

Current Concepts in Concussion Rehabilitation

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Current Sports Medicine Reports 2004, 3:316–323
Current Science Inc. ISSN 1537-890x
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Active rehabilitation of sport injuries is a concept familiar to athletes and those caring for them. Rehabilitation goals aim to optimize recovery efficiency and diminish chances of repeat injury. Rehabilitation programs take many aspects of recovery and wellness into consideration including physical, social, and psychologic components. Ultimately, this is important in the recovery process after concussion. In this article we introduce the largely unexplored concept of multidimensional concussion rehabilitation and discuss physical, psychologic, social, and sport-specific issues. As well, we propose future directions in this field.

How poor are they that have not patience! What wound did ever heal but by degrees?

William Shakespeare (Othello)

Introduction

Management of concussion injury in sport remains one of the biggest challenges faced by those caring for athletes, partly due to the high incidence and prolonged recovery period. Concussion may demand a lengthy recovery with prolonged down time and may impede many aspects of a player's life including career, sociability, family relations, professional and social relationships, and finances. Concussion largely remains the invisible injury that has no fixed timeline for recovery and, until resolved, oppresses the player with fear of the long-term consequences of the impact. That said, the concept of rehabilitation from concussion is relatively new, a surprising notion given that rehabilitation from injury plays a significant role in the life of most elite-level athletes. Of course most of what the athlete knows about rehabilitation has been learned from experience with orthopedic injury, not brain injury. In con-

trast, the concept of rehabilitation is familiar to those caring for brain-injured individuals, but it is applied more often after moderate or severe brain trauma rather than following mild head injury or concussion. James Garrick reminds us that there has been an evolution in the management of sports injury with "the employment of earlier and more active rehab programs" [1]. How then can we transpose that progressive thinking to concussion?

Rehabilitation Strategies

DeLisa *et al.* [2] describe six strategies to help mitigate disability from injury: 1) prevent or correct additional disability, 2) enhance systems unaffected by the pathologic condition, 3) enhance functional capacity of systems affected by the disease, 4) use adaptive equipment to promote function, 5) modify social and vocational environment, and 6) use psychologic techniques to enhance patient performance and education. We look at each of these in the context of concussion injury with the goal being to develop a sport concussion rehabilitation program.

Prevent or correct additional disability

It has long been recognized that even when the athlete is asymptomatic at rest, postconcussion symptoms may return with exertion, particularly if the athlete has been symptomatic for a prolonged period of time. The pathophysiology underlying this finding has not been elucidated; however, a clue may be gleaned from the work of Haykowsky *et al.* [3]. With resistance and Valsalva maneuvers (*eg*, biceps curl), significant elevations in intracranial pressure have been documented. This mirrors the experience of athletes who have recurrent symptoms with resistance training (many of whom associate only aerobic activity as exertion, not weight lifting). This finding of symptom aggravation with increasing levels of exertion is the basis for the graded return to activity programs currently in place (Table 1) [4,5,6,7]. The importance of being solidly asymptomatic prior to embarking on such a program cannot be overstated. Proactive measures must be taken at each step to ensure that the athlete's symptoms remain at bay throughout the process, not just during exertion, but also later the day of exertion, as well as the next