

**Concussion Management for the Physical Therapist and Physical Therapist Assistant**

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**Case Study 1:**  
 16 y.o. Female, Elite Soccer Player; oldest of 6 children, 7<sup>th</sup> concussion

- Out of school for 12 weeks and counting...Behind on school work
- Can't stand being around kids... has 5 siblings
- ▼ Can't drive because of post-concussion symptoms
- Multiple headaches, if not a constant headache during the day
- Has been advised to discontinue playing soccer

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**Case Study 2:**  
 15 y.o. male, Offensive Tackle/HWT Wrestler; 1<sup>st</sup> concussion

- In school full time now, but having a headache 2-3x per week
- Notices neck pain during the day, worse with looking to the left
- ▼ Doesn't feel like his balance is as good as it should be/or was

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**Post-concussive Syndrome (PCS):**

The diagnosis is determined based on symptoms developed within the initial 4 weeks after the concussion

The patient/athlete will be monitored for the following 8 symptoms:

- Headache
- Dizziness
- Fatigue
- ▼ Irritability
- Impaired sleep
- Impaired concentration
- Impaired memory
- Impaired tolerance for stress/emotional situations

If the patient/athlete exhibits 3 or more symptoms they will be diagnosed with PCS

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**Post-concussive Syndrome (PCS):**

Risk factors associated with a longer recovery:

- Prior history of concussion
- Female sex
- Collegiate vs High School Athlete
- ▼ Post-traumatic migraine
- History of psychiatric disorders or learning disability
- Dizziness on field
- Cognitive deficits in the first few days

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**Clinical Examination:**

Symptom Reporting Questionnaires:

- Riverhead Post-Concussion Symptoms Questionnaire
- Post-Concussion Symptom Scale
- ▼ Graded Symptom Checklist
- British Columbia Postconcussion Symptom Inventory

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**Clinical Examination: Overview**

Three main screening components involved:

- Cervical spine
- ▼ • Vestibular system
- Oculomotor/Visual system

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**Clinical Treatment: Overview**

Highly irritable/symptomatic

- Cervical spine
- ▼ • Vestibular
- Oculomotor
- Cervicogenic Headaches

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**Clinical Treatment: Overview**

Low irritability/asymptomatic

- Return to play progression
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### Clinical Examination: Red Flags

Screen for indicators that would require further medical work-up prior to physical therapy intervention

- Cervical instability/fracture
- Neurological signs and symptoms beyond what is expected:
  - Spasticity
  - ▼ • Ataxia
  - Cranial nerve involvement
  - Weakness
  - Sensory changes
- Seizures (after the acute stage)

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### Clinical Examination: Red Flags (Continued)

Screen for indicators that would require further medical work-up prior to physical therapy intervention

- Prolonged loss of consciousness
- Altered mental status (past the acute stage)
- Hypertension
- ▼ • Autonomic dysregulation
- "5 D's":
  - Dizziness, diplopia, dysphagia, dysarthria, drop attacks

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### Clinical Examination: Memory

- We aren't diagnosing the cognitive component
  - Awareness is of benefit to the clinician
  - Increases case for medical necessity
- ▼ • Can be easily incorporated:
  - What happened?
    - Compare their story to the story of MD, ATC, Parent
  - Who did you play last week?
  - Did you win? What was the score?

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**Clinical Examination: Cognition**

Orientation:

- What's today's date?
- Who's the president?
- What year is it?
- Etc...

▼ Immediate recall:

- Give them a list of words, have them repeat the words later when you are finished

Concentration:

- Count back from a certain number (i.e.: 55 by 3s)
- Months or alphabet in reverse order

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**Clinical Examination: Cervical Spine**

- Rule out upper cervical fracture
  - Do they need to go back for imaging?
  - Open Mouth x-ray???

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- Standard orthopedic cervical spine examination
- Headache evaluation
  - Is it cervicogenic or a central process???

