

VESTIBULAR HEALTH

Dizziness, Vertigo and Imbalance Symptoms after Concussion

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CANADIAN CONCUSSION CENTRE
Research | Diagnosis | Solutions

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University of Toronto UHN

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Outline


- Understand vestibular symptoms after concussions
 1. Dizziness
 2. Vertigo
 3. Imbalance
- Review anatomy of the vestibular system
- Review causes of vestibular problems
- Vestibular assessments
- Vestibular treatments
- Recovery patterns and tips

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UHN

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Dizziness after concussion



up to
80%

#2 Symptom
(#1 is headache)


(Maskell, 2006; Terrio, 2009; Kontos, 2012; Ellis, 2015; Nacci 2011; Lau 2011; Meehan 2010)

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Dizziness after concussion



up to
80%

Linked to protracted recovery

(Maskell, 2006; Terrio, 2009; Kontos, 2012; Ellis, 2015; Nacci 2011; Lau 2011; Meehan 2010)

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Dizziness

= NOT A DIAGNOSIS

= Symptom: non-specific

- Lightheaded
- Rocking
- Swaying
- Floaty
- Off balance
- Foggy
- Woozy
- Spinning

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Vertigo

= NOT A DIAGNOSIS

= illusion of movement of self or surroundings

- Spinning
- Rotation
- Dropping
- Tilting
- Pushed or Pulled

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History - dizziness & vertigo

STEP 1: DESCRIPTION

- Important to differentiate between dizziness and vertigo

STEP 2: TIMING

- Does the vertigo or dizziness last seconds?
- Minutes?
- Hours?
- Continuous?

STEP 3: TRIGGERS

- Spontaneous
- Triggered by head movements?
- Body movements?
- Motion in the environment?
- Screens?

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History - dizziness & vertigo

STEP 4: ASSOCIATED FEATURES

- Hearing loss
- Tinnitus
- Sense of Pressure or Fullness
- Nausea
- Vomiting
- Headache
- Visual disturbances- blurred vision, double vision, bouncing vision
- Imbalance

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Imbalance

= unsteadiness or disequilibrium

- Unstable when standing
- "Feel like I'm drunk"
- Associated with spatial disorientation
- Unstable when walking

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History - balance symptoms

STEP 1: DESCRIPTION

- Describe the imbalance

STEP 2: TIMING

- Episodic?
- Continuous?

STEP 3: TRIGGERS

- Related to movement? Better with rest or staying still?
- Effect of darkness or closing eyes
- Effect of head movement
- Effect of uneven ground
- Busy environments? Worse in grocery stores or malls

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Common causes of dizziness, vertigo & imbalance



Inner Ear
(peripheral vestibular)



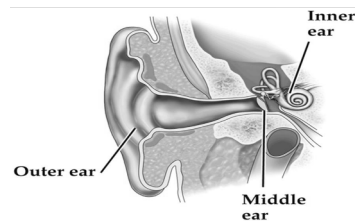
Brain
(central vestibular)

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Inner ear (peripheral vestibular)



Balance organs:

Deep in the ear, encased in temporal bone
Inner ear is vulnerable to injury

Semi circular canals

- 3 canals oriented at 90 degrees to each other: lateral, posterior and anterior
- Fluid in the canal moves in response to rotational movements of the head

Otolith Organs

- Sense gravity and linear acceleration
- Utricle and Saccule

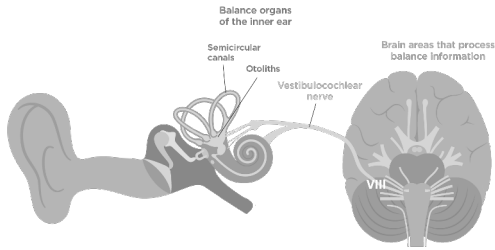
NEUROSCIENCE 1st Edition, Figure 13.3 (Part 3)
© 2012 Saunders, an imprint of Elsevier Inc.

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Brain (central vestibular)

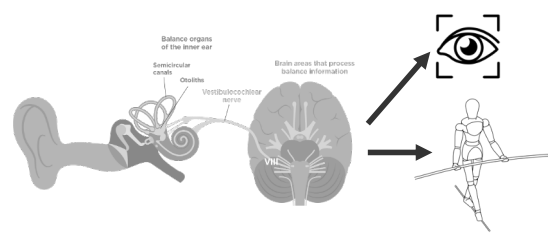


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Vestibular outputs



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Functions of the vestibular system

- Gaze stability
- Maintaining posture & balance
- Spatial orientation
- Prevent us from feeling dizzy!

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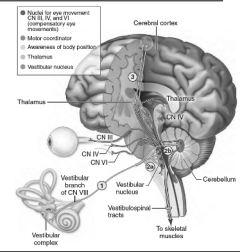
Vestibular problems after concussion

Brain can receive abnormal signals regarding spatial orientation (position and movement of the head) from the inner ear or nerve

OR...

