The effects of explanatory style on concussion outcomes in sport

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Abstract. Individuals with an optimistic explanatory style have generally been linked with improved mental and physical health across a variety of chronic and serious conditions. The purpose of the current study was to examine the effects of explanatory style on recovery time and number of sport-related concussions suffered in the last 12 months. University varsity athletes ($n=170$) suffering from at least one concussion over the last 12 months from six contact or collision team sports completed both the Attributional Style Questionnaire and the Sport History Questionnaire. The results indicated that athletes with an optimistic explanatory style took longer to recover than athletes with a pessimistic or average explanatory style. More specifically, optimistic athletes who suffered a complex concussion (requiring more than 7 days to recover) took significantly longer to return to play. However, the results showed that explanatory style did not influence whether an athlete suffered subsequent concussions. Overall, the current results can be used to better understand the psychology of concussions, as well as concussion prevention efforts and management strategies.

Keywords: Concussion, explanatory style, sport psychology

1. Introduction

Despite improvements in protective equipment, injury prevention, and rule changes, sport-related concussions remain a significant problem [11]. A concussion is the result of rapid acceleration/deceleration forces exerted on the brain [24]. Furthermore, a concussion typically results in a constellation of clinical signs and symptoms, such as loss of consciousness, headache, blurred vision, and nausea, that may disappear very quickly or linger for long periods [2]. Since these signs and symptoms prevent the athlete from both training and performing daily activities, it is important to explore ways to enhance recovery. Although research has attempted to identify the factors that influence and facilitate recovery following injury, there remains little that medical personnel can do to therapeutically intervene to shorten the recovery period following a concussion [3]. However, researchers have recently recognized that a number of psychological factors, such as depression, confusion, and social support, play a critical role in the susceptibility and recovery of concussions [3,16,18,21]. One psychological factor that has received increased attention in health psychology and which may help to better understand the area of concussion prevention and rehabilitation in sport is explanatory style.

Explanatory style is based on the premise that individuals have habitual ways of explaining events that occur in their lives [15]. Specifically, explanatory style refers to the ways that individuals explain their positive and negative life experiences [1]. The explanatory style construct emerged from the reformulation of the learned helplessness model, which contends that explanatory style varies on three dimensions: locus of
Given the prevalence of concussions in sport, members of the Concussion in Sport Group at the Second International Concussion meeting in Prague [23] recently updated the classification system for concussions. They operationalized concussions as either simple or complex in an attempt to assist medical personnel in the recognition, diagnosis, and recovery of athletes who may have suffered this type of injury. A simple concussion is the most common form and athletes usually recover within 7–10 days. On the other hand, complex concussions are characterized by persistent symptoms, specific sequelae, prolonged loss of consciousness, or prolonged cognitive impairment after the injury, and athletes take longer than 10 days to recover. Although researchers have examined the effects of concussion on athletes, the majority of these studies have focused on the physical dimension of this injury. Researchers have recently suggested that psychological factors also influence the susceptibility to and recovery from this injury [3,18].

Therefore, the purpose of the current study was to examine the effects of explanatory style on sport-related concussions. Two hypotheses were forwarded: first, using the suggestion proposed by Spencer and Norem [37], it was hypothesized that optimistic athletes would suffer more concussions than pessimistic or average explanatory style (neither optimistic nor pessimistic) athletes, as shown by the number of concussions experienced in the past 12 months. Second, using research from health psychology (e.g. [5,6,35]), it was hypothesized that simple and complex concussed athletes with an optimistic explanatory style would have a faster recovery than their pessimistic or average counterparts, as evidenced by a quicker return to play.

