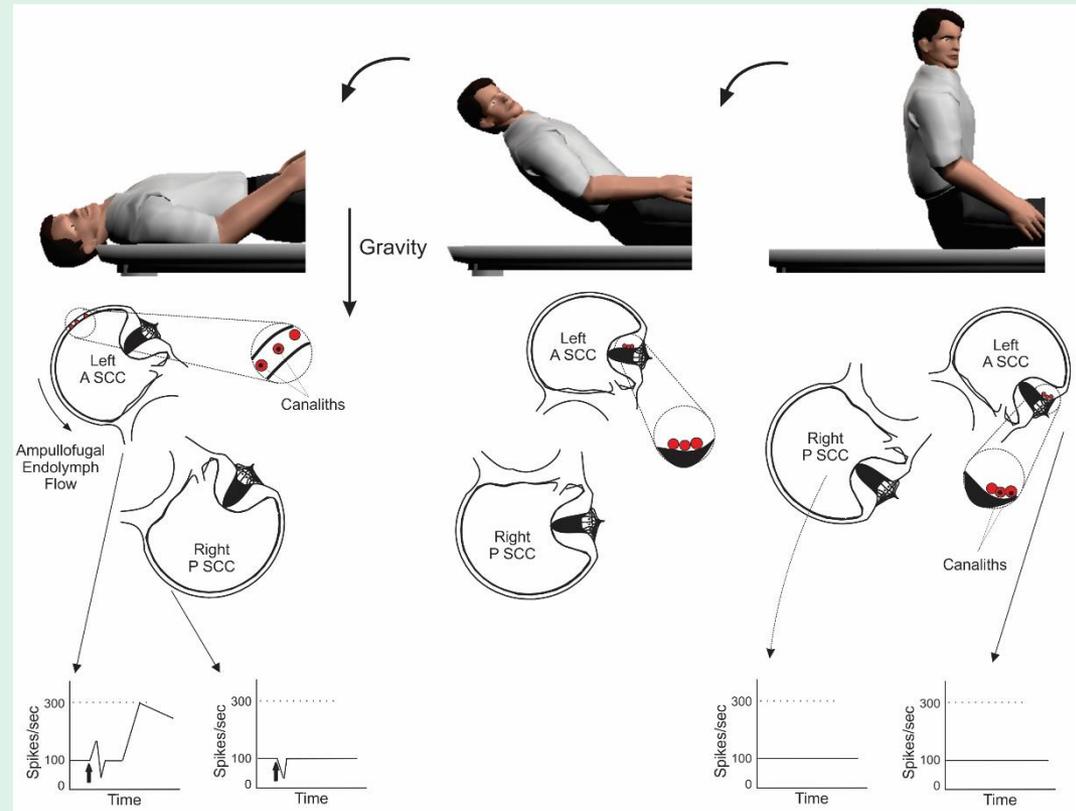
Posterior Canal BPPV Treatment



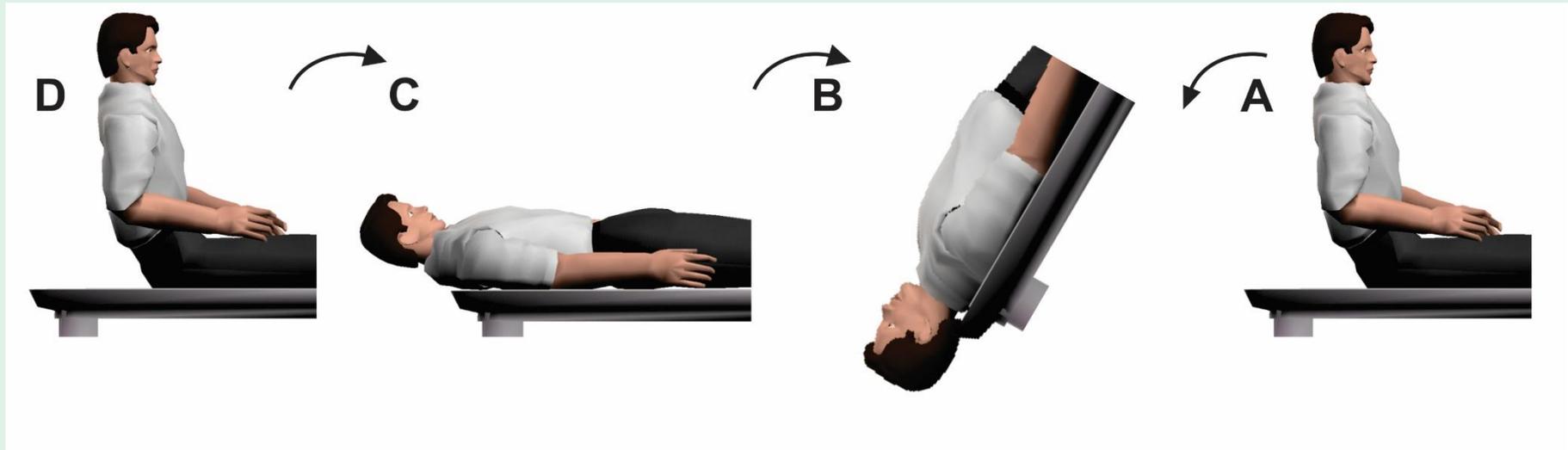
- Liberator (Semont) maneuver
 - After completing sidelying maneuver (A and B), move the head/body rapidly to the opposite side while maintaining head orientation with respect to the torso (C)
 - Bring the patient to the sitting position (D) after responses subside (> 60 sec)
 - With the exception of an intermediate step, Semont and Epley maneuvers are identical
 - This is a vigorous maneuver that should be reserved only if Epley is unsuccessful

