The Role of Active Recovery and “Rest” After Concussion

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ABSTRACT

For several years both cognitive and physical rest remained at the forefront in pediatric postconcussion management. However, the concept of “rest” has not been well defined and there remains significant variability both in terms of rest recommendations provided as well as adherence to such recommendations. More recently, there has been growing evidence to suggest that an earlier return to light or moderate activity is not detrimental and may, in fact, facilitate symptomatic improvement, thereby highlighting a new role for active rehabilitation in recovery from concussion. In this article, we compare historic recommendations for rest with emerging strategies focused on active rehabilitation. [Pediatr Ann. 2017;46(4):e139-e144.]

The widespread belief in concussion management has traditionally been that “rest is best,” and for several years both cognitive and physical rest were hailed as the cornerstones of treatment, as emphasized in the first Agreement Statement on Concussion in Sport.1 However, recent research has raised questions about this approach. Studies have shown that concussion management, especially recommendations related to rest, varies widely among pediatric practitioners.2-4 Not all providers have similar definitions of rest, leading to inconsistencies in recommendations about what types of activities or how much of a given activity should be avoided; the ability of children and adolescents to adhere to these recommendations has also not been considered.

Contrary to previously held beliefs on strict rest after concussion, mounting evidence suggests that active rehabilitation may be beneficial in promoting the recovery process.5-7 In this article, we attempt to further define the term “rest” and highlight the advances from the medical literature on the role of active rehabilitation after a concussion in the pediatric patient.

EPIDEMIOLOGY

Concussion is now recognized as the most common sports injury in children and adolescents, accounting for approximately 1 of every 10 sports-related injuries, and it also has become a leading cause of emergency department (ED) visits for pediatric patients.3,9 In fact, mild traumatic brain injury has been estimated to occur in up to 692 of every 100,000 children younger than age 15 years in the United States.10 Moreover, in their recent publication evaluating the point of health care entry for children with concussion, Arbogast et al.11 found that 81.9% of pediatric patients had their first visit for concussion within the primary care setting, versus 11.7% within the ED and 5.2% within specialty care clinics, demonstrating that prior estimates of pediatric concussion incidence based on ED visits alone likely underestimated the actual extent of these injuries.

Data have shown that 80% to 90% of patients with concussion typically recover within 7 to 10 days, and almost all recover within 4 weeks of injury.7,12 However, up to 10% to 20% of patients with concussion go on to have more prolonged recovery trajectories, with postconcussive symptoms (PCS) still present 3 months after injury (and even longer in some patients).13-15 Risk factors for prolonged concussive recovery have been identified and include prolonged loss of consciousness or amnesia, female sex, worse initial symptom severity, and premorbid history of attention-deficit/hyperactivity disorder, mood disorders, and migraines.16-18 A recent prospective, multicenter cohort study of more than 2,500 patients age 5 to 18 years also identified prior concussion with symptoms lasting longer than 1 week, headache, sensitivity to noise,
fatigue, answering questions slowly, four or more errors on the Balance Error Scoring System tandem stance, and age of 13 years or older as predictors for persistent postconcussion symptoms.15

DEFINITIONS AND DIAGNOSIS

The current definition of concussion originates from the Zurich guidelines of the 4th International Conference on Concussion in Sport, which defines concussion as “a complex pathophysiological process affecting the brain induced by biomechanical forces.”19 The neurometabolic changes underlying concussive injuries have been previously described. In brief, concussion may lead to diffuse disruption of brain networks, resulting in clinical symptomatology.20,21

Ultimately, concussion remains a clinical diagnosis based on patient history and physical examination, and although not diagnostic, sideline testing of balance and cognition can be used to help support the diagnosis, as can changes from baseline neuropsychological testing.19 Postconcussion syndrome is broadly understood as referring to a complex set of physical, cognitive, emotional, and sleep-related symptoms that patients experience either immediately or develop over the acute period after a concussion.17,22 Definitions for prolonged recovery from concussion are variable and can range from symptoms that persist for longer than 7 days to more than 3 months (depending on the study.)22

