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The Role of Injury Type (Concussion versus Orthopedic), Coping Style, Depressive Symptomology, and Neurocognitive Functioning in Predicting Student-Athlete Injury Rehabilitation

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The Role of Injury Type (Concussion versus Orthopedic), Coping Style, Depressive
Symptomology, and Neurocognitive Functioning in Predicting Student-Athlete Injury
Rehabilitation

by

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Master of Science

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A doctoral research project submitted to the College of Psychology and Liberal Arts
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We the undersigned committee, having examined the submitted doctoral research project, “The Role of Injury Type (Concussion versus Orthopedic), Coping Style, Depressive Symptomology, and Neurocognitive Functioning in Predicting Student-Athlete Injury Rehabilitation”
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Abstract

Title: The Role of Injury Type (Concussion versus Orthopedic), Coping Style, Depressive Symptomology, and Neurocognitive Functioning in Predicting Student-Athlete Injury Rehabilitation

Author: Eileen Margaret Croes-Orf, M.S.

Major Advisor: Frank Webbe, Ph.D.

Objectives: To examine the role of injury type, coping style, depressive symptomology, and neurocognitive functioning in student-athlete injury recovery

Method: Eighty-two (54.9% male; 45.1% female) students, aged 18-25, from the Florida Institute of Technology in Melbourne Florida were administered the Coping with Health Injuries and Problems and PHQ-9 questionnaires to study the relationship between coping and depressive symptomology. Baseline neurocognitive functioning data from ImpACT scores were gathered in both student athlete groups. Participants in the concussion group were assessed with the ImpACT during their follow-up concussion management appointments at the Florida Tech Neuropsychology Laboratory.

Results: A significant interaction was found between coping style and group, $X^2(6)=14.06, p<.05$, Cramer's $V=.29$. As anticipated, adjusted residuals indicated that within the concussion group, the percentage of participants who used instrumental coping (4.2%) was significantly lower the percentage of participants who used palliative coping (41.7%), distraction coping (33.3%), and emotional preoccupation (20.8%). Conversely, adjusted residuals showed that participants in the orthopedic

injury group were significantly more likely to utilize instrumental coping (43.3%) than distraction coping (23.3%), emotional preoccupation (23.3%), and palliative coping (10%). Recovery time and use of instrumental coping style was shown to have a significant positive relationship ($r(80)=.333, p=.05$). Additionally, emotional preoccupation ($r(80)=.306, p=.05$) and distraction ($r(80)=.332, p=.05$) coping styles were also found to have significant positive relationships with rehabilitation time. There was no significant relationship found between coping styles and the total PHQ-9 score. However, a significant negative relationship was found between instrumental coping and the item that measures a depressive symptom of suicidal ideation ($r(82)=-.272, p=.01$). Thus, increases in reported suicidal ideation were correlated with decreases in instrumental coping and vice versa.

Conclusions: The results showed that athletes recovering from concussion are significantly less likely to utilize instrumental coping than other coping styles whereas athletes recovering from an orthopedic injury were significantly more likely to utilize instrumental coping. Thus, type of injury appears to have a significant relationship with the athlete's coping style. In regards to this relationship, distraction, instrumental, and emotional preoccupation coping styles were all found to be significantly correlated with rehabilitation time. Additionally, the results from this study presented a better understanding of coping style and the presentation of specific depressive symptoms, such as suicidal ideation, anhedonia, and changes in appetite and/or weight in student athletes recovering from injury.

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Introduction

After an athlete sustains an injury, several factors and influences contribute to recovery duration. These influences include the intensity and type of injury sustained, the physical and mental impact of the injury, and the individual's ability to cope with the injury. There has been little research regarding the latter influence on recovery time; namely the athlete's coping style. The purpose of this study is to examine the relationship between different coping styles, depressive symptomology presentation, the recovery time across different types of injury, and their resulting level of neurocognitive functioning. What follows is a review of the several influences that affect injured college athletes' recovery duration, such as the differences between orthopedic and concussive sport-related injuries as well as the neurocognitive functioning that is impacted by concussions. Athletes' potential post-injury depression, appraisal and impact of injury, injury rehabilitation, and coping style will also be reviewed. A review of the literature was conducted to understand these influences on collegiate athlete injury recovery and to inform the research focus of this study, which was the examination of the role of coping style as it pertains to concussion and orthopedic injury rehabilitation, as well as the presentation of depressive symptomology.

Review of the Literature

Injury Type

The type of injury an athlete sustains can have an effect on their symptom expression, recovery time, and physical and mental impacts. Research shows that psychological responses to injury, such as emotional responses, differ in athletes who experience orthopedic injuries compared to athletes who sustain concussions (Mainwaring, Huchinson, Bisschop, Comper, & Richards, 2010). For example, Athletes recovering from concussion may be more likely to experience acute elevated depressive symptoms, confusion, and fatigue whereas athletes recovering from orthopedic injuries may be more likely to experience increased tension, frustration, and overall emotional disturbance.

The current literature offers many different definitions of concussion. McCrory et al. (2013) defines concussion as a “complex pathophysiological process affecting the brain... [and] induced by traumatic biomechanical forces” (p.250). The Center for Disease Control and Prevention (CDC, 2017) defines concussion as mild traumatic brain injury produced by a “bump, blow, or jolt to the head or by a hit to the body that causes the head and brain to move rapidly back and forth” that can result in a temporary loss of brain function. However, most definitions include an important commonality: concussions are metabolic, or functional injuries as opposed to tissue or structural injuries. Thus, the emphasis is placed on the disruption of brain function, which is why the diagnosis of concussion does not rely singularly on imaging techniques such as MRI and CT scans, but also upon careful evaluation. However, according to a recently published study by Churchill, Hutchison, Battista, Graham, &

Schweizer (2017), diffusion tensor imaging has shown athletes involved in contact sports and who have endured concussions or sub-concussions have differences in white matter structure post-season when compared to baseline. Symptoms of concussions range from more commonly expressed headache, dizziness, light-headedness, and trouble with concentration, to less common endorsements of cognitive, vestibular, and visual impairments (Collins et al., 2013). Most sport related concussions are resolved relatively quickly, with an average return-to-play estimate of seven to 10 days following the injury (McKeon, et al., 2013).

Sport injuries are common and the vast majority of these injuries are orthopedic (Zemper, 1993). The CDC (2017) defines orthopedic injuries as soft-tissue injuries produced by “sudden or sustained exposure to repetitive motion, force, vibration, and awkward positions.” Orthopedic injuries can involve the muscles, nerves, tendons, joints and cartilage in the upper and lower limbs, neck and lower back. Thus, orthopedic injuries represent a diverse group that varies from strains and sprains to bone fractures and dislocations (Brewer & Redmond, 2017). Because orthopedic injuries represent such a diverse group of conditions, recovery time varies.

