

Research Report

Acute Management of Concussion: The Role of Regulation versus Rest

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Abstract

Advancements in the management and treatment of concussion are occurring frequently, requiring medical professionals to remain vigilant of new research and subsequent recommendations affecting clinical practice. In recent years, one of the biggest changes in concussion management has involved a movement from the traditional strict rest approach to that of behavioral regulation. Behavioral regulation involves the practice and/or implementation of healthy lifestyle habits including maintaining a regular sleep-wake cycle, eating regular meals, maintaining adequate hydration levels, obtaining light levels of non-contact physical activity and regulating stress. Use of these habits following concussion can reduce the development of additional concussion symptoms, exacerbation of ongoing symptoms, and the need for medication in many cases.

An estimated 1.6 to 3.8 million concussions occur each year, making it essential for medical professionals to stay up-to-date in terms of current management and treatment options for concussion (Rutland-Brown, Langlois, Thomas, & Xi, 2006). Advances and improvements in management techniques are frequently occurring as we better understand concussion, the post-injury clinical profiles, and targeted treatment options (Collins, Kontos, Reynolds, Murawski, & Fu, 2014; Reynolds et. al., 2014). One of the biggest changes in concussion management in recent years has involved a movement from the previous strict rest approach to that of behavioral regulation or “usual care” (Thomas, Apps, Hoffman, McCrea, & Hammeke, 2015). Thomas and colleagues (2015) conducted a randomized control trial with adolescents who had presented to the emergency room, which revealed a greater amount of post-concussion symptoms and prolonged recovery for those assigned to the strict rest versus a usual care group. The differences in symptoms and recovery patterns between groups was attributed to the significant changes in normal daily life for the strict rest group such as reduced social interactions, changes in exercise patterns,

falling behind academically, and missing school (Thomas et. al., 2015). Based on these findings and other research, a management approach involving behavioral regulation is now being suggested for patients undergoing treatment for concussion (Womble & Collins, 2016).

Behavioral Regulation Following Concussion.

Behavioral regulation refers to implementation of healthy lifestyle habits into everyday life in order to avoid the development of additional concussion symptoms or exacerbation of ongoing concussion symptoms. Specifically, research has shown headaches and other concussion symptoms to occur as the result of poor sleep habits, inadequate nutrition, dehydration, lack of physical activity and stress (Choe & Blume, 2016; Kacperski, Hung, & Blume, 2016). Unfortunately, when strict rest is recommended it is common for patients to oversleep, miss meals, and reduce engagement in enjoyable activities. These changes to normal daily life can unfortunately lead to the development of increased stress and/or anxiety. Therefore, when managing concussion patients it is important to help them understand the importance of obtaining a regular sleep-wake cycle, eating regular meals, maintaining adequate hydration levels, obtaining light levels of non-contact physical activity and regulating stress as soon as possible after injury (Womble & Collins, 2016). Use of these habits following concussion, as compared to strict rest, can reduce the development of specific concussion symptoms (e.g., headaches, migraines) and the need for medication in many cases.

Regulated Sleep. Inconsistent sleep patterns have been shown to be a common headache trigger, particularly for the chronic, morning and awakening type headaches (Rains, Poceta, & Penzien, 2008). A dose-relationship has been identified between headache severity and sleep complaints such that greater headache severity is associated with more severe sleep complaints (Boardman, Thomas, Millson, & Croft, 2005). Given this information, it is recommended that patients maintain a regular sleep-wake schedule, similar



to their typical school or work-week schedule. It is generally recommended that patients obtain 7-9 hours of sleep per night and avoid napping to prevent difficulty falling asleep, poor sleep quality, and additional post-concussion symptoms (Womble & Collins, 2016). In cases where patients experience difficulty falling asleep or staying asleep, melatonin can sometimes be beneficial. Melatonin is an endogenous hormone produced primarily by the pineal gland from serotonin. Since it is non-toxic and safe, melatonin is often an ideal initial choice to aid in sleep issues post-concussion (Meehan, 2011). Currently, no published research exists regarding melatonin use for concussions; however, a double-blinded placebo-controlled study protocol for melatonin use at various doses for post-concussion syndrome in young athletes showed that it may have some beneficial roles in recovery (Halstead, 2016).