PHYSICAL AND COGNITIVE REST

In the practice guidelines and consensus statements from the American Academy of Neurology,23 the American Medical Society for Sports Medicine,17 Zurich guidelines,19 and others, rest has been promoted as the crux of concussion treatment; however, the concept of “rest” has not been well defined. Rest is typically understood as meaning limited physical, social, academic, and cognitive activities after injury. The first Agreement Statement on Concussion in Sport in 2001 advised “no activity, complete rest” until symptom resolution, but this was based solely on expert opinions.1 After multiple revisions, the newest consensus statement from the Zurich Conference in 2012 does not attempt to define rest per se, but endorses further research into the “type of rest” to recommend.19 The American Medical Society for Sports Medicine position statement also defines rest as limiting physical or cognitive activity that worsens symptoms, and historically some clinicians have proposed “cocoon therapy” or bed rest in a darkened room for several days.17 In practice, it has been shown that guidance related to rest varies widely between providers.2 A study performed in a large pediatric ED in the US demonstrated that physicians’ postconcussive discharge instructions ranged from providing no medical advice to recommending days or weeks of rest.3

Because children and adolescents generally recover more slowly from concussion than adults, many providers advocate a more conservative approach for pediatric patients when it comes to return to physical and mental activity. In fact, one of the widely held theories in support of rest after injury has focused on the neurometabolic cascade of physiologic changes in the brain that occur after a concussion. On this basis, the argument has been made that strict cognitive and physical rest should be imposed to minimize neuronal energy demands until patients are symptom free.24,25

Currently, there are mixed results from observational and retrospective studies with regard to recommending rest in youth and adolescents. For example, Moser et al.,24 Rose et al.,25 and Moser et al.26 described improved performance on Immediate Post-Concussion Assessment and Cognitive Testing as well as decreased symptom reporting after 1 week of prescribed cognitive and physical rest in youth athletes after a concussion. These patients were advised to avoid activities including “attending school, taking tests, doing homework, doing general household chores, traveling (eg, vacations), driving, trips outside of the home, social visits in the home, visually watching TV, video games, computer use, phone use, reading, playing a musical instrument, drawing/artwork, aerobic exercise and lifting weights.”24

In contrast, other studies have shown no clear benefits in recommending strict rest after a concussion.27,28 Thomas et al.29 published a landmark study in 2010 where strict versus limited rest was evaluated in patients age 11 to 22 years presenting to the ED within 24 hours after a concussion. Patients were randomized to either strict rest for 5 days or usual care (ie, rest for 1-2 days followed by gradual increase in activity). Results indicated that the intervention group of strict rest reported more daily PCS (total symptom score over 10 days was 18.7 vs 31.9, P < .03) and slower symptom resolution compared to the limited-rest group.29 Similarly, a recently published large, prospective, multicenter cohort study of 3,063 children and adolescents age 5 to 18 years with acute concussion investigated the association between participation in physical activity within 7 days of injury and incidence of persistent PCS.30 Results indicated that early physical activity participants (ie, within 7 days of acute injury) had reduced risk of persistent PCS at 28 days compared to those with no physical activity.30 Therefore, although some evidence exists in favor of both cognitive and physical rest in the acute postconcussive period, there is limited evidence to suggest a significant...
benefit to rest beyond that time, and mounting evidence that it actually may be detrimental to recovery. As such, many practitioners and the authors now agree that there is likely a “sweet spot” when recommending rest (with not too much and not too little), and that there is an initial benefit to rest immediately after injury, but no long-term benefits of more prolonged periods of rest.

Likewise, previous recommendations have also suggested that patients avoid activities until they are asymptomatic at rest. However, is this idea of resting until “asymptomatic” realistic? In the past, “asymptomatic” was defined as being symptom free without the need for medications to manage symptoms while at rest, but this may take longer than a few days. It has also not been specified how long patients should be symptom free before returning to activities. There is no current evidence supporting that this practice results in better clinical outcomes, and more prolonged activity restriction beyond the acute phase may place patients at risk for protracted symptoms and psychologic sequelae such as depression or anxiety. For example, consider the student-athlete who falls behind in schoolwork and no longer feels like part of a team may experience anxiety, limiting the recovery process.

