INDIANA TOTAL THERAPY

"World Class Rehabilitation Care"

Vestibular Physical Therapy and Concussion Management

Indiana Total Therapy WEST

Jamie L. Chichy, DPT

Introduction

- *80% of those diagnosed with a concussion have symptoms that resolve within the first three weeks*
- *Common symptoms of post-concussion syndrome include headaches, blurry vision, dizziness, noise and light sensitivity, balance impairments as well as difficulty with memory and concentrating*
- *Symptoms of dizziness and vertigo occur in up to 75% of mild TBI/Concussions*
- *Etiology of dizziness in concussions impacting the vestibular system include:*
  - *BPPV*
  - *Labyrinth concussion*
  - *Perilymphatic fistula*
  - *Temporal bone fracture*
- *Vestibular dysfunctions contribute to dizziness and imbalance and can also contribute to headache symptoms in those with concussion*

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Course Objectives

1). Demonstrate a knowledge of vestibular system anatomy

2). Demonstrate an understanding of a bedside exam to assist in identifying peripheral vestibular dysfunctions.

3). Demonstrate an understanding of Dix Hallpike and Roll tests.

4). Demonstrate an understanding of treatment options for treatment of BPPV and peripheral vestibular dysfunctions.

5). Demonstrate an understanding of the Zurich Protocol

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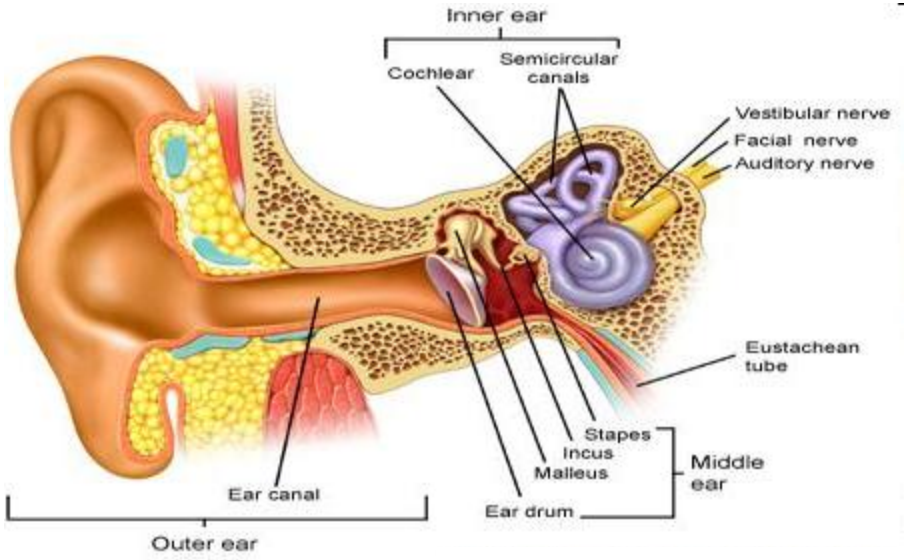
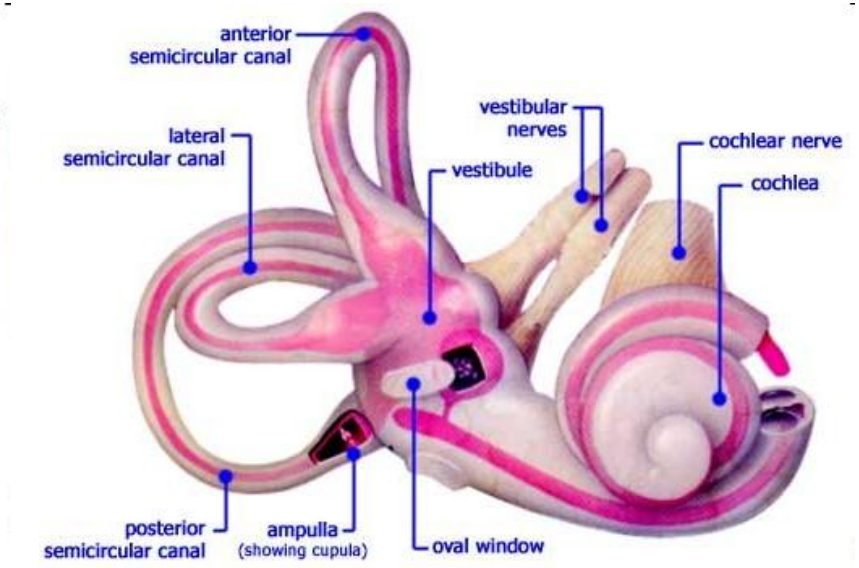
Anatomy of the Inner Ear



