Evaluating the Impact of Collaborative Care and Rehabiliation on Concussion Patients: Clinical Observations and Literary Review

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Introduction

Current research suggests that 1.6 - 3.8 million people each year suffer from concussions [1]. The impact of concussions on the brain cannot be seen with traditional brain imaging, but screening tools can indicate whether the physical and cognitive symptoms presented are consistent with a concussion diagnosis. In addition to physical symptom reporting, concussion rehabilitation has shifted to focus on additional mental health factors. The aims of this capstone project were to gain a more in-depth understanding of the neurobiological and psychosocial factors influencing the recovery from a concussion, understand the rehabilitative process of a concussion, as well as observe the neurobehavioral implications of experiencing and recovering from a concussion. The experience included observing Dr. Arlene Goodman, M.D., at the Saint Peter's Sports Medicine Institute, as she used screening tools, rehabilitation exercises and self-reported patient data to help facilitate recovery and to determine whether the patient was likely to experience Persistent Post Concussive Syndrome (PCS). The clinic also provided collaborative care through the help of a social worker. My experience highlights that improving he mental health of the patient through psychological intervention has the potential to provide the best rehabilitative outcomes.

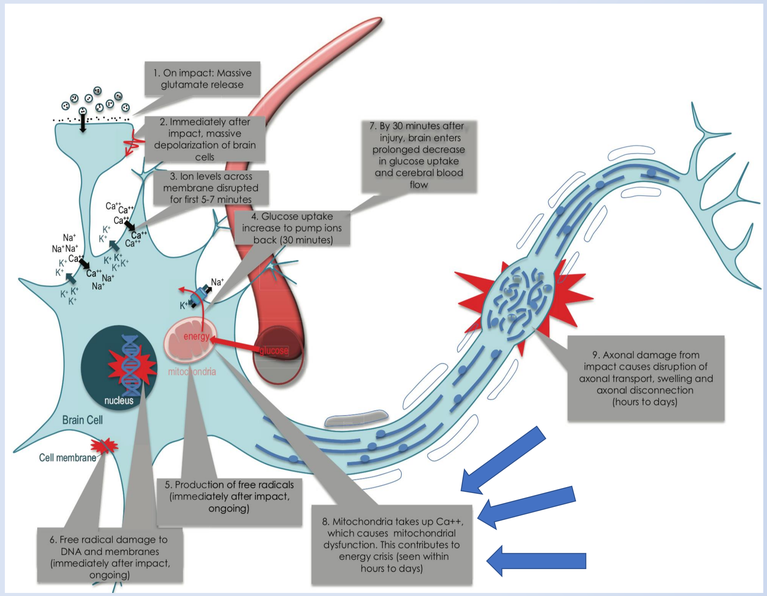

Figure 1. Neurochemical cascade of the secondary injuries from a concussion. Adapted from [3].

1° Injury: Mechanical forces acting on the skull, causing rapid acceleration-deceleration as well as rotational forces, stretching and compressing the brain.

2° Injury: Consists of the neurochemical cascade post impact (may be delayed). Diffuse axonal injury (DAI) is characterized by stretching and compression of the brain resulting in shearing of deeper axonal tissues and subcellular changes that alter action potential propagation and neuronal functioning. Shearing forces along axons leads to increased permeability as well as calcium influx [7]

Common symptomatology: Headache, dizziness, nausea, vestibular issues and visual deficits [3]. Dizziness following concussion may also suggest impairment in vestibular and ocular motor function and integration. Ocular motor dysfunctions can manifest as blurred vision, reading difficulty, eyestrain, headache, difficulty with visual scanning.

Diagnosis and Screening: Due to varied concussion symptomatology, the diagnosis must be clinical (Rose et. al, 2015). To determine if there has been a change in mental status or functioning, a baseline must be established. Common screening tools practitioners may use are: Post Concussive Symptom Scale (PCSS) as a self-reported inventory to assess and monitor sports related concussion (SRC) symptoms, Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) to establish a cognitive baseline, Vestibular Ocular Motor Screen (VOMS) to assess visual and vestibular deficits [4,10]

Recovery/Rehabilitation: May be within 7-10 days. Based upon screening, the clinician will be able to specify the trajectory of the concussion and properly help to rehabilitate the patient [2]. Some common therapies are vestibular rehabilitation or seeking help for psychiatric abnormalities.

Objective

To better understand the neurobiopsychosocial factors influencing recovery of a concussion. This was completed through observing the implementation of the VOMS, ImPACT testing interpretation as well collaborative care provided by social worker to properly address psychiatric abnormalities.

Treatment Observations

Mental Status- Prior to meeting with patient, the a social worker, Nicole, was to administer the PCSS to patients as well as record any behavioral abnormalities. Addressing abnormal behavior and mental health helps with treatment and management of prolonged post concussive syndrome.