Neurocognitive Functioning

It has become standard practice for collegiate athletic programs to conduct neurocognitive assessments at baseline and post head injury. Such neurocognitive assessments measure the cognitive deficits that are typical features within the concussion symptomology, and then assist in diagnosing concussions. Individuals who experience concussions often suffer decreased neurocognitive performance within the attention, concentration, cognitive processing speed and efficiency, learning and

memory, working memory, and executive function and verbal fluency domains (Covassin, & Elbin, 2010). Deficits in neurocognitive functioning like the ones just mentioned cannot only have detrimental effects on a student athlete's academic performance, but they also can influence one's cognitive ability to cope with injury. Although there has been some suggestion that nonconcussive injuries have contributed to a noxious mental state that may negatively affect performance on neurocognitive measures, there have been no significant results in the research to support this theory (Dretsch, Coldren, Kelly, Parish, & Russell, 2012). Thus, athletes who have sustained nonconcussive orthopedic injuries should have no significant differences between their baseline and post-injury neurocognitive functioning.

Post Injury Depression

The National Collegiate Athletic Association (NCAA) has recognized that the increased amount of stress placed on student athletes to perform, along with the high-risk behaviors that are associated with student athletes, are significantly associated with mental health problems, such as mood disorders (NCAA, 2005). However, research has shown that student athletes are not more likely than non-athlete students to experience symptoms of depression (Armstrong, Burcin, Bjerke, & Early, 2015). It can be argued that the positive benefits of being a student athlete, such as strong social bonds, higher self-esteem, and routine exercise, also serve as protective factors against the development of depression. Yet, when a student athlete suffers an injury and is removed from play, they are also removed from many of these protective benefits, thus leaving them more susceptible to experience depressive symptoms (Mainwaring, Huchinson, Bisschop, Comper, & Richards, 2010). Studies have found that

correlations such as athletes' strong relation between self-image and their identity as athletes, and the relationship between athletes' physical health status and their self-esteem, all point to a higher risk of developing depression in athletes with sports-related injuries (Armstrong, Burcin, Bjerke, & Early, 2015). Thus, the possible development of depressive symptomology can be a psychological impact of injury.

Impact of Injury

Injured athletes often experience more stress than just from the physical symptoms and limitations they have as a result of injury. Indeed, the scope of the impact of their injury widens beyond the physical, and thus gives them additional adversity from which to cope. One of the more immediate consequences that a collegiate athlete experiences after an injury is removal from play. This is a common practice executed by a coach or athletic trainer to assess the injury and protect the athlete from causing greater harm to her or himself. When it is determined the athlete has indeed sustained an injury, a longer removal from play during injury rehabilitation is usually required. Although this period of removal from play allows the athlete to recover from his or her injury, it can also produce unintentional negative repercussions for the athlete. Given that college athletes gain a large part of their identity and social network around the sport that they play, the abrupt removal from this major area of their life can cause them to experience feelings similar to loss. In fact, some professionals such as Lynch (1988) posit that athletes' psychological response after an injury follows a modified version of Kübler-Ross's (1969) stage theory of death acceptance wherein the athlete goes through sequential stages of denial, anger, bargaining, and depression before reaching acceptance.

Not only are athletes coping with this perceived loss as a result of being pulled from play, they are also separated from the physical activity that they may have come to rely on as a coping resource in itself. When athletes are removed from play due to injury, they are often also sidelined in other forms of physical activity, such as individual and/or team workouts. Additionally, a major aspect of team sports is the camaraderie among the players of the team. Social support is widely understood to be one of the most important predictors of positive outcomes following stress or injury (Brewer & Redmond, 2017). Specifically, studies have found that athletes who have higher level of social support during their rehabilitation period were less likely to experience emotional disturbance during their recovery (Brewer & Redmond, 2017). Therefore, injured athletes who are accustomed to channeling both their ordinary and post-injury stressors into the physical activity and social support that their sport provides, no longer have this coping option, as they have been removed from play. This phenomenon leave these injured athletes without an appropriate way to cope, making them more vulnerable to negative outcomes (Putukian, 2015).

Due to the nature of sports in general, student athletes have become accustomed to their sport providing them with a sense of self-worth, competence, and achievement (Russell, 2000). A very practical impact of injury for student athletes removed from play following an injury is that they often experience stress related to their missing out on practice, games, and the advancement or even maintenance of their athletic level. Athletes may become hyper-focused on the fact that although they are not allowed to play for the time being, their teammates are still in the game, and some may even be playing in the injured athlete's position. Injured athletes who gain

much of their self-worth from their sport are denied the opportunity for athletic achievement, the very thing that maintains their self-worth (Russell, 2000). These additional stressors widen the impact of injury on student athletes, as well as place strain on their coping capabilities, which may already be strained by the factors previously mentioned.

Furthermore, student athletes may find it difficult to continue to manage the dual roles of both student and athlete following an injury. An injury can not only interfere with the athletes' ability to train, but also can interfere with their ability to keep up with their academic responsibilities. Physical injuries, at the very least, may interfere with an athlete's schedule, since he or she may need to miss class for doctor visits or for rest. At the most, an injury can interfere with the student athlete's mental ability to withstand an academic course load (Moser, 2007). This can occur in an athlete who has sustained a concussion that results in neurocognitive symptoms that take a toll on the athlete's concentration and memory. Additionally, physical symptoms such as sensitivity to light and noise could result in the athlete's withdrawal from class and assignments. For example, an athlete who has sustained a concussion and is experiencing such symptoms may find it difficult to tolerate the lighting and noise in the classroom. This, then, makes the classroom an unappealing and potentially harmful environment for the injured athlete, and may cause him or her to avoid class. Other concussion symptoms such as headaches or trouble concentrating may prevent an injured student athlete from being able to complete assignments and maintain his or her course load.

Appraisal of Injury

Although there are some commonalities in symptom presentation, impacts of injury, and even rehabilitation, the ways in which athletes respond to injury can vary greatly, depending on how they appraise their injury. According to Lazarus and Folkman's (1984) theory of stress and coping, the way in which people appraise, or interpret an event, stressor, or situation, will determine how they react emotionally and behaviorally to it. Cognitive appraisal is divided into three major forms: primary appraisal, secondary appraisal, and reappraisal. During a sport injury, primary appraisal occurs when an athlete assesses the injury in terms of how it affects him or her (Brewer & Redmond, 2017). The first part of the primary appraisals may lead the athlete to the conclusion that the injury is irrelevant, benign-positive, or stressful. The second stage of primary appraisals is when an athlete who has deemed an injury to be stressful, classifies whether the injury is a threat, a challenge, or a harm-loss. Because athletic injuries involve physical damage, injured student athletes are likely to have appraisals of threat and harm-loss in response to their injury (Brewer & Redmond, 2017). Threat appraisals imply future harm whereas challenge appraisals may suggest the injury offers the prospect of growth, and therefore typically evokes a positive stress response. In secondary appraisal, athletes begin to consider what can be done to overcome the situation or injury (Lazarus & Folkman, 1984). Secondary appraisals also encapsulate the feelings associated with dealing with the injury or the stress that it may produce. Therefore, in secondary appraisals, athletes contemplate what can be done to treat the injury and whether they can do what is necessary to heal and recover. The third type of appraisal, reappraisal, takes place when an athlete is altering his or

her appraisal based on new knowledge, such as learning about a new treatment that could change his or her appraisal of the injury's effects (Brewer & Redmond, 2017).