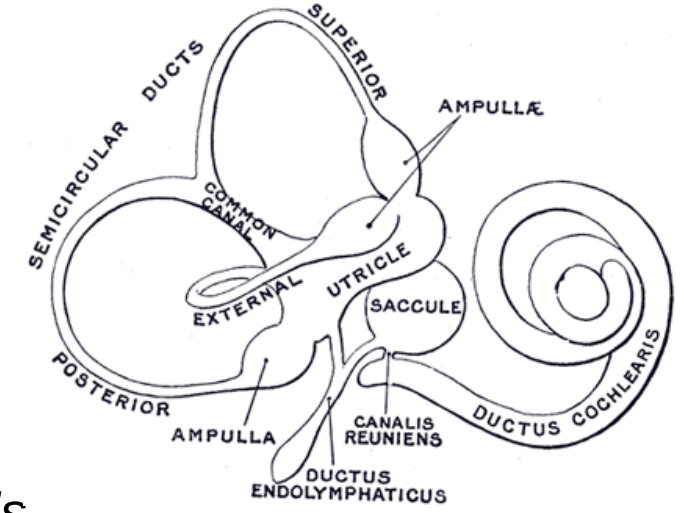


Functions of the Vestibular System

- *Detects linear and angular motion*
- *Postural stability*
  - *coordinate head, eye and trunk movements*
- *Gaze stability*
  - *Limit slippage of images during head movement*

Linear Acceleration

- *Utricle*
  - *Horizontal motion*
- *Saccule*
  - *Vertical motion*
- *Both contain otoconia*
  - *Calcium carbonate crystals*



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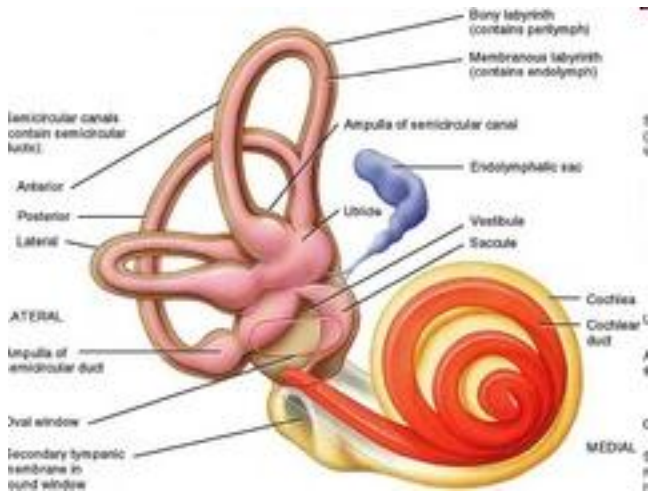
Angular Acceleration

- *Three semicircular canals*
  - *Anterior*
  - *Posterior*
  - *Horizontal*
- *Two in vertical plane*
- *Once in horizontal plane*
- *Contain endolymph*



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What is a Peripheral Vestibular Dysfunction?

- *Abnormal input from the vestibular labyrinth or nerve*
- *Unilateral or asymmetric input from one inner ear as compared to contralateral side results in asymmetric neural activity*
- *Horizontal nystagmus*

http://www.youtube.com/watch?v=TlZKRS5r3wE

- ***Asymmetry is interpreted as vertigo***

Central Causes of Vertigo

- *Central injury (brainstem, cerebellum, thalamus)*
- *Nystagmus is usually vertical*
  - *Not suppressed by visual fixation*
  - *Vertical nystagmus*

http://www.youtube.com/watch?v=q-N1G9BehcM

Dizziness and Concussion

- *Complaint in 75% of individuals with mild TBI/Concussion*
- *Vertigo*
  - *Peripheral Vestibular Dysfunctions*
    - *Labyrinth concussion*
    - *Temporal bone fracture*
    - *Perilymphatic fistula*
    - *Benign Paroxysmal Positional Vertigo (BPPV)*