ImPACT: Used to establish baseline before beginning play, used after potential concussion to help qualified healthcare professionals to determine the appropriate rehabilitative protocol[6,8].

- Word Memory
- Design Memory[SEP]
- X's and O's[SEP]
- Symbol Match[SEP]
- Color Match[SEP]
- Three Letter Memory
- Symptom Scale

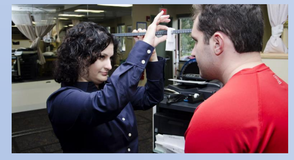

Figure 2. Dr. Arlene Goodman, M.D administers a near point of convergence (NPC) exam. [7]

Clinical Interview- The clinician will listen to symptoms that are self-reported and parent-reported for the patient.

Physical Examination- Upon examination, the clinician examined muscular strength, tenderness in the atlanto-occipital region as well as superior thoracic to address muscular or gross structural abnormalities. Normally, when a headache or migraine with muscular tension in the upper thoracic region of the trunk is presented, an upper trapezius stretch was added. The stretch can help to relieve the tension and alleviate the headache or migraine.

VOMS: Consists of Smooth pursuits, horizontal and vertical saccades, near point of convergence, accomodation, horizontal and vertical vestibular-ocular reflexes as well. Dr. Goodman has modified the VOMS to more accurately assess the concussion by Romberg's test, assesses balance in a tandem stance with arms on their hips with eyes both open and closed. She also added a movement exams to assess vestibular function as well as motion sensitivity.

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2:_____ Measure 3:_____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

Figure 3. An unscored VOMS.

Conclusion

The objective of this project was to better understand the factors influencing recovery from a concussion. Through observing the usage of the PCSS, the data obtained was routinely able to accurately assess the patients concussive symptoms. As a neurocognitive baseline, the ImPACT assessment was extremely useful in determining pre-existing conditions when reviewed by an experienced professional. The VOMS that was used was brief and easy to administer. Each parameter of the VOMS assessment has been shown to be significant as shown in Table 1, but the NPC exam can be a better predictor of PCS [9]. Finally, the use of collaborative care seemed to have a large impact on the patient population observed because of the varied neuropsychiatric abnormalities. As shown in Figure 4, the use of a psychological intervention has been reported by both parents and patients to improve quality of life. Aspects of concussion management, treatment and prevention that could be improved include:

1.) Making the ImPACT more available and utilized
2.) Development of technology to limit intracranial rotational forces
3.) Continually improve self-reporting system to more accurately convey patient signs and symptoms

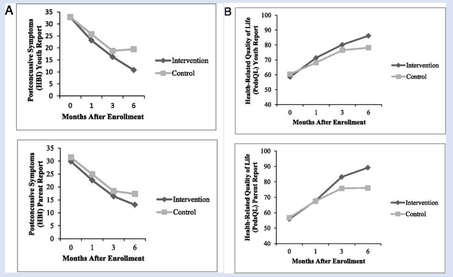

Figure 4. Time elapsed graphs of self and parent-reported quality of life between control group and group with psychological intervention Adapted from [6].

TABLE 1
Demographic and Condition-Specific Characteristics for All Patients and Recovery Groups With Between-Group Univariate Comparisons[a]

Variable	Total Sample (N = 69)	≤14 d (n = 27, 39.1%)	15-29 d (n = 25, 36.2%)	30-90 d (n = 17, 24.6%)	Between-Group Difference (*P* Value)
Vestibular/ocular motor					
Smooth pursuit	3.4 ± 3.9	1.7 ± 2.1	3.5 ± 4.1	6.5 ± 4.2	<.001
Horizontal saccade	4.2 ± 4.7	1.9 ± 2.2	4.3 ± 4.0	7.7 ± 6.2	<.001
Vertical saccade	4.6 ± 5.8	2.0 ± 2.3	4.1 ± 4.3	9.4 ± 8.4	<.001
Convergence, cm	4.5 ± 4.8	3.4 ± 2.7	3.5 ± 3.5	7.4 ± 7.3	.01
Horizontal VOR	4.6 ± 5.7	2.1 ± 2.7	4.2 ± 5.9	8.9 ± 6.4	<.001
Vertical VOR	4.8 ± 5.8	2.3 ± 3.1	4.5 ± 6.0	9.1 ± 6.4	<.001
VMS	5.9 ± 6.5	3.0 ± 4.1	5.7 ± 6.7	10.6 ± 6.8	<.001

Table 1. Significance of the VOMS. Adapted from [10].

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Acknowledgements

I would like to thank PCOM for giving me the opportunity to conduct this observational study and Dr. Sarah Allen, PhD. I would also like to thank St. Peter's Sports medicine Institute as well as Dr. Arlene Goodman, M.D., for letting me shadow her as well as and Nicole DiFonzio, MSW, LSW.