Dix-Hallpike in Anterior Canal Canalithiasis

- The orientation of anterior canal makes it less likely for particles to end up there
- Causes excitation of contralateral anterior canal and results in down-beating and torsional nystagmus beating toward the uppermost ear
- Other characteristics are similar to the posterior canal BPPV
- Bringing the patient back up to the sitting position may move the particles out of the involved canal and treat the condition!



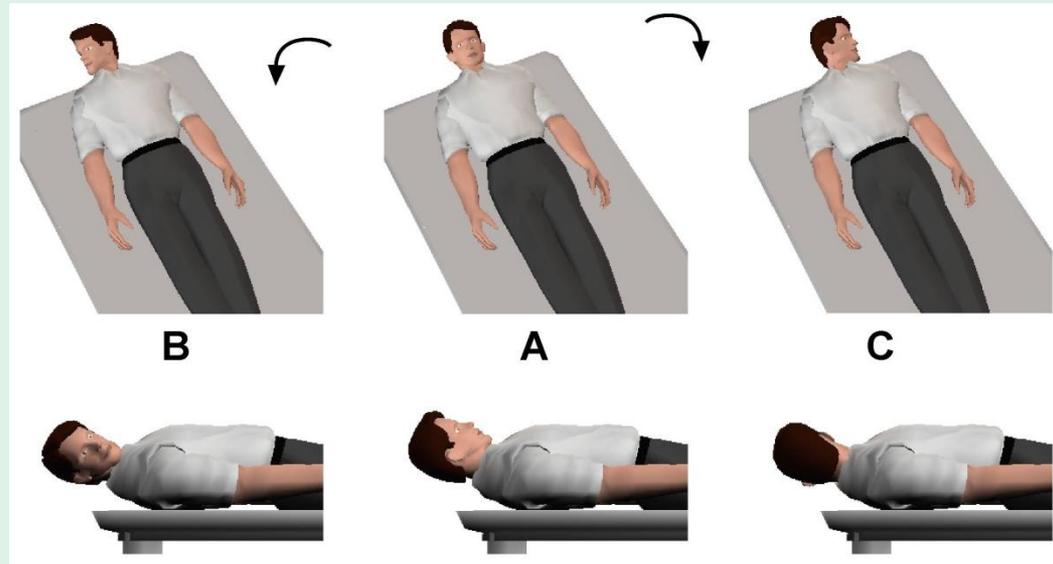
Anterior Canal BPPV Treatment – *Deep Dix-Hallpike*



- For deep Dix-Hallpike (aka Yacovino maneuver), move from sitting to supine position as in Dix-Hallpike but without turning the head
- Continue rotating another 60-90 degrees (requires a tilt table or a similar apparatus to avoid extreme neck extension) and remain in this position for a few minutes
- Move back up to sitting position with an optional stop in supine with head elevated 30°
- Works for both right and left anterior canal BPPV

