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Management and Recovery in a 17-Year-Old Athlete with Post-Concussion Syndrome

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ABSTRACT: This case highlights some of the key clinical findings of a 17-year old male athlete who experienced a assessment and management of concussion, and subsequently post-concussion syndrome. This case study documents the initial physiotherapy assessment, as well as the follow-up treatments. It highlights the main challenges experienced by the patient, the short-term and long-term goals, the physiotherapy interventions, and the outcomes.

The patient's main concerns were balance difficulties and severe headaches, and he also developed some psychosocial issues, all of which were preventing him from returning to sport and completing school work. The initial assessment revealed decreased cervical range of motion, pain and increased tone on palpation of the musculature around the neck, decreased accessory movements of the cervical spine, impaired balance and impaired eye movements. Interventions were focused on patient education, increasing cervical range of motion, decreasing pain with movement, improving balance and eye movements, aerobic exercise and functional activities to promote return to sport. After 6 weeks of treatment, the patient made significant improvements in all measured outcomes including cervical range of motion, the Community Balance and Mobility Scale, and the Post-Concussion Symptoms Scale.

I. INTRODUCTION

This case study presents a 17-year old hockey player who sustained a assessment and management of concussion and has now been diagnosed with post-concussion syndrome. A concussion typically results in physical and cognitive symptoms that are relatively short-lived and tend to resolve spontaneously within 7-10 days. However, some people experience persistent concussion symptoms that last beyond the general time frame of recovery and can be diagnosed with post-concussion syndrome (PCS).^[1] This persistence of symptoms can last for months and sometimes years. Studies have suggested that 21-59% of pediatric patients (under the age of 18) who experience a concussion, will develop the long-lasting symptoms of post-concussion syndrome.^[2]

Persisting concussion symptoms can leave the athlete in a vulnerable state and increase the risk of a more debilitating injury if more trauma occurs before recovery is complete.^[3] Physiotherapists should be familiar with post-concussion syndrome and understand that it is important to ensure full recovery before considering a return to sport.

The purpose of this case study is to provide an example of how a patient may present with post-concussion syndrome, as well as possible interventions and outcome measures that may be used to track the recovery progress. It is important to note that there are many symptoms and clinical presentations of post-concussion syndrome, therefore intervention strategies will vary among patients according to their functional impairments, activity limitations and participation restrictions.

II. PATIENT CHARACTERISTICS

A 17-year old male suffered a traumatic brain injury during a hockey game when he collided with a player from the other team. The impact of the collision resulted in a direct blow to the front of his head and he immediately lost consciousness and fell to the ice. The loss of consciousness was brief and lasted about 2 minutes. Once he regained consciousness, he reported feeling dizzy and confused. He was taken by ambulance to the emergency department where he was assessed and diagnosed with a mild traumatic brain injury i.e. concussion. The next day, he felt increasingly dizzy, nauseous and complained of an intense headache.



Over the next few months he experienced relapses in his recovery. He reports losing his balance quite often and having constant headaches. He has also been experiencing depression and has trouble concentrating. His mother has noted that he has become quite irritable and will often lash out on his family for no reason. He has a history of concussion about 1 year ago, but with rest the symptoms resolved within a couple of weeks. It has now been 3 months since his injury and the onset of his concussion symptoms. He was reassessed by his family doctor and diagnosed with post-concussion syndrome (PCS). He was referred to physiotherapy to improve his concussion symptoms and help him return to his previous function.

III. EXAMINATION FINDINGS

Subjective

During the assessment with the physiotherapist, the patient reported headaches that worsened with neck movement and bright lights (3/10 and dull at rest going up to 8/10 and sharp on the Numeric Pain Rating Scale (NPRS) with movement/lights). Dizziness and issues with balance were also reported. The MRI taken at the hospital immediately after the initial injury showed no significant lesions or other issues. The patient experienced no amnesia however, now had difficulty to focus in school. Using a computer for more than ½ hour also caused headache, dizziness and some nausea. He stated that he was taking Tylenol as needed for his headaches, which decreased his pain to 5/10. He reported that doing required readings for school was more difficult and took much longer. The patient also noted that he was unmotivated and found it difficult to enjoy his favourite activities.

Previously the patient was a very active and athletic individual, practicing with his hockey team, as well as doing resistance training 5 times a week. His family mentioned that now he was spending most of his spare time just laying in bed and was more impatient than usual. The patient reported avoiding some activities as he was worried it would make the pain worse. Sleep cycle is reported normal. The chief concerns of the patient are the headaches and dizziness and his main goal is to be able to complete his school year with minimal symptoms, as well as return to working out and playing sports as quickly as possible.