Proper Nutrition. Obtaining proper nutrition during recovery is essential in order to provide the brain and body fuel during the recovery process. We recommend eating regular daily meals and consuming a well-balanced diet, as irregular meals have been shown to be a trigger for migraine and/or tension-type headaches, fatigue and dizziness (Kacperski et al., 2016; Spierings, Ranke, & Honkoop, 2001). It has been estimated in the general population that 8-30% of school age children and adolescents skip breakfast (Healthy Children Magazine, 2015). Therefore, it is important to discuss the role of nutrition and regular meals with patients immediately following concussion. Research has shown the beneficial effects of breakfast on energy, memory recall, and overall cognitive functioning (Adolphus, Lawton, & Dye, 2013). Very little research exists in terms of specific foods to eat following concussion and consequently it is most important for patients to consume regularly scheduled meals and snacks throughout the day as a way to maintain nutrient stores and fuel the body during the recovery process.

Adequate Hydration. Maintaining adequate hydration during concussion recovery can help to reduce the occurrence of symptoms associated with both concussion and dehydration, such as headaches, dizziness, reduced cognitive performance, poor physical performance, and irritability (Kenney, Long, Craddock, & Gortmaker, 2015; Pollitt, Cueto, & Jacoby, 1998; Taras, 2005). Research has also shown the role of adequate fluid hydration in reducing headache duration and intensity (Kacperski et al., 2016). When working with concussion patients, it is important to keep in mind that 54.5% of a 6-19 year old sample were found to be dehydrated, with higher rates of dehydration for younger children, boys and non-Hispanic blacks as compared to girls, Caucasians and older children (Kenney et al., 2015). These rates of dehydration and the symptoms caused by dehydration emphasize the importance of discussing the need for hydration following concussion immediately. Recommended hydration levels vary from person-to-person; however, a simple rule is 0.5 ounces of water for every pound of body weight (e.g., 140 lbs = 70 ounces of water per day). Carrying a water bottle through the day can be a simple way to aid in maintaining hydration levels.

Light Physical Activity. Due to the beneficial effects of exercise for reducing pain, improving mood and managing headaches/migraines, it can be valuable for patient to incorporate light physical activity following concussion, with a gradual progression towards pre-injury levels and intensity as recommended by a medical professional. Although many patients become concerned regarding increased headaches or other symptoms while exercising, avoiding physical activity has not been recommended for migraine management which interestingly shares a common pathophysiology to concussion (Choe & Blume, 2016). Instead, patients are advised to continue with physical activity, while addressing migraine/headache prevention with other options such as pharmacological treatment. Given this, it is generally recommended that concussion patients engage in submaximal aerobic exercise



that does not lead to symptom exacerbation as an initial step (Dittrich et al., 2008; Womble & Collins, 2016). Since exercise can be a trigger for headache, it is important to inform patients that symptoms generally lessen once a routine is established (Daene et al., 2015). If they are to develop symptoms while exercising, they should utilize short breaks to manage symptoms reaching a moderate severity level (Daene, Varkey, Kellman, & Nijs, 2015; Reynolds et al., 2014). As patients tolerate submaximal exercise, a graded progression should be recommended to include cardiovascular activities, dynamic exercises, and sport-specific exercises. Screening assessments, exertion therapy evaluations and vestibular therapy evaluations are essential in determining the exact type of physical activity and developing an individualized program that can be most beneficial for the patient.