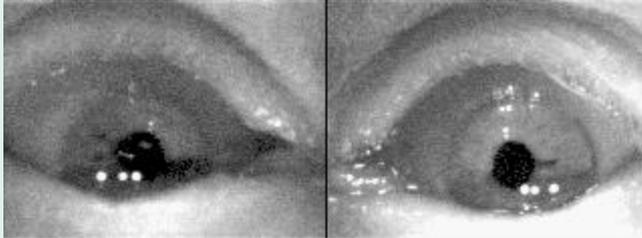
Roll Maneuver in Lateral Canal BPPV

- Purely horizontal transient nystagmus in Dix-Hallpike may indicate presence of lateral canal BPPV
- Roll maneuver must be performed to confirm as Dix-Hallpike is not very sensitive to lateral canal BPPV
- Begin in the supine position with the head flexed forward 30°
- Turn the head rapidly toward the right or left ear
- After responses subside, slowly return to the supine position
- Repeat the maneuver to the opposite side



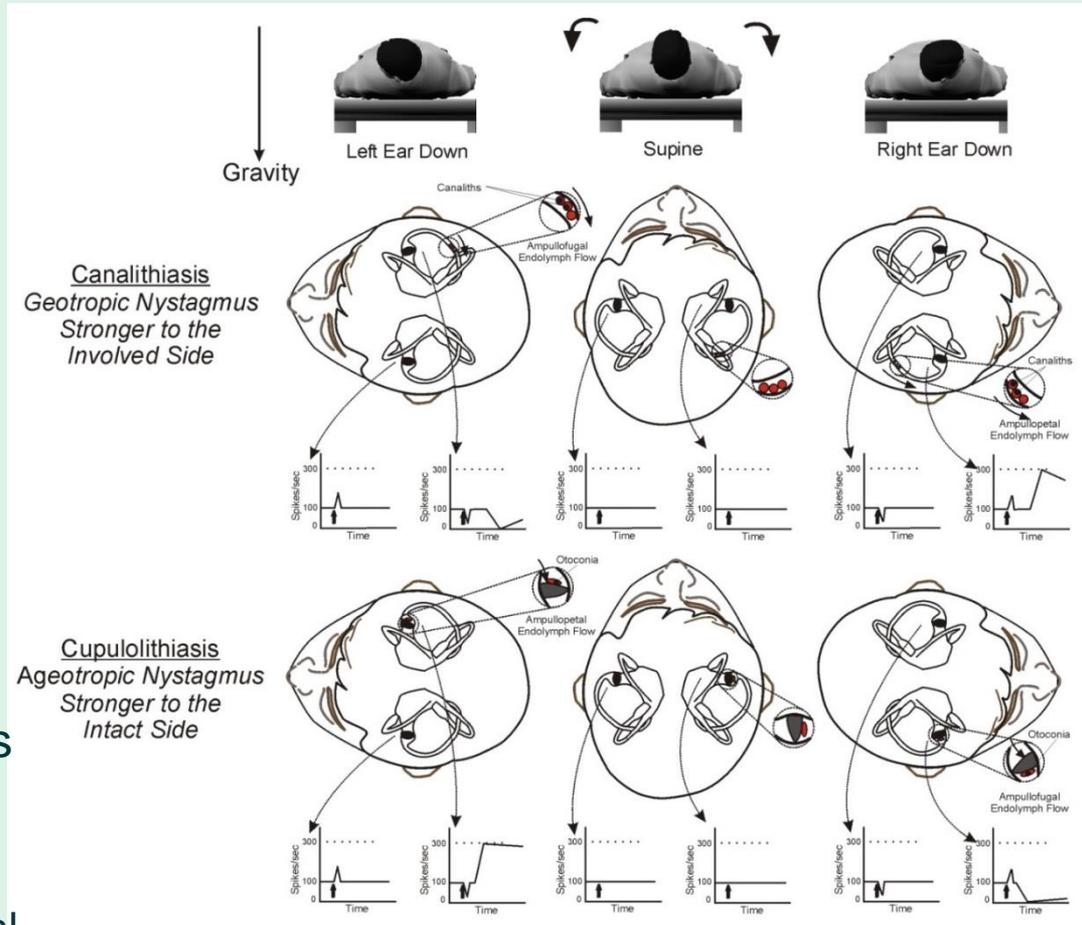
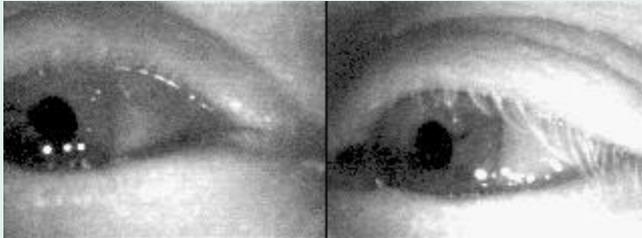
Roll Maneuver in Lateral Canal BPPV

