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# Vestibular Rehabilitation

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Vestibular Dysfunction and Treatment  
following a Traumatic Brain Injury

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**ThinkSMART!**

# Function of the Vestibular System

The vestibular system provides us with three basic functions:

- **sensory ability**
  - which detects head movements
- **central nervous system processing**
  - which gives feedback regarding body orientation
- **motor output to our body**
  - to correct eye, head and bodily positions (Hain and Helminski, 2007).



# Vestibular Reflexes

The processing of information from the sensory aspects of the vestibular system provides us with three very important reflexes:

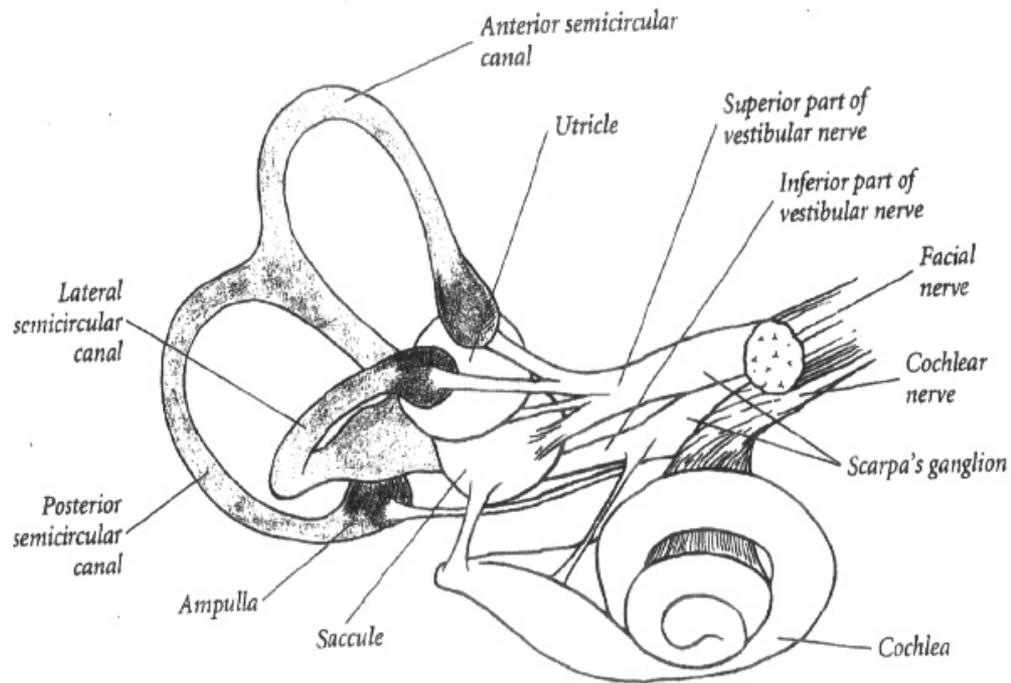
- **The vestibular ocular reflex (VOR)**, which keeps eye movements stable while the head moves
- **The vestibulocollic reflex (VCR)**, which keeps the head stable
- **The vestibulospinal reflex (VSR)**, which stabilizes bodily movement, impacting posture and balance



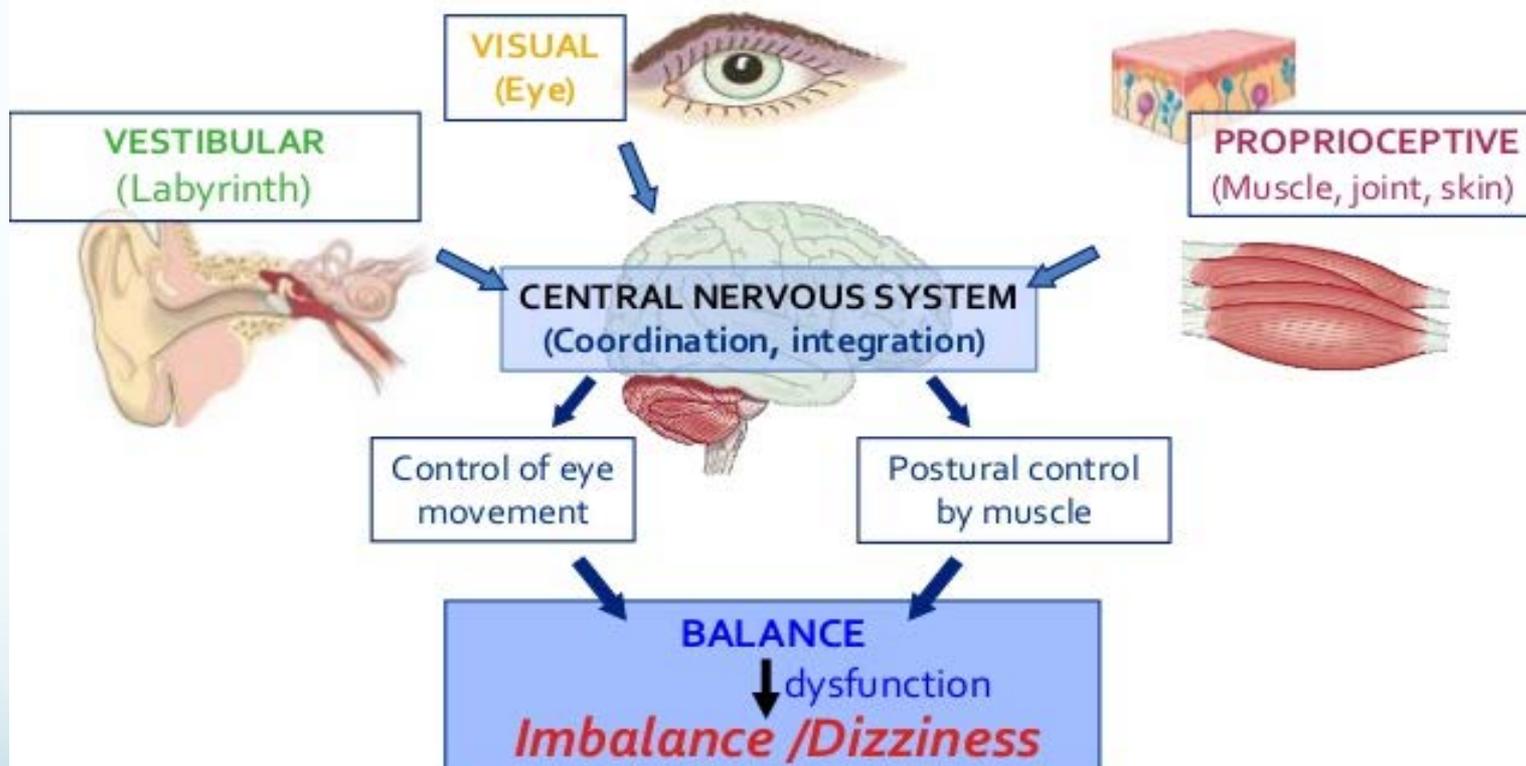
# Basic anatomy of the vestibular system