2. Method

2.1. Participants

Three hundred and forty-eight varsity athletes (209 males, 139 females) from two universities initially filled out the Attributional Style Questionnaire and the Sport History Questionnaire (see below for a description). From this initial pool of participants, 170 athletes (99 males, 71 females) were identified as having had at least one concussion the previous year, representing 48.9% of the participants. This sample represented a variety of collision or physical contact team sports including 34 ice hockey players (17 males, 17 females), 35 football players (all males), 5 lacrosse players (all...
females), 23 soccer players (9 males, 14 females), 55 rugby players (31 males, 24 females), and 18 basketball players (7 males, 11 females). There were 60 freshmen, 38 sophomore, 46 junior, and 22 senior level players.

2.2. Measures

2.2.1. Explanatory style

Explanatory style was measured using the Attributional Style Questionnaire [ASQ; 31], a self-report measure comprised of six hypothetical negative events and six hypothetical positive events from the domains of achievement and affiliation. Participants are asked to imagine these hypothetical events and assign causes to them. The scoring of the items is organized so that higher scores represent more internal, stable, and global attributions, whereas lower scores represent more external, unstable, and specific attributions [31]. The ASQ generates 36 scores, three items (internal, stable, global) for each of the 12 hypothetical events. While many scores can be derived from the ASQ, the present study used a composite total score which has shown the most consistent psychometric properties (e.g. [29]). A total composite score is obtained by subtracting the mean of the ratings of internality, stability, and globality for the positive events from the mean of the ratings of internality, stability, and globality for the negative events. Therefore, a total composite score can range from −18 to +18. Based on the total composite score, individuals were then classified as optimistic (a score greater than or equal to 6), pessimistic (a score less than or equal to 2), or average — neither optimistic nor pessimistic (a score ranging from 3–5). Cronbach alphas were 0.80 for the positive events and 0.76 for the negative events.

2.2.2. Concussions

The Sport History Questionnaire (SHQ) [9] was used to examine the incidences and characteristics of concussions. More specifically, the SHQ is a self-report, retrospective inventory that determines the number of concussions experienced during the previous 12 months of sport participation, the duration of symptoms, and the time for return to play. Symptom based questionnaires have been shown to be more sensitive to detecting possible concussions than traditional pre-participation evaluations [19]. The SHQ consists of questions regarding sport history, past concussions, and concussion symptoms. This includes information from past recognized and unrecognized or undiagnosed concussions. The SHQ asks about symptoms that the athlete may not have reported prospectively because they were either unaware that the symptoms experienced were the result of a concussion or they were aware that their symptoms were possibly due to a concussion, but they did not wish to volunteer this information to the medical staff. This may have occurred if the athlete were worried they would be prohibited from returning to competition. Furthermore, the SHQ gathers information on recovery time (days) the athletes sat out of competition and the duration that their symptoms persisted. A modified version of this questionnaire, made generic for athletes of all sports, was used for the current study since the original inventory was created for soccer and football. The current study used the same criteria as Delaney et al. [9,10] to determine if a concussion occurred. For instance, if an athlete reported any of the most commonly recognized concussion symptoms immediately after being hit in the head playing their sport, a concussion was identified.

2.3. Procedures

Varsity coaches were first contacted and informed about the nature of the study and were asked if the surveys could be administered to their teams. Once permission was obtained from the coaches, athletes were approached with a description of the study and were asked to participate. All participants were informed that participation was voluntary and were assured anonymity and confidentiality of their responses. Informed consent was obtained from all athletes prior to their completion of the questionnaires. The administration of the surveys occurred pre-season following either a team meeting or practice. One of the researchers was present at all times to answer any questions. Completion of the questionnaires took approximately 20 minutes. Institutional review board approval was obtained prior to data collection.