Labyrinth Concussion

- *Membranous structures are concussed during injury*
- *No structural pathology*
- *Results in a vestibular hypofunction of involved inner ear*
- *Causes dizziness and vertigo*

Temporal Bone Fracture

- *Vestibular and auditory symptoms*
- *Damage to the vestibular labyrinth causes dizziness and vertigo*
- *May have associated tear of the tympanic membrane (ear drum), sensorineural hearing loss, and/or facial nerve injury*

Perilymphatic Fistula

- *Rupture of the round or oval windows that separate the middle and inner ear*
- *Symptoms fluctuate with valsalva*
- *Presents with vertigo*
- *Diagnosis by surgical exploration*

Benign Paroxysmal Positional Vertigo (BPPV)

- *Otoconia are displaced from vestibule*
- *90% in posterior semicircular canal*
- *Symptoms include vertigo and ataxia lasting only seconds to minutes*
- *Mixed vertical and torsional component to the nystagmus*

http://www.youtube.com/watch?v=siL3MTNUIQI

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Vestibular Evaluation to Identify a Peripheral Vestibular Dysfunction

- *ModCTSIB*
- *Romberg and Sharpened Romberg*
- *Fukuda Step Test*
- *Gaze Stabilization Assessment*
  - *With/without fixation (Frenzel Lenses)*
- *Positional Testing*

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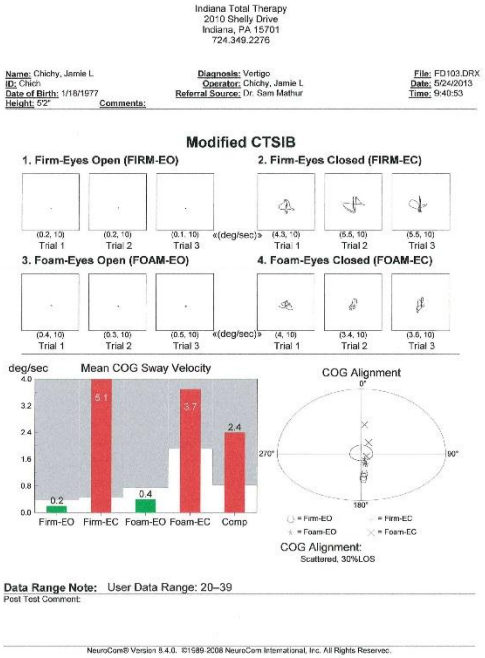
ModCTSIB

Modified Computerized Testing Sensory Integration and Balance



Indiana Total Therapy
2010 Shelly Drive
Indiana, PA 15701
724.349.2276

Name: Chichy, Jamie L.
ID: Chich
Date of Birth: 1/18/1977
Height: 5'2"
Comments:

Diagnosis: Vertigo
Operator: Chichy, Jamie L
Referral Source: Dr. Sam Mathur

File: FD103.DRX
Date: 5/24/2013
Time: 9:40:53

Modified CTSIB

1. Firm-Eyes Open (FIRM-EO)
2. Firm-Eyes Closed (FIRM-EC)
3. Foam-Eyes Open (FOAM-EO)
4. Foam-Eyes Closed (FOAM-EC)

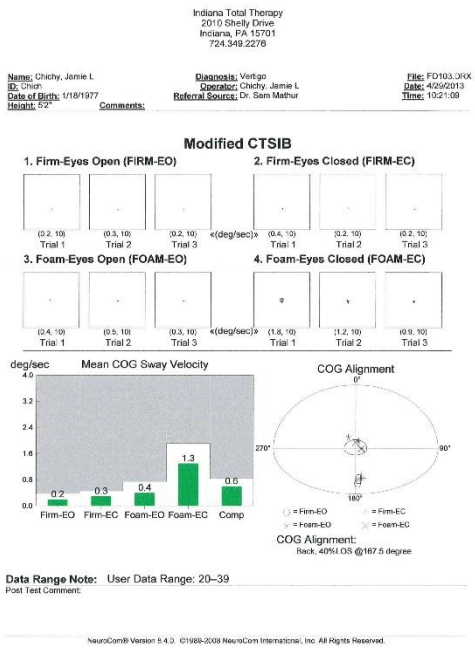
deg/sec Mean COG Sway Velocity

Firm-EO Firm-EC Foam-EO Foam-EC Comp

COG Alignment

COG Alignment:
Scattered, 30%LOS

Data Range Note: User Data Range: 20–39
Post Test Comment:



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Name: Chichy, Jamie L.
ID: Chich
Date of Birth: 1/18/1977
Height: 5'2"
Comments:

Diagnosis: Vertigo
Operator: Chichy, Jamie L
Referral Source: Dr. Sam Mathur

File: FD103.DRX
Date: 4/29/2013
Time: 10:21:09

Modified CTSIB

1. Firm-Eyes Open (FIRM-EO)
2. Firm-Eyes Closed (FIRM-EC)
3. Foam-Eyes Open (FOAM-EO)
4. Foam-Eyes Closed (FOAM-EC)

deg/sec Mean COG Sway Velocity

Firm-EO Firm-EC Foam-EO Foam-EC Comp

COG Alignment

COG Alignment:
Back, 40%LOS @167.5 degree

Data Range Note: User Data Range: 20–39
Post Test Comment:

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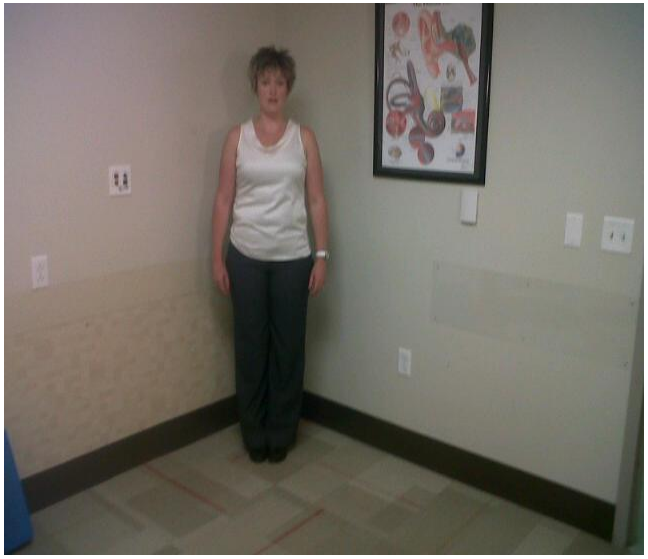
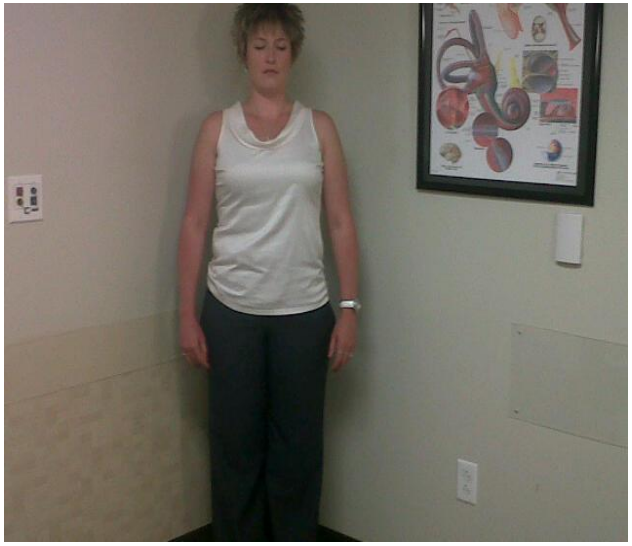
Romberg

The exam is based on the premise that a person requires at least two of the three following senses to maintain balance while standing: proprioception (the ability to know one's body in space); vestibular function (the ability to know one's head position in space); and vision (which can be used to monitor [and adjust for] changes in body position).