Stress Management. Concussion symptoms can be exacerbated or provoked by physical and emotional stress. After concussion, stress can develop, for example, due to fear of concussion, lack of understanding regarding the symptoms, and activity restrictions. Therefore, it is important as medical professionals to recognize the role of education post-concussion in order to mitigate unnecessary stress and prepare the patient and their family for the recovery process (Choe & Blume, 2016). Patients with vestibular dysfunction following concussion and/or a history of previous mood diagnoses may be more likely to experience stress and mood-related symptoms after concussion. Recommending individualized and targeted treatments for the underlying symptoms is essential to reducing the length of recovery and development or exacerbation of symptoms. Other recommendations to help with stress include academic or work adjustments/accommodations; however, long-term use is generally not recommended. If stress and mood symptoms persist and interfere with recovery, nonpharmacological (e.g., psychotherapy, relaxation training) and pharmacologic treatments should be considered.

Headache Management with OTC Medications.

In addition to behavioral regulation and implementation of healthy lifestyle habits, we must also consider acute symptom management. Headache is experienced in more than 50% of concussion cases and often acetaminophen or ibuprofen is recommended as the initial management strategy. However, caution must be taken to avoid taking these medications more than 3 times per week (Tepper & Tepper, 2010; Womble & Collins, 2016). Using these medications frequently can result in rebound headaches, as a result of taking the OTC medications too much for persistent, frequent headaches. A retrospective chart review of adolescent patients treated in a headache clinic with chronic posttraumatic headache found that 70% met criteria for medication overuse headaches (Halstead, 2016). After discontinuation, 68.5% of patients had resolution or improvement of their headaches, suggesting caution in chronic administration of over the counter analgesics in concussion headache management (Halstead, 2016).

Conclusion

As we better understand concussion, recommendations regarding general clinical and home management are changing and improving. Medical professionals must stay vigilant of these changes, in order to utilize the most up-to-date clinical management strategies with patients, reduce the development of concussion symptoms following injury, help patients recover as soon as possible, and to avoid recommending unnecessary treatments. By remaining vigilant and up-to-date, we will be better able to demonstrate the advancements in concussion treatments over time while also reducing current fears regarding this treatable injury.

Commentary

This article discusses the important issue of post-injury concussion management. The identification and management of sports-related concussion has been continuously evolving over the past three decades and will likely to continue to undergo revision as new potential treatment



programs undergo scientific validation. This article reviews the current state of thought regarding the post-injury management of concussion and offers valuable advice to researchers and clinicians alike.

As highlighted by Womble et al., 2016, earlier concussion guidelines for post-concussion management were based on strict standards for physical and cognitive rest following injury. Specifically, no return to physical or cognitive activity was recommended until the athlete was completely without symptoms. These standards were developed to minimize provocation of symptoms during the recovery period. In retrospect, these recommendations may have been overly conservative as the emphasis on restriction of activity after injury may have resulted in the unintended consequence of a longer recovery process (e.g. loss of time in school, social seclusion, loss of participation time in usual activities). Furthermore, although well-intended, these prior standards were based more on clinical lore and not on empirical research conducted to study outcome from injury. As underlined by the Womble et al. article, contemporary concussion management has progressively been based on empiric research that has promoted a more active program of post-injury rehabilitation.

In the article above, Womble et al. provide a framework for the management of the recovery process and eventual return to play. The authors emphasize the progressive introduction of physical and cognitive activity earlier in the recovery process. The authors specifically highlight the advantages of engaging the concussed patient in activity earlier on in the recovery process. This model is based on the implementation of an active recovery process that pushes the recovery process forward while not resulting in an exacerbation of concussion symptoms.

In summary, this article provides a scientifically-based model for concussion management that emphasizes a multi-disciplinary perspective on the assessment of post-concussive signs and symptoms and an empirically-based strategy for rehabilitation.