3. Results

3.1. Preliminary analyses

First, typical assumptions of multivariate analyses were tested. In particular, assumptions for normality (e.g., skewness, kurtosis), linearity, and multicollinearity were satisfied. However, the Mahalanobis distance criterion revealed multivariate outliers and resulted in the removal of seven participants from further analyses. Thus, a total of 159 participants were used in subsequent analyses. Second, assumptions regarding the use of MANOVA were met as indicated by nonsignificant Box’s and Levene’s test (p > 0.05).
3.2. Descriptive statistics

The results showed that the athletes had a mean score for explanatory style of 3.27 (SD = 2.79, range = −3 to +13). In particular, the results revealed that 21.4% of the participants were optimistic, 43.4% were pessimistic, and 35.2% were average (neither optimistic nor pessimistic). In addition, the average number of concussions that athletes suffered over the last 12 months was 3.05 (SD = 2.30). On average the number of days it took the athletes to return playing after suffering a concussion was 2.83 days. Finally, 91% (n = 145) of the concussed athletes were classified as having a simple concussion, whereas 9% (n = 14) suffered a complex concussion (see [23]).

3.3. Tests of hypotheses

In order to examine the hypotheses regarding differences in recovery time and total number of concussions suffered in the past 12 months, a MANOVA was conducted. The sample was divided into three groups based on their explanatory style score (optimistic, pessimistic, or average), and type of concussion (simple or complex). In the between-subjects MANOVA that compared the three explanatory style groups and the two types of concussion, the dependent variables were recovery time and total number of concussions. The overall MANOVA was significant, Pillai’s Trace, $F(4, 153) = 4.85; p = 0.001$. Insofar as recovery time is concerned, the results showed a significant main effect for explanatory style, $F(2, 153) = 8.02; p = 0.000$, type of concussion, $F(1, 153) = 636.67; p = 0.000$, and a significant interaction for explanatory style and type of concussion, $F(2, 153) = 9.61; p = 0.000$. As for total number of concussions, there were no significant main or interaction effects.

Planned comparison post hoc analysis using the Tukey-Kramer procedure showed that athletes with an optimistic explanatory style took longer to recover from their concussion than either athletes with a pessimistic or average explanatory style (p < 0.05). Furthermore, the post hoc analysis showed that, in terms of recovery time, explanatory style appeared to have no significant impact with the simple concussion group. That is, regardless of an individual’s explanatory style (optimistic, pessimistic, or average), they did not return to play sooner (p > 0.05). However, there were significant differences between explanatory style and complex concussion in regard to recovery time. More specifically, the post hoc results showed optimistic athletes who suffered a complex concussion took longer to return to play than either pessimistic or average athletes who also suffered a complex concussion (p < 0.05; see Table 1 for the means).

4. Discussion

The purpose of the present study was to examine the effects of explanatory style on sport-related concussions. First, it was hypothesized that optimistic athletes would suffer more simple and complex concussions than either pessimistic or average explanatory style athletes. Contrary to this hypothesis, the results showed that optimistic athletes did not suffer more simple or complex concussions than athletes with a pessimistic or average explanatory style. Second, it was hypothesized that simple and complex concussed athletes with an optimistic explanatory style would have a faster recovery than their pessimistic or average counterparts. Once again contrary to our hypothesis, optimistic athletes who suffered a complex concussion took significantly longer to recover, compared to athletes with either a pessimistic or average explanatory style. Of note, athletes who suffered a simple concussion returned to their sport in the same amount of time, regardless of explanatory style. Beyond these findings, a number of aspects related to the results should be highlighted.

The current results suggesting outcome variability relating to explanatory style and number of concussions may be attributed to various factors. On the one hand, previous research using self-reporting of symptoms has demonstrated that optimism was associated with decreased reporting of physical symptoms in both healthy individuals and those who were ill (e.g. [33,40]). Thus, it is unclear whether optimists truly have a more favorable health status or are optimistically biased and deny signs of illness or injury. Since a concussion is an invisible injury, it is possible that optimistic athletes deny the injury without others being aware.

On the other hand, it was believed that optimistic athletes would put themselves into more risky situations and hence receive more simple and/or complex concussions. However, Peterson et al. [28] conducted a series of 6 studies to investigate a possible link between explanatory style and risk for traumatic injuries in college students, dancers, athletes, and trauma patients. The results from their research found that optimists avoided perilous places whereas pessimists preferred potentially dangerous situations. Perhaps this result helps explain why the current results found no signifi-
than reckless risks. Likely to attempt skills that involved calculated rather than reckless risks.