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**Clinical Examination: Cervical Spine**

Upper Cervical Stress Tests:

- Transverse ligament
  - Sharp-Purser
    - Patient is seated, examiner is supporting the patient's head in slight flexion. Grasp C2 spinous process, apply counter force through the forehead

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- + is a clunk, or alleviation of quadrilateral paresthesia

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**Clinical Examination: Cervical Spine**

Upper Cervical Stress Tests:

- Transverse ligament



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**Clinical Examination: Cervical Spine**

Upper Cervical Stress Tests:

- Alar Ligament Stress Test
  - Sidebend should be coupled with immediate opposite movement of C2 spinous process.
  - Can screen in sitting, stress in supine
  - Patient in supine, lumbrical grip of C2, applying sidebend force while blocking C2. Should be none
  - Test in neutral, flexion, and extension
    - + in 2 of 3 can be considered a + test

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**Clinical Examination: Cervical Spine**

Upper Cervical Stress Tests:

- Alar Ligament Stress Test



Neutral                      Flexion                      Extension

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**Clinical Examination: Cervical Spine**

- Jefferson Fracture test
- Burst fracture of C1
  - Patient is supine
  - Provide medial compression (sideglide) of C1 transverse process while stabilizing other side
  - + is movement or crepitus

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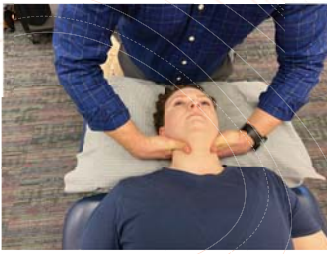
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**Clinical Examination: Cervical Spine**

- Jefferson Fracture test



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**Clinical Examination: Cervical Spine**

**Odontoid Fracture Stress Test (Dens fracture)**

- Sideglide of C1 on C2
  - Stabilize the left C2 transverse process and apply a medial force on the right C1 transverse process
  - + is an empty endfeel/no resistance or reproduction of symptoms
- Anterior glide of C2
  - Patient is supine
  - Stabilize C2 bilaterally posterior with PIPs, apply posterior glide on C1
  - + is an empty endfeel/no resistance or reproduction of symptoms

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### Clinical Examination: Cervical Spine

Odontoid Fracture Stress Test (Dens fracture)

Sideglide C1 on C2

Posterior glide C1 on C2

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### Clinical Examination: Cervicogenic Headache

- Cervicogenic headache (upper cervical spine)
  - "Cervicogenic headache is pain perceived in the head but referred from a primary source in the cervical spine. The physiologic basis for this pain is convergence between trigeminal (CN V) from the upper three cervical spinal nerves. The possible sources of cervicogenic headache lie in the structures innervated by the C1-C3 spinal nerves, including joints and C2-3 disc"

-Nikolai Bogduk MD, PhD, DSc, FAFRM

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### Clinical Examination: Cervicogenic Headache

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### Clinical Examination: Upper Cervical Spine

- Upper cervical differentiation
  - Flexion-Rotation Test:
    - Cervical spine is fully flexed to isolate movement to C1-C2 which can still rotate while in flexion
    - Normal range of motion in endrange flexion is 44°
    - In those that are experiencing headache there is an average loss of 17° to one side

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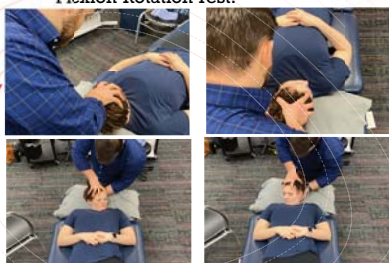
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### Clinical Examination: Upper Cervical Spine

- Upper cervical differentiation
  - Flexion-Rotation Test:




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### Clinical Examination: Upper Cervical Spine