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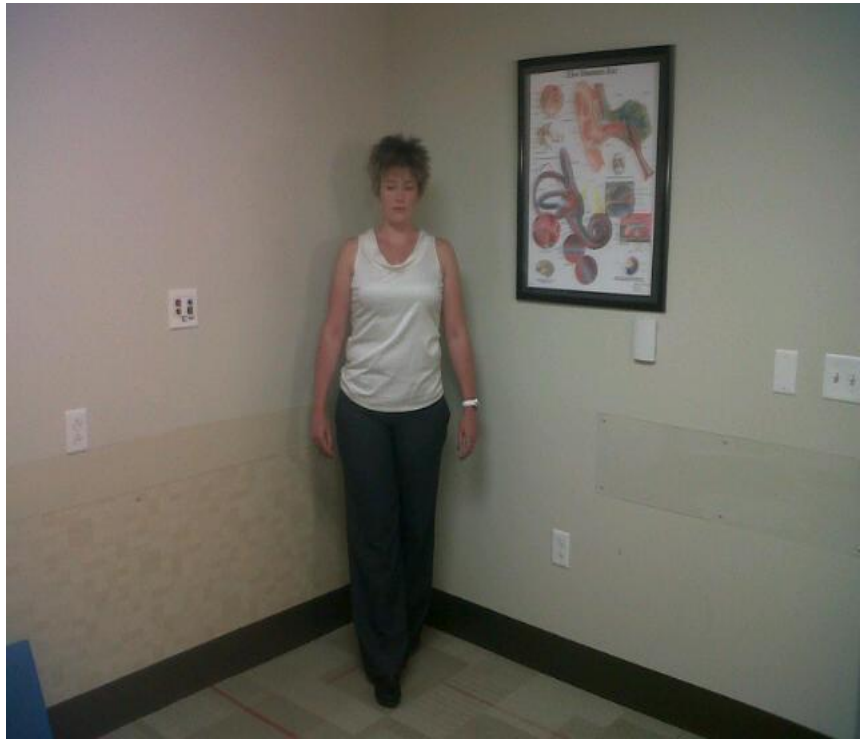
Sharpened Romberg



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Fukuda Step Test

A vestibulospinal test to measure asymmetrical labyrinth function. Patient with vestibular weakness will rotate to the side of the weak labyrinth 45 degrees of more.

http://youtu.be/atXCNq_CgHk

Gaze Stabilization

- ***Spontaneous Nystagmus***
  - ***fixation present and suppressed***
- ***Smooth Pursuit***
- ***Convergence***
- ***Saccades***
- ***Cranial Nerve Assessment (III, IV, VI)***
- ***Dynamic Visual Acuity***
  - ***This test can be used to sort out patients with bilateral vestibular weakness. With this test, a patient is asked to read the lowest line possible on the Snellen eye chart to establish a baseline visual acuity. This is followed by asking the patient to do the same task while rotating the head back and forth at a rate of 1-2Hz. Loss of one line is considered normal, whereas loss of 2-3 lines suggests vestibular weakness. This test should be abnormal in patients with bilateral weakness.***

Gaze Stabilization Continued

- ***VOR Head Thrust***
  - ***This test is used to evaluate for unilateral vestibular function. In this test, the patient's head is turned 15-30 degrees from center and then rapidly rotated to the other side with the patient focusing on the examiner's eyes or nose. Patients with unilateral vestibular weakness will have a catch-up saccade when rotated rapidly to the side of the lesion.***
  - ***http://youtu.be/BmNCEhN61gM***
- ***VOR Cancellation***
  - ***The VOR is essential in maintaining stable vision on a target when the head is moving but the brain requires a way to suppress the VOR with combined head-eye tracking (such as visually pursueing a moving object). VOR cancellation is managed by the vestibulocerebellum. An abnormal response would be for the patient to make repetitive refixations (jerking nystagmus) during the middle of each rotation pass.***
  - ***http://youtu.be/D5AVkyQzZ58***
- ***Post Horizontal Head Shaking***
  - ***This test is performed to evaluate asymmetry in the vestibular ocular reflex. The patient is instructed to tilt his or her head down 30 degrees to allow maximal stimulation of the horizontal canals. The head is moved back and forth quickly for approximately 30 seconds. Immediately following cessation of movement, the eyes are opened and observed for nystagmus. Patients with unilateral vestibular dysfunction will have unopposed stimulation of the intact labyrinth which results in a slow phase to the side of the lesion and rapid nystagmus to the intact side. This response is brief. No nystagmus is expected in normal subjects. The prescense of head shake nystagmus correlates with peripheral vestibular dysfunction and has been indentified in those with cerebellar dysfunction, however those with cerebellar dysfunction will have a vertical component to the nystagmus.***
  - ***http://youtu.be/Wh4swhhDizg***

Gaze Stabilization Continued

- ***Valsalva***
  - ***The valsalva maneuver can induce nystagmus in patients with Arnold-Chiari malformation, perilymphatic fistula or superior semicircular canal dehiscense.***