Two major factors thought to influence cognitive appraisals are the athlete's commitments to the sport and his or her perception of control (Brewer & Redmond, 2017). For example, because of commitment to their sport, a sprained knee is more likely to be appraised as a major life disruption by soccer players than by administrative assistants with a sedentary work life. Additionally, whether athletes hold an external or internal locus of control, which is the degree to which people attribute events to internal or external causes (Rotter, 1966), will influence how they appraise their injury, secondary appraisals in particular (Brewer & Redmond, 2017). Therefore, the way an athlete appraises his or her injury could have a greater impact on recovery than the injury itself, as it affects the athlete's emotional and behavioral response as he or she recovers and eventually returns to play.

Coping Style

Coping has been defined as the reaction one has to external stressful or negative events, as opposed to one's reaction to internally motivated threat or stress (Endler & Parker, 2000). Furthermore, coping is one's cognitive and behavioral attempts to manage the external or internal demands that this stressful or negative event is causing him or her (Lazarus & Folkman, 1984). There are various, different types of coping styles that may be expressed by an individual. Most commonly, research has split coping styles into two groups: problem-focused or emotion-focused coping (Wolters, Stapert, Brands, & Van Heugten, 2010). Problem-focused coping styles are generally more action-based, as the individual is acknowledging and

confronting the problem or event that is causing stress. Athletes using a problem-focused coping style following an injury may present as attempting to change the circumstances surrounding their injury or, they may try to collect more information about their injury, or gather more skills to deal with the injury. Alternatively, emotion-focused coping styles are focused more on managing the emotional reaction that a problem or negative event may provoke, rather than focused on changing the stressful situation (Wolters, Stapert, Brands, & Van Heugten, 2010). An athlete recovering from an injury who is utilizing this style of coping may engage in reassuring thoughts, either suppression or expression of emotions, accepting the situation, distraction, and avoidance.

More recently, authors have taken to categorizing coping styles slightly differently, as either engagement coping or disengagement coping. Engagement coping is considered the more active style of the two and can include both problem focused and emotion-focused strategies, such as seeking social support or cognitive restructuring (Scheenen, et al., 2017). Synonymous with passive coping, disengagement coping often includes emotion-focused strategies such as avoidance, denial, and wishful thinking (Scheenen, et al., 2017, Wolters Gregario, et al. 2015). People who rely on passive coping styles, which generally involve the focus on negative feelings rather than effectively solving the problem that has evoked these feelings, have been associated with a higher likelihood of negative outcomes following a concussion (Scheenen, et al., 2017). Research has also shown that patients who have sustained a severe traumatic brain injury also are more likely to use passive coping styles. It has been suggested that this is due to the cognitive impairment

concussions often induce, thus damaging certain functions necessary for problem-focused coping such as executive functioning (Woltors Gregario, et al. 2015).

However, there has been limited research devoted to examining this suggested relationship between cognitive deficits and passive coping styles in those recovering from less severe brain injuries, such as concussions.

Passive coping strategies have been associated with a greater likelihood for the development of distress symptomology following physical injury (Victorson, Farmer, Burnett, Ouellette, & Barocas, 2005). Moreover, research has indicated that perceived stress following a concussion, coupled with unsuccessful or ineffective coping strategies, has resulted in a greater likelihood for the injured athlete to experience depressive symptoms (Roiger, Weidauer, & Kern, 2015). Thus, athletes' ability to cope with their injury can not only directly influence their rehabilitation, but also indirectly influence their susceptibility to experience psychological difficulties, such as depression, which may also prolong injury recovery (Putukian, 2015). This makes the examination of student athletes' coping styles following injury an important area to study, as identifying how athletes respond to their injuries (such as their coping style) will help those involved in caring for these athletes better aid them in reaching a recovery with the fewest possible long-term effects, both physically and psychologically.

Injury Rehabilitation

The severity of an injury is not necessarily a predictor of how the athlete may recover psychologically. Similar to physical recovery, several factors can influence an athlete's psychological recuperation. The same factors that can affect the risk of injury

such as stress levels and coping can also influence rehabilitation (Brewer & Redmond, 2017). Physical readiness and psychological readiness to return to sport following injury are not always reached in synchronicity (Podlog, Dimmock, & Miller, 2011). While an athlete may be physically rehabilitated from his or her injury and probably quite motivated to return to sport, psychological effects from the injury are likely to linger longer and can greatly influence the athlete's return to play. While there is not currently a definition of psychological readiness to return to sport, researchers have identified characteristics that a recovered athlete may hold that demonstrates psychological readiness to return to sport. These include minimal levels of fear or anxiety, confidence, and motivation (Brewer & Redmond, 2017).

Common psychological themes among athletes' return-to-play concerns include re-injury anxiety, concern that they will not be able to perform at their pre-injury level, feelings of isolation, a lack of athletic identity they temporarily lost due to injury, and pressures to return to their sport (Podlog, Dimmock, & Miller, 2011). Athletes who utilize strong, healthy coping strategies will likely have the coping resources to allocate to these return to play concerns, and to decrease the likelihood of these concerns negatively impacting their return. Additionally, problem-focused coping has been shown to be positively related to rehabilitation adherence, while emotion-focused coping has been negatively related to rehabilitation adherence (Brewer & Redmond, 2017). Therefore, athletes' coping style remains important beyond onset of their injury and even their injury rehabilitation, but in return to their sport and likely, their adjustment to playing post-injury.

Mood disturbances can be significant features from the onset of injury throughout rehabilitation. The type and severity of an injury is strongly associated with the risk and severity of depression, and longer recovery times have been linked to higher frequency of negative emotional health consequences (Mainwaring, et al. 2010). Research has indicated that athletes who sustain injuries that require relatively long rehabilitation periods, such as knee injuries, generally have more comorbid depressive symptoms than athletes who sustain concussions. This is thought to be due to the difference in recovery time, as the required rehabilitation time for concussions is generally shorter than that of knee injuries (Mainwaring et al., 2010). However, unique circumstances of recovery from concussion, such as the lack of a predictable course that might be more apparent in a knee injury for example, can impose challenges to student athletes recovering from a concussion (Putukian, 2015). Concussions do not offer the athlete with a clear timeline for recovery and return to play that would otherwise give them comfort in knowing when they will be back to “normal.” Thus, this uncertainty can cause great emotional turmoil and can also result in longer rehabilitation times (Putukian, 2015).

It is important to note that not all sport related injury recoveries are the same. Aside from injury type and severity differences, individuals can respond to the recovery process differently. While some athletes will merge quickly from a negative to positive state, others may have emotional ups and downs (Quinn & Fallon, 1999). Athletes may differ in the trajectory and length of time required to recover from similar injuries. These differences can be due to a variety of factors, beginning with how athletes appraise their injury to how they cope with their injury. Thus, it is crucial

to resist the expectation that athletes will recover similarly and to remember to treat athletes differently, as they individually and idiosyncratically respond and cope with their injury and rehabilitation (Quinn & Fallon, 1999).

Goals and Objectives

Although researchers have been able to identify factors that seem to influence sport injury recovery time, as well as the psychological effects that occur post injury and throughout recovery, questions remain. The role of coping styles as they pertain to concussion and orthopedic injury rehabilitation, as well as the presentation of depressive symptomology, is still an area that requires more exploration. The primary purpose of this present study was to examine the relationship between the type of injury (concussion versus orthopedic) and the coping style utilized by the injured athlete. A secondary goal of this study was to determine what role the coping style plays in recovery time and the presentation of depressive symptoms. Establishment of these relationships could help physicians, athletic trainers, and therapists tailor treatment protocols that best benefit athletes' coping styles to ensure smoother recoveries and possibly fewer risks for negative outcomes.