Determining when a patient is truly asymptomatic can also be complicated by multiple factors, such as underreporting of symptoms, premorbid medical conditions, and symptoms unrelated to the injury.
to the concussion. There are also practical difficulties in implementing rest until symptom freedom, and there is literature to suggest that youth and adolescent patients may have difficulty complying with strict rest recommendations despite decreasing their activity level.

**ACTIVE REHABILITATION**

Although historically rest has been at the forefront of PCS management, a recent paradigm shift has taken place emphasizing the benefits of early return to physical activity. The rationale behind this has stemmed from animal studies demonstrating that exercise may promote neuroplasticity, and that in models where animals are deprived of social interaction and exercise emulating strict rest conditions, animals showed deficits similar in nature to those having sustained mild traumatic brain injuries. Similar responses have been observed in patients with concussion who are slow to recover, where earlier return to mild or moderate aerobic activity with graded increase in exercise intensity and symptom monitoring may facilitate long-term recovery and result in improved PCS. Leddy et al. in their seminal work published in 2010, evaluated 12 patients age 16 to 53 years with postconcussion syndrome at an average of 19 weeks after injury. Patients performed a treadmill test for symptom exacerbation threshold both before and after 2 to 3 weeks of baseline, then exercised once per day 5 to 6 days per week at 80% of their established subsymptom threshold heart rate, with repeat treadmill exercise testing every 3 weeks. Overall, results indicated improvements in symptom scores across the population, and the rate of postconcussion syndrome symptom improvement was related to peak exercise heart rate. Leddy et al. have further postulated that the mechanism by which aerobic activity may help alleviate postconcussion syndrome symptoms is through improving cerebral autoregulation and addressing alterations in autonomic function typically seen after concussive injuries.

Figure 1. Flowchart of proposed multidisciplinary approach to postconcussion disorder (PCD). Adapted from Ellis et al.22
Furthermore, graded exercise programs have shown positive effects in children and adolescents as well. In a recent pilot study, 10 adolescents with ongoing PCS for a mean of 7.9 weeks after injury were enrolled in an active rehabilitation intervention program. After participation, PCS significantly decreased, and fatigue and mood symptoms improved 6 weeks after enrolling in the intervention. In addition to the aforementioned physiologic benefits, there are also multiple psychosocial benefits of an active rehabilitation model. It should be intuitive that student-athletes who are highly motivated to return to their previous level of activity are encouraged and feel better as they see tangible improvements in their function. Moreover, self-efficacy has been found to be impaired after mild traumatic brain injuries in children, suggesting that earlier reengagement through rehabilitation may be beneficial.

It should be emphasized that within an active rehabilitation model, a multidisciplinary treatment approach is encouraged to both individualize patient therapy and to provide comprehensive care. Although subsymptom threshold exercise training may help those with symptoms exacerbated by exertion, alternative therapies are available to address vestibular or musculoskeletal symptoms. To this end, Ellis et al. have proposed subdividing patients with postconcussion syndrome into three distinct groups based on their pathophysiologic presentation, which they then use to help direct therapy recommendations and an individualized treatment plan (Table 1 and Figure 1).

Finally, an active recovery model also embraces the importance of early education in explaining mild traumatic brain injuries and the expected clinical trajectory, as this has been shown to improve patient outcomes. Specifically, education should be framed in a positive light, stressing that most patients can return to preinjury activities within weeks, and that a full recovery is the anticipated course.

Thus, early education and gradual activation not only foster patients’ perceptions of wellness, but they also help children gain a sense of control over their recovery, leading to improvements in mood and self-esteem while integrating them back into their daily activities and preinjury lives.

CONCLUSION

As discussed in this article, the lack of clearly defined rest and active recovery guidelines lends itself to significant variability in how children are managed after a concussion. Evidence now suggests that a “sweet spot” may exist for transitioning patients from strict rest back to mild-to-moderate physical activity, and that it is reasonable to recommend a conservative gradual increase in activity after 1 to 2 days of rest given the activity does not significantly exacerbate symptoms. Active rehabilitation models show promise in facilitating symptomatic and functional recovery in pediatric patients’ after injury; however, further studies are needed to validate previous findings and to determine effective implementation.

REFERENCES