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Position Testing

- ***Dix-Hallpike***
  - ***http://youtu.be/kEM9p4EX1jk***
- ***Roll Test***
  - ***http://youtu.be/JaDtDt7Ruz8***

Treatment

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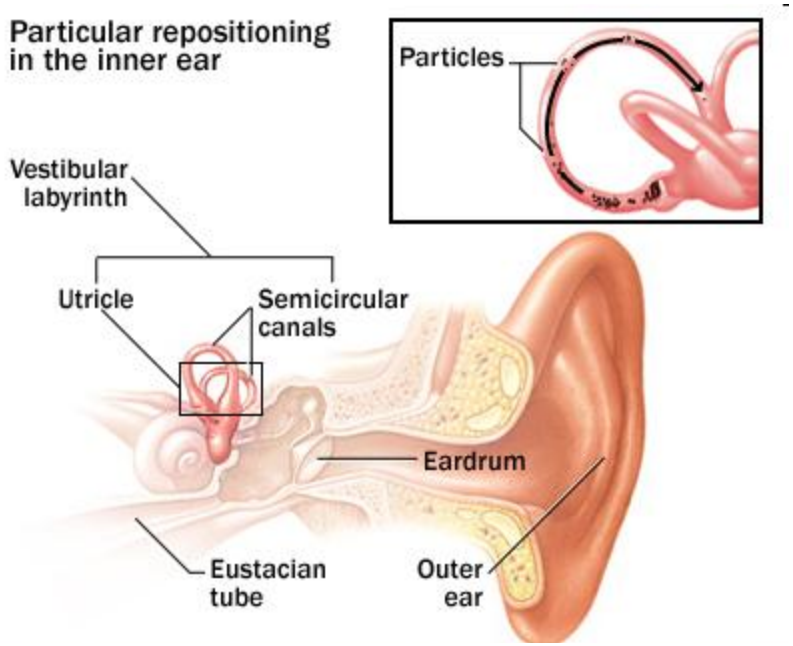
Vestibular and Balance Rehabilitation

BPPV



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Vestibular and Balance Rehabilitation

BPPV

- ***BPPV Posterior/Anterior Canal***
  - ***Canalith Repositioning Maneuver (CRM/Epley)***
  - ***http://www.youtube.com/watch?v=ZqokxZRbJfw***
- ***BPPV Horizontal Canal***
  - ***http://youtu.be/nkBoOCBmOXE***

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Vestibular and Balance Rehabilitation In Concussion Management

- ***Peripheral Vestibular Dysfunction***
  - ***Labyrinth concussion***
  - ***Temporal bone fracture***
  - ***Perilymphatic fistula***

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Vestibular and Balance Rehabilitation In Concussion Management

- ***Adaptation and Habituation Exercises***
- ***Gaze Stability Exercises***
  - ***VOR 1 and 2***
  - ***Saccade exercises***
- ***Dual Task Exercises***
- ***Convergence exercises***

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Vestibular and Balance Rehabilitation In Concussion Management

- ***Balance Exercises***
  - ***Static***
  - ***Dynamic***
  - ***Vary visual and proprioceptive input***

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Zurich Protocol

- ***Patient symptom free to enable progression to Phase II***
- ***Symptoms and vitals monitored during progression***
  - ***Symptom recurrence results in patient returning to physical and cognitive rest and remaining symptom free for 24 hours before progressing Zurich***

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Zurich Protocol

	Rehabilitation Stage	Functional Exercise	Stage Objective
1	No activity	Physical and cognitive rest	Recovery
2	Light aerobic exercise	Walking, swimming, or stationary cycling, keeping intensity to 70% max predicted HR, no resistance training	Increase heart rate
3	Sport specific exercise	Skating drills in ice hockey, running drills in soccer, no head impact activities	Add movement
4	Non-contact training drills	Progression to more complex training drills, i.e., passing drills in football and ice hockey, may start progressive resistance training	Exercise, coordination, and cognitive load
5	Full contact practice	Following medical clearance, participate in normal training activities	Restore athlete's confidence, coaches assess functional skills
6	Return to play	Normal game play	ONLY WITH MEDICAL CLEARANCE

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Thank you!

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Questions?