- The inner ear is located within the temporal bone and contains three parts:
  - 1. **The cochlea** the aspect responsible for hearing
  - 2. **The vestibule and the semicircular canals** (anterior, posterior and lateral) responsible for sensing rotational movements of the head
  - 3. **The membranous labyrinth** (sacs and ducts) consists of the utricle, saccule and the semicircular ducts
    - is responsible for sensing accelerative movements of the head

# Anatomy



# Body Balance is Controlled by 3 Sensory Systems: *Vestibular, Visual, Proprioceptive*



Goebel JA. Otolaryngol Clin North Am 2000;33:483-93.

Shepard NT, Solomon D. Otolaryngol Clin North Am 2000;33:455-69



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The vestibular system and the central nervous system work together to help us control our eye, head and body movements to maintain balance.

Trauma to the brain can result in abnormal vestibular system functioning.



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# Vestibular System Dysfunction

When trauma to the brain occurs

- The brain can receive abnormal signals regarding the position and movement of the head in space.
- When vestibular information is inaccurate, the brain most often relies on visual input to stabilize the head on the body.
  - This means that the visual system becomes the most reliable system to quickly assess ones position in space and to remain balanced.
  - Relying upon vision alone as the primary source of balance often leads to fatigue and difficulty performing routine daily activities



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# Vestibular dysfunction in regards to TBI

As many as 30% to 65% of patients with TBI suffer symptoms of traumatic vestibular pathology at some point during their recovery

Patients, who have experienced a head injury, exhibit vertigo and dizziness between 20-58% of cases (Rubin et al., 1995)



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# Prevalence of Vestibular Dysfunction in TBI

Of 100  
patients  
with  
dizziness  
post-TBI

- 71% Peripheral Vestibular Dysfunction
- 61% BPPV
- 8% Central Vestibular Dysfunction



# Incidence of Dizziness in TBI

24-80% will experience symptoms initially

20-47% will continue to experience symptoms at 5 years

- Minor TBI: 20-32%
- Moderate TBI: 37-47%
- Severe TBI: 26%



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# Differential Diagnosis for Dizziness Associated with TBI

BPPV

Labyrinthine Concussion

Brainstem Concussion

Central Vestibular Dysfunction

Cervicogenic Dizziness

Post-traumatic Menieres Disease

Post-traumatic Migraine

Perilymphatic Fistula

Psychogenic Vertigo

Epileptic Vertigo

Temporal Bone Fracture



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# Benign Paroxysmal Positional Vertigo (BPPV)

- Most common type of dizziness
- Occurs in approximately 28% of persons with post-traumatic vertigo (Hoffer et al., 2004)
- Can even be caused by injuries that do not directly affect the head such as a whiplash injury
- BPPV is easily recognized by the pattern of dizziness that is experienced only when the head is placed in certain positions (bending over, lying down in bed, rolling over in bed, sitting up and looking up)
- Symptoms usually last only a few seconds up to two minutes



# Post-traumatic BPPV

- Onset with mild TBI within a few days
- Higher incidence of bilateral involvement
- Consider checking all 3 canals on both sides before treating
- Recurrence rate of 26-30%
- Results in quicker relapses than non-traumatic
- Requires repeated repositioning compared to those with non-traumatic BPPV



# Labyrinthine Concussion

- Damage to the labyrinth, with or without bony fracture
  - Membranous labyrinth very fragile and easily damaged
- Abnormal findings
  - Unilateral peripheral loss with caloric testing
  - Asymmetric sensorineural hearing loss due to damage to the cochlea
  - Rotational chair testing abnormal if compensation is not complete



# Brainstem Concussion

- Shearing on the root entry zone of the 8<sup>th</sup> cranial nerve may lead to hemorrhage or cell death in the area of the vestibular nuclei
- Signs and symptoms
  - Dizziness/Vertigo
  - Postural instability
  - May be associated with other cranial nerve damage or CNS signs
  - VOR and saccadic eye movement abnormalities
  - Implicated if compensation does not occur with labyrinthine concussion



# Central Vestibular Dysfunction

- Dysfunction of the vestibular nuclei, cerebellum and other vestibular pathways
  - Presentation depends on location of the lesion
    - Less likely to have true vertigo
    - More likely to have constant symptoms
    - More likely to have balance dysfunction
    - More likely to have CNS signs



# Cervical Vertigo

- Imbalance following a severe neck injury
- Causes for cervical vertigo include trauma, arthritis and chronic neck pain
- Patient complains of feeling dizzy, lightheaded, and/or sense of the head not being connected to the body
  - Patient may complain of dizziness while reading
- Treatment consists of vestibular rehabilitation and anti-inflammatory medications
- **Head-Neck Differentiation test:** is a simple screening test is used to help differentiate cervical vertigo from vestibular vertigo.
  - **\*\*look for provocation of symptoms not nystagmus\*\***

# Post-traumatic Menieres Syndrome

- Episodes of dizziness accompanied by noises in the ear, fullness, or hearing changes (muffled hearing)
- Mechanism thought to be bleeding into the inner ear, followed by the disturbance of fluid transport.
- Onset of symptoms may vary from immediate to as long as one year later
- Attacks may last as little as 20 minutes, but usually last 2-4 hours