References

- Adolphus, K., Lawton, C.L., & Dye, L. (2013). The effects of breakfast on behavior and Academic performance in children and adolescents. *Frontiers in Human Neuroscience*, 7, 1-28. doi:10.3389/fnhum.2013.00425
- Boardman, H.F., Thomas, E., Millson, D.S., & Croft, P.R. (2005). Psychological, sleep, lifestyle, and comorbid associations with headache. *Headache: The Journal of Head and Face Pain*, 45(6), 657-669.
- Choe, M.C. & Blume, H.K. (2016). Pediatric posttraumatic headache: A review. *Journal of Child Neurology*, 31(1), 76-85 doi:10.1177/0883073814568152
- Collins, M.W., Kontos, A.P., Reynolds, E., Murawski, C.D., Fu, F.H. (2014). A comprehensive, targeted approach to the clinical care of athletes following sport-related concussion. *Knee Surgery, Sports Traumatology, Arthroscopy*. 22(2), 235-46. doi: 10.1007/s00167-013-2791-6
- Daene, L., Varkey, E., Kellman, M., & Nijs, J. (2015). Exercise, not to exercise, or how to exercise in patients with chronic pain? Applying science to practice. *Clinical Journal of Pain*, 31(2), 108-114. doi:10.1097/AJP.0000000000000099
- Dittrich, S.M., Günther, V., Franz, G., Burtscher, M., Holzner, B., & Kopp, M. (2008). Aerobic exercise with relaxation: Influence on pain and psychological well-being in female migraine patients. *Clinical Journal of Sports Medicine*, 18(4), 363-365. doi:10.1097/JSM.0b013e31817efac9
- Halstead, M.E. (2016). Pharmacologic Therapies for Pediatric Concussions. *Sports Health*, 8 (1), 50-52. doi: 10.1177/1941738115622158



Kacperski, J., Hung, R., & Blume, H.K. (2016). Pediatric posttraumatic headache. *Seminars in Pediatric Neurology*, 23(1), 27-34. doi:10.1016/j.spn.2015.08.005

Kenney, E.L., Long, M.W., Craddock, A.L., & Gortmaker, S.L. (2015). Prevalence of inadequate hydration among US children and disparities by gender and race/ethnicity: National health and nutrition examination survey. *American Journal of Public Health*, 105(8), e113-e118. doi:10.2105/AJPH.2015.302572

Meehan, W.P. (2011). Medical Therapies for Concussion. *Clinics in Sports Medicine*. 30(1), 115-124.

Pollitt E., Cueto S., Jacoby E.R. (1998). Fasting and Cognition in Well- and Undernourished Schoolchildren: A Review of Three Experimental Studies. *American Journal of Clinical Nutrition*, 67(4): 779-784.

Rains, J.C., Poceta, J.S., & Penzien, D.B. (2008). Sleep and headaches. *Current Neurology and Neuroscience Reports*, 8(2), 167-175.

Reynolds, E., Collins, M.W., Mucha, A., & Troutman-Ensecki, C. (2014). Establishing a clinical service for the management of sports-related concussion. *Neurosurgery*, 75(4), S71-S81. doi:10.1227/NEU.0000000000000471

Spierings, E.L., Ranke, A.H., & Honkoop, P.C. (2001). Precipitating and aggravating factors of migraine versus tension-type headache. *Headache*, 41(6), 554-558.

Taras, H. (2005). Nutrition and Student Performance at School. *Journal of School Health*, 75(6): 199-213.

Tepper, S.J., & Tepper, D.E. (2010). Breaking the cycle of medication overuse. *Cleveland Clinic Journal of Medicine*, 77(4), 236-242. doi:10.3949/ccjm.77a.09147

The case for eating breakfast. (2015). *Healthy Children Magazine*. Retrieved from <https://www.healthychildren.org/English/healthy-living/nutrition/Pages/The-Case-for-Eating-Breakfast.aspx>

Thomas, D.G., Apps, J.N., Hoffman, R.G., McCrea, M., & Hammeke, T. (2015). Benefits of strict rest after acute concussion: A randomized controlled trial. *Pediatrics*, 135(2), 1-10. doi:10.1542/peds.2014-0966

Womble, M.N & Collins, M.W. (2016). Concussions in American Football. *The American Journal of Orthopaedics*, 45(6), 352-356.

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