Supine to Right Ear Down



Courtesy of Mary Ava Gossman, Boys Town Institute

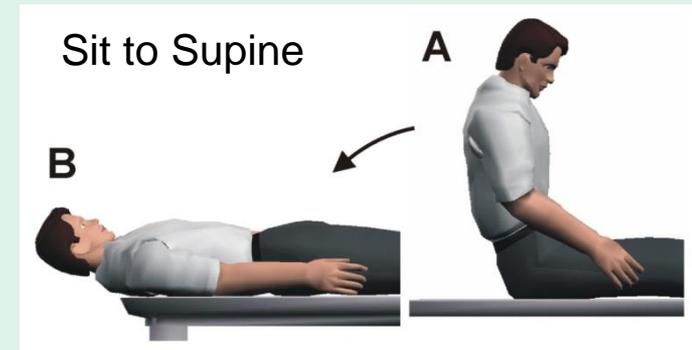
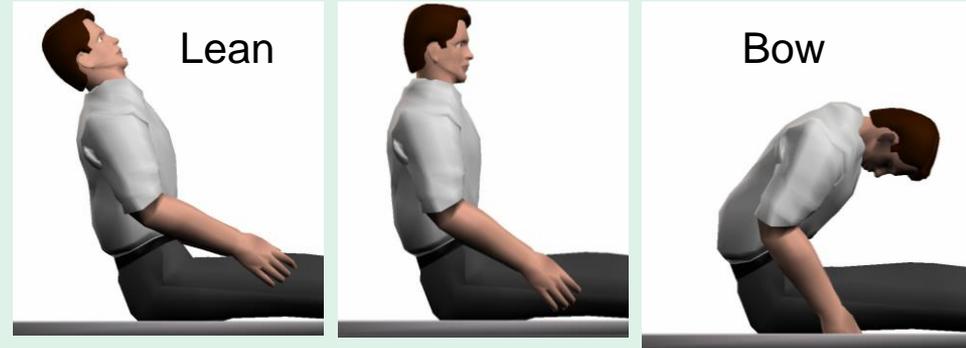
Supine to Left Ear Down



- In lateral canal BPPV, response should be present in both directions
 - Geotropic indicates canalithiasis
 - Ageotropic indicates cupulolithiasis (interpret cautiously as some central abnormalities mimic lateral canal cupulolithiasis)