Brain may not process the information coming from the ear properly

If information is inaccurate, asymmetric, or it is processed as inaccurate - then the output is inaccurate = SYMPTOMS (dizziness, vertigo, imbalance, visual symptoms)



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Common vestibular causes of dizziness

- Benign Paroxysmal Positional Vertigo (BPPV)
- Visual-vestibular/sensory mismatches
- Vestibular hypofunction
- Vestibular Migraine
- Temporal bone fracture
- Labyrinthine concussion
- Post traumatic Meniere's Disease
- Utricular or saccular injury
- Post-traumatic endolymphatic hydrops
- Perilymphatic fistula
- Superior canal dehiscence

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BPPV

- Benign Paroxysmal Positional Vertigo
- The most common cause of vertigo
- Under age 50, the most common cause is head injury

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BPPV symptoms

Vertigo lasting ≤ 60 sec, recurrent

Triggered by changes in head position relative to gravity

- Lying down
- Turning in bed
- Bending forward
- Looking up

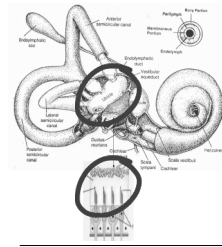
Often with nausea, vomiting and imbalance

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BPPV



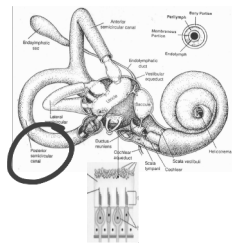
- Utricle has small crystals sitting on the hair cells - normal part of the anatomy
- Can get dislodged due to a concussive or deceleration force
- Migrate into semi circular canals

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BPPV



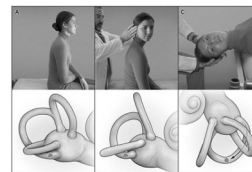
- Head movements cause crystals to move
- Sends false signals to the brain
- Triggers the VOR - vertigo (nystagmus)
- Triggers the VSR - imbalance
- May occur immediately or can take 3-4 weeks to appear

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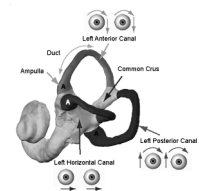


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Assessment for BPPV: Dix Hallpike



CARDINAL SIGN BPPV = NYSTAGMUS



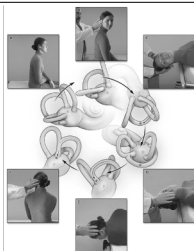
(Kim et al. 2014; Picture courtesy of GM Halmagyi/M Welgampola/H MacDougall)

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Treatment for BPPV



- Epley maneuver
- Canalith or particle repositioning maneuver

(Kim et al. 2014)

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BPPV treatment is effective

Clinical Practice Guideline: Benign Paroxysmal Positional Vertigo (Update)

Nail Bhattacharyya, MD¹, Samuel R Guletskiy, MD², Scott A Schwartz, MD, MPH³, Jonathan A. Edlow, MD⁴, Rebecca B. Kadish, MD⁵, Terry Fife, MD⁶, James M. Rubinberg, PT, DPT, NCS⁷, Kathryn Mahoney⁸, Dennis R. Halmagyi, MD, PhD, PhD⁹, Richard R. Rasmussen, PhD¹⁰, Michael D. Sullivan, MD¹¹, Robert W. Prasad Seltzer, MD, PhD¹², Barry T. Furlow, MD¹³, Courtney C. J. Walker, MD, PhD¹⁴, Richard W. Wagenvoort, MD¹⁵, and Maureen D. Corrigan¹⁶

Strong Evidence to support diagnostic assessments & treatment maneuvers

80-90% success rate within 1-3 treatments

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Post-traumatic BPPV

BPPV due to head injury is often **more complex & difficult to treat**

- 67% require multiple treatments (vs. 14% idiopathic)
- 25% bilateral (vs. 2% idiopathic)
- 3x more likely to be in multiple canals
- 57% had recurrence (vs. 19% idiopathic in 22 month f/u)

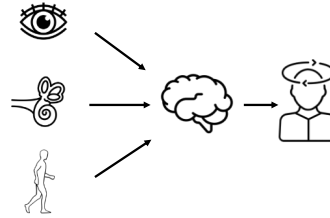
(Gordon, 2004; Liu H, 2012)

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Sensory Mismatches



After a concussion brain often relies more on visual cues for balance (Lehmann, 1990)

Remove visual cues and patients post-concussion often have a hard time balancing (Guskiewicz, 2001)

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Persistent Postural Perceptual Dizziness

Diagnostic Criteria

- Nearly constant (non-spinning) dizziness
 - Floating, swaying, rocking, unsteadiness
- Present on most days for at least 3 months
- Worse with upright posture, active or passive motion
- Dizzy with exposure to moving visual stimuli or complex visual patterns

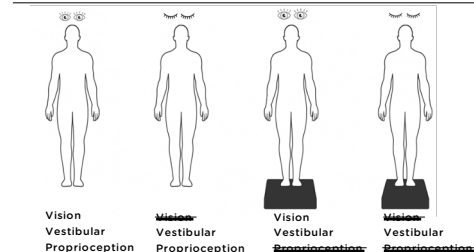
(Classification of Vestibular Disorders Bárány Society, J Vestib Res. 2017)