# Post-Traumatic Migraine

- Dizziness combined with migraine headaches
- Patient usually describes vertigo, dizziness, and full motion sickness
  - Symptoms usually exacerbated by watching television, computer monitors, or while a passenger in a moving car
- Migraine has been reported as common as 41% in persons with post-traumatic vertigo (Hoffer et al., 2004)
- Headaches and vertigo are common after head injuries and it may be difficult to distinguish post-traumatic headaches from migraines
- Spells usually last minutes at a time

# Perilymphatic Fistula

- Most commonly occur at the round and oval windows of the inner ear and can be caused by head trauma, mastoid or stapes surgery, penetrating injury to the tympanic membrane, barotrauma, or vigorous straining
  - Nystagmus or dizziness with valsalva maneuver
- Patient typically experiences a “pop” in the ear followed by sudden vertigo, hearing loss and loud tinnitus
- Later on patients will complain of imbalance, positional vertigo, and nystagmus as well as hearing loss
- Symptoms of imbalance and dizziness are provoked by sneezing, straining or blowing the nose
- People with a fistula may also get dizzy with loud noises

# Psychogenic Vertigo

- Psychogenic vertigo is vertigo that is related to psychological causes such as depression or anxiety
- Anxiety and depression may result from traumatic brain injury that creates a self-perpetuating psychological reaction (Alexander, 1998)
- Sensations of floating, swimming, or swimming “inside the head” are frequently the symptoms of anxiety (panic attacks, agoraphobia, obsessive-compulsive disorder), somatoform disorders (including conversion), or depression (Herdman, 2007)

# Epileptic Vertigo

- Vertigo due to an injury to the brain, typically the part of the temporal lobe that processes vestibular signals
- Loss of consciousness usually occurs at the time of the injury and vertigo is generally accompanied by altered consciousness (Tusa et al., 1990)
- Typical symptom is “quick spins”, although this symptom has other potential causes such as BPPV and vestibular neuritis

# Temporal Bone Fracture

- Severe dizziness would be experienced after the injury
- CT of the skull or temporal bone would indicate a fracture
- Often accompanied by hearing loss (conductive or sensorineural) or peripheral facial weakness
- There is often blood seen behind the ear-drum
- Longitudinal fractures are 4X more common than transverse fractures



# Vestibular System Treatment

- When an injury occurs to parts of the vestibular system, the brain is not getting accurate information to help regulate balance and equilibrium.
- If this system does not compensate for the deficit, the person will end up becoming more dependent on the other systems (musculoskeletal, somatosensory and vision) for balance.
- When all of these other systems are affected, the person is at risk for impaired mobility and is at very high risk for falls.

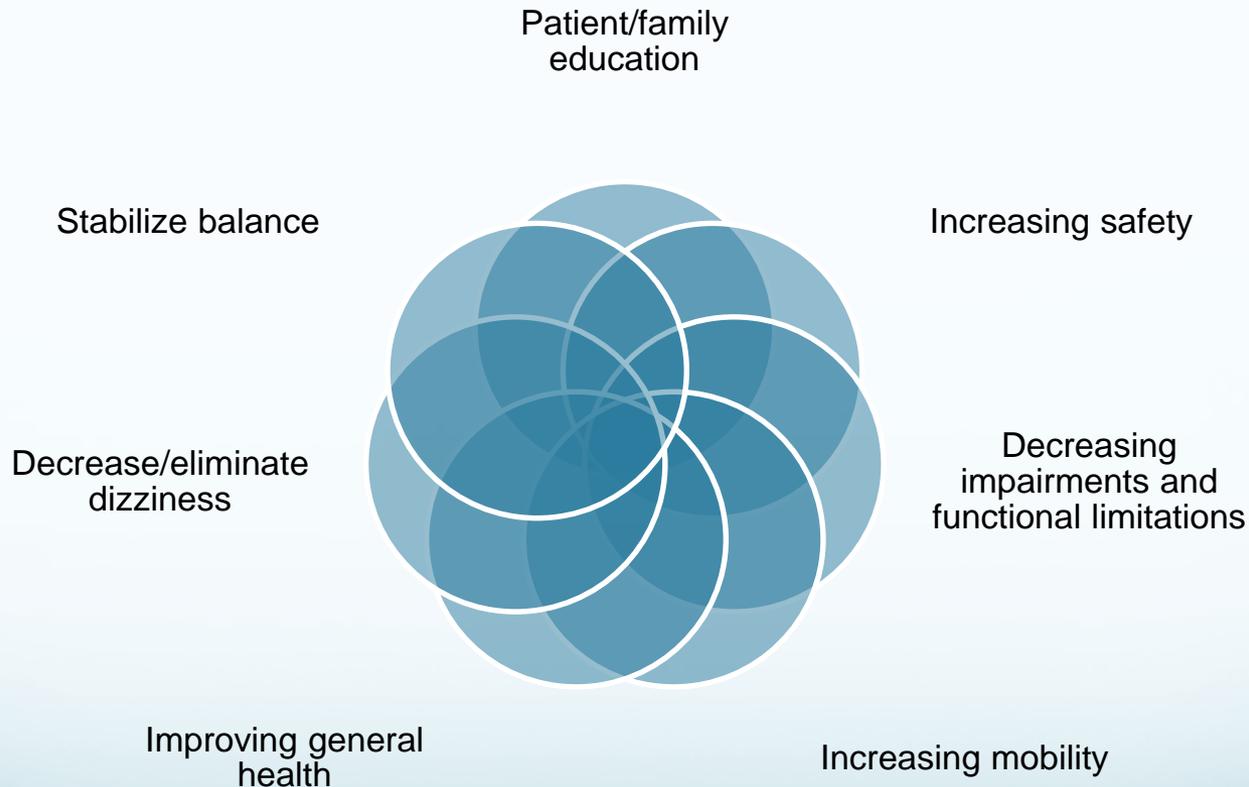


# How Does Vestibular Rehabilitation Work

- The purpose of vestibular therapy is to retrain the brain to recognize signals from the vestibular system and work collaboratively with vision and proprioception
- Desensitizing of the abnormal vestibular response may need to occur along with strengthening exercises for gaze stabilization
- The best treatment for symptoms of a TBI involves a physical therapy assessment of vestibular function and a cervical spine examination