Based on the information gathered to date, the following hypotheses were proposed:

Coping styles. The way in which athletes cope with the stressors that accompany injuries are expected to impact the athlete's length of recovery from injury. Coping styles were measured with the Coping with Health Injuries and Problems (CHIP). It was hypothesized that particular coping styles will be utilized to deal with the impact of injury, specifically:

H₁: The athletes who rehabilitate quickest and most successfully will utilize problem-focused (instrumental) coping styles.

H₂: Athletes with concussions will be less likely to use problem-focused (instrumental) coping styles than athletes with orthopedic injuries.

H₃: Athletes who utilize problem-focused (instrumental) coping styles will experience fewer depression symptoms during rehabilitation.

Method

Participants

The sample included 82 male and female students, aged 18-25, from the Florida Institute of Technology in Melbourne, Florida. The study consisted of two experimental groups: 24 athletes with concussion injuries confirmed by FIT's concussion management program and 30 athletes with orthopedic injuries, confirmed by FIT's athletic trainers. The study also included a control group comprised of approximately 28 non-athlete FIT students. These non-athlete students were recruited using the university's online research system, in which undergraduate students receive classroom credit for their participation in research studies. Athletes with orthopedic injuries who chose to volunteer to participate in the study were recruited via coordination with their athletic trainers. Athletic trainers strongly encouraged participation. Athletes with concussions were recruited from FIT's concussion management program. Additionally, advertisements for participation in the study were posted throughout campus. Both athletes and non-athletes who participated in the study were entered in a drawing to win one of three \$100 visa gift cards as compensation. All participants consented to the use of their test data and relevant demographic information for the purposes of research. Informed consent was also obtained prior to each volunteer's participation. Participants were presented with a form explaining the use of de-identified results for research purposes.

Materials

All participants provided demographic information about their background, such as their ethnicity, native language, and number of years of education, age, and

concussion history via a demographic questionnaire. Additionally, all participants completed the following assessments to measure coping and depressive symptoms: the Coping with Health Injuries and Problems (CHIP), the Patient Health Questionnaire (PHQ-9). Student athlete participants' baseline neurocognitive functioning data was measured by the Immediate Post Concussion Assessment and Cognitive Testing (ImPACT). Additionally, post-concussion neurocognitive functioning data was measured by the ImPACT for student athletes in the concussion group.

The CHIP is a coping measure, which measures the way in which individuals respond to health problems and injuries through distraction, emotional preoccupation, palliative, and instrumental coping styles (Endler & Parker, 2000). Problem-focused coping style was examined via the instrumental coping scale and emotion-focused coping style was examined via the emotional preoccupation scale.

The CHIP is a self-report assessment that usually takes 5 to 10 minutes to complete. Participants are asked to think about their injury, and respond to the 32-items describing potential responses to the event. They indicate how frequently they engage in each of the activities by circling a value from 1 (not at all) to 5 (very much). Participants' responses are then scored among four scales identified by the coping styles measured by the CHIP: distraction, emotional preoccupation, palliative, and instrumental coping styles. Whichever scale the participant scores highest determines his or her coping style. Examples of items that load onto the instrumental coping scale are "find out more information about the illness," "seek medical treatment as soon as possible," and "learn more about how my body works." Examples of possible responses to the injury that load onto the emotional preoccupation scale are "get

frustrated,” “feel anxious about the things I can’t do,” and “worry that my health might get worse.” Internal reliability coefficients for the scales in ages 18 to 29 years range from .76 to .84, and test-retest reliability coefficients for a two to three-week period range from .64 to .85, indicating good reliability for the CHIP. Factor analysis demonstrated that the items “loaded at least moderately on their matching factor, and low or very low on the other factors” (Endler & Parker, 2000).

The PHQ-9 is a multipurpose, self-report tool used to screen, diagnose, monitor, and measure the severity of depression. The PHQ-9 consists of nine questions that measure the frequency of depressive symptoms such as “little interest or pleasure in doing things” and “feeling down, depressed, or hopeless” (Kroenke, Spitzer, & Williams, 2001). Respondents are asked to indicate how frequently they have been bothered by the prompted problems over the last two weeks by circling a value from 0 (not at all) to 3 (nearly every day). PHQ-9 scores of 5, 10, 15 and 20 indicate mild, moderate, moderately severe, and severe depression, respectively. PHQ-9 scores of 10 or higher were shown to have a sensitivity of 88% and a specificity of 88% for Major Depressive Disorder (Kroenke, Spitzer, & Williams, 2001). Participants who scored high (total score of 9 or above) or who endorsed suicidal ideation on item nine of the PHQ-9 were assessed for immediate risk and were referred to the student counseling center.

The ImPACT is among the most widely utilized computerized assessment tools for concussion diagnosis. The standard practice is to collect individual baseline ImPACT data for each athlete to compare to post-trauma ImPACT data in the event of an injury to either rule out or diagnose concussions. In addition to a post-concussion

symptom inventory, the test includes six cognitive modules that make up the four core clinical composite indexes: verbal memory, visual memory, visual motor speed, and reaction time composites (Lovell, 2016). The test includes two additional composites to aid concussion diagnosis: the impulse control and the total symptom composites. The former provides a measure of errors on testing and is useful in determining test validity and the later provides a summary of the athlete's self-reported symptom data. These composite scores are automatically produced after the athlete has completed taking the ImPACT test. A significantly lower score achieved by an athlete during post injury assessment on verbal and visual memory, and motor processing speed indicates decreased neurocognitive performance. Conversely, a significantly higher score on reaction time indicates slower reaction time and suggests decreased performance as well. ImPACT is useful in evaluating changes in neurocognitive performance after concussion and takes approximately 20 to 30 minutes to administer. Test-retest intra-class correlation coefficient estimates for a two-year period range from .74 (processing speed), .68 (reaction time), and .65 (verbal memory) to .46 (verbal memory) and .43 (symptom scale), indicating good temporal reliability in healthy controls (Lovell, 2016).

Procedure

This study was approved by the Institutional Review Board (IRB) of the Florida Institute of Technology in July 2017, prior to obtaining consent and beginning testing with the first student-athlete and non-athlete participants. All FIT student athletes are required to participate in the Concussion Management Program. During pre-season baseline testing, all athletes attend a mandatory education session that

offers psychoeducation about concussions, describes the research aims of the concussion management team, and provides all student athletes with forms for informed consent. Students are informed that they may withdraw participation in the research aspect of the program at any time without impacting their athletic eligibility. In addition to this general consent, all participants in the concussion and orthopedic groups consented to this specific study protocol at the time they volunteered. For the non-athlete participants, consent was also obtained after they volunteered for the study.

All participants were treated according to the ethical principles outlined by the American Psychological Association (APA). Each testing session lasted approximately 20 to 45 minutes. Participants in the orthopedic injury group were assessed with the CHIP and PHQ-9 at the Florida Tech Athletic Training office. Athletes in this group acquired injuries that ranged from ankle sprains to anterior cruciate ligament (ACL) tears, and wrist fractures. As the questionnaires were given upon recovery from the participants' respective injuries, the participants were instructed to answer the items on the PHQ-9 and CHIP in accordance to how they coped and felt during injury recovery. Participants in the concussion group were assessed with the CHIP, PHQ-9, and ImPACT during their follow-up concussion management appointments at the Florida Tech Neuropsychology Laboratory. FIT's athletic training office provided further information regarding athletes' injury incidence and recovery and return to play. FIT's concussion management team provided information regarding participating athletes' concussion diagnoses, recovery, and return to play clearance. Participants from the control group were instructed to

identify a recent injury or health problem and answer the PHQ-9 and CHIP items in accordance to how they coped and felt during their recovery.

