

# Comparison of Recovery from Initial Concussion and Second Impact: A Case Report

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## Introduction

Post-Concussion Syndrome (PCS) occurs when a patient who has sustained a concussion continues to experience symptoms after a seven to fourteen day period.<sup>1</sup> It is estimated up to 40% of individuals who sustain a concussion will experience PCS.<sup>2,3,4</sup> Second Impact Syndrome (SIS), a phenomena that may occur anytime during the recovery process of a concussion, is defined as an individual experiencing a second blow to the head while recovery from an initial concussion.<sup>5</sup> Outcomes from a second impact vary greatly from increased symptoms to functional deficits such as decreased balance and use of limbs to even death.<sup>6</sup>

## Patient History/Systems Review

- 15 y.o. male with history of impact to the head from a football game (diagnosed by a neurologist) 10 days ago
- Initial symptoms following hit to the head: memory issues, fatigue, confusion, neck pain, glazed over eyes, headaches, and decreased balance; Also experienced post-traumatic amnesia (no memory of the week leading up to the game, including the game)
- Symptoms upon initial evaluation include: intermittent frontal headaches, lightheadedness, photo and phono phobia, decreased balance, decreased thinking and processing abilities, “floaty head feeling” (fogginess)
- Headaches were rated as 4/10 on a 0-10 pain scale, lasting between 10-15 minutes
- Headaches were aggravated by reading and bright lights, and alleviated by rest

## Examination

- Slight exophoria of left eye with cross cover, saccadic smooth pursuits in all directions, uncoordinated saccades with quick movement, and a BESS test score of 17
- Convergence, near point of convergence, VOR, VOR cancellation, coordination, and fixation blocked testing were all intact
- A dynamic gait index (DGI) score of 24/24

## Clinical Impression

- Diagnosis – patient previously diagnosed with a concussion, but was exhibiting three different PCS trajectories/sub-types: cognitive/fatigue, ocular, and vestibular
- Problem List – decreased oculo-motor reflexes, saccadic smooth pursuits, uncoordinated saccades, decreased balance, cognitive fatigue
- Prognosis – negative impact factors included sub-acute fogginess, post-traumatic amnesia, headache, imbalance, and difficulty concentrating (All of these are associated with protracted recovery periods)
- Plan – 1 time per week with HEP and Patient education focusing on cognitive fatigue monitoring/modifications

## Initial Impact

Visit Number	1	2	3
Days Post Injury	10 days	19 days	24 days
Headache Severity and Average Length	4/10 10-15 minutes	5/10 1 minute or less	5/10 30 minutes
Smooth Pursuits	Saccadic in all directions	Mildly saccadic in all directions	Patient felt 100% back to normal before hitting his head; After hitting his head headache began after 10 minutes and reached 9/10 by end of the day, had several bouts of severe 9/10 headaches lasting 30 minutes over the next two days
Saccades	Mildly uncoordinated in all directions	Mildly uncoordinated vertically	
BESS Test Score	17	12	
PCSS Score	NT	9/132	

\*Feeling 80-85% back to normal

## Second Impact

Visit Number	1 (4)	2 (5)	3 (6)
Days Post Injury	7 (31) days	21 (45) days	37 (61) days
Headache Severity and Average Length	4-5/10 30 minutes	2-5/10 2 seconds to 3 hours	0/10 N/A
Smooth Pursuits	Mildly saccadic left, saccadic vertically and diagonally	Mildly saccadic all directions	Intact
Saccades	Mildly uncoordinated vertically	Mildly uncoordinated horizontally, moderately uncoordinated vertically	Intact
BESS Test Score	15	17	9
PCSS Score	16/132	5/132	0/132

\*Feeling 98-99% back to normal

## Intervention

- Initial PT intervention focused on balance deficits as many portions of the examination exacerbated the patient’s symptoms. Patient education was focused on activity modification to reduce strain/stress to the brain and decrease aggravation of symptoms throughout the patient’s day
- As the patient progressed, oculo-motor exercises were given and updated as needed
- However, on the day of expected discharge following a Buffalo Concussion Treadmill Test, the patient hit his head again on a hand dryer in a school bathroom
- The patient had experienced severe headaches, 9/10, that had progressively increased to this point since the incident
- Following the second impact, the patient was noted to have similar symptoms and intensities compared to the initial concussion symptoms
- Over the course of the next few weeks, a similar trajectory of recovery was also noted; A break down of the similarities is provided to the left

## Outcomes

- On Visit 6, which occurred 61 days post initial concussion and 37 days post second impact, the patient reported being symptom free and felt 98-99% back to normal
- Objectively, smooth pursuits, saccades, convergence, near point of convergence, and a BESS test score were all intact/normal
- The patient was taken through a modified Buffalo Concussion Treadmill Test<sup>48</sup> (each level was 2 minutes long rather than 1 minute long) to assess physiological/symptom response to exercise. The patient was symptom free during and after testing, and his vitals were normal following administration of the test
- The patient monitored symptoms for the next 24 hours and was symptom free for that time. The patient was placed on hold rather than discharge just in case any exacerbation or re-injury occurred within the next week and during his return-to-play program which was to be administered by his school’s athletic trainer

## Clinical Implications

- The patient demonstrating significantly similar recovery timelines from initial concussion and second impact
- There are very few research studies on the topic of second impact syndrome, and even less of those focus on the recovery process from a second impact
- What appears to be a mirroring syndrome presentation of recovery from initial concussion and second impact may influence future interventions and research
- There is a need for further research into the recovery process from a second impact, and the potential for a mirroring effect comparatively to an initial concussion recovery