IV. OBJECTIVE

Cervical spine AROM at initial assessment

- Scan exam: normal
- Cranial nerve testing: normal
- Reflexes: normal (grade 2)
- Decreased cervical spine Range Of Motion (ROM):
 - 50% flexion, 75% extension, Left (L) rotation and side flexion (SF) = 90%, Right (R) rotation and SF = 40%, all with pain bilaterally (worse with R rotation, R SF and flexion)
- Palpation: Increased tone and tenderness of bilateral upper fibres of trapezius, sternocleidomastoid, and sub-occipitals. Tenderness on palpation over C3/C4 and C4/C5 facet joints
- Passive Physiological Intervertebral Movements (PPIVMs): decreased rotation and side flexion at C3/C4 and C4/C5
- Passive accessory intervertebral movement (PAIVM): decreased mobility and pain at C3/4 and C4/5 with IMP (inferior, medial, posterior) glide on the right
- Flexion-rotation test: normal
- Cranio-cervical flexion test: able to perform craniocervical flexion at 24mm Hg for 2-3 seconds, but not at 26mmHg
- To test for benign paroxysmal positional vertigo the dix-hallpike test was completed: normal
- Visual tests: Smooth pursuit and saccadic eye movement was noticeably slower than normal

V. OUTCOME MEASURES

1. Post-concussion Symptom Scale (PCSS) is a computerized program to assess concussion symptoms.
2. His score was 64, which is considered a high score and a risk factor for poor prognosis.^[4]
3. **Patient Health Questionnaire-9** (PHQ-9) is a screening questionnaire used to indicate the severity of depression. His score was 11, which indicated moderate depression (Cut score = 10). Although diagnosing a mental illness is considered outside the scope of physiotherapy, it is important for the therapist to consider



this as a yellow flag and to be aware of the potential impact on recovery. Communication with the family physician would be helpful to share these findings.^[5]

4. **Community Balance and Mobility Scale (CBMS)** is an outcome measure designed for patients with traumatic brain injuries that are higher functioning. The tasks include more difficult activities such as walking and multitasking, hopping and lateral dodging. His score was 45/96 (MCID=8) and can be used to track progress over time.^[6]
5. **Fear of Mental Activity Scale (FMA)** is an adapted version of the Tampa Scale of Kinesiophobia that replaces the word pain with common concussion symptoms such as headache, dizziness, concentration issues and fatigue. The questions are altered to make them suitable for a mild traumatic brain injury. His initial score was 50/68, indicating a high level of fear avoidance behaviour.^[7]

VI. CLINICAL IMPRESSION

Patient is a previously active 17-year old who has sustained a concussion 3 months ago. He presents with decreased and painful cervical mobility, dizziness, impaired balance and eye movements, and intense headaches which affect his ability to complete school work and participate in sports. Personal factors that may be contributing to pain are depression, fear of movement, and high irritability.

The patient's previous functional level and supportive home environment are factors indicating a high likelihood of a full recovery and return to sport. The patient is an excellent candidate for physiotherapy activities aimed at restoring pain-free cervical range of motion, and improving balance and functional mobility suitable for his return to sport and school.

Problem List

- Headaches and nausea (caused by neck movement and using screens ex. computer, phone)
- Eye movement slower than normal and affecting ability to complete school work
- Balance and dizziness issues affecting ability to be physically active
- Fear of movement also affecting physical activity
- Depressive symptoms including lack of motivation
- Personality changes including impatience and quick to anger

Intervention

Short-term Goals

- The patient will be able to complete school work for 45 minutes using a computer (or any other screen)
- without developing a headache within 6 weeks.
- The patient will increase cervical ROM by 10% in all movements with no pain or headache within 3 weeks.

Long-term Goals

- The patient will be able to return to playing with his hockey team with no headaches or dizziness by the beginning of his next hockey season in 8 months.
- The patient will be able to sit and study/complete school work on his computer for 2 hours with no headaches, nausea, or dizziness within 4 months.

Management Program

This intervention program was developed alongside the recommendations of the Fowler-Kennedy Post-Concussion Syndrome Management Guidelines.[1] Treatment techniques were utilized based on the assessment findings and tailored to the patient's impairments and goals.

1.Patient Education: Educate the patient about the expected recovery time, and provide cognitive and emotional reassurance. Recommend staying active with the goal of gradually increasing symptom tolerance without crossing the symptom threshold. He should continue doing activity that will challenge his body but not result in an exacerbation of his symptoms.