Statistical Methods

All data were analyzed using SPSS. Preliminary analyses consisted of computing descriptive statistics to describe characteristics of the sample of athletes and non-athletes such as age, sex, education level, sport, and number of previous concussions. Means and standard deviations were computed for the scores on all measures applicable. The relationship between type of injury and coping style was assessed by Pearson's Chi Square test of independence and bivariate correlation. Comparative analyses aimed at evaluating the relationship between athletes' coping styles and injury recovery time were assessed with bivariate correlational analyses. Additionally, independent samples *t*-tests and bivariate correlation analyses were conducted to compare coping styles and depressive symptomology among athletes who have sustained a concussion with athletes who have sustained an orthopedic injury.

Results

Participant Demographics

Demographic characteristics of the participants are shown in Table 1. Participants in the study included 54 student-athletes and 28 non-athlete students from the Florida Institute of Technology. The sample included 45 male (54.9%) and 37 female (45.1%) participants. Twenty-four participants were student athletes with a diagnosed concussion, 30 were student athletes with an orthopedic injury, and 28 were non-athlete student controls. Participants' mean age was 20.07 years ($SD= 1.67$); however, there is a statistically significant difference between groups determined by one-way ANOVA [$F(2,79)= 4.029, p=.022$]. A Tukey post hoc test revealed that the age between the orthopedic injury group ($M=20.67; SD=1.40$) and the concussion group ($M=19.42, SD= 1.28$) differed significantly ($p=.016$); no other significant differences of age between groups were observed. Participants described themselves as Caucasian (63.4%), African American (15.9%), Hispanic/Latino (8.5%), multiracial (6.1%), Asian (4.9%), and Native Hawaiian/Other Pacific Islander (1.2%). Seventy (85.4%) participants declared English as their first language, while 12 (14.6%) participants reported English was not their first language. The mean years of education was 13.46 ($SD=1.22$) and the majority of student-athlete participants were members of the football (22.2%), women's soccer (14.8%), and men's lacrosse (13%) teams (table 2). The large majority of participants (78%) reported no history of previous concussion.

Table 1. Participant Demographics

Variable	Mean (SD)	Participants n (%)	Concussion Group	Orthopedic Injury	Control Group
Gender					
Male		45 (54.9%)	12 (50%)	15 (50%)	18 (64.3%)
Female		37 (45.1%)	12 (50%)	15 (50%)	10 (35.75%)
Age					
	20.07 (1.67)				
18		15 (18.3%)	9 (37.5%)	1 (3.3%)	5 (17.9%)
19		20 (24.4%)	2 (8.3%)	6 (20%)	12 (42.9%)
20		18 (22.0%)	8 (33.3%)	7 (23.3%)	3 (10.7%)
21		13 (15.9%)	4 (16.7%)	7 (23.3%)	2 (7.1%)
22		11 (13.4%)	1 (4.2%)	7 (23.3%)	3 (10.7%)
23		1 (1.2%)	0 (0%)	1 (3.3%)	0 (0%)
24		2 (2.4%)	0 (0%)	1 (3.3%)	1 (3.6%)
25		2 (2.4%)	0 (0%)	0 (0%)	2 (7.1%)
Years of Education					
	13.46 (1.22)				
12; Freshman		24 (29.3%)	9 (37.5%)	4 (13.3%)	11 (39.3%)
13; Sophomore		19 (23.2%)	4 (16.7%)	8 (26.7%)	7 (25%)
14; Junior		19 (23.2%)	8 (33.3%)	6 (20%)	5 (17.9%)
15; Senior		17 (20.7%)	3 (12.5%)	9 (30%)	5 (17.9%)
16; 5 th Year/Graduate		3 (3.7%)	0 (0%)	3 (10%)	0 (0%)
Ethnicity					
Caucasian		52 (63.4%)	14 (58.3%)	21 (70%)	17 (60.7%)
African American		13 (15.9%)	5 (20.8%)	5 (16.7%)	3 (10.7%)
Hispanic/Latino		7 (8.5%)	2 (8.3%)	1 (3.3%)	4 (14.3%)
Asian		4 (4.9%)	0 (0%)	0 (0%)	4 (14.3%)
Native Hawaiian/Other Pacific Islander		1 (1.2%)	0 (0%)	1 (3.3%)	0 (0%)
Multiracial		5 (6.1%)	3 (12.5%)	2 (6.7%)	0 (0%)
Previous Concussions					
None		64 (78%)	16 (66.7%)	24 (80%)	24 (85.7%)
One		14 (17.1%)	6 (25%)	4 (13.3%)	4 (14.3%)
Two		2 (2.4%)	1 (4.2%)	1 (3.3%)	0 (0%)
Three		1 (1.2%)	0 (0%)	1 (3.3%)	0 (0%)
Four		1 (1.2%)	1 (4.2%)	0 (0%)	0 (0%)

Table 2. Sports

Sport		Athletes n (%)	Concussion Group	Orthopedic Injury
Football		12 (22.2%)	8 (33.3%)	4 (13.3%)
Basketball	(M)	1 (1.9%)	1 (4.2%)	0 (0%)
	(W)	2 (3.7%)	2 (8.3%)	0 (0%)
Soccer	(M)	1 (1.9%)	0 (0%)	1 (3.3%)
	(W)	8 (14.8%)	1 (4.2%)	7 (23.3%)
Lacrosse	(M)	7 (13%)	1 (4.2%)	6 (20%)
	(W)	4 (7.4%)	4 (16.7)	0 (0%)
Swim	(M)	1 (1.9%)	0 (0%)	1 (3.3%)
	(W)	3 (5.6%)	1 (4.2%)	2 (6.7%)
Softball	(W)	5 (9.3%)	1 (4.2%)	4 (13.3%)
Baseball	(M)	1 (1.9%)	1 (4.2%)	0 (0%)
Track and Field	(M)	3 (5.6%)	1 (4.2%)	2 (6.7%)
	(W)	2 (3.7%)	0 (0%)	2 (6.7%)
Volleyball	(W)	1 (1.9%)	1 (4.2%)	0 (0%)
Tennis	(W)	1 (1.9%)	1 (4.2%)	0 (0%)
Rowing	(W)	1 (1.9%)	1 (4.2%)	0 (0%)
Golf	(M)	1 (1.9%)	0 (0%)	1 (3.3%)
Total		54	24	30

Injury Recovery

Injury recovery time was defined as the amount of cumulative days student athlete participants were removed from play from the date of injury to the date they were cleared to return to play. The mean recovery time of concussion was 15.29 days ($SD=10.48$) and the mean recovery of orthopedic injury was 124.23 days ($SD=130.02$). An independent t test showed there was a significant difference in the recovery time for the orthopedic injury and concussion groups; $t(29.47)= 4.57$, $p<.001$.