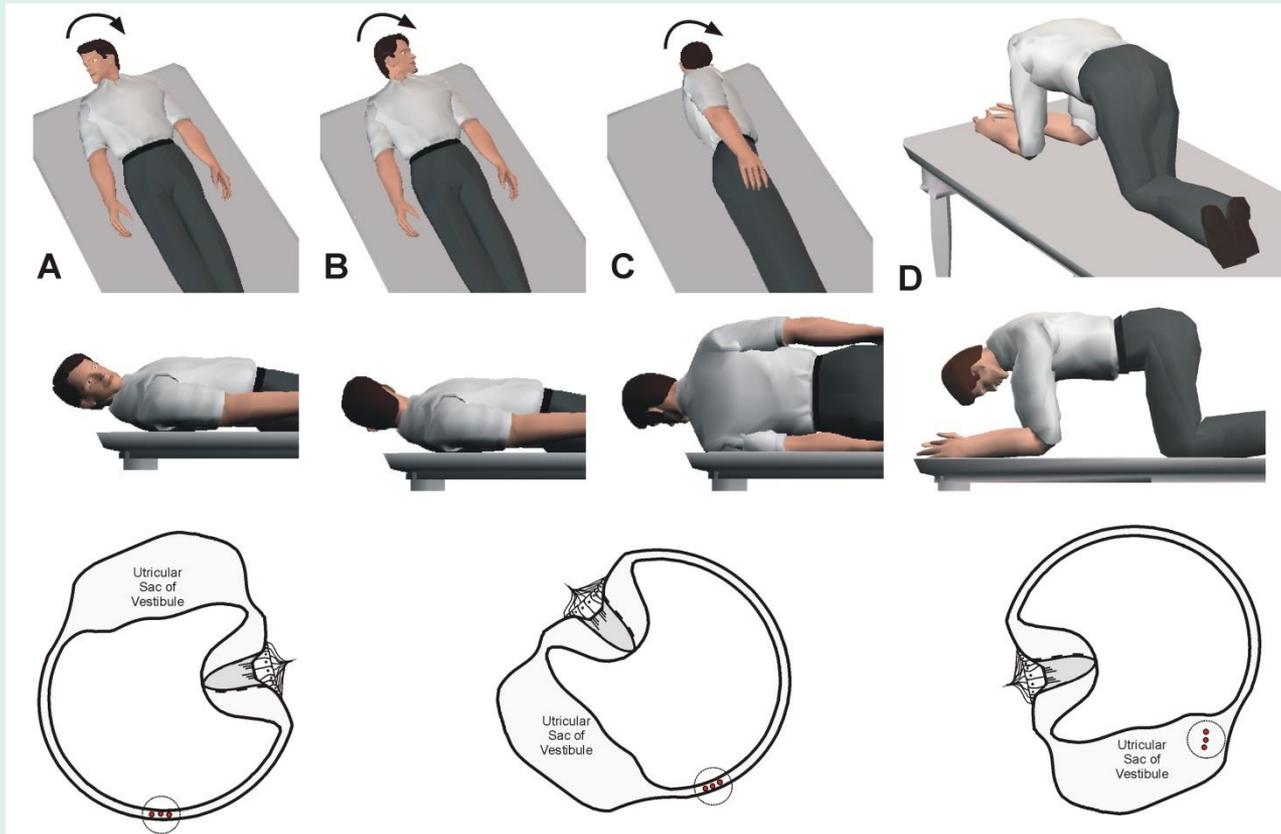
Side of Lesion in Lateral Canal BPPV

- The success of repositioning maneuver for lateral canal BPPV is lower than the success rate for the treatment of posterior canal BPPV
- After the roll maneuver, “bow and lean” or “sit to supine” procedure can be used to increase the chance of correctly identifying the affected side
- The results from the roll maneuver and bow and lean tests can be discordant



	<i>Roll Maneuver (side of lesion)</i>	<i>Bow</i>	<i>Lean or Sit to Supine Maneuver</i>
Canalithiasis	Geotropic nystagmus (stronger response)	Beats <i>toward</i> the involved side	Beats <i>away</i> from the involved side
Cupulolithiasis	Ageotropic nystagmus (weaker response)	Beats <i>away</i> from the involved side	Beats <i>toward</i> the involved side

