

## CONCUSSION CASE SCENARIO

### History and Interview

A 16-year-old male arrives to your physical therapy clinic with a diagnosis of concussion after falling while skiing 8 days ago. He is accompanied to the evaluation by his mother, who states that he hit a patch of ice and fell backwards, striking the posterior aspect of his head. He was wearing a helmet and denies a loss of consciousness. Ski patrol assisted with preliminary evaluation and the patient was taken to the local hospital where he underwent head and neck computed tomography, which were negative for brain bleed and fracture, respectively. Since the injury, the patient has been resting at home and has not returned to school. Currently, he complains of occipital and frontal headaches, neck stiffness, and eye strain. He reports his baseline headache is a 3/10 on the Numeric Pain Rating Scale (NPRS) and notes screen time >10 minutes increases his headache and eye strain to 6/10. The patient has no prior history of concussion and no notable previous medical or surgical history.

### Systems Review

The physical therapist determined the patient was appropriate for musculoskeletal evaluation as he had been examined by a physician and brain bleed and fracture were ruled out. The physical therapist also determined that screening of the neurological system (vestibulo-oculomotor function) was warranted due to patient's diagnosis and chief complaints.

### Tests and Measures

Evaluation of the cervical spine revealed active range of motion (ROM) measurements of 30° flexion with pain and tightness, 80° extension, 40° bilateral side bending with tightness, and 70° bilateral rotation with pain and tightness. Palpation revealed tenderness and hypertonicity in bilateral suboccipitals and paraspinals. The cervical flexion-rotation test was 45° bilaterally with pain. Joint mobility was normal throughout the cervical spine. DNF endurance test was 7 seconds. Vestibular/ocular-motor screening (VOMS) was notable for a 3-point increase in headache and 2-point increase in dizziness during smooth pursuits, horizontal saccades, and near point of convergence (NPC). NPC was measured at 8 cm. Dynamic visual acuity test (DVAT) was 1 line difference. The patient was able to perform single leg balance with eyes closed for >10 seconds and demonstrated no gait abnormality.

1. Which of the following pieces of information would increase the patient's risk of prolonged recovery from concussion (>30 days)?
  - a. Convergence insufficiency.
  - b. Male gender.
  - c. History of no prior concussion.
  - d. Symptoms of eye strain.

The correct answer is **a. Convergence insufficiency**. It is well established in the literature that NPC >5 cm significantly increases risk of prolonged recovery from concussion. Other options do not increase risk of prolonged recovery.

2. Which of the following impairment profiles is most applicable to the patient?
- Autonomic/exertional tolerance.
  - Cervical musculoskeletal.
  - Vestibulo-oculomotor.
  - b and c.

The correct answer is **d. b and c**. The patient fits both cervical musculoskeletal and vestibulo-oculomotor impairment profiles. Subjectively, he is complaining of neck stiffness, headache, and eye strain. Objectively, he presents with painful and limited cervical ROM, palpation abnormalities, and abnormal DNF endurance test, which implicates the cervical spine. The patient's oculomotor function is impaired, as he increased symptoms with smooth pursuits, horizontal saccades, and NPC and presents with convergence insufficiency. Vestibular function was unremarkable (no significant symptom increase on VOMS, negative DVAT, balance/gait normal).

### Prognosis and Plan of Care

Clinical examination and additional historical information confirmed both cervical musculoskeletal and vestibulo-oculomotor impairment profiles, and the patient is deemed appropriate for treatment with physical therapy interventions. The initial home program was provided based upon impairments observed during examination. The patient was instructed to perform the exercises 3x/day as tolerated for 1 week before following up in clinic. He presents with convergence insufficiency, which increases risk of prolonged recovery >30 days, but is overall at low risk for prolonged recovery and is therefore expected to fully recover in 4 to 5 weeks.

### Intervention

The patient's initial home exercise program included oculomotor exercises as well as self-soft tissue mobilization of the suboccipital muscles followed by chin tucks in the supine position. Patient education was provided regarding diagnosis and prognosis with an emphasis on performing activities of daily living to tolerance, allowing for a mild increase in symptoms (<3/10 NPRS) that decrease within 1 hour. Additionally, both the patient and his guardian were educated on a plan for gradual, symptom-limited resumption of physical activity.

2. At first follow-up, the patient demonstrates exertional intolerance. Which type of physical activity is most appropriate to address this?
- Aerobic exercise.
  - High-intensity interval training.
  - Sport-specific activity.
  - Weightlifting.

The correct answer is **a. Aerobic exercise**. It is well established in the literature that exertional intolerance post-concussion should be addressed with aerobic exercise, the parameters of which are prescribed based on performance on an objective exertion tolerance test, such as the Buffalo concussion treadmill test.

## Outcomes

The patient returned to the physical therapy clinic after 4 sessions of physical therapy over a 3-week period. He regularly performed the prescribed home exercise program and was compliant with all activity modification recommendations. He was reporting less frequent and less intense headaches and was able to tolerate >1 hour of screen time before needing to take a break. Additionally, he reported his neck pain and stiffness had resolved. The patient had been performing aerobic exercise daily without any subsequent increase in symptoms. His chief complaint was of fatigue at the end of the school day and after exercising.

2. The physical therapist provided the patient with education regarding fatigue with cognitive and physical activities post-concussion. Which of the following is most important for the physical therapist to emphasize?
  - a. Activity pacing.
  - b. Avoidance of all activities that cause fatigue.
  - c. Prioritizing physical activity over cognitive activity.
  - d. Pushing through symptoms.

The correct answer is **a. Activity pacing**. Activity pacing is recommended in the Clinical Practice Guidelines and all other high-level literature to facilitate successful resumption of normal physical and cognitive activities. Activity avoidance is now not recommended, and cognitive activity should be prioritized over physical activity, particularly in pediatric concussion. Pushing through symptoms aggressively is not encouraged.

## REFERENCES

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