- Upper cervical differentiation
  - C2-3 confirmation
  - Example: pain with right rotation
    - Passively sidebend to the right and re-assess R rotation, if gone think C2-3
    - If not gone think A-A or A-O joints
    - To further examine, side bend left, and rotate right, if pain think R C2-3 opening issue
      - i.e.: capsule strain
    - Still in left sidebend, rotate to the left, if pain think R C2-3 closing issue
      - i.e.: joint compression

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### Clinical Examination: Vestibular/Oculomotor

- Assessment is the same as Dr Umarvadia discussed
- ▼ • Deficits lead directly into treatment
- BPPV is a possibility, performing Dix-Hallpike can be an added beneficial assessment
  - Typically a complaint of "spinning" sensation

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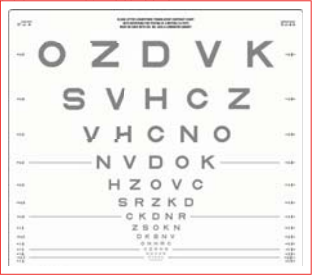
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Clinical Examination:  
Vestibular/Oculomotor

- Dynamic Visual Acuity
  - Differentiate between static and dynamic visual acuity
  - Need to be sitting 4 meters away
  - "Read the lowest line you can"
  - Passively flex the patient's head and shake at 1-2Hz oscillations
  - "Read the lowest line you can"
  - Normal is loss of 2 lines difference

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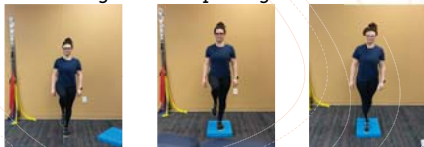
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### Clinical Examination: Balance Assessment

- Static balance on firm surface (eyes open/closed)
- Static balance on foam surface (eyes open/closed)
- Tandem balance (eyes open/closed)
- Dynamic Gait Index
- ▼ • Functional Gait Assessment
- Dual Cognitive Task paradigms




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### Return to Play

- Athletes should be immediately removed from play when concussion suspected
- No athlete should be permitted to return to play on the same day as suspected concussion
- Prior to return to sport, athletes should be symptom free and not taking symptom-modifying medications
- Prior to return to sport, athletes should participate in a graduated return-to-play protocol, after which normal functioning and no return of symptoms are confirmed

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### Return to Play

Graduated Return-to Play Protocol		
Step	Rehabilitation Stage	Objective of Stage
1	No activity	Recovery
2	Light aerobic exercise	Increased heart rate
3	Sport-specific exercise	Add movement
4	Non-contact training drills	Exercise, coordination, cognitive load
5	Full-contact practice	Restore athletes confidence, coaching staff assess functional skills
6	Return to play	

- 24 hours without symptoms to progress to the next step

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### Return to Play: Stage 1



- Highly irritable/symptomatic
- Treat:
    - Cervical spine
    - Vestibular
    - Oculomotor
    - Cervicogenic Headaches

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### Return to Play: Stage 2

- Target Heart Rate 30-40% of maximum exertion
  - $(\text{Max HR} - \text{Resting HR} \times .30) + \text{Resting HR}$
- Recommendations
  - Exercise in a quiet area (i.e. treatment room)
  - No impact activity
  - Limit head movement/position changes
  - Limit concentration/dual task activity
  - Light cardiovascular exercise 10-15 minutes

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### Return to Play: Stage 2

Example Balance Exercises:




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### Return to Play: Stage 3

- Target Heart Rate 40-60% of maximum exertion
  - $(\text{Max HR} - \text{Resting HR} \times .40) + \text{Resting HR}$
- Recommendations
  - Exercise in open gym area
  - Incorporate various exercise equipment
  - Allow some head movement/position changes
  - Moderate Balance activities
  - Low-level concentration/dual task activity
  - Light cardiovascular exercise 20-30 minutes