Lateral Canal BPPV Treatment – *Log-Roll*

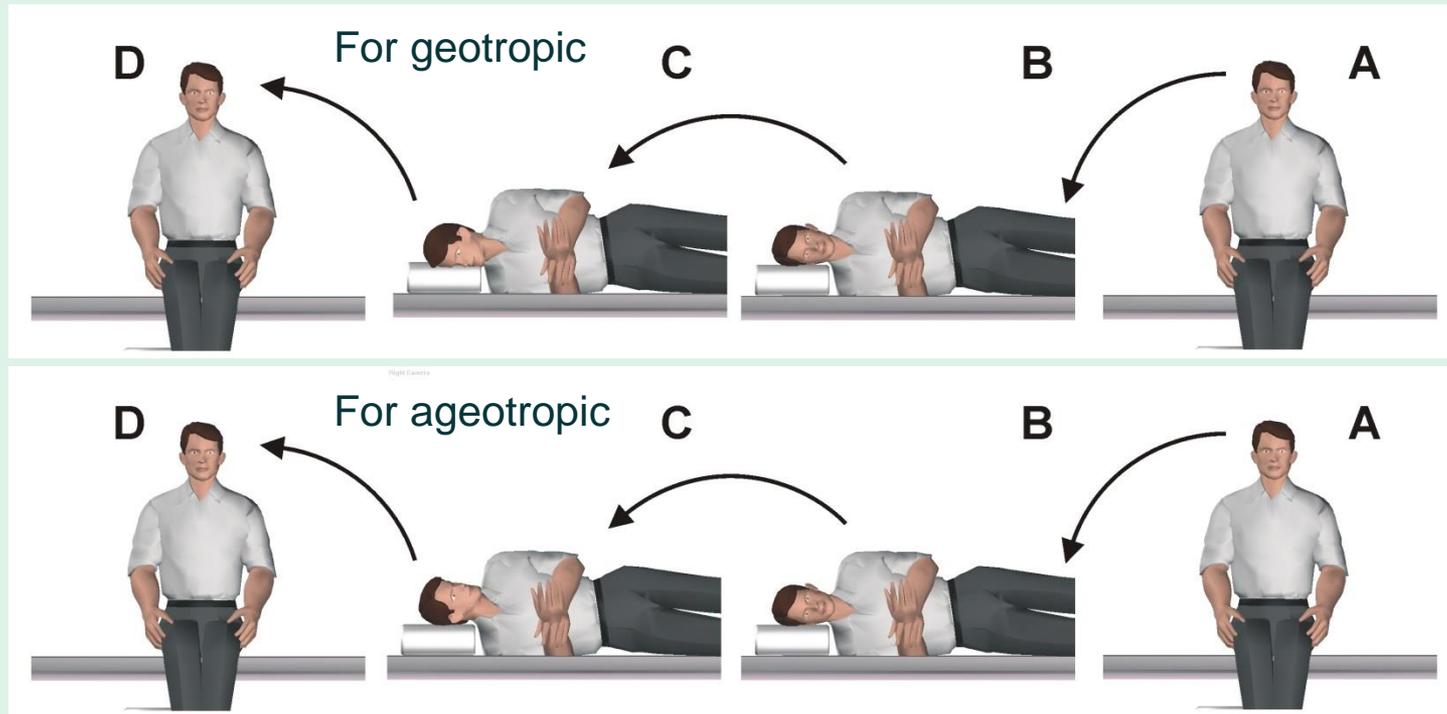


- With the head turned toward the involved ear, rotate the head/body in the plane of lateral canals 360° toward the unaffected ear in 90-degree increments
- In place of Steps D, E, and F, the patient can be placed on hands and knees with the head tilted down about 30 degrees (best to perform the maneuver on the floor)

Alternative Treatments for Lateral Canal BPPV

- The success rate of log-roll maneuver for lateral canal BPPV is not as high as the repositioning maneuver for the posterior canal
- Several variations, such as the Gufoni maneuver, have been developed and high success rates have been reported
 - These procedures may shorten the time to perform the log-roll maneuver but are unlikely to have a better success rate
- Another procedure with a reported high success rate is the *forced prolonged positioning* maneuver where the patient is instructed to sleep on one side the whole night
 - Typically, the patient is instructed to sleep on the unaffected side but the opposite side has also been used

Lateral Canal BPPV Treatment – *Gufoni Maneuver*



- From the sitting position looking straight ahead (A), move the patient to the side that generates weaker nystagmus (B)
- After a pause, rotate the head 45° downward for geotropic nystagmus or 45° upward for ageotropic nystagmus (C)
- After waiting for a minute, return the patient to the sitting position (D)

Treatment Maneuvers – *Practical Issues*

- What about bilateral BPPV?
 - First treat for the side with stronger responses and if necessary, repeat at a later date for the other side
- What about “subjective” BPPV?
 - Try the repositioning maneuver (success rate ~87%)
- What about post-therapy instructions?
 - No instructions are needed except for avoiding vigorous head movements
- What about vibration during the maneuver?
 - Not needed for canalithiasis but may be necessary for cupulolithiasis
- How many retries of the treatment maneuver?
 - Success rate for the repositioning maneuver exceeds 90% after one retry
 - If unsuccessful after two retries, first rule out central lesions
- What about report of unsteadiness after a successful treatment?
 - Likely indicates otolith syndrome (high incidence of abnormal oVEMPs)

Treatment of BPPV – *Complications*

- Transference of debris to another canal
 - Treat for the new type of BPPV
- Neck stiffness and muscle spasms
 - Prior to the procedure, the patient can receive muscle relaxant
- Severe vertigo and nausea
 - Prior to the procedure, the patient can receive anti-vertigo medications
- Drop attack immediately after the procedure
 - Hold the patient to avoid potential injury and allow time for full recovery before the patient is released
- **WATCH FOR INTRACRANIAL LESIONS**
 - If treatment is unsuccessful after two tries, a full workup, including imaging studies, should be considered before continuing with alternative treatments for BPPV

TRV Chair

Overview

- TRV chair is designed for diagnosis and treatment of BPPV
 - Ideal for hard-to-treat and complicated cases
- The patient can be moved safely in three dimensions using a mechanical weight-balanced apparatus
- Common maneuvers for diagnosis and treatment of BPPV can be performed using precise trajectories recording the resulting eye movements

Dix-Hallpike, Epley, and Semont Maneuvers



Clinical Use of TRV

Right PC-BPPV
treated by an Epley maneuver