Peterson et al. speculated, optimists were more likely to pay attention to risks to their health and were more likely to attempt skills that involved calculated rather than reckless risks.

The second hypothesis examined whether concussed athletes with an optimistic explanatory style had a faster recovery than their pessimistic counterparts, as evidenced by a quicker return to play. Due to some of the favorable benefits of optimism, a number of researchers have examined whether optimism helped recovery and rehabilitation from illness (e.g. [6,34,35]). Generally, research has shown that optimists recovered and rehabilitated quicker from athletic injury [12], breast cancer [6], and end-stage renal disease [38]. In contrast, the results of the present study showed that optimistic athletes took significantly longer to recover from a complex concussion than athletes with a pessimistic or average explanatory style. However, athletes who suffered a simple concussion returned to their sport in the same amount of time regardless of explanatory style.

The results running contrary to the proposed hypothesis may be attributed to various factors. First, past research has suggested that explanatory style may influence the recovery from illness in several ways. For example, individuals with a pessimistic explanatory style may become passive in the face of illness by either not seeking or following medical advice [30]. Furthermore, these individuals might initially neglect health care even because they see no connection between anything they might do and the onset of illness. Overall, pessimistic explanatory style has been associated with unhealthy habits and low self-efficacy to change these habits for the better [26]. For example, Lin and Peterson [20] found that pessimistic college students who developed colds or flu symptoms were less likely than their optimistic counterparts to take steps to combat their illness, such as increasing sleep and fluid intake. As such, the optimistic athletes in the current study who suffered a complex concussion may have taken longer to recover because they were more in tune with their bodies and understood the need to fully recover before resuming activity.

Second, optimism has been associated with less mood disturbances to a variety of stressors, including recovery from breast cancer [6] and coronary artery bypass surgery [35]. One explanation for the associations is that optimists cope more effectively with their stressors than do pessimists. There is substantial evidence that optimists use different coping strategies such as problem focused coping and use less denial and behavioral disengagement techniques, which contributes to a more timely recovery [7]. However, several studies have suggested the positive association between optimism and better adjustment during recovery does not occur under conditions of persistent or uncontrollable stress. For example, Cohen and colleagues [8] demonstrated that optimists fared worse than pessimists when faced with persistent stress. They suggested that optimists generally felt they had control over outcomes and could avoid prolonged difficulties; therefore, they reacted negatively when faced with an uncontrollable situation. One of the major issues surrounding concussion injury is the inability of medical personnel to therapeutically intervene to shorten the recovery period [3]. As a result, concussed athletes often become frustrated because there is nothing they can do to speed their recovery. As such, optimistic athletes may have been unable to cope with the situation, resulting in a more prolonged recovery.

Along the same line, Mittenburg and Strauman [25] suggested that the initial cause of postconcussion symptoms may be physiological in nature, but persistence in postconcussion symptoms could arise out of psychological factors. In fact, Gouvier and colleagues [14] found that postconcussion symptoms varied in accordance with an individual’s level of stress, coping style, and cognitive appraisal. Likewise, King and colleagues [17] found that psychological vulnerabilities such as anxiety and depression contributed to the per...
existence of postconcussion symptoms because anxious and depressed individuals tend to become overly in
tuned with themselves and their physical state, as well as
less pain tolerant. Therefore, the optimists in the
present study may have engaged in less effective coping
strategies [35] and experienced higher levels of negative
emotions such as anger, anxiety, and depression [22] as
a result of not being able to control the rehabilitation,
thus leading to a slower recovery.