# Goals of Vestibular Rehab



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# Vestibular Rehab

The **goal** is to facilitate the compensatory process by incorporating exercises that include:

- head movement with eye stabilization
- head movement with eye movement
- habituation exercises to retrain and help the vestibular system to adapt
- balance tasks that require the weakest system to be strengthened
- strengthen hip and ankle balance strategies
- relaxation exercises



# Vestibular Evaluation Post TBI

Patient will be referred for evaluation of:

- Vertigo
- Dizziness
- Disequilibrium
- Balance abnormality
- Oculomotor dysfunction
  - Nystagmus
- Severe headaches
  - Recurrent falls
- Unilateral hearing loss, tinnitus, fullness or ear pain
  - Gait abnormality



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# Vestibular PT Evaluation

## Examination:

- History
- Hearing status
- Cranial Nerves (CN VIII)
- Pressure Sensitivity (Fistula)
- Positional Nystagmus
  - \*Dix-Hallpike \*Roll Test
- Hyperventilation (R/O Anxiety, acoustic neuroma)
- Vestibular- Oculomotor exam
- Assessment of balance activities that involve the vestibular, vision and proprioceptive systems
- Posture
- Movement
- Compensatory mechanisms



# Differential Diagnosis

	<b>Unilateral Peripheral Vestibular Dysfunction</b>	<b>Bilateral Peripheral Vestibular Dysfunction</b>	<b>Central Vestibular Dysfunction</b>	<b>BPPV</b>
Onset	Sudden	Sudden or Gradual	Gradual	Sudden
Frequency	Episodic	Constant	Constant	Episodic
Duration	Minutes to Hours	Hours to Days	Hours to Days	Seconds to Minutes
Symptoms	Vertigo, Nausea, Imbalance	Dizziness, Imbalance	Lightheadedness Imbalance	Vertigo

# Peripheral or Central Vertigo?

Peripheral	Central
Severe Nausea	Moderate Nausea
Mild Imbalance	Severe Imbalance
Hearing Loss is Common	Hearing Loss is Rare
Mild Oscillopsia*	Severe Oscillopsia*
Neurological Symptoms are Rare	Neurological Symptoms are Common
Rapid Compensation	Slow Compensation

\*Oscillopsia- visual sensation that sensory objects are swaying back and forth

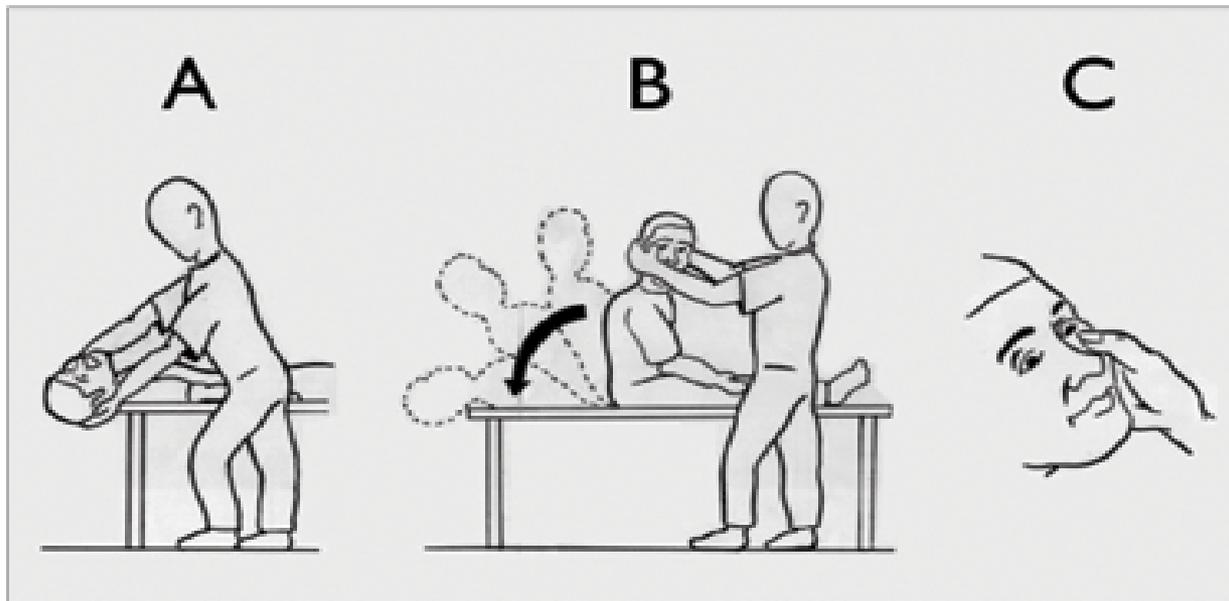
# Positional Testing for BPPV

- **Dix-Hallpike:** Tests the anterior and posterior canals.

Patient sits on the table and the clinician turns the head 45 degrees horizontally. The clinician then quickly brings the head and trunk straight back so that the head is hanging over the table by 20 degrees. Nystagmus is sought and the patient is asked if they are experiencing vertigo. The patient is then slowly returned to the seated position and is again observed for nystagmus. This is then repeated to the opposite side.

- Tests the anterior and posterior canals
- Anterior canal will present with a downward beat/torsional
- Posterior canal will present with an upward beat/torsional
- Duration typically <1-2min
  - Canalithiasis <60 sec
  - Cupulolithiasis >60 sec

# Dix-Hallpike Test



**Figure 1.** Dix-Hallpike test (1952)36: A) patient seating in bed, turns head  $45^{\circ}$  to the side being studied; B) with the help of the examiner, the patient quickly lays down on her back and keeps her head hanging, keeping head position at  $45^{\circ}$  to the side, and C) the examiner watches the patients eyes, looking for positional nystagmus.



# Positional Testing for BPPV

- **Roll test:** tests the horizontal canal.
- If the Patient is able to tolerate the Dix-Hallpike position you can leave them in supine position once the testing is completed and elevate the head of the table ~30 degrees. The clinician then rotates the patient's head to the Right for 60 seconds and then returns to neutral followed by rotation to the Left for 60 seconds
- Positive test is pure horizontal nystagmus (no rolling or rotation is observed). Named according to the direction
  - Geotropic = towards the earth
  - Ageotropic = away from the earth
    - Has to be consistent on both sides or it is atypical
    - Increased intensity is usually towards the affected side.