Tests of hypotheses

Type of injury and coping style.

The primary purpose of this present study was to examine the relationship between the type of injury (concussion versus orthopedic) and the coping style utilized by the injured athlete. I hypothesized that athletes with concussions will be less likely to use problem-focused (instrumental) coping styles than athletes with orthopedic injuries. A one-way MANOVA revealed there was a statistically significant difference in coping styles based on group, $F(8, 152) = 3.473, p < .05$, Wilk's $\Lambda = 0.715$, partial $\eta^2 = .155$. Univariate testing found the effect to be significant for instrumental coping ($F(2, 79) = 6.602; p < .05$). Follow-up testing indicated that athletes with orthopedic injuries were more likely to utilize instrumental coping than athletes with concussion ($p < .05$).

A chi-square test of independence was calculated comparing the frequency of coping styles utilized in the concussion, orthopedic injury, and control groups. A significant interaction was found between coping style and group $X^2(6) = 14.06, p < .05$, Cramer's $V = .29$. As anticipated, adjusted residuals indicated within the concussion group, the percentage of participants who used instrumental coping (4.2%) was significantly lower than the percentage of participants who used palliative coping (41.7%), distraction coping (33.3%), and emotional preoccupation (20.8%). Conversely, adjusted residuals showed that participants in the orthopedic injury group were significantly more likely to utilize instrumental coping (43.3%) than distraction coping (23.3%), emotional preoccupation (23.3%), and palliative coping (10%). There

were no significant differences based on adjusted residuals observed in coping styles used by participants within the control group.

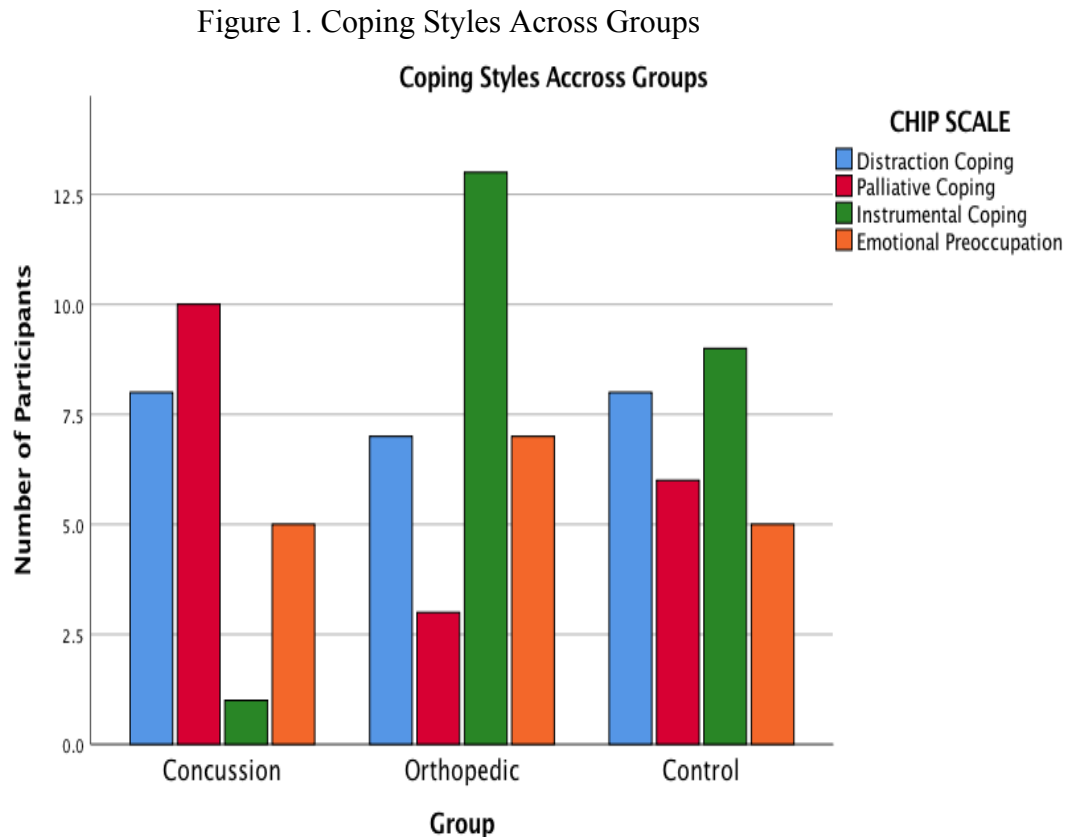


Figure 1 displays the number of participants in each group (concussion, orthopedic, control) and the extent that they identified as using a particular coping style. As demonstrated in Figure 1, participants in the concussion group utilized the lowest frequency of problem-focused (instrumental) coping styles. In fact, only one out of 24 participants in the concussion group identified as using instrumental coping more than the other coping styles, compared to 13 out of 30 participants in the orthopedic group and 9 out of 28 participants in the control group. In regards to palliative coping, 10 concussion group participants, 3 orthopedic injury group

participants, and 6 control group participants utilized this style the most. The frequency of utilization of distraction coping was similar amongst participants across all three groups: 8 in both the concussion group and the control group, and 7 in the orthopedic injury group. Similarly, in regards to emotional preoccupation, five participants in both the concussion group and control group, and seven participants in the orthopedic injury group utilized this coping style the most.

The current literature has suggested that individuals who have sustained a brain injury also are more likely to use passive coping styles than problem-focused coping styles, possibly due to the cognitive impairment concussions often induce, thus damaging certain functions necessary for problem-focused coping (Woltors, et al. 2015). In order to understand the significance of the lack of instrumental coping within the concussion injury group, a Pearson product-moment correlation coefficient was computed to assess the relationship between post-concussion cognitive functioning and coping styles within the concussion group (Table 3). There was a significant positive relationship between the Verbal Memory Composite Score and instrumental coping ($r(22)=.415, p<.05$). Thus, decreases in attentional processes, learning, and memory within the verbal domain were associated with decreases in use of instrumental coping styles in the concussion group. Additionally, a significant negative relationship was found between the Reaction Time Composite and use of emotional preoccupation ($r(22)=-.478, p<.05$). Thus, increases in response speed were correlated with decreases in use of emotional preoccupation, and vice versa. Lastly, a significant positive relationship between emotional preoccupation and the Cognitive Efficiency Index was found ($r(22)=.716, p<.01$), suggesting that increases

in cognitive efficiency were correlated with increases in use of emotional preoccupation. No significant relationships were observed between coping styles and baseline ImPACT data in either injury group.

Table 3: Correlation of Neurocognitive Functioning (ImPACT scores) and Coping Styles in Concussion Group

	Distraction Coping	Palliative Coping	Instrumental Coping	Emotional Preoccupation
Memory Composite Score Verbal	.278	.323	.415*	.243
Memory Composite Score Visual	.074	-.079	.154	.129
Visual Motor Composite Score	-.182	.253	-.054	.266
Reaction Time Composite Scores	.154	-.098	-.096	-.478*
Impulse Control Composite Scores	-.381	.402	-.171	.303
Total Symptom Score	.287	-.141	-.016	-.073
Cognitive Efficiency Index	.067	.244	.63	.716**

**Correlation is significant at the .01 level (2-tailed)

*Correlation is significant at the 0.05 level (2-tailed)

Coping style and recovery time.