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Assessment: Posturography/Balance Testing

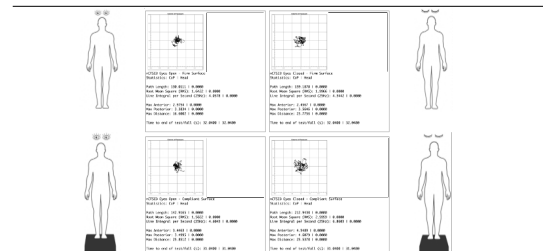


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Assessment profile: Normal

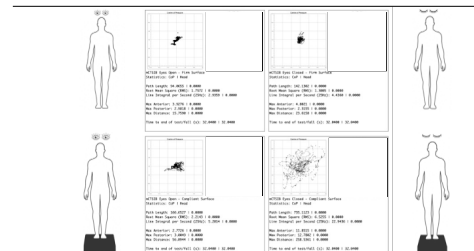


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Assessment profile: Vestibular weakness

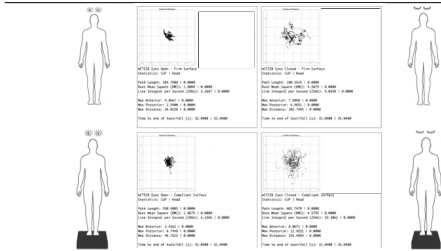


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Assessment profile: Vision dependency

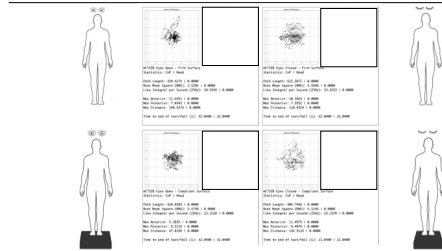


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Assessment profile: Central processing



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Treatment - sensory re-weighting

Figure out what system is not working or overworking and correct it!

- Normalize vestibular inputs
- Relearn how to use of vestibular inputs
- Reduce dependence on vision
- Improve use of proprioception

Once this is achieved, most patients are no longer DIZZY!

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What does vestibular therapy involve?

Comprehensive assessment

- Thorough history
- Clinical tests of inner ear & central vestibular function
- Evaluate balance with posturography and walking tests
- Establish a diagnosis

Treat!

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What does vestibular therapy involve?

Treatment is guided by assessment & your goals

- Individualized and targeted
- Train your brain to recalibrate how it interprets vestibular signals - driven by movement
- Active and exercise based
- Focused on meaningful activities
- Home exercise program



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Treatment: Aerobic exercise

Walking x 20-30 min - BRISK!

Gradually increase time and intensity

Aim to not let dizziness increase more than 3 points from baseline

Benefits:

- Facilitate vestibular stimulation
- Allow the brain to compare vision, vestibular & proprioceptive inputs
- Increase BDNF → helps neuroplasticity/rewiring
- Builds activity tolerance
- Reduce anxiety & improve mood

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Treatment: Other exercises

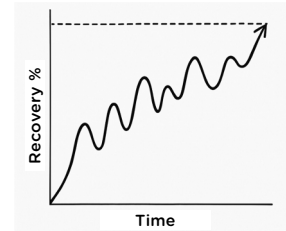
1. Repositioning maneuvers for BPPV
2. Balance Exercises
 - ❖ **Vision dependent** - exercises with eyes closed
 - ❖ **Vestibular deficient** - specific exercises to improve vestibular function (involve head and eye movement training)
 - ❖ **Improve proprioception**
3. Walking exercises to stimulate vestibular system
 - ❖ **Includes head movements**
4. Vestibular ocular reflex exercises if gaze stability is affected
5. Habituation exercises to reduce brain sensitivity to movement

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Recovery Profile - not linear!

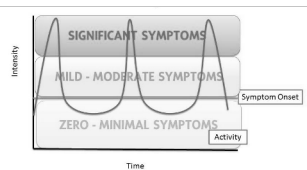


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Pacing with Dizziness



AVOID THIS!

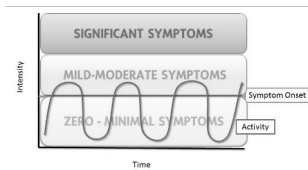
(Source: Parkwood Hospital)

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Pacing with Dizziness



DE-ESCALATE

Close eyes
Grounding
Breathing
Cognitive reframing
Distraction

(Source: Parkwood Hospital)

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What to do if you have dizziness

- Consider ENT consultation or a multidisciplinary clinic that specializes in dizziness
- Consider assessment with a vestibular rehabilitation physiotherapist
- Treatment is best with a team approach

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Take home messages

Dizziness is a common symptom after concussions and is often accompanied by balance impairments and visual symptoms

Initial presentation of dizziness is an important clinical finding and should be evaluated further with vestibular and balance testing

Benign Paroxysmal Positional Vertigo is the most common inner ear disorder and responds well to treatment

There is hope - Dizziness, Vertigo and Imbalance can improve!

Speak to your doctor if you have dizziness or contact us for a short phone consultation to see if Vestibular Physiotherapy is right for your symptoms.

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Thank you!



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