# Oculomotor Examination

- Examination of convergence and vergence can help quantify convergence insufficiency
  - Symptoms of dizziness, blurred vision or headache precipitated by these maneuvers are very common in patients with vestibulo-ocular issues and their resolution is a good gauge of recovery of this sub-system
  - To assess convergence bring your finger/object in towards the patients nose and ask them to tell you when the object doubles (not blurs)
    - Normal convergence is  $\leq 6$  inches
    - Positive test is that their eyes will move out of sync which is indicative of CNS involvement
    - Observed in 23-46% of patients with diagnosis of TBI

# Skew Deviation

- Test is performed in room light
- Test is performed by covering one eye at a time in an alternating fashion. Covering each eye for at least 10 seconds
- Typically resolves within a few days of onset
- Assess to see if one eye is lower than the other.
  - Lower side is side of deficit (Ipsilesional)
  - Monocular vision eyes will become normal
  - Binocular eyes will move up and down

# Saccades

- Oculomotor exam performed in room light
- Fast and accurate. Assesses patients ability to use their eyes to follow a target that rapidly changes position utilizing cues such as “nose” and “finger” in all 6 quadrants making sure to place finger randomly throughout
  - Look at:
    - Accuracy- how close amplitude of saccade matches amplitude of target step
    - Velocity- should be brisk and equal in both eyes
    - Latency- time from target step to beginning of saccade
- Greater than 2 is abnormal
  - Could indicate CNS involvement
  - Peripheral vestibular defects do not impair saccades

# Smooth Pursuit

- Perform in room light
- Smooth pursuit eye movements are used to maintain stable gaze on objects that are moving within the visual field
- Test is performed by moving clinician's fingertip in all planes (up, down, left, right, and diagonally) while the patient follows with their eyes keeping the patient's head stable
- Look at quality of the movement
  - Corrective or catch-up saccades
  - Tracking should be smooth and symmetrical
  - Positive test is inability to follow fingertip which is indicative of CNS or oculomotor dysfunction

# VOR

- The VOR normally acts to maintain stable vision during head motion.
- Assess for saccades by having patient fixate on your nose and turn their head side to side to assess horizontal plane and up and down to assess vertical plane.
- This reflex has two components
  - The linear VOR- compensates for translation
    - Important when near targets are being viewed and the head is being moved at relatively high frequencies
    - Mediated by the otoliths
  - The angular VOR- compensates for rotation
    - Responsible for gaze stabilization
    - Mediated by the superior semicircular canals (SCC)

# VOR Cancellation

- Perform in room light
- Tests ability to maintain eyes fixed on clinician's nose while clinician moves patient's head and clinician's body side to side. The head is moving in sync with the target.
  - Perform with head in ~30 degrees of flexion
- Positive test is an inability maintain eyes fixed on clinician's nose which is indicative of CNS involvement
- Unilateral peripheral vestibular lesion does not impair VOR cancellation unless the spontaneous nystagmus from the lesion is so high that it prevents the eye tracking systems from functioning normally

# Head Thrust Test (Head Impulse Test)

- Perform in room light
- If a patient normally wears glasses they should continue to wear them for this test as the VOR is calibrated for visual inputs through those glasses
- To perform tilt patients head forward ~30 degrees (so horizontal canals are in a forward plane). Patients eyes need to be fixed forward and stabilized while head is moving. Perform small oscillations followed by a thrust to either side making it random
  - **Normal function:** the patient will keep gaze on target
  - Arefixation saccade after the head thrust indicates decreased VOR
  - **Hypofunction:** the eyes will move with head (gaze error) which leads to a corrective “refixation” saccade at the end of the head movement
    - Refixation saccade to Right indicates Right ear and to Left indicates Left ear

# DVA- Dynamic Visual Acuity

- Perform in room light
- Requires use of an eye chart- Patient will read chart.
  - Last line that they can read is the static visual acuity
  - Then oscillate head at 2 Hz (using a metronome) and read until they miss a letter for dynamic visual acuity
- Measured as difference between static visual acuity and dynamic visual acuity during 2 Hz oscillations of the head
- Normal is 2 line or less difference (Increases to 3 with age)
- DVA decreases as vestibular loss increases
- One of the most useful tests for following functional VOR in patients with unilateral and bilateral vestibular deficits

# Vision blocked examination with Frenzel lenses

- Nystagmus-
  - Spontaneous
    - If spontaneous nystagmus is seen remove goggles and place 1 finger in front of patient and have them fixate on that finger
      - If it persists indicates CNS involvement
      - If it disappears think PNS involvement
      - Decreases at 1 week and is largely but incompletely recovered at 1 year



# Vision blocked examination with Frenzel lenses

- Nystagmus-
  - Gaze-evoked
    - Need to stabilize patients head and have them look to the Right for 7-10 seconds and then return to neutral for 7-10 seconds and then look to the Left for 7-10 seconds followed by looking up for 7-10 seconds and down for 7-10 seconds
      - Left beating nystagmus indicates Right ear involvement
      - Right beating nystagmus indicates Left ear involvement
      - Down beating nystagmus indicates CNS involvement

# Head Shaking Nystagmus

- Performed in dark room with Frenzel lenses
- Clinician holds patients head flexed at 30 degree angle and tells them to close their eyes and clinician shakes their head for 30 seconds. Have patient open eyes just before finishing
  - Elicitation of jerk nystagmus during this procedure indicates a vestibular imbalance.
  - This sign may persist indefinitely after a peripheral or central unilateral or vestibular lesion
  - A Down Beat or “perverted” nystagmus may be seen indicating central origin (seen in migraines, cerebellar disturbances)
  - Patient with unilateral hypofunction will have a nystagmus that beats away from the side of the lesion with the fast phase beating toward the intact side
    - Left beating nystagmus indicates Right ear
    - Right beating nystagmus indicates Left ear

# Balance Assessment

Balance testing is typically deferred to the second session as vestibular assessment will exacerbate symptoms and skew results