A secondary goal of this study was to determine what role the coping style plays in recovery time. I hypothesized athletes who rehabilitated quickest and most successfully would utilize problem-solving coping styles. A Pearson product-moment

correlation coefficient was computed to assess the relationship between coping style and recovery time across both injury groups combined (Table 4). As shown in Table 4, distraction, instrumental, and emotional preoccupation coping styles were all found to be significantly correlated with rehabilitation time. Recovery time and use of instrumental coping style was shown to have a significant positive relationship ($r(80)=.333, p=.05$). Additionally, emotional preoccupation ($r(80)=.306, p=.05$) and distraction ($r(80)=.332, p=.05$) coping styles were also found to have significant positive relationships with rehabilitation time. There was no significant relationship observed between palliative coping and recovery time. Thus, increases and decreases in days of recovery were associated with changes in the same direction in the use of distraction, instrumental, and emotional preoccupation coping styles.

Table 4: Correlation of Recovery Time to Coping Styles Across Injury Groups

	Recovery Time	Distraction Coping	Palliative Coping	Instrumental Coping	Emotional Preoccupation
Recovery Time	1	.332*	-.049	.333*	.306*

*Correlation is significant at the 0.05 level (2-tailed)

Due to the significant differences in recovery time between the two injury groups, the groups were separated to examine the relationship between coping styles and recovery time within the concussion and orthopedic injury groups. While recovery time displayed no significant relationship to instrumental coping (Table 5) in either group, recovery time significantly correlated with use of distraction coping ($r(28)=.422, p=.05$) within the orthopedic injury group. Thus, increases or decreases in days of recovery from orthopedic injury were correlated with changes in the same direction in the use of distraction coping styles.

Table 5: Correlation of Recovery Time to Coping Styles in Injured Student Athletes

		Time to Recovery	Distraction Coping	Palliative Coping	Instrumental Coping	Emotional Preoccupation
Concussion	Time to Recovery	1	-.024	.225	-.096	.156
Orthopedic Injury		1	.422*	.104	.165	.282

*Correlation is significant at the 0.05 level (2-tailed).

Coping style and depressive symptoms.

An additional goal of this study was to determine what role the coping style played in the presentation of depressive symptoms. It was hypothesized that athletes who utilize problem-focused (instrumental) coping styles will experience fewer depression symptoms during rehabilitation. Total PHQ-9 scores from a possible range of 0 to 27 were computed for each participant. Participants' total PHQ-9 scores ranged from 0 to 20 with a mean of 3.52 ($SD= 4.00$) PHQ-9 total scores across all groups. An independent samples t test was performed to compare the means of total PHQ-9 scores in the concussion and orthopedic injury groups. There was a significant difference in PHQ-9 total scores between the concussion ($M=1.25$, $SD=1.82$) and the orthopedic injury ($M=3.63$, $SD=3.51$) groups $t(45.37) = -3.217$, $p = .002$. However, depressive symptomology, as measured by total PHQ-9 scores, displayed no significant relationship to coping styles across all three groups (Table 6).

Table 6: Correlation of Depressive Symptoms (PHQ-9 Total score) to Coping Styles
in Injured Student Athletes and Control Group

		Depressive symptoms	Distraction Coping	Palliative Coping	Instrumental Coping	Emotional Preoccupation
Concussion	Depressive symptoms	1	.136	-.064	-.119	-.2.64
Orthopedic Injury	Depressive symptoms	1	-.245	.001	-.326	.190
Control	Depressive symptoms	1	-.001	-.007	-.246	.315

*Correlation is significant at the 0.05 level (2-tailed)

Because some depressive symptoms may overlap with concussion symptoms (e.g. fatigue and concentration difficulties), the participants' responses to each item were analyzed to determine which depressive symptoms were endorsed the most frequently in relation to coping style. In order to examine the relationship between coping styles and specific symptoms of depression across all three groups, a Pearson product-moment correlation coefficient was computed to assess the relationship between coping styles and response to the nine different items of the PHQ-9 that measure specific symptoms of depression. A significant negative relationship between instrumental coping and the item that measures suicidal ideation ($r(82)=-.272, p=.01$). Thus, increases in reported suicidal ideation were correlated with decreases in instrumental coping and vice versa. However, it should be noted that a relatively small number of participants endorsed at least a 1 out of 3 on the item that measures suicidal ideation ($n=4$).

Within the concussion group, there was a significant negative relationship between instrumental coping and both of the items that measures changes in appetite and weight ($r(22) = -.48, p < .05$) and the item that measures little interest or pleasure in doing things ($r(22) = -.53, p < .01$). This indicates there is an inverse relationship between use of instrumental coping and the presentation of depressive symptoms of anhedonia and changes in appetite and/or weight. Within the control group, there was a significant positive relationship between emotional preoccupation and the items that measure depressive symptoms of anhedonia ($r(26) = .38, p < .05$) and changes in appetite and/or weight ($r(26) = .45, p < .01$). Thus, increases or decreases in the use of emotional preoccupation coping style were significantly correlated with changes in the same direction in the presentation of depressive symptoms of anhedonia and changes in weight and/or appetite in the control group. Additionally, there was a significant negative correlation between PHQ-9 items that measure suicidal ideation and utilization of instrumental coping style in the control group ($r(26) = -.389, p < .05$). Hence, increases in reported suicidal ideation were correlated with decreases in instrumental coping and vice versa within the control group. As noted above, this relationship was also observed when groups were combined. No significant relationships between coping styles and the specific items of the PHQ-9 were observed in the orthopedic injury group.

Discussion

The type and intensity of injury as well as the physical and mental impact of injury have been shown previously to influence injury recovery. However, there has been little research regarding the relationship between an athlete's coping style and their recovery from injury. Since injury recovery can vary from individual to individual and can sometimes result in negative outcomes such as season-ending injuries, depressive symptomology, and lingering symptoms, it would be advantageous for athletes and individuals responsible for caring for these athletes to understand the role coping style plays in recovery.

The results of this study supported the hypothesis that athletes with concussions will be less likely to use problem-focused coping styles than athletes with orthopedic injuries. This result is supported by literature that has shown that individuals who have sustained a brain injury are more likely to use passive coping styles. It has been suggested that this is due to the cognitive impairment brain injuries often induce that damage certain functions necessary for problem-focused coping such as executive functioning (Woltors et al. 2015). However, almost no previous literature had addressed this relationship in sport-related concussion injuries with definitive findings. Results of the present study showed a significant relationship between post-concussion scores on the Verbal Memory Composite and instrumental coping in the concussion group, suggesting that increases or decreases in use of instrumental coping was correlated with changes in the same direction in attentional processes, learning, and memory within the verbal domain. Thus, the concussed athlete's attentional processes, learning, and memory within the verbal domain appear to correlate with his

or her utilization of problem-focused coping styles. This is a particularly important finding because it supports current literature that indicates concussed athletes' ability to utilize problem-focused coping styles is associated with changes in neurocognitive functioning (Woltors et al. 2015).

The hypothesis regarding the interaction of recovery time and problem-solving coping styles predicted a significant negative correlation between recovery time and instrumental coping. This hypothesis was not supported and in fact, the data suggested an opposite relationship. This might be due to the significant differences in mean recovery times between injury groups such that athletes in the concussion group demonstrated much quicker recovery times than athletes in the orthopedic injury group. Therefore, the between-group differences may have influenced the results of the correlation across all groups.