2. Pain-free cervical ROM

Cervical ROM can be achieved by:

- Soft tissue release^[8] for tight Upper Fibres of Trapezius (UFT), Sternocleidomastoid (SCM), sub-occipitals
 - Progression: passive → active-assisted → active



- Cervical ROM- flexion, extension, rotation, side flexion
- UFT stretch
- Deep neck flexor (DNF) training
 - Progression: starting in supine → sitting → incorporate arm movements and functional activities
 - Provide BP cuff for bio-pressure feedback^[9]

3. Balance exercises: provide a variety of tasks to challenge somatosensory, visual, and vestibular system^[10]. We will ensure that the tasks are functional and meaningful to the patient to help improve his motivation.

Progressions: 2 to 1 foot, firm to soft surface, level ground to incline or uneven surface, add upper/lower extremity movements, add resistance, add dual tasks requiring cognitive attention, incorporate visual training exercises

4. Eye movement exercises

1. Saccadic eye movement: eyes jump back and forth between 2 targets
2. Smooth pursuit eye movement: use eyes to track a moving object (patient can hold pencil at arms length)
Progression: increase duration and speed of movement

5. Graded Activity Plan: return to school activity

Gradually expose the patient to increasingly more activity as his tolerance increases

6. Non-contact aerobic exercise (i.e. stationary bike, treadmill, elliptical): start with amount of time that will not cause an exacerbation of symptoms.

Progression: as tolerance increases, gradually increase intensity (i.e. duration, speed, resistance).

Week	Amount of Activity (school work completed on laptop without symptoms)
1	20 minutes
2	25 minutes
3	30 minutes
4	35 minutes
5	40 minutes
6	45 minutes

Graded Activity Table

7. Full Contact Practice exercise

- Training the athlete in simulated sports scenarios
- Progress to controlled practice with team

8. Return to Sport:

There is a consensus statement issued in 2017 which gives a protocol for gradual return to play of an athlete.[11]

VII. OUTCOMES

After 6 weeks of treatment, the patient demonstrated significant improvements in response to the interventions.

Cervical spine AROM: post-intervention

- The tone and tenderness of bilateral upper fibres of trapezius, sternocleidomastoid, and sub-occipitals had decreased significantly
 - Increased Cervical Spine AROM: 80% flexion, 100% extension, L rotation and SF = 100%, R rotation and SF = 75% (no pain, just stiffness)
 - NPRS was 0/10 at rest and 4/10 at its worst
 - The patient reached his goal of working on a computer or other screen for 45 minutes with no headache or dizziness and is on track to meet his long term goal of 2 hours
1. **PCSS:** The patient's score decreased from 64 to 52, which is greater than the meaningful change score of 6.8 points. ^[12] He has reported a decrease in headaches, nausea, dizziness, and balance problems.



2. **PHQ-9:** The patient's post-intervention score decreased to 9, indicating mild depression severity. As mentioned previously, diagnosing mental health disorders is not within the physiotherapy scope of practice. He was referred to a psychologist to be further assessed and adequately treated as his depressive symptoms have persisted throughout the treatment period.^[5]
3. **CBMS:** MCID = 8. The patient's score increased to 62/96, which is clinically significant. He showed improvements in tasks that were previously challenging such as lateral dodging and hopping forward. His score is still below the mean score for his age group, 88.71/96, indicating further progressions and improvements can be made.^[6]
4. **FMA:** After the intervention, the patient scored 30/68, indicating an improvement in his fear-avoidance behaviours. He is below the cut-score of 48, which previously indicated a high level of fear-avoidance behaviours.^[7]

VIII. DISCUSSION

This case study illustrates a detailed case of Post-Concussion Syndrome. This patient presented with a variety of physical and behavioural symptoms commonly seen in someone with PCS. His depressive symptoms and personality changes were beyond the scope of the physiotherapist and he was appropriately referred to a psychologist to be further assessed and treated. He was a suitable candidate for physiotherapy as he had a number of impairments that needed to be addressed prior to returning to school and participating in sports. The intervention approach included a wide variety of techniques including cervical ROM, endurance training, balance training, eye movement exercises, and aerobic exercise. The treatment method, alongside patient education, significantly improved this patient's symptoms and functional activity level. He was able to achieve his short-term goals of ROM and completing school work without symptoms, and is progressing well to achieve his long-term goals.

The significant improvements seen in this patient's outcome measures post-intervention can help inform other physiotherapists, as well as other healthcare providers, when assessing and treating individuals with PCS. However, it is important to note that this is one particular patient and each person will present differently. Each individual with PCS should be assessed and treated with a patient-centered approach given their impairments and goals. This case may help inform clinicians when faced with patients presenting in a similar manner.

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