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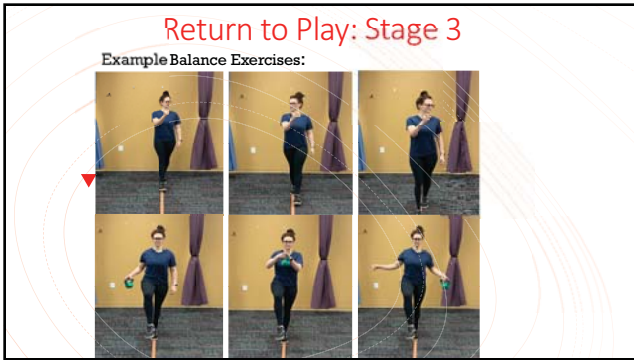
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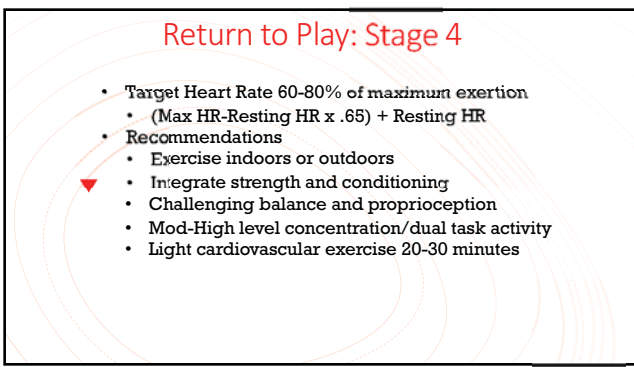
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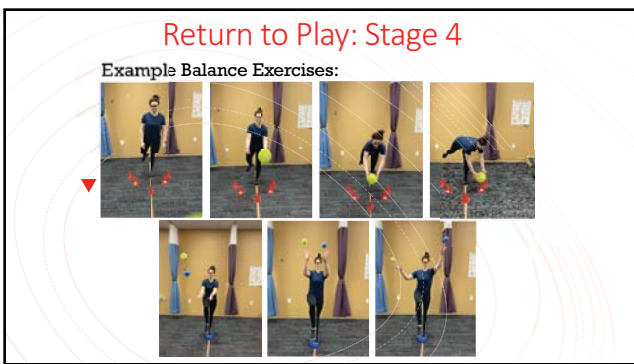
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### Return to Play: Stage 5 (sport performance)

- Target Heart Rate 80%+ of maximum exertion
  - $(\text{Max HR} - \text{Resting HR} \times .80) + \text{Resting HR}$
- Recommendations
  - Continue to avoid physical contact
  - ▼ • Aggressive strength training
  - Impact activities/plyometrics
  - Sport specific performance training
  - Graded treadmill testing

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### Return to Play: Stage 6 (sport performance)

- Full exertion
- Recommendations
  - Initiate physical contact (with MD clearance)
  - Continue aggressive strength and conditioning training
  - ▼ • Impact activities/plyometrics
  - Sport specific performance training
  - Practice and game intensity sport activity

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### Communication

- Medical team:
  - Sports med MD, Neuro MD, Psych, PT, ATC
- Family:
  - Convey importance of compliance without causing fear
- ▼ • Coaches/Agents (depending on athletic level)



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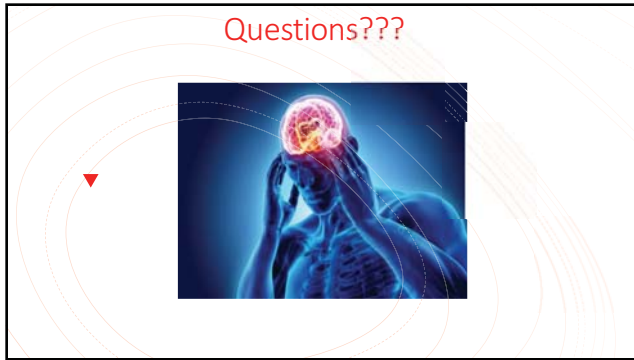
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