However, distraction and emotional preoccupation coping styles were also shown to have a significant positive relationship with recovery time. And when the injury groups were separated to examine this relationship more, distraction coping styles were shown to be positively correlated with recovery time in the orthopedic injury group. Distraction coping styles are typically defined by the individual's engagement in distracting thoughts and activities and are closely related to avoidance coping (Endler & Parker, 2000). The initial hypothesis and study design did not account for the fact that orthopedic injuries took significantly longer time to recover from than concussions in the sample population; thus, this discrepancy between recovery times likely influenced the correlation with distraction and recovery time in the orthopedic injury group. This interaction between distraction coping styles and

longer recovery time is supported by the literature (Brewer & Redmond, 2017; Scheenen, et al., 2017). Passive coping strategies have been associated with a greater likelihood for the development of distress symptomology following physical injury (Victorson, et al., 2005). Understanding this relationship can provide the basis of empirical support for rehabilitation interventions utilized by professionals responsible for the care of collegiate athletes recovering from orthopedic injury. Thus, although analysis of the relationships between coping styles and recovery time did not result in the findings that were initially anticipated, other interactions were found to be significant to understanding the overall relationship between coping styles and injury recovery.

Athletes' ability to cope with their injury not only can influence directly their rehabilitation, but also indirectly influence their susceptibility to experience psychological difficulties, such as depression. This makes the examination of student athletes' coping styles following injury an important area to study, as identifying how athletes respond to their injuries (such as their coping style) will help those involved in caring for these athletes better aid them in reaching a recovery with the fewest possible long-term effects, both physically and psychologically. Comparisons of means of total PHQ-9 scores between injury groups revealed that athletes with orthopedic injuries endorsed more depressive symptomology on the PHQ-9 than athletes with concussions. This finding supports previous research outcomes that suggest longer recovery times pose a higher probability of susceptibility of depressive symptoms (Mainwaring, et al. 2010).

It was hypothesized that athletes who utilize problem-focused (instrumental) coping styles will experience fewer depression symptoms during rehabilitation. This hypothesis was not supported by the data, as depressive symptomology measured by total PHQ-9 scores displayed no significant relationship to coping styles across all three groups. However, when this relationship was examined across the specific symptoms of depression measured by the PHQ-9, a very interesting and significant relationship was found: increases in suicidal ideation were significantly correlated with decreases in instrumental coping and vice versa. Since suicidal ideation is a diagnostic criterion of depression and is a significant risk factor, especially for college students, this significant negative correlation suggests that instrumental coping may play a role in reducing suicidal risk in college students recovering from an injury or health problem (American Psychiatric Association, 2013). As such, additional research examining the role of coping style on the expression of suicidal ideation in a college population is warranted.

The results of this study have provided more insight into the role of coping style in student-athletes' recovery from differing types of injuries. These findings may be helpful in guiding athletic trainers and mental health professionals' selections of interventions to aid recovery based on injury type. Professionals involved in student-athletes' care and injury recovery should be aware of the relationship between coping style and the possible presence of depressive symptoms. The results suggest use of instrumental coping may protect against suicidal ideation. Thus in order to reduce suicidal risk, instrumental coping strategies should be encouraged amongst athletes recovering from orthopedic injuries. Instrumental coping is often already facilitated by

athletic trainers and physicians via the delivery of education about their specific injury including typical injury recovery time, possible treatments, and long-term recovery.

This can be further facilitated by encouraging the student-athlete to focus on what they can do to improve recovery, thus focusing on the problem (the injury) rather than the ensuing stress, which results in a greater feeling of control for the athlete that might be dealing with the overwhelming impact of an unexpected injury. However, the results of this study suggest it may not be helpful to encourage concussed student-athletes to engage in problem-focused coping strategies such as cognitive restructuring or information gathering about their injury as they might not have the cognitive resources to devote to this style of coping. Therefore, athletes recovering from concussions should be closely monitored for possible symptoms of suicidal ideation.

Limitations and Future Directions

There are several limitations to the present study. First, a small sample size was used, which likely hindered results. This was due to the limited number of student-athletes who met criteria for diagnosis of concussion during the enrollment period of this study. The total amount of participants in this group (n=24) was slightly fewer than anticipated based on data collected from previous years. This was likely a result of beginning data collection near the end of the football season, as football players accounted for 33.3% of the concussion group. There were a limited number of student-athletes recovering from orthopedic injury as well. Thus, the significance of results was limited by the overall small sample size.

Another significant limitation to this study was the disparity in mean recovery times between the concussion and orthopedic injury groups. This was likely affected

by the variability in orthopedic injuries that resulted in a wide range of possible recovery times. Thus, orthopedic injury was not as clearly defined as concussion. Future research should narrow orthopedic injury to a specific injury with a relatively predictable recovery time, such as a ligament sprain, to compare with concussion.

Additionally, the CHIP scales were limited in providing information about coping styles as only two coping styles clearly loaded into the problem-focused (instrumental coping) and emotion-focused (emotional preoccupation) comparisons. Thus, as these were the two styles of coping the present study aimed to explore, having only two coping styles to examine limited the ability to explore this relationship more thoroughly. Although the CHIP had strengths and weaknesses in this study, it was the most appropriate measure of coping to apply to the research questions.

Summary and Conclusions

While the subject of sport concussion has been an expanded area of public interest and research as of late, there has been little research done on the subject of how one copes with a concussion during his or her recovery. How one copes with sport injury, in general, is a promising and novel area of investigation. As explored in the review of literature, the experience of being a student athlete offers a unique set of influences that guide the athlete's coping style and recovery (Podlog, Dimmock, & Miller, 2011; Russell, 2000; Quinn & Fallon, 1999). Additionally, the type of injury that a student athlete endures affects the cognitive, emotional, and behavioral coping resources that are available to him or her. Comparing the coping style of athletes in the concussion injury group with athletes in the orthopedic injury group and non athletes

in the control group has provided a better understanding of how concussion injuries may affect athletes' ability to apply certain cognitive resources to problem-focused coping. The ability to better understand this layered coping response will provide the professionals who are involved in treating these injured athletes the ability to better individualize treatments to aid recovery.

The significance of this study offers a meaningful contribution to the rehabilitation and recovery of student athletes' injuries. The short-term implications for the knowledge gained from the results of this study are to first, know the impact of injury type on an athlete's coping style. The results showed that athletes recovering from concussion are significantly less likely to utilize instrumental coping than other coping styles whereas athletes recovering from an orthopedic injury were significantly more likely to utilize instrumental coping. Thus, type of injury appears to be related to the athlete's coping style. A second short-term implication for the knowledge gained from this study was to know which coping style leads to the least amount of depressive symptoms and the shortest recovery time. Although there were no significant results to support a hypothesis about which coping style directly results in the shortest recovery time, results provided more information about the relationship between coping and recovery. Additionally, the results from this study presented a better understanding of coping style and the presentation of specific depressive symptoms, such as suicidal ideation in student athletes recovering from injury. The long term implication for the information derived from this study is the knowledge of the complex relationships between injury type, depressive symptomology,

neurocognitive functioning, and use of particular coping styles, which will aid in informing the best treatment approach.

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