- **Single Leg Stance:**
  - Record the best of three trials
  - Target is 30 seconds, <5 seconds indicates high risk of falls
- **Fukuda Stepping:**
  - The subject is asked to step in place for 50 steps with arms extended and eyes closed
  - Progressive turning to one side of more than 30 degrees is abnormal
  - A positive test is frequently found in patients with a unilateral vestibular deficit
    - Can also be seen in patients with a leg-length discrepancy or other structural abnormalities of the legs



# Balance Assessment

**“Sharpened Rhomberg” or Tandem stance:**  
Patient is asked to stand heel-to-toe position

- target >30 seconds
- Eyes open
- Eyes closed

**Rhomberg test:**  
Patient is asked to stand with feet together and arms folded across their chest

- target >30 seconds
- Eyes open
- Eyes closed



# Vestibular Function Tests

## Modified Clinical Test of Sensory Interaction in Balance mCTSIB:

- Evaluates if sensory input (vision, vestibular, somatosensory) is normal or abnormal
- 4 conditions: Max Score of 120 (30 each condition)
  - firm surface with EO (somatosensory and vision)
  - firm surface with EC (somatosensory)
  - Foam surface with EO (vision)
  - Foam surface EC (vestibular)

## Neurocom: Balance Manager Sensory Organization Testing (SOT)

- Analysis of Vestibular, Visual, Somatosensory, and Performance systems
- When self-reported symptoms of dizziness and imbalance were compared with objective measurements of postural stability and vestibular function from the sensory organization test (SOT) in a concussed athlete cohort, moderate correlations (Spearman Rs = -0.39 to -0.57) were reported. (Broglia et al., 2009)



# Gait Assessment

## Assess ambulation:

- -Head rotation
- -Decreased BOS
- -Gait velocity
- -Absent vision
- -Altered support surface
- -Assistive device

## Dynamic Gait Index (DGI)

- Very helpful in quantifying gait dysfunction in people with vestibular disease
- Eight item test that takes less than 10 minutes to perform and requires little equipment (a shoebox, two cones, and stairs)
- Scores of 19 or less have been related to falls
- Scores as low as 3/24 can be seen in people with vestibular dysfunction
- Validated in vestibular patients: scores  $\leq 19$  are 2.58X more likely to fall (Whitney et al. 2000)



# Vestibular Treatment for TBI

Based on examination findings, treatment is customized to the patient and involves:

- Canal Repositioning Maneuvers if indicated
- Gaze stability exercises
- Habituation exercises
- Adaptation exercises
- Static and dynamic balance activities
- Vestibular stimulation exercises
- Manual therapy to the cervical spine
- Cardiovascular exercises (stationary bike, treadmill walking or jogging)
- Sports specific drills (agility ladder, hurdles)



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# Canal Repositioning

- The **goal** of the canalith repositioning procedure is to move displaced otoconia (which are normally attached to the otolithic membrane in the utricle of the inner ear) to stop false signals and the debilitating symptoms they can cause.
- Through a series of head position changes, CRP moves the otoconia from the canal to the utricle.
- Once inside the utricle, the otoconia may re-adhere to the otolithic membrane, dissolve, be broken up, or move someplace where they cant cause symptoms.



# Maneuvers

There are two primary maneuvers:

- Epley maneuver
- Semont-Liberatory maneuver

The choice of the maneuver depends on:

- the results of the Dix-Hallpike which will indicate which canal is involved
- whether or not the otoconia is inside the canal being **canalithiasis** or hung up on the cupula of the canal being **cupulolithiasis**



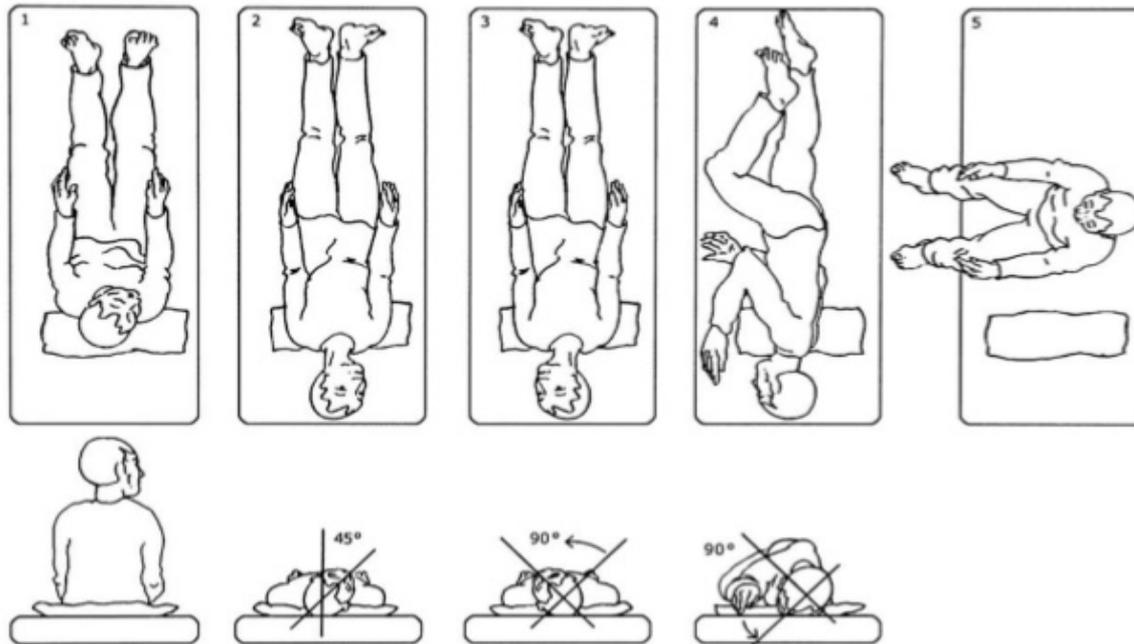
# Epley Maneuver

- Effective in treating canalithiasis
  - Used to treat BPPV of the posterior semicircular canal or the anterior semicircular canal
  - Each position held for 30sec to 2min
  - 70-90% success with one treatment
  - ~30% rate of recurrence



# Epley Maneuver

Figure 1. Instruction for the modified Epley's procedure (for benign paroxysmal positional vertigo of the posterior semicircular canal of the right ear).



