Active Rehabilitation of Concussion and Post-concussion Syndrome

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KEYWORDS

• Rehabilitation • Concussion • Post-concussion syndrome • Active
• Physiology • Treatment

KEY POINTS

- Patients with concussion are advised to rest until all symptoms resolve. Recent research suggests that a more active approach to concussion management may be beneficial.
- Practitioners should perform a physical examination in patients with concussion and PCS to try to identify one or more potentially treatable post-concussion disorders.
- Active treatments (e.g., subthreshold aerobic exercise and/or cervical, vestibular, cognitive behavioral, and vision therapy) may improve recovery from concussion if implemented at the right time.

INTRODUCTION

Rest has been the mainstay of the treatment for concussion.[1] Research based on animal physiological concussion studies suggests that the concussed human brain is in a vulnerable state that places it at increased risk of more debilitating injury should it sustain more trauma or experience undue stress before metabolic homeostasis has been restored.[2,3] This vulnerable state can be inferred to exist in humans after concussion from the rare but devastating (and controversial) phenomenon of second impact syndrome,[4,5] from data that concussion risk increases after having had one or more concussions[6] and from retrospective data suggesting that high levels of physical and/or cognitive activity soon after concussion delay recovery.[7] The timing and amount of rest after concussion have not been established; as such, the most recent world consensus concussion statement recommends that an initial period of rest in the acute symptomatic period following injury (24–48 hours) may be beneficial, followed by gradual return to school and social activities (before contact sports) in a manner

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Phys Med Rehabil Clin N Am 27 (2016) 437–454
http://dx.doi.org/10.1016/j.pmr.2015.12.003 **pmr.theclinics.com**
1047-9651/16/$ – see front matter

that does not result in a significant exacerbation of symptoms.[8] The concept of "rest until asymptomatic" is also recommended by some clinicians when advising patients with prolonged recovery after concussion, which is called post-concussion syndrome (PCS).[1,9] Recent clinical and experimental studies are, however, beginning to challenge the utility of prolonged rest as treatment of concussion and PCS.[1,10] The purpose of this article is to review the emerging evidence for the active, nonpharmacologic rehabilitation of concussion and PCS.

DEFINITION OF CONCUSSION

- Concussion is a brain injury that involves a complex pathophysiological process induced by biomechanical forces.[8]
- This complex pathophysiological process includes metabolic,[2] physiological,[11] and microstructural[12] injury to the brain that produces excitatory neurotransmitter release, abnormal ion fluxes, increased glucose metabolism, lactic acid accumulation, and inflammation.
- The macrophysiological insult to the brain affects the autonomic nervous system (ANS) and its control of both cerebral blood flow (CBF) and cardiac rhythm.[13]
- The majority (80%–90%) of sport-related concussions (SRC) in adults resolve in a short (7–10 days) period, although the recovery time frame may be longer in children and adolescents.[8]
- Recent research that accounts for vestibular-oculomotor problems that often accompany SRC suggests that recovery time for adolescents after SRC may take 3 to 4 weeks, which is longer than the commonly reported 7 to 14 days.[14]

DEFINITION OF POST-CONCUSSION SYNDROME

In some cases, concussion symptoms are prolonged.[8] Persistence of symptoms beyond the generally accepted time frame for recovery is called "post-concussion syndrome."

- PCS is not a single pathophysiological entity. It is a term used to describe a constellation of nonspecific symptoms (eg, headache, fatigue, sleep disturbance, vertigo, irritability, anxiety, depression, apathy, and difficulty with concentration and exercise) that are linked to several possible causes that do not necessarily reflect ongoing physiological brain injury.[9]
- The differential diagnosis of PCS includes depression, somatization, chronic fatigue, chronic pain, cervical injury, vestibular dysfunction, ocular dysfunction, or some combination of these conditions.[15]
- The challenge for clinicians is to determine whether prolonged symptoms after concussion reflect a prolonged version of the concussion pathophysiology versus a manifestation of a secondary process such as premorbid clinical depression, a cervical injury, or migraine headaches.[16,17] It is therefore essential that the clinician obtain a history of prior affective or medical problems, perform a careful physical examination, and consider the response to exertion (ie, whether exertion reliably exacerbates symptoms)[18] when developing the differential diagnosis of persistent post-concussion symptoms. Through this process, the clinician may be able to link symptoms of post-concussion "syndrome" to one or more definable post-concussion "disorders."[19] For example, establishing a premorbid history of migraine headaches, depression, anxiety, attention deficit hyperactivity disorder, or learning disability is crucial because concussion can exacerbate these conditions, and they in turn can be responsible for ongoing symptoms.[17]