While the results of this study provided considerable
information regarding concussion prevalence and recov-
ery, many questions surrounding sport-related con-
cussions still remain. For instance, the present study
used a retrospective self-reporting of symptoms in eval-
uating an athlete’s concussion history. Although this
method was beneficial since it allowed the athletes to
respond anonymously, athletes’ responses may have
been affected by a number of factors. That is, ath-
letes may have not accurately remembered the details
of their past concussion, such as duration and frequen-
cy of symptoms. As a result, there is a need for further
research that assesses explanatory style and concussion
recovery longitudinally, comparing athletes with com-
plex concussions with those who have a quick recovery
to determine whether explanatory style predicts recov-
ery outcomes. Finally, other factors that might have in-
fluenced number of concussions more than explanatory
style include sport chosen, position of play, number of
previous injuries, non-concussion injury rate, and
protection worn.

In sum, many athletes and coaches may not be fully
aware of the significance of their concussion symptoms
and the seriousness of sustaining additional brain in-
jury during the recovery process. Educating athletes on
the effects of concussion, what to expect during recov-
dry and the dangers of playing while concussed may con-
tribute to better injury recognition and prevention of
more serious injury [18]. Therefore, this study has the
potential to advance knowledge regarding the oc-
currence of concussion in sport, as well as aspects re-
lated to the rehabilitation process. Moreover, the con-
cussion literature has only begun to explore psycholog-
ical variables, such as emotional functioning [21], that
may influence concussion frequency and rate of recov-
ery. Thus, the current results may help predict those at
risk for concussion or suggest a possible variable (e.g.,
explanatory style) to enhance the recovery process. It
is hoped that the results from the present study will
stimulate research examining the role of psychological
variables in an attempt to better understand concussion
prevention and management.

References

helplessness in humans: Critique and reformulation, Journal
of Abnormal Psychology 87 (1978), 49–74.

ston, J. Kelly, M. Lovell, P. McCrory, W. Meeuwisse and P.
Schamusche, Summary and agreement of the first International
Conference on Concussion in Sport, Vienna 2001, Clinical

Sport psychology and concussion: New impacts to explore,

[4] C.S. Carver, B. Blaney and M. Scheier, Focus of attention,
chronic expectancy, and responses to a feared stimulus, Jour-
nal of Personality and Social Psychology 37 (1979), 1186–
1195.

[5] C.S. Carver and J.G. Gaines, Optimism, pessimism, and
postpartum depression, Cognitive Therapy and Research 11

Robinson, A. Ketcham, F. Moffat and K. Clark, How coping
mediates the effect of optimism on distress: A study of women
with early stage breast cancer, Journal of Personality and

strategies: A theoretically based approach Journal of Person-

D. Stites, Differential immune system changes with acute and
persistent stress for optimists and pessimists, Brain, Behavior,

Concussions during the 1997 Canadian Football League season,

[10] J.S. Delaney, V.J. Lacroix, S. Leclerc and K.M. Johnston,
Concussions among university football and soccer players,

sonde, Concussion in athletes produce brain dysfunction as re-
vealed by event-related potentials, Clinical Neuroscience and

[12] I. Ford, R. Eklund and S. Gordon, An examination of psy-
chosocial variables moderating the relationship between life
stress and injury time loss among athletes of a high standard,

[13] M. Fournier, D. de Ridder and J. Bensing, Optimism and adap-
tation to chronic disease: The role of optimism in relation
to self-care options of type 1 diabetes mellitus, rheumato-
arthritis and multiple sclerosis, British Journal of Health Psy-

Post concussion symptoms and daily stress in normal and head-
jured college populations, Archives of Clinical Neuropsy-
chology 7 (1992), 193–211.

[15] D.M. Isaacowitz, Correlates of well-being in adulthood and
old age: A tale of two optimism, Journal of Research in Psy-
chology 39 (2005), 224–244.

[16] K.M. Johnston, G.A. Bloom, J. Ramsay, J. Kissick, M. Lovell,
D. Montgomery, D. Foley, J.K. Chen and A. Pito, Current con-
cussion rehabilitation, Current Sports Medicine Reports 3
(2004), 316–323.

[17] N.S. King, S. Crawford, F.J. Weden, F.E. Caldwell and D.T.
Wade, Early prediction of persisting post-concussion symp-