Radtke A et al. Neurology 1999;53:1358



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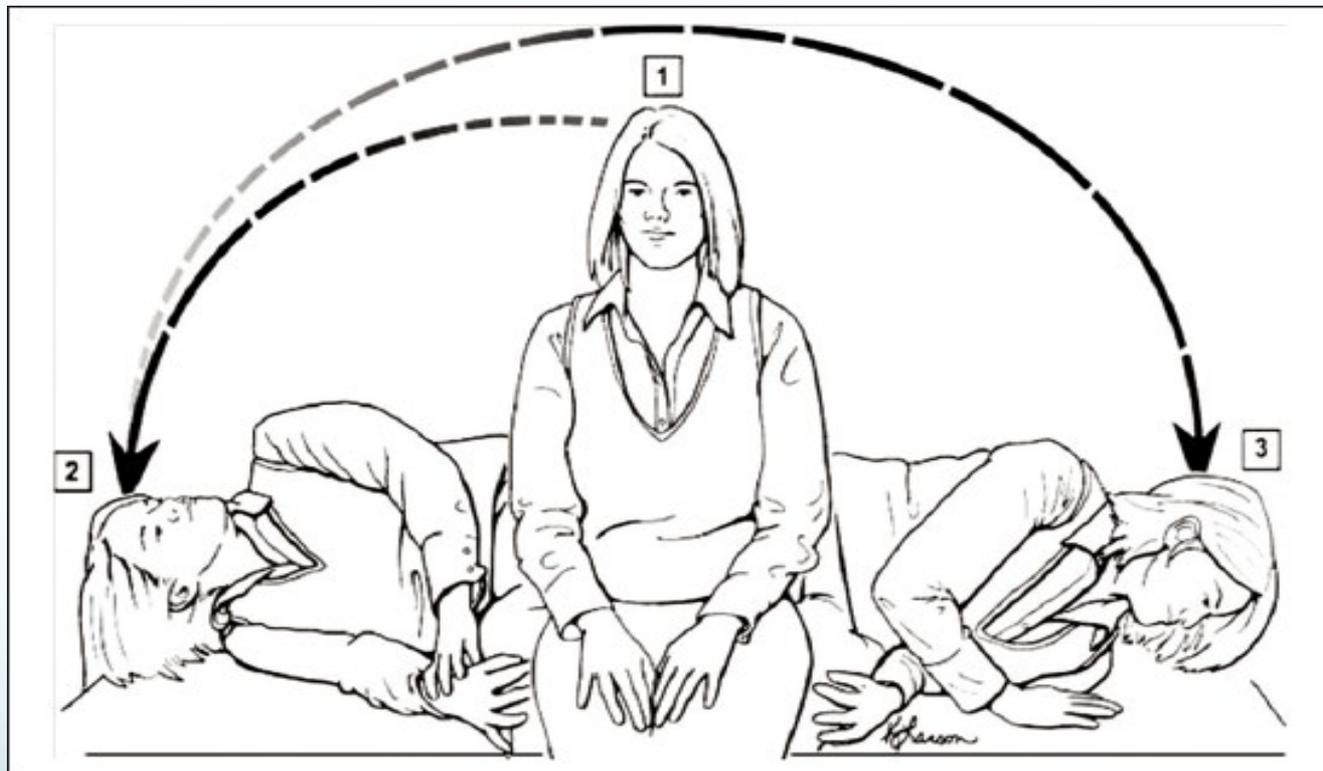
# Liberatory Maneuver

Used to treat  
Cupulolithiasis  
of anterior and  
posterior  
canals



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# Liberatory Maneuver



Posterior Canal BPPV: Cupulolithiasis

# Brandt-Daroff Exercises

Used to treat Cupulolithiasis

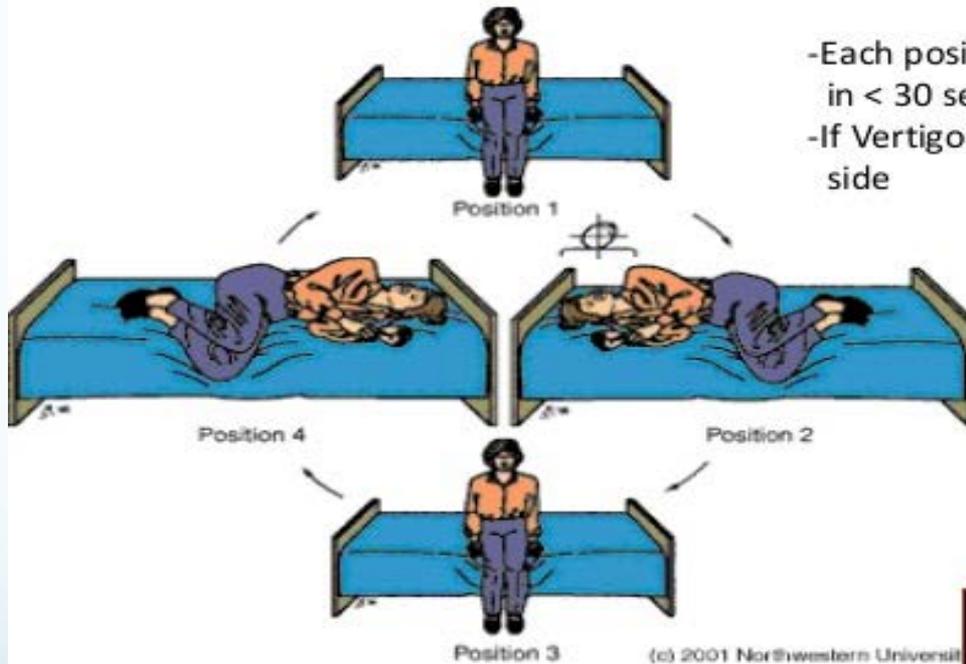
Done multiple times over a period of time extending until 2 days after vertigo has ended

The goal is to loosen and disperse particles from the cupula of the posterior semicircular canal



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## c. Brandt Daroff maneuver



- Each position 30 sec or vertigo subsides in < 30 sec
- If Vertigo >30 sec → sit up 30 sec → other side

Time	Exercise	Duration
Morning	5 X	10 min
Noon	5 X	10 min
Evening	5 X	10 min

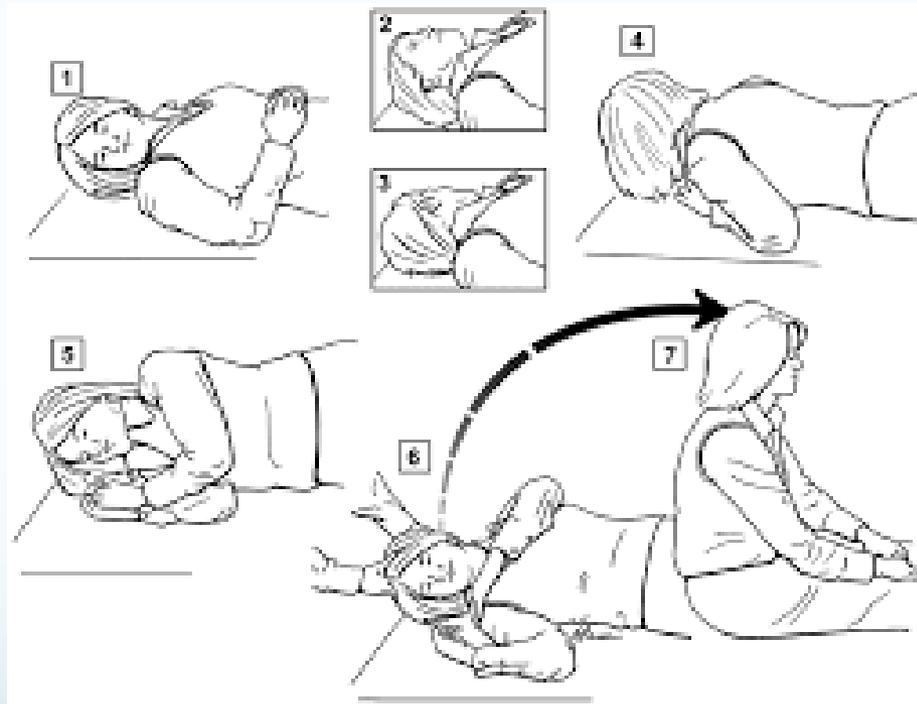
Habituation/Treatment of anterior SCCBPPV

# BBQ Roll

- Used to treat Horizontal canal BPV
- Both geotropic and ageotropic
  - Less common than Ant/Post canal BPPV
  - More severe symptoms of nausea and vertigo



# Bar-B-Que Roll



Horizontal SCC BPPV Canalithiasis

# Gaze Stabilization

- Exercises are used to improve gaze stabilization when the head is still and in motion
- Saccadic and smooth-pursuit tracking exercises are performed initially if the patient has dizziness during these eye movements
- XI Viewing exercise: The patient is asked to keep the gaze fixed on a central target “B” while moving the head either horizontally or vertically for a progressively longer period of time
  - Start with 1 minute and progress as tolerated
- Finally patients are given exercises to improve visual modulation of vestibulo-ocular responses
- Patient performs exercises in supported sitting then progresses to performing them while standing and walking



# Habituation Exercises

Exercises that are used to diminish dizziness in patients who have movement-provoked symptoms of vertigo

- Repeated, large amplitude head rotation
- Sit to side, lying to sit
- Rolling over in bed
- Sitting trunk flexion and extension
- Rapid, whole body rotation

Habituation exercises involve repeating the movements that provoke vertigo between 5 and 10 times, two to three times a day

- Initially done in sitting and can be progressed to standing

With improvement there should be an increase in intensity to bring on the same degree of symptoms. Symptoms should start to decrease within 4 weeks



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# Dynamic Balance Training

Wide and  
Narrow base  
of support on  
varied  
surfaces

Having patient  
turn head in  
horizontal and  
vertical planes  
while walking

Tossing a ball  
to patient while  
walking on  
stable and  
dynamic  
surfaces

Gait exercises  
on unstable  
surfaces

Rotational  
activities



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# Coordination Exercises / Sports

## Specific Drills



# Manual Therapy

- Manual therapy to the cervical spine
  - cranio-sacral
  - Joint mobilization (upper C-spine and Cervico-thoracic junction)
  - Soft tissue mobilization/Muscle energy technique
  - Postural corrections
  - Cervical kinesthetic sense
    - Following a moving target with active head movements
    - Maintaining gaze on a fixed target with active head movements while trunk is moved passively
  - Cervical muscle strength and endurance
  - Manual Traction



# Progression of TBI Patients Through Vestibular Therapy

Constant monitoring of symptoms allowing for frequent rest periods or termination of treatment as appropriate for safety

Appropriate guarding and supervision due to fall risk

Progressing through the stages of exercise more slowly because the multiplicity of the patient's problems

Eventual progression for individuals to return to normal activity

- In an athletic sense make sure the athlete can return safely to regular practice (Return to Play Protocol)
- Coordination with physician to clear patient for return to normal activity



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# Considerations for Patients with TBI

## Musculoskeletal Involvement

- May limit type of exercise a patient can perform
- Vestibular rehabilitation exercises may need to be modified or postponed

BPPV should be ruled out on all patients

Confusion and decreased processing need to be considered

## Cognitive Impairments

- Memory issues may interfere with HEP and/or compliance with exercises



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# Vestibular Function Recovery Rates

UVL (Unilateral Vestibular Loss): 6-8 weeks

BPPV: Remission in one/few treatments

BVL (Bilateral Vestibular Loss): 6 months- 2 years

CNS Lesion: 6 months-2 years

Typical time course for recovery for patients with TBI requires one to three times longer than in patients with vestibular disorders from other causes

Recovery depends on extent of injury and course of treatment

# Prescription

## Individualized vestibular rehabilitation program

- Outpatient, 2-3 times/week for 4-6 weeks or longer depending on symptoms
- HEP
  - 5 minutes, 3X/day
  - Patient compliance with HEP will decrease time needed for recovery
- Walking program
- Exercise graduated for possible increase of symptoms during first 2 weeks



Think**SMART!**<sup>™</sup>

Thank You

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